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CONSTRUCT SKILLS4LIFE

Education and training of building professionals in Hungary

Status Quo Analysis on education and training of building professionals- skills needed to achieve the 2030 energy-efficiency and climate targets

Build Up Skills Hungary

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Further information

More details on BUILD UP Skills can be found at www.build-up.ec.europa.eu

More details on the LIFE CET programme can be found at https://cinea.ec.europa.eu/programmes/life_en

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ConstructSkills4LIFE PROJECT

Co-funded by the European Union (EU) under the LIFE programme, the aim of the ConstructSkills4LIFE project is to support the Hungarian construction sector by paving the way to upgrade the skillset of blue- and white-collar workers needed to reach the targets set by EU and national policies until 2030 concerning the Hungarian building stock.

The project emphasizes a holistic approach focusing on a more intensified integration of digital technologies applicable in buildings, improved process management and qualitative renovation practices, subsequently fostering stakeholder cooperation and entrepreneurship that results in a more sustainable built environment.

Building on the results of the implemented national BUILD UP SKILLS projects (BUSH, TRAINBUD) the Consortium revitalizes the National Platform engaging relevant stakeholders from the construction industry (educational institutions, policy makers, professional associations, market actors) and conduct an up-to-date Status Quo Analysis (SQA) to have a clear picture of the current state of the Hungarian construction sector in relation to skill gaps of both blue- and white-collar workers, market demand and necessary measures to lead Hungary towards climate-neutrality. Based on the results of the SQA the Consortium and the Platform members will jointly co-develop in form of participatory workshops an upgraded Roadmap to provide an effective strategy and recommendations to tackle the challenges and foster development in the construction sector especially in clear energy transition, circular economy, digitalization, upskilling the sectors human capacity and health related to indoor air quality.

EXECUTIVE SUMMARY

In order to achieve the energy-efficiency and climate goals related to buildings set by the European Union and Hungary by 2030, the presence of a sufficient number of qualified professionals in the construction industry is essential. However, there are currently several challenges impeding this progress.

One of the major challenges in the construction industry is the shortage of skilled workers, both in the field of engineering and manual trades. The main reasons for this are:

- Professional emigration: for decades, a major problem in the domestic construction industry has been the emigration of design engineers and craftsmen.
- The low number of professionals leaving the school system, many of whom have inadequate professional and practical experience.
- In the next two years, the number of people retiring from the profession is expected to exceed the number entering the construction labour market.

The success of training programmes must be enhanced not only for students, but also for teachers and trainers. The training and upskilling of trainers is a priority for the process as a whole. Life-long learning must be a basic principle for both trainers and construction professionals in training. An important feature of industrial development is the rise of digitalisation and automation, which is expected to bring changes to the labour market. The number of low-skilled jobs will decrease, while new jobs and occupations will emerge where skills will become more valuable.

In line with this, the knowledge and skills of workers and professionals working in the construction industry in Hungary should include knowledge about the circular economy, digitalisation, smart buildings and the use of renewable energy. In the future, the focus will be on technological skills as technology becomes an integral part of the construction industry. There is a growing need for workers who are skilled in the use of digital tools. Automation and robotics are gradually spreading in the construction industry to increase productivity and safety. This trend is creating demand for skilled workers who can operate and maintain advanced machinery and robotic systems. With an increasing emphasis on sustainable and environmentally friendly building practices, workers with knowledge of sustainable building practices, green materials and energy systems are increasingly in demand.

The demand for multi-skilled workers is also growing among skilled workers. Construction companies are looking for professionals who can perform several skilled tasks at the same time, such as carpentry, plumbing and electrical work. This improves overall efficiency. The skills shortage needs to be tackled first and foremost in vocational education and training. Dual and trials programmes and training development are needed, in which students are more motivated and employers get a workforce whose training is tailored to the needs of the company. Additionally, demand-driven education development is also crucial in this regard.

There should also be a strong focus on bridging the information gap, such as improving information so that firms are aware of the employer and training support that is currently available.

The Hungarian government has made great efforts in recent times to make Hungary an increasingly work-based society. In order to achieve this goal, it is paying special attention to vocational education, based on broad social consultation. The extremely accelerated changes and development of industry and technologies require young people entering the labour market to acquire new knowledge, competences and skills, for which vocational education system must provide a solid basis and modern content. The new vocational education and training system should provide a solid core of professional knowledge and key competences, while at the same time being flexible and interoperable. As a result, students should have pathways open to both higher education and the labour market, while participants in adult education can easily and efficiently acquire the necessary new competencies.

The greatest employment challenge in 2023 will be to retain skilled workers and engineers while maintaining efficient employment in the face of declining job opportunities.

Within the scope of the Status Quo Analysis, the existing data and the building sector target values set for 2030 were taken into account to identify gaps and needs regarding education and training. The main figures of the document are as follows:

Number of professionals currently employed in the construction sector

The number of people employed in the construction sector in 2022 was **380,400**, accounting for **8.1% of the total employed population** in the national economy. The number of professionals involved in the construction and renovation of buildings according to the European/Hungarian Qualificaton Framework categories:

- HuQF 1-4:
- construction: 93 472
- building engineering.: 61 062
- electrical engineering: 46 431

- HuQF 5-7:
- construction: 37 795
- building engineering: 24 944
- electrical engineering: 15 951

Current energy consumption in Hungary in the building sector

Hungary's **final energy consumption** in 2022 was **735.6 PJ**, of which 334.94 PJ (8.0 Mtoe), equalling to 45.5%, is connected to buildings [IEA, 2020]. The total installed capacity of household-sized solar power plants at the end of 2021 was 1,125 MW (113,749 dwellings had solar power plants with a total output of 757 MW) [MEKH].

Hungary's Strategic Energy Targets 2030 and the expected contribution of the construction industry

Hungary energy targets		2020	strategic energy targets 2030	contribution of the construction industry - 2030
GHG emission	CO_2 emission	43,8 Mt CO_2	reduction of GHG emissions by 40% (level of 1990)	- 20% (residential buildings) - 18% (public buildings) (level 2018-2020)
Energy efficiency	final energy consumption	776 PJ	max 785 PJ	refurbishment of residential buildings 3% per year
				20% reduction in energy consumption in resid. build.
				refurbishment of public buildings 3% per year
				20% of buildings with near-zero energy performance
Renewable energy share	gross final energy consumption	13,80%	21%	average 4kW roof-mounted solar panels in a 200,000 households (800MW in total)

Number of building professionals to be trained to achieve the 2030 energy targets

In order to achieve **the 3% annual rate of refurbishment** of residential buildings set out in the strategies, the **additional demand is 4,800 professionals per year**, which is approximately **30% of the current people** enrolled in education and training. Specifically, within this, training for 2,600 people at levels 1-5 of the HuQF, and training for 1,200 people at levels 6-8 of HuQF is required annually, in addition to the current participants in education and training.

Qualification needs

The following conclusions can be drawn as a result of a comparison of the required competence levels of those professionals who have a significant impact on the energy efficiency of buildings and the current education system:

- **HuQF 3-5:** The current education system requires partial development in terms of building rehabilitation and energy modernization of historic buildings, or in terms of nearly zero-energy buildings. Serious development is necessary in the areas of circularity, digitization (in particular BIM), and smart solutions and buildings.
- **HuQF 6-7:** The current education system requires development in the field of building rehabilitation, energy modernization of historic buildings, environmental life cycle analysis - circularity, building rating systems, smart buildings and smart cities/communities.

Based on our calculations to meet the necessary training and further education needs of professionals, a total of **28,524 one-day courses per year is required**. The detailed framework will be developed in the National Roadmap.

1 INTRODUCTION

The European Commission, recognizing the pivotal role of the construction industry in achieving climate neutrality and energy goals - **a 55-60% reduction in carbon dioxide emissions by 2030 and zero greenhouse gas emissions by 2050** - published its **Renovation Wave strategy** on October 14, 2020. The strategy aims to improve the energy performance of buildings and double the renovation rate of buildings over the next ten years, thereby ensuring higher energy and resource efficiency.

However, achieving this goal is significantly hindered by the lack of skilled workforce and the absence of necessary skills in green design, technologies, and materials in the construction industry. The availability of skilled construction workers is crucial for the success of the European Green Deal's renovation wave; therefore, the **new European Skills Agenda** sets ambitious and measurable goals for upskilling and reskilling. The transition of the European Union to a resource-efficient, circular, digitized, and climate-neutral economy, as well as the widespread application of artificial intelligence and robotics is expected to create new jobs. However, this also means that there is a significant need for changes in workers' knowledge and skills. Lifelong learning and continuous upgrading of skills are key to sustainable growth, productivity and innovation, and are therefore key factors for business competitiveness. One of the main elements of the program is the **Pact for Skills**, which brings together stakeholders - both private and public actors - to promote the goals. In 2022, under the Pact the construction industry committed to upskilling or reskilling at least 25% (3 million people) of its workforce over the next five years.

In 2023, the EU launched the initiative "**European Year of Skills 2023**" to help businesses, particularly small and medium-sized enterprises, address existing skills shortages. The aim of the campaign promoting training and upskilling is to help individuals acquire the necessary skills for quality jobs. The objective is to guarantee that a minimum of 60% of the adult population in the European Union engages in training activities on an annual basis. The success of the green transition can be reached only if the skilled workforce necessary to maintain competitiveness is available, which **requires professionals to acquire the skills needed for the green and digital transition.** To achieve this, **significant investments need to be made by the EU and the Member States in the development of vocational and adult training systems** to facilitate the rapid acquisition of skills and competencies required by new technologies.

All these initiatives can provide significant support to Hungary meeting its' goals. The low level of energy efficiency significantly hinders Hungary's recovery from the economic crisis. Reducing energy consumption through energy-efficient renovations and the construction of energy-efficient new homes can lead to significant social and climate benefits while minimizing costs. Approximately 70% of Hungary's building stock, consisting of 4.2 million buildings, requires renovation, and around 10% of them are so outdated that new construction is necessary. Currently, buildings account for 40% of the total energy consumption in Hungary, with heating and cooling contributing to about two-thirds of that figure. Buildings are also the largest CO2 emitters. Energy bills make up an increasing portion of households' and public institutions' budgets. Moreover, Hungary's heavy reliance on

imported natural gas for heating purposes contributes to its significant import dependence, ranking among the highest in Europe.

Given these circumstances and the substantial economic changes in the global landscape during the 21st century, **it is crucial for the Hungarian construction industry to enhance its productivity and value proposition**. This requires **technological changes, digitalization, and the development of innovation skills** within the workforce. Prior to 2020, vocational training and adult education did not meet the demands of the labour market, leading to the need for significant system changes. The spread of nearly zero-energy buildings (NZEB) and the design, construction, and renovation of energy-efficient and sustainable buildings, as well as the energy-conscious transformation of existing structures, increasingly highlight the importance of the appropriate skills and knowledge among construction industry stakeholders. However, **vocational training and higher education currently do not meet the needs of the modern construction sector**, as there is a lack of adequately trained instructors and targeted educational materials.

The purpose of this Status Quo Analysis is to update the document titled "Energy efficiency and use of renewable energies in buildings: opportunities and needs in the Hungarian education system" published in 2012 by the Build Up Skills Hungary project. It aims to assess the changes occurred over the past ten years, examine the needs of professionals in the construction industry in collaboration with ConstructSkills4LIFE project partners and involved experts.

The study covers the analysis of energy efficiency and use of renewable energy throughout the entire life cycle of our built environment. It also evaluates the status of vocational education and training as well as higher education, continuing education, and qualifications related to the life cycle of buildings (covering European Qualifications Framework levels 1-8). This includes assessing the availability of training programs, analysing the structure of formal education and adult training programs. The labour market demand and supply are also demonstrated taking into account the perspectives, interests, and suggestions of relevant market players.

Another objective of the Status Quo Analysis is to provide reliable information and a basis for the development of the National Roadmap with will provide recommendations covering training strategy for the construction sector and human resource management system until 2030. To establish this, the strengths and weaknesses as internal factors, and opportunities and threats as external factors, have been evaluated through a SWOT analysis, considering the existing knowledge and skills of building professionals.

The applied methodology aims to gather the opinions and inputs of a diverse range of stakeholders. To achieve this, expert groups were formed, involving experts from the construction industry, training and education. Questionnaires and in-depth interviews were conducted gaining opinion of building professionals, educators and students of VET and higher education.

The **ConstructSkills4LIFE** project consortium consisting of five members, through their members and network, covers a significant portion of the construction industry as well as

education and training of building professionals. Therefore, the consortium possesses the necessary knowledge to reflect the current situation in Hungary in this comprehensive Status Quo Analysis. The **ÉMI Nonprofit Ltd**., with a sixty-year history, is Hungary's leading complex building and construction materials industry approval, testing, inspection, certification body. It has a leading role in the building construction industry. Its main strengths lie in impartiality, experience, the background infrastructure for testing, and its role as a "bridge-building" organization, enabling active collaboration among Hungarian small and medium-sized enterprises, large construction companies, material manufacturers, local governments, the general public, as well as decision-makers. Additionally, ÉMI is an active and influential participant in several international projects as a permanent member or leader, including its role as the coordinator of the Build Up Skills Hungary project, which developed the previous Status Quo Analysis a decade ago. The **Hungarian Coordinating Association for Building Engineering**, operating as an umbrella organization, represents the interests of over 40 organizations working in the field of building services. It is important mission is to align and promote vocational, higher, postgraduate, and adult education in accordance with market demands within the social, economic, and scientific framework. The **Budapest University of Technology and Economics**, with a history of nearly two and a half centuries, is Hungary's foremost institution offering technical, natural sciences, and economic education. The university is committed to environmental, human, and technical quality, environmentally conscious, healthy, and cost-effective architecture in both architectural and building engineering education. The **Békéscsaba Center of Vocational Training**, consisting of eight member schools, including construction, electrical engineering, and building engineering programs, ensures that training programs meet labour market demands in vocational education and training, not only in traditional "manual" trades but also in technical professions. **Geonardo Ltd**., for over 20 years, has been the most successful Hungarian participant in the EU's research, development, and innovation framework programs in areas such as energy efficiency, renewable energy, and sustainable development. The company's portfolio includes life cycle analysis (LCA), the application of geospatial information system and remote sensing technologies (GIS-RS), building surveys (TLS), building and urban-scale modelling (BIM and CIM), as well as the development of energy-efficient building renovation strategies and proposals. Through training and information materials and e-learning services, the company supports numerous professional fields in Hungary and the EU.

2 OBJECTIVES AND METHODOLOGY

The purpose of this chapter is to present the objectives, circumstances, and limitations of the current study, while also offering an in-depth understanding of the comprehensive methodology utilized in its development.

2.1 Objectives of the study

The BUILD UP Skills initiative, launched by the European Commission in 2011, strives to foster the upskilling of construction experts in order to enhance the quantity of highly energy-efficient building renovations and the construction of new near-zero energy buildings throughout Europe.

Among the objectives of the ConstructSkills4LIFE project is to revive the previously established national platform and continue the successful professional dialogue. Building on the results of the BUILD UP Skills projects (BUSH, TRAINBUD, NEWCOM, Bus-GoCircular, Train4SUSTAIN) previously implemented in Hungary with the participation of the consortium partners, the consortium will revive the **National Platform** involving the construction industry and relevant organizations in construction-related education and training (e.g. educational institutions, legislators, professional associations, market stakeholders). The primary goal of this Status Quo Analysis is to assess whether blue- and white-collar professionals currently working in the construction industry, as well as those preparing to enter the job market, possess the necessary skills and knowledge to meet Hungary's energy efficiency and decarbonization targets for 2030 and 2050. Additionally, by examining market demands and expert perspectives, the study aims to identify occupations that are facing a substantial shortage of qualified professionals, both in terms of their quality and quantity.

The aim of this study is to update the Status Quo Analysis titled "**Study on the training needs and capabilities of Hungarian building energy efficiency and renewable energy use**" published within the framework of the Build Up Skills Hungary project in 2012. The main objective is to evaluate the changes that have occurred in the past decade in collaboration with partners involved in the project and with experts invited by the ConstructSkills4LIFE project. Unlike the previous study, which primarily examined formal education, vocational education and training (VET) and adult education, the current survey encompasses the entire range of education and training in the construction industry, including higher education. This comprehensive approach ensures coverage of all eight levels of the European Qualifications Framework (EQF 1-8). The study analyses the challenges associated with acquiring the necessary skills within the framework of training, qualifications, and credentials.

The research will focus specifically on assessing the availability of skilled labour throughout the **entire life cycle of construction,** including design, construction, operation, and demolition. It aims to cover a **wide range of professions related to the construction industry**, such as architects, contractors, civil engineers, building services engineers, building services technicians, and many others. The main target groups of this project include construction professionals, associations, companies, architectural offices, policy makers, researchers, and

education market actors, including vocational education and training (VET) schools, training institutions, and the entire spectrum of higher education.
The structure of the study follows the template document provided by the European Climate, Infrastructure and Environment Executive Agency (CINEA), which oversees the LIFE Clean Energy Transition Programme. This approach enables a comprehensive comparison of the Status Quo Analysis conducted by all national consortia receiving support through the Build Up Skills Initiative, including the ConstructSkills4LIFE project.

Utilizing the findings of this study regarding the identified gaps, challenges, and opportunities, the actions and policy recommendations outlined in the previous National Roadmap will be revised to align with the energy efficiency and decarbonization goals for 2030 (and 2050). This update process will actively engage the participants of the National Platform and key stakeholders in the relevant field.

This study encompasses **three main objectives:**

a) To provide an in-depth analysis of the wider context surrounding energy-efficient building renovations and construction, including near-zero energy buildings.
b) To identify skill gaps, evaluate challenges within the construction sector, draw conclusions, and propose initial recommendations.
c) To facilitate professional dialogue and foster partnerships, ensuring a comprehensive discussion among experts regarding the study's findings and identified gaps. This serves as the foundation for co-developing a National Roadmap.

2.2 Defining the scope of the study

To effectively address the challenges faced by the construction sector and support the energy efficiency and climate goals set for 2030, as well as the decarbonization targets by 2050, it is crucial to assess the current situation, identify gaps, and determine the most important measures. In order to contribute to the European Green Deal's renovation wave and the European Skills Agenda, it is essential to ensure an adequate number of skilled professionals and to incorporate knowledge of **circular economy, digitalization, smart buildings**, and **renewable energy utilization** into the expertise of domestic workers. The ConstructSkills4LIFE project aims to facilitate the achievement of these objectives, and thus, the content of this document covers the following areas:

- Prioritising energy efficiency, environmental impact, and decarbonisation **throughout the entire life cycle of our built environment,** including manufacturing design, construction, operation, refurbishment and renovation, recycling and disposal.
- Assessing the current situation and offer of **school-based vocational training and education, further training and qualifications** (EQF1-8) related to the life cycle of buildings, as well as analysing the content and structure of school-based and adult training programs.
- Conducting an analysis of the **labour market's supply and demand** situation, including staff structure, competences, skills and responsibility hierarchy.
- Presenting the perspectives, interests, and recommendations of the consortium, **National Platform members**, **construction professionals** and **training providers**

regarding the **skills needs of the blue- and white-collar workers** active in the construction sector, including those who will enter the market in the near future.
- Mapping shortage occupations and estimating shortages within the construction sectors.

The consortium acknowledges the European Commission's finding that the successful implementation of circular and low-carbon solutions in design, installation, and operation often requires a high level of technical expertise. To attain climate neutrality in the domestic building stock, it is crucial to have a pool of experts specializing in deep renovation of buildings as well as to adapt existing jobs and enhance the skills of professionals to encompass green, digital, and circular skills. Professionals need to acquire knowledge on advanced resource and energy efficiency technologies throughout the supply chain, from manufacturing and design to construction stages, in order for the end-users to effectively know and apply them. Training programs are therefore essential to equip professionals with the necessary knowledge and skills.

The document also includes important content highlighting the opportunities for women and young talents to engage in the renovation and construction sectors, along with proposals on how to make the profession more appealing to them in the future.

This study conducted as part of the ConstructSkill4LIFE project considers it important to present and further investigate the system of skills, knowledge, qualifications and the associated entitlements and responsibilities that are acquired through them. However, it does not intend to offer an exhaustive analysis of the building sector or provide detailed guidance or specific proposals for renovation incentives or targeted financing mechanisms to attain the national building energy and climate objectives.

The ConstructSkills4LIFE consortium, within the project framework aims to update, define and propose actions the National Roadmap for the Clean Energy Transition. The previous Roadmap will be updated and developed with the involvement of national platform members and experts after the completion of the current Status Quo Analysis. The consortium will address the following four main challenges, covering levels 1-8 of the European Qualifications Framework:

- Structural and policy challenges
- Challenges related to training programs
- Human resources-related barriers
- Economic barriers

The technical implementation of the ConstructSkills4LIFE project is also overseen by a 4-member External Advisory Board, whose role is to continuously monitor and review the project's objectives and results ensuring alignment with the proposed objectives. The Advisory Board members are invited to participate in ConstructSkills4LIFE events such as conferences, workshops, receive draft deliverables of the project and provide recommendations for improvement. Additionally, the Status Quo Analysis has been also proofread by the experts.

2.3 Methodology for research development

To achieve the objectives of the study, the document was developed using a combination of primary and secondary research methods to ensure the inclusion of a wide range of stakeholders' inputs. The elements of the research methodology used to prepare the study were **1) literature review; 2) questionnaires; 3) direct, face-to-face interviews and 4) expert group discussions**.

The results of the data collection are presented and summarised in a **SWOT analysis**. Strengths and weaknesses, as internal factors, as well as opportunities and threats, as external factors are evaluated in relation to the existing knowledge and skills of building professionals. Based on these findings, the ConstructSkills4LIFE consortium, in collaboration with the national platform, will develop, a roadmap that will include a set of recommendations for policy makers and a wide range of professional actors involved in promoting the construction industry.

2.3.1 Literature review

The detailed objectives of the literature review (desk research) in the study were as follows:

- **Presenting the policy, strategic and legal framework** related to building energy efficiency and decarbonization goals, with particular emphasis on ongoing policy documents at the EU and national levels.
- **Presenting the situation, condition and characteristics of the building stock** in Hungary**,** including statistical information available on the residential sector and building energy efficiency.
- **Describing the situation of the construction labour market, employment, vocational training and higher education in Hungary**, including data collection and analysis.
- Presenting the structural, strategic, and legal framework concerning **vocational education and training, further education, and qualifications** related to the construction industry at the beginner, intermediate and higher levels (corresponding to levels 1-8 of the European Qualifications Framework and the Hungarian Qualifications Framework), considering the life cycle of buildings.

The basic working methodology used for the development of the study was a literature synthesis, utilizing the following sources of information:

- **Professional and scientific publications** in national and international literature, journals and monographs.
- **Studies and strategy documents** produced by independent professional organisations, NGOs, associations, scientific workshops, public bodies.
- Official data sources from national and international statistical offices (Central Statistical Office, construction industry statistics, etc.).
- **Background studies and analyses** commissioned by the government.
- **Strategies, concepts, plans, legislation** and their supporting materials.

2.3.2 Questionnaires

The aim of the questionnaires were to obtain direct information from three main target groups regarding the status of expertise within the construction industry, specifically focusing on competences, skills, knowledge related to energy-efficient building renovation and nearly zero-energy buildings. The target groups of the questionnaires were as follows:

- Professionals working in the construction industry, including companies involved in the building material production, design, construction and operation.
- VET teachers and students.
- Educators and students in higher education.

Three separate questionnaires were developed for the three target groups, containing identical content elements for comparability. The questionnaires can be found in Annex 1, of the Status Quo Analysis (1.1: construction companies and professionals, 1.2: VET institutions' teachers and students, 1.3: higher education institutions' teachers and students). The findings of the questionnaires, which received **a total of 245 responses**, are presented in Chapters 5 and 7. The sampling period for collecting responses to the questionnaires occurred between February 23, 2023, and May 21, 2023.

Construction companies

During the collection of questionnaire responses, it was crucial to gather insights from professionals involved in the entire life cycle of building projects. Therefore, it was necessary to engage a broad range of construction companies and professionals including design offices, operators, contractors, and building material manufacturers, as well as professional associations.

In Hungary, stakeholders from all segments of the value chain are represented, including large multinational and internationally significant companies, as well as small and medium-sized enterprises. Conducting a representative survey of construction companies requires substantial resources, which are beyond the scope of this project. Therefore, the extensive network of partners helped in providing a larger sample, including members of professional organizations and associations (e.g., Hungary Green Building Council - HuGBC), which provided the consortium with a solid foundation for the roadmap and strategy development process. The questionnaires were distributed via email.

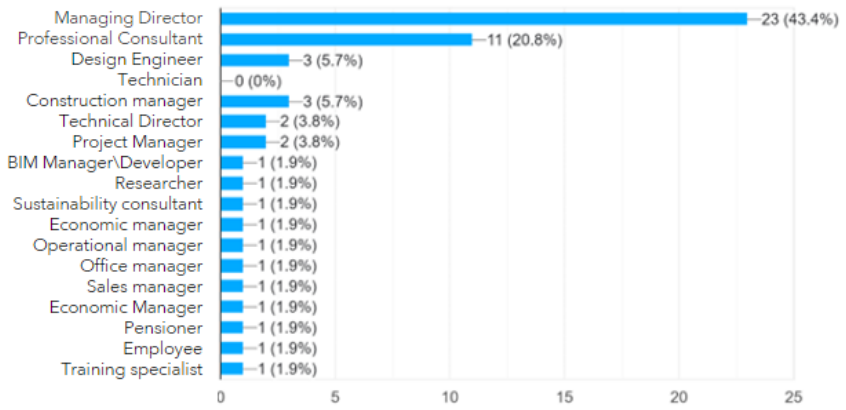
By surveying market actors about the quality of the workforce and potential shortages, valuable insights can be gained into the current challenges and ongoing changes. This process enables the identification of specific skills in demand, shortages of skills or skilled workers, and training gaps within these stakeholder groups.

The method used in the previous Status Quo Analysis and roadmap involved the utilization of an online questionnaire to collect information from market actors, encompassing various aspects of the project. The same method was in this study taking place a decade later. The questionnaire focused on the following key aspects:

- The qualifications and qualities of professionals.
- Current and up-to-date professional knowledge, or any gaps therein.
- Opportunities and support for acquiring knowledge and skills.
- Availability of services to acquire knowledge and skills.

- The need for fundamental skills of trained professionals (through formal training).
- Shortage of professionals in the field.

The questionnaire has been carefully designed to gather valuable responses from construction companies, as well as design, property development, and management firms, in order to provide crucial support to the consortium's work.
In total, the online questionnaire **received 53 responses.** Among the respondents, a significant proportion (43.4%) identified themselves as "managing directors" within their respective companies. This was followed by "professional consultants" (20.8%) and "construction managers" as the next most common positions, which is shown in Figure 1.



1. Figure: Distribution of respondents to the construction questionnaire by position held

The questionnaires are presented in Annex 1. The results of the detailed analysis based on the questionnaires are presented in Chapter 7.

Vocational training institutions: vocational training, technician vocational training, adult training

The website of the IKK Innovative Training Support Center Plc[1] offers a comprehensive map-based search tool for vocational training institutions across the country. Users can easily find relevant vocational training institutions by selecting their desired criteria such as county, locality, industry, profession, institution, or vocational qualification. The database of this search tool served as the source for identifying target groups of the questionnaires, with a specific focus on relevant professions and vocational qualifications.

In the case of a professional search, a total of 135 results were obtained for the construction sector, 60 for the building services sector and 92 for the electrician sector. In the case of qualifications, a search for architecture and construction produced 11 results. After excluding the institutions with multiple appearances, the questionnaire has been sent to 164 heads of institutions via e-mail.

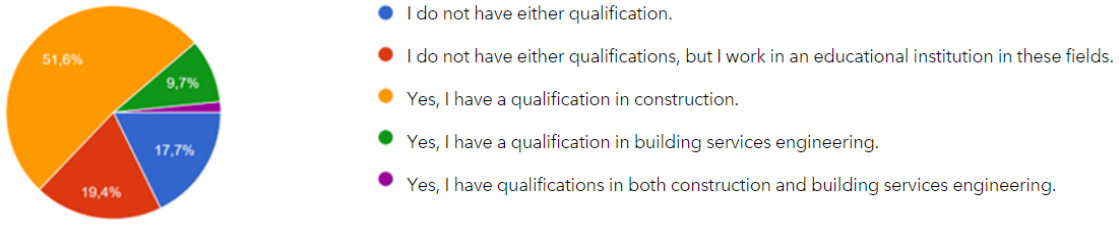
The **online questionnaire consisted of two parts,** one dedicated for people working in VET and adult education institutions (managers, trainers, teachers, vocational trainers) and one

[1] https://ikk.hu/terkep

for students or young people enrolled in VET and adult education. The main elements of the questionnaire are as follows:

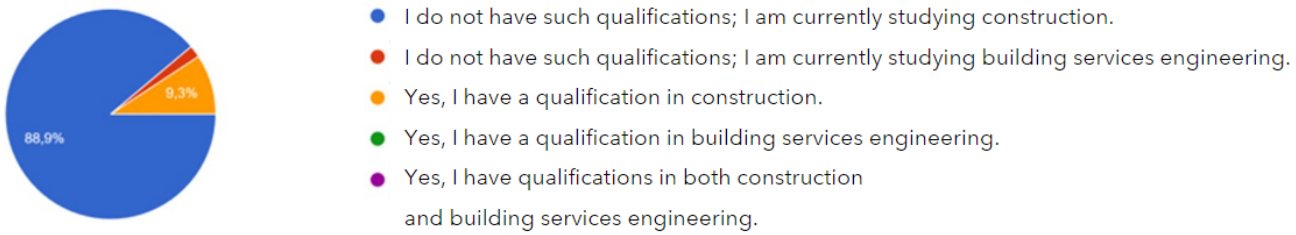
- professional background, qualifications, and level of sustainability and environmental awareness in their work and studies;
- knowledge on energy performance of buildings, circular economy, recycling of construction materials, life cycle assessment methods, the importance of digital techniques in the construction industry, and the level of familiarity and utilization of these;
- presence of knowledge and skills in vocational training necessary to achieve the 2030 energy performance and climate goals;
- the significance of professions for the implementation of new buildings and the energy renovations of existing ones;
- opportunities and support for necessary acquiring knowledge and skills.

A **total of 116 questionnaires were completed, including 62 from employees (managers, instructors, teachers, vocational trainers) and 54 from students.** The questionnaires were sent out at national level to the vocational training institutions of the public vocational training centres involved in the surveyed field. These institutions are authorized to provide vocational training for adults in acquiring professions and qualifications. The questionnaire responses were anonymous.



2. Figure: Breakdown of employee responses by level of education (based on 62 responses)

Among the respondents completing the employee questionnaire (based on 62 completed questionnaires), 51.6% have a qualification in the construction industry, 9.7% in building services, and 1.6% have both qualifications, as shown on Figure 2. The remaining 19.4% do not have either of these qualifications but work in educational institutions in these fields. Among those with qualifications in the construction industry or building services (42 respondents, accounting for 67.7% of the questionnaire results), 73.8% have a higher education degree, while 26.2% have a secondary education degree (including 11.9% with a technician certificate, 9.5% with a master's qualification, and 4.8% with a skilled worker certificate).



3. Figure: Distribution of students' responses by level of education (based on 54 responses)

From the 54 students (early career professionals) completing the questionnaire, 9,3% already have some form of qualification in construction or building services, typically skilled worker or technician qualifications. (Figure 3.) The rest of the respondents have no previous training of this kind.

Higher education institutions: post-secondary and post-graduate courses

For higher education, the first level of analysis was identifying which of the 65 higher education institutions currently operating in Hungary provide training for construction professionals within the framework of the following bachelor's and master's degree programmes:

- architect;
- civil engineer;
- electrical engineer;
- mechanical engineer;
- engineering management;
- environmental engineering;

The report summarizes the departments of institutions that offer courses related to the topic of the Status Quo Analysis. The heads of these departments were contacted by email with the link to the online questionnaire, which in several cases were forwarded to instructors whom they deemed to have valuable insights on the subject matter.

The **questionnaire consists of two parts:** one dedicated for teachers and one dedicated for students in their 4th and 5th years (MSc students), early career and postgraduate students. The questionnaires were completed anonymously.

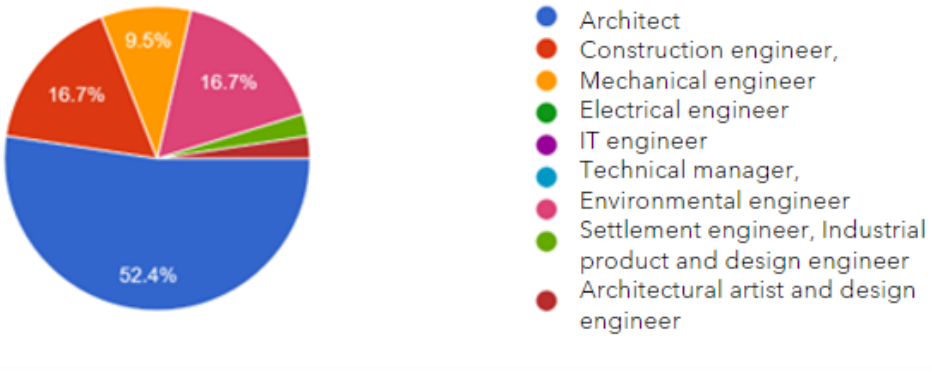
At the beginning of the questionnaire, various subject areas were collected, which are necessary to achieve the 2030 energy and climate goals. The aim was to determine to what extent these topics are covered in the educational programmes provided by higher education institutions. These topics include the followings:

- Design of nearly Zero Energy Buildings (NZEB) (architecture, mechanical and electrical engineering)
- use of renewable energy sources
- building renovation, refurbishment (architecture, mechanical and electrical engineering)
- energy-efficient refurbishment of historical buildings
- circular construction model (building materials, construction technologies, water management)
- building Information Modelling (BIM)
- dynamic building simulation
- intelligent/smart buildings (building management system)
- environmental life cycle analysis (global warming potential assessment)
- building certification systems (LEED, BREAM, WELL)
- smart cities and communities

In the two questionnaires, both teachers and students answered the following questions:

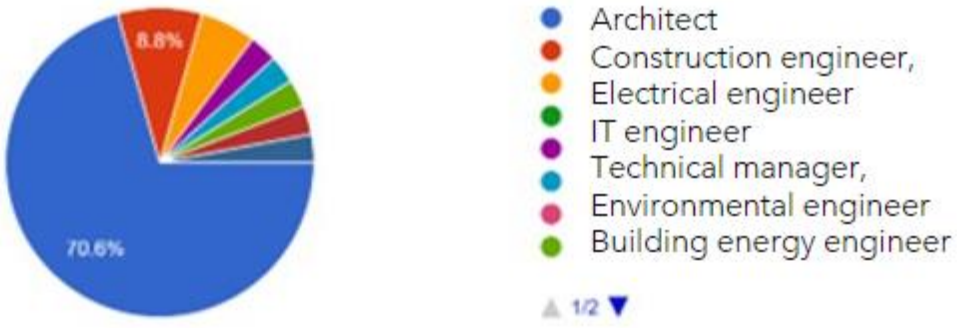
- the extent of materials in the curricula necessary to achieve the 2030 energy and climate goals for buildings;
- the format of knowledge transfer, including the availability of notes and supplementary materials, and the methods of assessment;
- the extent to which acquired knowledge is applied in student assignments;
- the existence of scientific student research projects (TDK) on the topics and awareness of additional training opportunities;
- the extent of further training of teachers in related subject areas.

In the case of **higher education institutions,** it was important to explore the educational activities of as many universities as possible that are related to the research topic. A **total of 76 questionnaires were completed**, of which 42 were completed by teachers and 34 by students. It is important to note that this sample does not reflect the views of 42 training institutions, but fewer - as it was not possible to filter out the anonym forms returned by trainers from the same institution. However, the primary goal was not the understanding the opinions of the institutions or their management, but rather to gain an overall understanding overview of the educational side, primarily influenced by the opinions of the teacher. Figure 4 shows the responses of teachers in higher education based on what qualifications they teach.



4. Figure: Distribution of teachers' responses to the questionnaire (based on 42 responses)

In addition to the opinions of the trainers, it was important to consider the responses of graduating students and young professionals to the same questions related to their education. A total of 34 student questionnaires were completed. Figure 5 shows the programs the responding students have been enrolled in higher education.



5. Figure: Distribution of student responses to the questionnaire

The questionnaires are presented in Annex 1. The results of the analysis based on the questionnaires are presented in Chapters 7.

2.3.3 Interviews

To complement the questionnaires and their preliminary results **personal and online interviews were conducted with** a total of **35 experts, professional partners (17), representatives from higher education institutions (8) and VET centres (10)**.

The primary **target group of the** interviews was, similarly to the questionnaires, consisted of stakeholders in the construction industry, covering the entire life cycle of buildings: construction companies - such as design offices, facility managers, contractors, building material manufacturers, etc. -, as well as representatives from higher education and teachers involved in vocational education and training. To complement the questionnaire responses, the interviews also included representatives from professional interest organizations, chambers, and construction industry specialized journalists. The consortium utilized its extensive network of contacts to select interviewees, including those organizations that expressed their interest during the questionnaire completion process.

The interviews were conducted **to provide explanation for the identified obstacles challenges, and other findings based on the preliminary results from literature** review **and the questionnaires among the professionals in the field,** Specific questions were posed to interviewees based on their different backgrounds. However, to ensure comparability and effectiveness, some fundamental questions were the same across all interviews. Depending on the interviewee's role (construction industry and educational stakeholders), the questions were supplemented with additional inquiries to obtain a more comprehensive understanding of the situation in Hungary. The interview questions can be found in Annex 3. The interviews lasted approximately 30 minutes, although the interviewer had the flexibility to deviate from this timeframe and delve into more detailed questions. The interviews were conducted via telephone, online, or in person. The responses received were documented in writing.
Interviewees includes the following stakeholders:

- design offices,
- general contractors, subcontractors in the construction industry,
- enterprises functioning as dual training sites,
- facility managers,

- building material manufacturers,
- professional associations, unions, chambers,
- trainers from vocational education and training institutions,
- teachers form higher education institutions,
- journalists related to construction sector.

Interview methodology:

- individual or thematic groups
- in-person or online

Construction industry

The interviews primarily involved representatives from small and medium-sized enterprises in the construction sector, encompassing manufacturers, contractors, designers, and operators throughout the entire value chain. In total, **17 interviews were conducted with company executives, project managers, technical managers and experts.**
In addition to the questionnaire's target group, the interviews aimed to also gather insights and perspectives from individuals with deeper knowledge and understanding of construction skills. This approach also provided an opportunity for representatives of construction trade associations, federations, chambers, and construction trade journals to express their views.

Vocational Training Centres (VTCs)

A total of **ten interviews were conducted with the heads and trainers from 7 schools of 5 vocational training centres and one company training centre in different areas of the country** (Vác, Kecskemét, Tatabánya, Kisvárda, Békéscsaba). The subjects taught by the teachers who were approached cover almost the entire range of construction professions, including building construction technician; mason; tiler; carpenter; tinsmith; painter, plasterer, wallpaperer; structural engineer; plumber; refrigeration and ventilation system installer; central heating and gas system installer; electrician; road, railway construction and maintenance technician. The company, which also operates as a dual training centre, employs students in the field of heating and gas distribution systems.

Higher education institutions

A total of **8 interviews were conducted** with representatives from various higher education institutions**, representing different universities and faculties,** including **mechanical engineering, architecture, civil engineering, urban planning and computer engineering.**
The results of the analysed interviews are presented in Chapter 7.

2.3.4 Expert groups

To ensure that the most challenging issues are addressed the project partners also invited experts - throughout the project implementation. The insights and expertise of these professionals contributes to the effective analysis of the identified challenges outlined in this study.
Main subject areas are as follows:

- Digitisation
- Training and education
- Building technology solutions

Three expert groups have been set up since the launch of the ConstructSkills4LIFE project to regularly consult and support the professional work around the main challenges and opportunities outlined above. The three expert groups are as follows:

1. **Digitalisation, BIM, digital twinning** (led by Péter Gyuris - Geonardo)

The expert group comprises of companies, research institutes and professional institutions with extensive experience and expertise in the use, advancement, and application of digital tools. The expert group members also possess valuable insights into various building cycles ranging, from design to operation. This collective knowledge and experience enable the participating organizations to engage in discussions that are directly aligned with the project's objectives, ensuring a comprehensive exploration of strategic issues that hold significance for the project's success. The discussions conducted thus far have taken place in a combination of online face-to-face and hybrid meetings, allowing for effective communication and collaboration among the expert group members.

2. **Education and workforce** (led by Attila Zoltán - Hungarian Building Engineering Coordination Association)

The expert working group is composed of professionals with a proven track record in the fields of secondary and higher vocational education and training as well as adult education. Their extensive experience and network enable them to conduct a comprehensive review of the field, formulate questions, analyse tasks, assess the current situation, and devise effective strategies. The working group held two fu meetings with all the members and several smaller meetings with a smaller number of participants during the preparatory phase of the SQA. These meetings allowed collaborative discussions to take place, often involving external experts, to ensure diverse perspectives and insights. The group maintains regular communication, either online or in person, based on the specific needs of the project. In the initial stages, the primary focus of the working group was to define the project objectives, identify the relevant professional areas and stakeholders, and the update of the National Platform. This critical groundwork sets the stage for the project's success and provides a clear direction for future actions.

3. **Building technology solutions - Circularity, energy efficiency, renewable energy, smart solutions** (led by Dr. Károly Matolcsy - ÉMI Nonprofit Ltd.)

The expert working group comprises experts from the partner organisations as well as from external organisations. Its primary aim is to outline new innovative materials, products and systems in the field of i educational and training that surpass the solutions outlined in the previous BUSH project, either in terms of novelty or relevance. The group discussions centred around the objectives outlined in EU and national strategies, EU calls for proposals, national tenders, and the expertise provided by professional associations. The focus areas for these discussions encompass a range of topics, including nature-based solutions, life-cycle assessment, circular economy, smart cities, communities, and digital solutions. By drawing upon the collective knowledge and experiences of the group members, the working group aims to generate cutting-edge concepts and advancements in the field of education and training. These efforts align with the broader objectives of EU and national strategies, fostering innovation and progress within the industry.

3 NATIONAL POLICIES AND STRATEGIES TO CONTRIBUTE TO THE EU 2030 ENERGY AND CLIMATE TARGETS IN THE BUILDINGS SECTOR

This chapter provides an overview of the EU and national strategic and policy framework that shapes the construction industry's role in the national economy. Special emphasis is placed on examining the sector's potential and the significant impact it has on vocational education and training, qualifications, skills, and competences. The discussion extends to all stages of the built environment and facilities' life cycle, recognizing the dynamic nature of the construction sector and its influence on various aspects of our society. By exploring this context, we gain insights into the broader landscape within which vocational training and skill development operate, paving the way for informed decision-making and targeted interventions.

European Union outlook

Buildings are responsible for around 40% of the European Union's (EU) **energy consumption and around 36% of its greenhouse gas emissions**. **However, only 1 % of buildings undergo energy efficiency upgrades annually, and the rate of deep renovation is even lower, at 0.2-0.3 %. These figures are far from achieving the target of climate neutrality in Europe by 2050.**

In the EU, 85% of buildings were constructed over 20 years ago, and it is projected that 85-95% of these buildings will still be standing in 2050. Unfortunately, the majority of these buildings are not energy efficient, relying on fossil fuels for heating and cooling and utilizing outdated technologies and inefficient equipment.[2]

A significant issue arises from the fact that nearly 34 million Europeans struggle to afford proper heating for their homes. Implementing public policies that promote energy-efficient modernization is not only a solution to address the challenges faced by these households, but it also promotes people's health and well-being while helping to reduce their energy bills. In response to these concerns, the European Union has implemented various legislative measures and initiatives to encourage the construction of more energy-efficient buildings and to achieve the set energy targets. The most relevant of these initiatives include:

Energy Efficiency Directive - 2018 [3]

The European Union's objective is to develop a sustainable, competitive, secure and decarbonised energy system. To achieve this, the Climate and Energy Policy Framework sets out ambitious EU commitments up to 2030:

- reducing greenhouse gas emissions by at least 40% by 2030 compared to 1990 levels,
- increase the share of renewable energy consumption,

[2] A European programme for the modernisation of buildings - greening our buildings, creating jobs, improving quality of life, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, Brussels, 14.10.2020, COM(2020) 662 final

[3] DIRECTIVE 2018/844/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency

- energy savings in line with EU-wide targets,
- and improve Europe's energy security, competitiveness and sustainability.

Going beyond these targets, in the spirit of the review of the Energy Efficiency Directive to be completed by in June 2021, based on a detailed impact assessment, EU leaders agreed at the Brussels Summit on 10-11 December 2020 to further increase climate policy targets. The agreement will see the 27 Member States reduce EU greenhouse gas emissions by at least 55% over 10 years compared to 1990 levels, compared to the previously planned 40% emission reduction.[4]

European Green Deal - 2019[5]
As a new growth strategy, the EU aims to eliminate net greenhouse gas emissions by 2050 and to ensure that economic growth is not resource-dependent.

To transform the EU economy for a sustainable future, the European Commission is proposing the following policy actions in the area of energy and resource efficient construction and modernisation:

Building and Renovation[6] - European Green Deal
Since the construction, use and renovation of buildings requires significant amounts of energy (buildings account for 40% of energy consumption) and resources, the aim is to launch a "Building Renovation Wave". This means that the current rate of modernisation of public and private buildings should be at least doubled.

Criteria for energy efficient buildings:

- Prices of different energy sources should incentivise energy-efficient buildings,
- Design of building should be in line with the circular economy,
- Increased digitalisation,
- More climate-proofing of buildings,
- Strict enforcement of rules on energy performance of buildings.

New Renovation Initiative 2020[7]
Key objectives of the strategy:

- Help the 50 million consumers to keep their homes warm,
- Renovate social housing, schools and hospitals.

Renovation Wave for Europe programme (Renovation Wave) - 2020[8]
Objectives, priorities:

- Effective response to the difficulties of the households to be supported: lower household bills,

[4] Emissions cuts agreed at EU summit, Euronews/MTI - Latest Developments: 11/12/2020
[5] The European Green Deal, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE EUROPEAN COUNCIL, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, Brussels, 11.12.2019 COM(2019) 640 final
[6] Construction and Modernisation: European Commission, Information note, Brussels, 11 December 2019, FS/19/6725
[7] Construction and Modernisation: European Commission, Information Notice, Brussels, 11 December 2019, FS/19/6725
[8] A European programme for the modernisation of buildings - greening our buildings, creating jobs, improving quality of life, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, Brussels, 14.10.2020, COM(2020) 662 final

- Reducing emissions and energy use to support climate policy goals,
- Improving the quality of life and health of residents,
- Carbon-free, digitised and smarter homes,
- Affordable, sustainable design in the frame of the new European Bauhaus (the "new European Bauhaus" announced by European Commission President Ursula von der Leyen combines style with sustainability, with a focus on natural materials and sustainable design).

Removing barriers to modernisation:

- Information, incentives and legal certainty for owners and tenants;
- Funding through the Next Generation EU financial fund and other EU and private sources;
- capacity building of public authorities and training of workers;
- developing the market for sustainable consumer products;
- community-led approaches, starting from the local level.

Renovation Wave Strategy - 2020[09]

The European Commission's strategy for the renovation programme of buildings' objectives:

- To double the rate of renovation over the next ten years.
- The renovations should lead to greater energy and resource efficiency.
- 35 million buildings renovated by 2030.
- 160 000 green jobs created.
- Expanding the market for sustainable building products and services, integrating new materials and nature-based solutions.

3.1 Energy policy framework for buildings

3.1.1 National regulatory and policy framework

This chapter reviews existing domestic building energy strategies, including strategies to integrate renewable energy and efficient heating and cooling technologies. Education-related plans included in these documents are also presented.

National Energy and Climate Plan

The 2020 Strategy sets targets up to 2030.

Greenhouse gas emissions target

In line with the EU's Climate and Energy Policy Framework adopted by the European Council in October 2014, Hungary aims to **reduce its greenhouse gas emissions by at least 40% by 2030 compared to 1990**, such as gross emissions in 2030 should not exceed 56.19 million t CO_2eq.

[9] Construction and Modernisation: European Commission, Information Notice, Brussels, 11 December 2019, FS/19/6725

Renewable energy target
Hungary **aims to achieve a share of renewable energy sources of at least 21% in gross final energy consumption by 2030**.
In the **heating and cooling sector, the share of renewable energy could approach 30% in 2030**.

Hungary is encouraging the installation of solar panels to partially replace electricity consumption. The aim is to **have at least 200,000 households with an average of 4 kW of roof-mounted solar panels by** 2030.

Energy efficiency target
The country's **final energy consumption in 2030 should not exceed the 2005 level** (785 PJ). If the final energy consumption increases above 2005 levels, the increase can only come from carbon neutral energy sources.

Objectives related to buildings
According to the National Energy Strategy for Buildings (NÉeS), about 40% of primary energy use in Hungary takes places in buildings, with residential buildings accounting for the largest share of nearly 60%.

In terms of final energy consumption, according to Eurostat, the residential sector's share of energy consumption is at around 35%, with buildings accounting for the majority of this.

According to the Hungarian Energy and Public Utility Regulatory Office (hereinafter: MEKH), a significant share (three quarters) of energy use by Hungarian households is for heating, which is mainly based on natural gas (almost half of the national gas use is residential).

The other two major areas of energy use are the production of domestic hot water and the use of lighting and electrical appliances (one-tenth to one-tenth of the total). For residential buildings, the greatest potential for energy savings therefore lies in modernising buildings and heating.

With the modernisation of the residential building stock to improve energy efficiency, and the increasing use of alternative heating methods, it is estimated that up to a quarter of natural gas imports (~2 billion m^3 of natural gas per year) could be replaced. The reduction in residential final energy consumption will be most significant for natural gas consumption, with planned measures **expected to reduce residential natural gas consumption by around 50% between 2016 and 2030** (nearly 2 billion m^3, around 1500ktoe).

Deep renovation of 3% of the central government building stock's the floor space per year is also a strategic goal. In addition, the aim is to achieve **energy savings of around 15-30%** in public buildings.

Objectives related to education
In order to improve the quality of the education system, the **content of vocational training programmes should be adapted to labour market needs**. **Higher education needs to be**

further developed to attract young people and encourage them to study in Hungary. The education system should focus on digitalisation and digital competences, including the training of teachers and students. Education and research should have a stronger focus on sustainability and educational institutions should provide training programmes on the challenges of climate change and energy efficiency. In higher education, investment in innovation, research and development needs to be increased to develop a knowledge-based economy. The education system should also support lifelong learning and the recognition of qualifications in other countries.

National Clean Development Strategy 2020-2050

The final energy mix have to change significantly to **reach the climate neutrality target by 2050**.

Currently the building sector still consumes a significant amount of resources, with a particularly high consumption of materials and energy. However, new technologies could bring significant savings in the future. Green building and insulation materials and new architectural solutions can reduce both material and energy consumption. Clean energy technologies (solar panels, heat pumps), smart solutions for more efficient energy use and advanced lighting and ventilation technologies offer solutions for clean and efficient energy use in the sector. In the longer term, there is also great potential for household-level energy storage solutions.

Today, the use of CO_2 is still limited to a few industries, such as carbamide production and carbonated drinks. Other possible future uses of CO_2 could be in the construction industry (incorporated into building materials).

Decarbonising households will require the phase-out of natural gas (modelled to start in the 2040s, with a reduction in natural gas use) and the deployment of alternative solutions (in particular heat pumps). This is mainly due to the low energy consumption of new buildings as well as the return on investment after renovation as, the savings in energy consumption after renovation can compensate for the cost of the renovation. In terms of fuel mix, the use of firewood is steadily **declining**, **from an initial level of 74 PJ to a few PJ by 2050**. This is because households are switching to more efficient and in the long-term more economical fuels, mainly natural gas. Electricity consumption will decrease due to the expected replacement of household appliances, as new appliances will operate at a significantly lower energy intensity.

Objectives related to education

The document specifically underlines the importance of education and training in addressing climate change, as highlighted also in Article 12 of the Paris Agreement. **Education and training have a key role to play in shaping attitudes towards sustainable development** and related **knowledge should be integrated into curricula at all levels of education**, from primary to tertiary and post-graduate education. These important aspects are already included in the National Curriculum for primary and secondary education, while in higher education, comprehensive and specific sustainability and climate change knowledge adapted to the needs and aspects of the individual specialisations needs to be provided.

Long-Term Renewal Strategy

The strategy was established to meet the eligibility criteria for cohesion funding for the period 2021-2027 under Directive (EU) 2018/844 (hereinafter: HTFS).
The overall objective of the Strategy is to lay the groundwork for achieving a sustainable, energy-efficient and cost-effective domestic building stock by 2050 through energy efficiency, value, comfort and health improvement measures, renewable energy utilisation and smart technologies, reducing national primary energy use and carbon dioxide emissions. This contributes extensively to the objective of significantly reducing the Hungarian energy import dependency and indirectly reinforcing the long-term sustainability of the household savings.

Operational objectives and targets:

- **20% savings in the energy use of the domestic housing stock by 2030,**
- **A 60% reduction in CO_2emissions related to the energy use of buildings by 2040** from the average level in 2018-2020,
- **By 2050, the percentage** of nearly zero-energy buildings should **reach 90%**.

Renovation targets:

- By implementing the measures set out in the strategy, the objective of achieving the renovation rate of 3 % per year for the total residential stock by 2030 can be achieved. This means total energy use in residential buildings and CO_2 emissions shall decrease by approximately 20 %.
- During the same period, the aim is to strengthen the annual renovation rate of the public buildings stock of 5%. If this is achieved gradually, the overall energy consumption of public buildings, as well as CO_2 emissions, can decrease by 18 %.

Objectives related to education

The document includes a specific chapter on the role and importance of higher education in the fight against climate change. It is recommended that **universities and colleges integrate sustainability and climate change issues into their educational programmes** (e.g. medical education, disaster management, economics, engineering, law, etc.). Additionally, that universities and colleges support research and policy making in the field of climate change and provide opportunities for students and researchers to participate in this type of research and projects.

National Energy Strategy 2030, looking ahead to 2040

Quantified targets for 2030 and 2040 for the transformation of the energy sector as a whole:

- **The gas import ratio should be close to 70% by 2030 and below 70% by 2040**.
- **Import less than 20% of** the required electricity.
- **Reduce GHG emissions by at least 40%** compared to 1990.

Labour market objectives:

To improve the labour market conditions in the energy sector, it is necessary to raise the quality of vocational education **by better exploiting the potential of the dual training system**. The number of students in the energy and technical fields needs to be increased through **career guidance programmes**, following an assessment of educational needs and the

identification of knowledge gaps. In particular, company wage increases, and providing a secure vision of the future can play a role in reducing emigration and 'brain drain' from other industries. Intra-country mobility can be encouraged by reducing the tax burden on subsidies facilitating it.

Measures planned for energy-conscious and modern Hungarian homes:

- **Install 1 million smart meters** in the electricity sector.
- **Continuation of smart cost-sharing schemes** in district-heated homes.
- Encourage the installation of solar photovoltaic systems to partially substitute own electricity consumption. The aim is to **have at least 200,000 households with an average of 4 kW of roof-mounted solar panels by 2035.**
- **Encourage the use of heat pumps to** meet the heating and cooling needs of modern buildings and the **combustion of biomass in efficient individual heating systems**.
- Support the **development of energy communities.**

Improving the energy efficiency of residential buildings and modernising their heating/cooling systems is also a useful tool for stimulating the construction industry. The **aim is to transform the stock of private residential buildings into a highly energy-efficient and decarbonised building stock by 2050**. The objective is to cost-effectively convert existing buildings into near-zero energy buildings.

Furthermore, it is estimated that by upgrading the residential building stock to improve energy efficiency, up to a quarter of natural gas imports (2 billion m^3 of natural gas per year) could be replaced.

The report confirms that the strategic goal is to achieve a 3% annual deep renovation o of the central government building stock's floor area, and the energy modernisation of other public buildings, in order to be able to provide customer-friendly and energy-efficient public services. Among the objectives of the energy efficiency innovation programme is the reduction of energy use in the building stock and increase the participation of domestic industry in building energy investments, with a positive impact on employment and economic performance. Building automation and the development and deployment of building monitoring and control systems could be a target area for innovation.

Objectives related to education

Job creation and vocational training for the energy sector, in particular for renewable energy plants is the primary related educational objective. Where is the aim is to **develop and transform energy training** by adapting higher education institutions to the needs of the energy labour market. Cooperation among institutions and professionals both on a national and international scale is essential for more effective and efficient R&D activities. Higher education institutions have an important role to play in promoting energy saving and energy efficiency and can contribute to energy awareness by communicating with students.

National Smart Specialisation Strategy (S3), 2021-2027

Energy, Climate Priority

In the construction and building materials industry. The production and application of advanced product technologies foster significance change in the construction and building materials industry. The energy consumption of old buildings is increasing, so it is essential to modernise them as soon as possible with a focus on energy efficiency. The strategy therefore prioritizes the energy issues of buildings. The construction industry is within the priority areas.

Related objectives:

- Research and dissemination of **solutions for residential energy efficiency through the** widespread use of existing and new methods.
- **Strengthening climate awareness** in society through social innovations (e.g. skills development and smart solutions).
- The strategy **aims to develop and strengthen the smart specialisation of higher education institutions** in Hungary. It highlights the importance of **research and development** in the field of smart technologies and aims to increase the focus of higher education institutions on digitalisation and innovation. Emphasis is placed on cooperation with companies and other organizations, as well as the strengthening of international links through joint research projects and programs. The strategy aims to promote efficient and effective knowledge transfer, building on the mutual benefits of higher education and business, and to **ensure** high quality, **practice-oriented training.**

Second National Climate Change Strategy 2018-2030, looking ahead to 2050

The strategy focuses on the whole supply chain, recognising that the greatest potential for efficiency in Hungary lies in the renovation of buildings.

The set out short, medium and long-term actions:

- The **support schemes to encourage renovation**, should be designed in line with energy savings or CO_2 emission reductions.
- Particular attention should be paid to the renovation of **public buildings, which** are significant for energy efficiency upgrades.
- In the renovation of building services and heating systems, the **integration of renewable energy sources** should be explored, and efforts should be made to **replace fossil fuel-based heating systems**.
- There is a need for a gradual shift towards the construction of smart buildings with near-zero energy consumption, both for new constructions and renovations. This can be achieved by creating the necessary domestic manufacturing and construction infrastructure and strengthening a conscious consumer attitude.
- To mitigate financial risks and ensure the full renewal of the Hungarian building stock, it is important to develop and widely adopt **financial schemes** that facilitate energy efficiency renovations on a market basis.

It is essential to fully integrate climate change as a fundamental consideration in building energy strategies, implementation programs, and regulations. This should take into account decarbonization requirements and the actual impact of climate change.

Objectives related to education

- As part of the strategy, a Partnership for Climate Awareness Action Plan was developed to **coordinate** awareness raising **actions to tackle** climate change and to **strengthen established partnerships.**
- Education-training integration: **climate change and awareness raising on sustainability should be integrated into the education system**.
- This requires a review of the framework curricula, higher education training requirements and teacher training systems.
- In addition, the material in the administrative exams should also be reviewed in terms of sustainability and climate change knowledge. Furthermore, the content of administrative exams should also be reviewed to incorporate knowledge on sustainability and climate change.

National Waste Management Plan 2021-2027

The medium-term strategic objective is to transform the Hungarian waste management sector to become an exemplary model of circular economy in Europe. To achieve this, the **domestic waste management sector needs to be restructured** to a system that treats waste as a raw material. The annual amount of construction and demolition waste generated is closely linked to the development and crisis of the construction sector. When the construction industry has fewer orders, this has an impact on the amount of waste generated. When the construction industry experiences a downturn, it has an impact on the amount of waste generated. However, since the development of the construction sector remains a priority for the national economy, a steady increase in waste generation is expected.

According to the regulation, construction and demolition waste exceeding a certain threshold must be collected separately from other categories of waste categories. The waste collected separately can be utilized by the builder during the construction process, if technically feasible, or handed over to a waste treatment operator. Once the construction activity is completed activity, the main contractor is responsible for declaring on the summary sheet of the construction works logbook whether the quantity of demolition waste generated on the construction site has reached the level required by the relevant regulation. h Additionally, the waste must have been treated in accordance with the requirements and properly removed from the site upon completion of the construction activity.

The plan's objectives for construction and demolition waste:

- **increase the recycling rate** of non-hazardous construction and **demolition waste**, and its energy-efficient recovery,
- **increase recycling**,
- **the recycling rate in the material should increase year by year**,
- support for investments **to promote on-site recovery in** order to continuously increase the processing rate,
- increasing the **possibility for** residents **to drop off construction and demolition waste**,
- all effort should be made to **divert construction and demolition waste from landfill**, to preserve existing landfill capacity as well.

3.1.2 Regulations under development in relation to the implementation of the EPBD and RES Directives

Energy Performance of Buildings Directive (EPBD)

- The first Energy Performance of Buildings Directive (EPBD) entered into force on January 4, 2003, with a 3-year implementation period granted by the Commission. This implementation period was later extended for an additional 3 years. The directive has since been transposed into national legislation. TNM Decree 7/2006 (V.24.) on the regulation of the energy performance of buildings.
- Government Decree 176/2008 (VI.30.) on the certification of the energy performance of buildings.
- Government Decree 264/2008 (XI.6.) on the energy audit of heat generating equipment and air conditioning systems.

The amended EPBD, namely the EPBD "recast" Directive 2010/31/EU, was **transposed into domestic legislation, by** the **TNM Decree 7/2006** and the **Government Decree 176/2008.** These domestic regulations are currently in force.

The next amendment to the EPBD, is the EPBD “recast” Directive 2018/844/EU, which has the following objectives:

- Sets a clear path towards achieving a decarbonized building stock in the EU by 2050**.**
- Prioritises **long-term building renovation strategies**.
- Encourages the use of **information and communication technologies** (ICT) and **smart technologies** (such as automation and control systems) for energy-efficient building operation.
- Introduces the Smart Readiness Indicator (SRI).
- Supports the deployment of **e-mobility** infrastructure (charging points for electric vehicles in new buildings and buildings undergoing major renovation).
- Mobilizes **public and private financing** and investment (aggregation of projects, including investment platforms or groups and consortia of SMEs, enabling access for investors and solution packages for potential clients).
- Renovating old buildings helps to **fight energy poverty** and reduce energy bills.

The EPBD "recast" Directive 2018/844/EU has changed the calculation method and the certification system, according to which a draft decree of the Ministry of Innovation and Technology (hereinafter: ITM) has been prepared in 2020 to replace Decree 7/2006 TNM as well as a draft amendment to Government Decree 176/2008 However, despite the time that has passed, the **appropriate domestic regulations for the implementation of the EPBD "recast" have not been published to this day**.

In accordance with the EPBD recast Directive 2018/844/EU, Government Decree 176/2008 is expected to be amended, and the draft of the Decree - which we are aware of and have made available for public discussion - contains the following changes:

- Change in the **classification** categories.

- In addition to the classification based on aggregated energy performance indicators, there will also be a classification based on specific **carbon dioxide emissions** as shown in Table 1.
- The **energy performance rating of the technical building system** will be introduced, which will encompass the efficiency of the heating system, the domestic hot water system, the cooling and air-conditioning system and the efficiency of installed lighting (Annex 5).

Classification by aggregated energy performance		Specific carbon dioxide emissions classification	
classification	Energy quality (%)	classification	Carbon dioxide emissions (%)
A+++	≤0	A+++	≤0
A++	0<...≤40	A++	0<...≤40
A+	40<...≤70	A+	40<...≤70
A	70<...≤100	A	70<...≤100
B	100<...≤130	B	100<...≤130
C	130<...≤160	C	130<...≤160
D	160<...≤200	D	160<...≤200
E	200<...≤250	E	200<...≤250
F	250<...≤310	F	250<...≤310
G	310<...≤390	G	310<...≤390
H	390<...≤500	H	390<...≤500
I	500<...	I	500<...

1. Table: Planned classification of aggregated energy performance and specific carbon dioxide emissions according to the expected changes of the Government Decree 176/2008

The national regulations corresponding to the EPBD "recast" Directive 2018/844/EU have not yet been published, yet significant progress has been made with the preparation of the next revised draft of the EPBD. This draft document has undergone several public consultations incorporating valuable feedback and multiple modifications. It is anticipated that the revised EPBD will be enacted in 2023, bringing forth a range of ambitious objectives, including:

1. By 2030, all new buildings should be nearly zero energy buildings.
2. From 2030, all new buildings should be zero carbon emission buildings.
3. Existing buildings should have a renovation passport, with the aim of achieving zero emission buildings by 2050.
4. Member States should also be given financial incentives to achieve these ambitious targets.

Use of renewable energies

The origins of EU directives related to the use of renewable energy can be traced back to the 1990s. The first step towards EU regulation was the White Paper[10] in 1997, which set a target of generating 12% of energy consumption from renewable energy sources by 2010. Subsequently, the 2001/77/EC Directive, which was later repealed in 2009, included specific targets for Member States. Directive 2009/28/EC (hereafter RED I) came into force, requiring a 20% share of renewable energy in the EU's total energy consumption by 2020. RED I marks

[10] COM(1997)599 final,

the first milestone achieving the goal of 55% greenhouse gas emission reductions by 2030[11]. Directive 2018/2001/EU (hereafter RED II) replaced RED I and entered into force on 24 December 2018.

The Directive promoting the use of energy produced from renewable sources is part of the "Clean Energy for All Europeans" package[12], along with other relevant directives. Its aim is to establish new comprehensive regulations in the energy sector by 2030.

The Directive 2018/2001/EU, also known as RED II, establishes a common framework for promoting energy from renewable sources in various sectors. The objectives of this directive are:

- defining a mandatory EU target for 2030,
- regulating self-consumption,
- developing a common set of rules for the use of renewable energy in the electricity, heating and cooling as well as transport sectors.

On April 23, 2021, the Office of the National Assembly published the summary document titled **"Regulation of renewable energy use".** Hungary's objective, according to the National Energy and Climate Plan (NECP), is to achieve a 21% share of renewables within the gross final energy consumption by 2030.

According to RED II, the European Union aims **to cover at least 32% of its total gross energy consumption** (excluding the transportation sector) from renewable sources **by 2030**. The European Green Deal[13] established to address climate and environmental challenges, emphasizes the vital role of renewable energy sources in clean energy transition.

Construction Act

The primary legislation governing the construction sector is the Construction Act, officially known as the **Act on the Formation and Protection of the Built Environment** (Act LXXVIII of 1997). This establishes the fundamental requirements, tools, rights, obligations, and responsibilities of authorities involved in the forming and protection of the built environment. It serves as the basis for the regulation of construction, buildings, and building products. The Construction Act, similarly, to other legislation, outlines the key and overarching rules. Specifically, it states that building products can only be designed or incorporated into buildings if they meet the basic requirements for buildings [Article 41(1)].

Furthermore, the Act assigns the minister responsible for the building industry with tasks related to determining the energy performance of buildings and energy certification within their jurisdiction [Article 5(1c)a]. It defines the concept of an Energy Performance Certificate [Article 2(20)], and sets out the fundamental conditions for energy certification, and regulates the registration of certifiers [Article 38/C, Article 58]

[11] COM(2020) 952 final
[12] COM(2016) 860 final,
[13] COM(2019) 640 final

National Urban Planning and Building Requirements (OTÉK)

In the field of construction, the other important legislation is the National Spatial Planning and Building Requirements (hereinafter: OTÉK), namely **Government Decree 253/1997 (XII. 20.) on the national spatial planning and building requirements.** This regulation provides guidelines on the range of buildings and structures that can be placed in areas, the conditions for land development and placement of structures within plots, requirements for the placement of structures and access to utilities, conditions for the construction of structures and building elements, and regulations for existing buildings**.**

The decree defines the concept of **renewable energy sources** in the section on Definitions: energy derived from renewable, non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal energy, water energy, energy derived from biomass, gases produced in waste disposal sites and wastewater treatment plants.

The definition of **Life Cycle** can also be found in the Definitions section: the entirety of successive stages of materials and structures from raw material acquisition or production from natural resources to final disposal.

As mentioned earlier, the highest level of legislation, namely the law, specifies the conditions for incorporating construction products into structures. However, due to the general nature of the law, it only formulates the rules in a general sense. The OTÉK, being a government decree, provides detailed regulations on the basic requirements that buildings must meet according to their intended purpose [Section 50 (3) a)-h)]. These requirements include **energy efficiency, thermal insulation**, and **sustainable use of natural resources**. The decree also stipulates that buildings must be designed and constructed in a way that allows for the installation or connection of **renewable energy sources** without significant disruption to the structure.

In addition to the enumeration, the decree also provides detailed explanations of each requirement:

- **Energy saving** and thermal protection

The structure and its components must be designed and implemented in a way that minimizes energy consumption required for intended and safe use. The selection and incorporation of construction products should aim to achieve the lowest possible energy consumption. The possibility of utilizing **renewable energy sources** must be considered in the design program in all cases [56. §]

- **Sustainable use of** natural resources

The design, construction and demolition of the building and its components shall aim at rational use of energy, energy recovery and the use of **energy from renewable sources**, energy efficient operation of building services and **life cycle** assessment. [56/B. §]

It is important to mention that the Hungarian legislation is closely linked to a highly significant European Union legislation in the field of construction, namely **Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products and repealing Council Directive**

89/106/EEC (hereinafter: CPR). Annex I of the CPR sets out the seven essential requirements for structures, which have been adopted by the OTÉK and supplemented with the requirements for life and property protection.

The OTÉK also includes several other provisions that are important for **energy efficiency** and the **utilization of renewable energy:**

- The building must be installed within the site in a way that allows for the later installation of energy-efficient building parts and building services equipment within the construction site . [34. § (4)]
- In the absence of a public energy supply or with the authorized replacement of such supply, modern and professional utility replacement systems can be applied using **renewable energy sources** [§ 47/A (1)].

Energy Efficiency Act

The legislator considers energy efficiency such an important area that it is regulated by the highest level and strongest legal source since 2015, namely **Act LVII on Energy Efficiency,** which also deals with renewable energy, stating that the Hungarian Chamber of Engineers shall provide free energy audits to businesses and monitor the energy savings achieved as a result of the audits. It encourages small and medium-sized enterprises to conduct energy audits and implement the recommendations of the audits. Free energy audits are also provided to the general public and the resulting energy savings are monitored. Information is provided on available energy efficiency grants and information on energy performance certificates under the Government Decree on the certification of the energy performance of buildings, including their purpose and objectives. The law also promotes **renewable energy use and highly energy-efficient solutions** through cost-effective measures. Within the framework of renovation advice, it facilitates the improvement of building energy efficiency and the increase of renewable energy use through financial instruments. Additionally, it encourages the replacement of boilers operating with fossil fuels with more sustainable alternatives based on renewable energy, waste heat, or waste cooling energy. [§ 21 (4)].

The implementing regulation of the Act, namely **Government Decree 122/2015 (V.26) on the implementation of the Energy Efficiency Act,** stipulates that the energy audits should encompass the identification and analysis of cost-effective energy use methods, the potential for utilizing **renewable energy sources**, and the presentation of advanced operating procedures and possible new equipment [§ 13 (4) d)].

In the National Energy and Climate Plan adopted in 2020, Hungary set a target to achieve approximately 7 PJ energy savings annually. To achieve this the **Energy Efficiency Obligation Scheme (hereinafter: EKR)** was introduced in 2021. This market-based mechanism obliges designated actors in the energy market such as electricity and gas traders, service providers to achieve a specified and verified level of energy savings among end-users in proportion to their energy sales. The Hungarian Energy and Public Utility Regulatory Authority is responsible for the management and control of the system.

Definition of the energy performance of buildings (TNM Regulation)

The **minimum requirements for the energy performance of buildings** in Hungary are regulated by the **Ministry without portfolio Decree No. 7/2006. (V.24.) on the determination of buildings' energy performance.** The requirements must be complied with for all new buildings, as well as for energy-saving renovations, which are subject to certain requirements. The requirements have gradually become more stringent in recent years, and currently, for new buildings, there is a level in force that pertains to nearly zero-energy buildings. There are six types of requirements to be met:

1. **The heat transfer coefficient requirement** specifies the degree of insulation required for different building envelope structures, such as external walls, roofs, or basement ceilings. Typical heat transfer coefficients are around 0,17 - 0,24 W/m ^{2}K.

2. The **specific heat loss coefficient** indicates the energy performance of the building itself without the building services systems. It includes the heat loss from all envelope's structures and the solar gain from incident solar radiation in winter. The shape, size and orientation of the building is also taken into account. An average, relatively well oriented and compact building can typically meet this requirement with minimum insulation thicknesses. However, additional insulation may be required for buildings with complex layout or unfavourable orientation.

3. The **overall energy performance indicator** describes the energy consumption of the building, taking into account heating, hot water production, cooling if applicable, and mechanical ventilation, but excluding the energy demand of domestic appliances, machinery and lighting in the case of residential buildings. This indicator is given **in terms of** so-called **non-renewable primary energy**, which also takes into account the efficiency of energy conversion, which is why in Hungary, for example, electricity weighs 2.5 times more than natural gas. For nearly zero-energy buildings, the maximum requirement for primary energy consumption is 100 kWh/m2year.

4. The **indicator for summer overheating** describes the risk of overheating of the building. The requirement can typically be met with good external shading and night ventilation of the building.

5. The **specifications for the technical building system shall** specify the expected quality of the system elements, such as the type of boiler to be installed, control and regulation requirements.

6. According to the requirement for the **minimum share of renewable energy, at least 25%** of renewable energy sources must be used in the building. This requirement can typically be fulfilled with a heat pump or biomass boiler for heating, and in many cases, district heating is also suitable. For gas heating, the installation of solar panels or solar collectors is necessary. According to the recent regulations, the renewable energy requirement can also be fulfilled through alternative means with increased energy efficiency if the options for renewable energy utilization are limited. In such cases, the maximum value for the overall energy performance indicator can be 76 kWh/m2year. For example, in densely built areas, solar energy utilization or biomass heating may be

limited or not possible, but energy efficiency can be improved through heat recovery mechanical ventilation and enhanced insulation.

Compliance with the requirements must be ensured by the architect and the building services engineer. Energy calculations must also be performed for the building. Based on these calculations, an **energy performance certificate** must be issued at the occupancy stage, providing the energy performance classification of the building. Nearly zero energy buildings are classified as BB category or higher.

For existing buildings undergoing energy-saving renovations or expansions, the requirements depend on the extent of the intervention. If **the renovation is "major"**, meaning that it affects at least 25% of the total surface area of the building envelope (e.g. typically the entire façade is insulated), or if **the extension is "substantial"**, i.e. the extension exceeds the floor area of the building to be extended, then several requirements must be met. In addition to complying with the thermal transmittance requirement for the affected structures and the requirements for new building services systems, the specific heat loss coefficient for the entire building and the overall energy performance indicator must also be met. However, these requirements are less stringent than for new buildings. These regulations encourage comprehensive deep renovations, which involve implementing multiple renovation measures together, leading to significantly greater energy savings. There is no obligation for **renewable energy utilization** in renovations, but it is expected that renovated buildings reaching the **nearly zero-energy** level will be favoured when applying for grants and support. [14] The expected change to the decree is detailed in Chapter 3.1.4.

Certification of the energy performance of buildings

The certification is governed by **Government Decree 176/2008 (VI. 30.) on the certification of the energy performance of buildings.** It specifies in detail the rules for certification, the content requirements of the certificate, provisions regarding the certifier as well as the quality control of the certificate. The decree specifies that the certificate may indicate the **renewable energy** use [§ 3 (6)] and may contain additional information on the quantity of renewable energy use [§ 7 (2)]. In all cases where renewable energy equipment is used, the supporting documentation shall include a photograph of these systems. The expected changes related to the decree are explained in more detail in Chapter 3.1.4

3.1.3 Provisions for buildings in the National Recovery and Resilience Plan

The National Recovery and Resilience Plan (NRRP) is an EU approved plan, developed in consultation with the European Commission, with the aim of **mitigating the social and economic impacts of the coronavirus pandemic** and making the Hungarian economy and society more sustainable and resilient by preparing Hungary for the **green and digital transition.**

[14]IS-SusCon project: spreading innovative solutions for sustainable construction, Handbook. Available:www.howtobuildgreen.eu/hu/tudastar

The chapter on Reforms consists of the following sub-chapters, of which the ones highlighted in bold will be presented in more detail below, based on their relevance:

Component A: Demography and public education
Component B: A highly skilled and competitive workforce
Component C: Catching up settlements
Component D: Water management
Component E: Sustainable and environmentally friendly transport
Component F: Energy - green transition
Component G: Transition to a circular economy
Component H: Health
Component I: Governance and public administration

The first two components (A and B) are significant because they confirm that the infrastructure associated with these components (practically educational buildings) are required to have the energy performance indicators in force for the corresponding planned renovations and new buildings. This is particularly important because these buildings serve both to provide a healthy, balanced and clean environment and are of particular importance for the provision of information on energy efficiency, because of their exemplary value and their role in raising awareness.

Component C: Catching up settlements
The Catching-up municipalities component is relevant to the project objectives in several respects. On the one hand, energy and building renovation programmes will be (or are already) dedicated to the municipalities concerned, which will create demand for those involved in the construction industry, especially design and construction companies. Furthermore, given the current specificity of the catching-up municipalities, a pool of people who can be attracted to the labour market and whose training can be adapted to the corresponding market demand is still available here. The mobility of people living in these settlements will be facilitated by infrastructure and transport programmes (optimisation of public transport).

The C component contains the following initiatives:

- Renewable energy production: mainly **the installation of solar energy capacities** and their supply to the settlements, greening the energy mix (at least 1 room heated by electricity);
- building renovations: **modernising existing buildings and increasing their energy efficiency**, and constructing new buildings to promote mobility;
- training and retraining of the population: based on labour market and national economic aspects, especially **training for the unemployed and women, providing local and regional job opportunities**.
-

Programmes will involve the necessary stakeholders, from relevant independent organisations to market actors and decision-makers, to ensure that all aspects of the programmes are covered and, where necessary, experts are involved in consultations and the development of implementation plans.

The programmes are already operational in some catching-up municipalities and their experience will be used in further projects. Tables 2 and 3 present examples of social housing construction and renovation, as well as measures for pedagogical and professional development in vocational training institutions.

Activity	2021	2022	2023	2024	2025	2026
Adoption of an intervention plan based on housing diagnoses for the municipalities involved		1 plan				
Renovation of social housing				800 pcs		1600 pcs
Construction of social housing				200 pcs		400 pcs

2. Table: Building renovation schedule (Source: NRRP)

Activity	2021	2022	2023	2024	2025	2026
Development of public education and vocational training institutions in selected municipalities			40 pcs			100 pcs

3. Table: Timeline for the development of training services (Source: NRRP)

Component F: Energy - green transition

One of the highlights of the component, which mainly concerns the energy modernisation of domestic private buildings, is the creation of about 175 MW of new installed renewable energy generation capacity through small-scale household power plants (<50 kW) and the provision of heating retrofit for households at risk of energy poverty. The measures under this component as a whole will contribute to the green transition and to the achievement of the Hungarian climate neutrality objective by 2050, in numerical terms reducing annual GHG emissions from the energy sector by about 49 720 tonnes per year.

Planned reforms that indirectly affect the residential sector and the industrial stakeholders (designers, contractors):

- Facilitating investment in wind energy.
- Increasing the effectiveness of energy efficiency programmes: requiring a 30% reduction in energy consumption for subsidised building renovations.

Planned investments within the scope of the component:

- Developing the electricity grid to increase the renewable generation capacity that can be connected to the grid.
- Support for residential solar PV upgrades and heating modernisation: increasing the renewable energy production capacity and energy efficiency of 35,000 households.
- Installation of grid energy storage at transmission and distribution licensee companies, energy market operators.
- Spreading smart metering.

The development of multi-stakeholder, multi-directional, active consumers and decentralised electricity generation, which will result from the implementation of the component (and the corresponding NEKT), requires a comprehensive knowledge and quality of work from the

design and construction professionals (electricians, refrigeration, air conditioning and heat pump installers, building services and building automation). The component can thus indirectly raise expectations for adult education and vocational training.

The social impact of the Hungarian NRRP specifically mentions: "The main social impact of the component is the reduction of GHG emissions by the previously indicated amount and the replacement of the outdated heating system in at least 11 600 households, thereby reducing the resulting air pollution (e.g. particulate matter, sulphur dioxide)."

In addition, the socio-economic impact mentioned by the National Clean Development Strategy is: "the potential to create around 38-41 thousand jobs by 2050. The employment-enhancing impact of investments from this component is estimated at around 500 people." The planned timetable for the objective referred to in the component (Table 4 and 5):

	2023 Q3	2024 Q3	2025 Q3	2026 Q3
Surplus of electricity generating power plant, potentially connected to the electricity grid utilizing a weather-dependent renewable energy source, MW	119	772	1 749	2 925

4. Table: Evolution of excess grid-connected electricity generation capacity 2023-2026. (Source: NRRP)

	2024 Q3	2025 Q3	2026 Q3
number of households with solar system and/or heating modernization	13 793	23 320	34 920

5. Table: Evolution of the number of households with PV heating modernisation 2024-2026. (Source: NRRP)

3.1.4 Expected changes in the regulatory framework

In Hungary, legislation on construction and the economy is constantly changing. An example of this is the Act LXXVIII of 1997 **on the Formation and Protection of the Built Environment** which became effective on January 1, 2023, but there are already draft amendments scheduled to come into force on February 1, 2024, and January 1, 2025. The planned modifications to the Act mainly concern procedural and registration rules.

An important piece of building legislation, the Government Decree 253/1997 (XII. 20.) **on the National Urban Planning and Building Requirements (OTÉK)** (see Chapter 4.1.3.) will also undergo changes on January 1, 2025, concerning parking regulations. It should be noted that the upcoming architectural law mentioned below is also expected to bring changes to the OTÉK; however, the precise details of these modifications are not yet known.

Encouragingly, two other significant regulations in the construction sector, the Government Decree No.191/2009 (IX. 15.) **on Construction Executing Activities**, and the Government Decree No.312/2012 (XI. 8.) **on Procedures and Inspections of Construction and Building Supervision Authorities and on the Construction Authority** Services are currently in effect The former has been effective since June 15, 2022, while the latter has been in effect since

January 1, 2023, and there is currently no information regarding any planned amendments to these regulations.

On May 25, 2023, the Government Decree 200/2023 (May 25) was published, which pertains to the modifications of certain government decrees related to building regulations. It specifically focuses on energy performance requirements for buildings. Additionally, the Government Decree 9/2023 (May 25) on the Determination of the Energy Performance of Buildings was also issued. The latter will replace the Government Decree 7/2006 (V. 24) on the Determination of the Energy Performance of Buildings. Both decrees will come into effect on November 1, 2023.

At the time of preparing this assessment study, the details of the planned amendments to the **Construction Act in 2025** are not known. However, it can be stated that the government is preparing for a more comprehensive overhaul of the legal regulations in the construction industry.

The concept of **the Hungarian Architecture Act is** currently being discussed in a broad social consultation between professional stakeholders and interested citizens from almost all levels of society, in line with the role of architecture in the society. The new law is expected to significantly transform the regulatory framework by introducing an administrative acknowledgment procedure instead of a simple notification, reinstating regulatory oversight. The role of planning councils will change, and green areas within settlements may receive protection. It is delightful to note that the circular economy is expected to play an important role: "Construction products will be traceable based on the product database, from BIM planning through transportation and installation to the end of the entire life cycle. Energy efficiency will be a goal from manufacturing to building energy performance and carbon emissions, with the aim of making the carbon footprint visible by 2030."

The other significant legislation in the area, the draft **Law on the Regulation of State Construction Investments,** was submitted to Parliament on April 19, 2023. The specific provisions of the draft are currently under further discussion and consultation.

According to the draft published in January this year, changes in the digitalisation of the construction industry in Hungary are expected in the coming years (at least for projects reaching the EU public procurement threshold). To implement these regulations, it will require not only BIM modelers and managers but also other stakeholders in the construction industry to familiarize themselves with digitalization, specifically with BIM. The demand for implementation will generate a "skill demand," and the skill demand will lead to a "training demand." Although there are currently a few training programs directly related to construction industry digitalization (ranging from technical schools to specialized continuing education and master's programs), there is expected to be a significant increase in the number of participants in these training programs in 2-3 years.

Summary

In summary, the aim of building energy policies for higher education is to **align training programmes to labour market needs in order to improve the quality of the education system**. A **stronger sustainability approach** in education and research **is needed** and

educational institutions should provide training on climate change challenges and energy efficiency. It should be stressed that the education system should support lifelong learning and the recognition of qualifications in other countries. The development of training aims to enable higher education institutions to meet the demands of the energy industry job market and equip students with knowledge and skills that can be applied in practice. Despite all these objectives, the national legislation in compliance with the EPBD "recast" Directive 2018/844/EU has not yet been published.
Interviews conducted with professionals of the construction sector concluded that **the constant** change in the **legislative environment is** a recurrent and significant problem.

3.2 Legal environment for vocational education and training

Before presenting the legal environment of vocational training, the European Qualifications Framework, which forms the basis of the Hungarian education and training structure will be introduced. Due to the changing legislation and terminology, it is necessary to define the basic terms used in this Status Qua Analysis, which are presented in the Glossary.

3.2.1 Implementation of the European Qualifications Framework in the construction sector

The **European Qualifications Framework for** lifelong learning (hereinafter: EQF) aims to create transparency, comparability and portability of qualifications acquired in different countries.

"Qualifications express what people know, understand and are able to do ('learning outcomes')". Qualifications are recognised in the form of a certificate, diploma or degree. Based on learning outcomes, qualifications are **classified into eight levels** and the **learning outcomes** associated with each level are defined in **three areas**: 1) knowledge; 2) skills; 3) responsibility and autonomy.

The Hungarian Qualifications Framework (hereinafter: HuQF) based on the EQF system adopted in Hungary in 2012, and it was officially recognised by the European Commission in 2015. The recognition includes the alignment of classified qualifications and the correlation between the HuQF and the EQF. As a result, qualifications classified within the HuQF now indicate both the HuQF level and the corresponding EQF level, as mandated by legislation in the field of higher education and vocational training. (see Chapter 5 for further details).

The level descriptors of the **Hungarian Qualifications Framework** in the areas of knowledge, skills, attitudes, responsibility and autonomy are set out in the Annex to Government Decision 1229/2012 (VII.6). The detailed expected learning outcomes assigned to each level can be found in Annex 5.

HuQF levels	Training outputs
1	▪ completed 6th grade ▪ professional qualifications / vocational qualifications in adult education
2	▪ completed 8th grade ▪ basic partial qualification ▪ basic vocational qualification ▪ professional qualifications / vocational qualifications in adult education ▪ vocational school qualification in special skills ▪ part-time - intermediate vocational qualification
3	▪ completed 10th grade ▪ lower secondary part-qualification ▪ lower secondary qualification ▪ lower secondary qualification-training ▪ professional qualifications / vocational qualifications in adult education ▪ sub-profession - intermediate qualification
4	▪ school leaving certificate (completed grade 12) ▪ secondary vocational qualification ▪ secondary vocational qualification-training ▪ upper secondary part-qualification ▪ upper secondary vocational qualification ▪ professional qualifications / vocational qualifications in adult education ▪ vocational school qualification in special skills ▪ profession - secondary vocational qualification
5	▪ upper secondary vocational qualification ▪ higher level qualification ▪ advanced level qualification-training ▪ professional qualifications / vocational qualifications in adult education ▪ tertiary level vocational qualification ▪ technician qualification
6	▪ a qualification linked to higher education ▪ Bachelor's degree in higher education (BA/BSc) ▪ higher vocational education and training (BSc/BA degree) ▪ Master's degree from the Chamber ▪ professional qualifications / vocational qualifications in adult education
7	▪ Master's degree in higher education (MA/MSc) ▪ higher vocational qualification (MSc/MA degree)
8	▪ doctorate (PhD/DLA)

6. Table: Training outcomes according to the levels of the HuQF

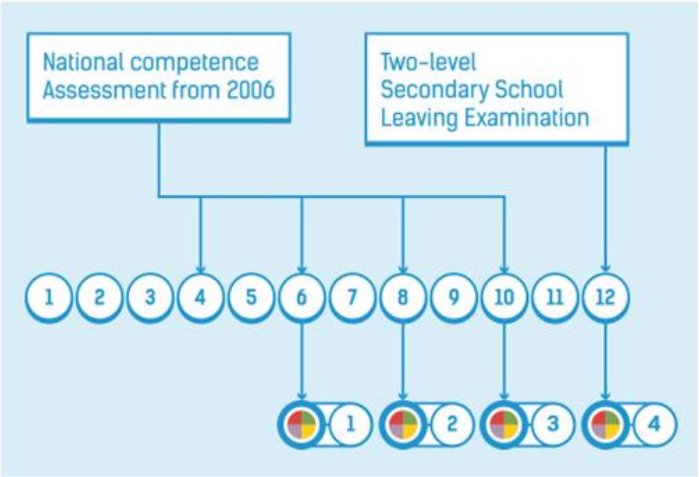
The **4 subsystems of the** Hungarian **education system (Table 6)** and their institutions:

- Public education (HuQF levels 1-4): nursery school; primary school; upper secondary school, vocational upper secondary school, vocational school and skill development school.
- Vocational education (HuQF levels 3-5): technicum and vocational school.
- Higher education (HuQF levels 6-8): university and college.
- Adult education (HuQF 1-8)

The laws governing the Hungarian education system:

- Public education: Act CXC of 2011 on National Public Education
- Vocational education and training: regulated by Act LXXX of 2019 on Vocational Education and Training.
- Higher education: Act CCIV of 2011 on National Higher Education and Government Decree 139/2015 (9.VI.)
- Adult education: Act LXXVII of 2013 on Adult Education

In Hungary, children **required to attend school compulsorily** (Figure 6) **until the end of their 16th year**, which means that after 3 years of kindergarten, they continue their education within the school system for at least 10 more years.



6. Figure: Correlation between years of compulsory education in Hungary (white circle) and the levels of the EQF/HuQF (coloured circle) (source: https://www.magyarkepesites.hu/pub_bin/HuQF_referencing_report.pdf)

Vocational training

Vocational education and training prepare individuals for occupations or activities that do not require tertiary level qualifications. It includes both basic vocational education and specialized vocational education and training for a specific profession, which is regulated by the Vocational Education and Training Act.

The vocational education and training system undergone significantly changes as of September 1, 2020. The new training structure consist of a range of vocational **qualifications that** can be obtained through vocational education and training institutions (VET) as well as a set of vocational **qualifications** that can be acquired through vocational training offered by VET institutions or adult education and training (adult education) programs. The range of vocational qualifications which may be obtained through vocational training is not laid down in legislation. Vocational training can be initiated on the basis of a Programme Requirement registered by the Minister.

The new vocational education and training system offers students a choice of **174 basic vocational pathways.** These basic professions will be acquired **through school-based training.** VET students obtain a state-recognised upper secondary education qualification and a vocational qualification upon successful completion of a vocational examination at an accredited examination centre. Vocational training is provided in two types of institutions:

- vocational school: 3 years of training: 1 year of basic sectoral education + 2 years of specialised education: vocational certificate (MKKR level 4);
- technicum school: 5 years of training: 2 years of basic sectoral education + 3 years of specialised education: technician diploma with baccalaureate (MKKR level 5).[15]

Higher education

Based on the Act CCIV of 2011 on National Higher Education, Government Decree 139/2015 (VI.9) define the MKKR level of further vocational training, higher education vocational training and the corresponding qualifications. It also outlines the bachelor's degree programmes and qualifications that can be obtained through them, as well as the master's degree programmes and qualifications that can be obtained through them. Additionally, it contains split training programmes.

At universities and colleges, undergraduate studies (BSc) typically last for 7-8 semesters, while graduate studies (MSc) usually span 3-4 semesters. For more detailed information on the available programs and their duration in Hungary please see Chapter 5.1.2.

3.2.2 The Digital Competence Framework

In 2019, the Hungarian Government approved the Government Decision titled " On the Development and Implementation Steps of the Digital Competence Framework" submitted by the former Ministry of Innovation and Technology, which fosters the **establishment of a Hungarian digital competence framework based on the** European Digital Competence Framework for Citizens (DigComp 2.1.). The Hungarian system, called DigComp, is a unified framework that enables the definition, development, assessment and validation of digital competence, as well as their recognition by the state.

According to the decision, the **concept of the DigKomp System has been developed**, which includes the DigKomp Citizenship Digital Competence Framework. The competence framework consists of **five competence areas**, with a total of 21 competence elements associated with them:

1. Information and data management
2. Communication and cooperation
3. Creating digital content
4. Security
5. Handling of specific issues

Eight proficiency levels can be assigned to each competence area:

- Basic level 1-2;
- Intermediate level 3-4;
- Advanced level 5-6;
- Master level 7-8.

[15] *Source: szakkepzes.ikk.hu and https://far.nive.hu/*

Level 1 indicates that the user can handle simple tasks and processes with guidance, solve simple problems and remember these steps, while the highest (master) level at level 8 signifies that the user is capable of independently solving complex, multifactorial problems integrating new ideas and processes into the procedures of the given domain and creating solutions for them.[16] Vocational school occupations are generally at level 4, while technicum occupations are at level 5-6.

3.2.3 Regulatory and strategic framework

Vocational Training 4.0

The foundation of the Hungarian vocational training and adult education system is the ***Vocational Education and Training 4.0: the*** *medium-term policy strategy for the renewal of vocational education and training and adult education, responses of the VET system to the challenges of the fourth industrial revolution*, which was approved by the **Government Decision No.1168/2019 (III.28).**

The Hungarian government has undertaken significant efforts in recent times to transform Hungary into aa more work-based society. To achieve this objective, it is placing particular emphasis on vocational education within secondary education, based on broad social consultation. The extremely rapid and dynamic changes occurring in various industries and technologies necessitates that young individuals entering the labour market acquire new knowledge, competences and skills. Thus, vocational education and training must provide a solid basis and up-to-date content to meet these demands.

An important feature of industrial development is the **increasing prominence of digitalisation and automation**, which is expected to reshape to the labour market. The demand for low-skilled jobs is projected to decline, while **new job opportunities and occupations will emerge, placing greater value on specific skills**. At the same time, as employment rates rise, labour supply is shrinking, making it imperative for vocational education and training to address the significant skills gaps and enhance the productivity and effectiveness of existing workers to sustain economic growth.[17]

The new vocational education and training system should provide a solid foundation of skills and key competences, while being flexible and interoperable, opening the way for students to higher education and the labour market, and for adult learners to acquire the new skills they need in an easy and efficient way.

VET 4.0 set out a comprehensive package of measures for the renewal of the vocational education and training system, including among others a **high level of alignment between the requirements of a competitive economy and the vocational education and training system**, the **development of digital skills**, the **development of sectoral basic training**, the **strengthening of dual training with the participation of SMEs**, the **more coordinated operation of career guidance**, as well as the **development of infrastructure and tools**.

[16] Source: https://digitalisjoletprogram.hu/hu/tartalom/digkomp

[17] https://tka.hu/hir/16058/digitalizacio-a-szakmai-kovetelmenyekben-digitalis-kovetelmenyek-pontositasa-a-szakmak-kkk-jaban

Transition in higher education

The higher education strategy was initially adopted in 2014 and updated in 2016 titled "Transition in higher education: Medium-term policy strategy - 2016" taking into account the changes between 2014 and 2016, and setting out the current situation specifying the refined objectives.

In summary, the objectives pertaining to higher education revolve around the vision of a **knowledge-based society**, where the economy is driven by an increasing share of domestic production and organised by an innovation network around higher education institutions. It is crucial to recognize that the future of higher education necessitates a mindset that embraces renewal meaning that the knowledge acquired at the outset of one's career cannot sustain lifelong without a commitment to **continuous learning and ongoing performance improvement.**

In the field of technical education **dual higher education courses** were launched in the academic year 2015/2016 in the fields of engineering, IT, agriculture and economics, in cooperation with higher education institutions and their partner companies and other organisations. Subsequently, the range of offerings expanded significantly.

The strategy emphasizes the **significant skills gaps in science, technology and information technology education** underlining the importance of attracting and preparing students with the necessary skills and knowledge for admission and success. This process should begin in secondary school to ensure an adequate supply of new talent.

Regarding **technical education,** the document points out the impact of **rapid technological advancements** which result in significant changes in subject matter every few years. Therefore, curricula and subjects **need to be revised every few years and updated if necessary.** To this end, **closer collaboration between potential employers and higher education institutions is necessary.** Students should be prepared during their studies to work with tools and technologies that may not have existed during their studies but will be integral to their careers. They will acquire the necessary knowledge and competences in science and in the basic vocational subjects.

Objectives and actions in the field of technical training:

- Reform **the structure of bachelor and master programmes:**
  - for bachelor programs, the transformation of the training content includes the elimination of the initial exclusivity of basic vocational subjects and a more even distribution within the curriculum;
  - further enhancement of the coherence of the bachelor's and master's programmes in the revision of curricula.
- **Establishing new partnership and regulating the collaboration between higher education institutions and companies employing graduates**:
  - Develop new regulations to encourage partnerships between companies and higher education institutions.
  - Development and extension of dual training system. Involvement of new business partners. Refining the structure and content of training, based on

previous years" experience and improving the organisation of training. Continuous quality control of existing dual training.
    - Elaboration the details of the involvement of practitioners in education: determining the extent of their participation and knowledge transfer they can provide to support higher education. Consideration of this involvement during the accreditation process by the Hungarian Accreditation Committee (MAB) to ensure the adequacy of the programs.
    - Developing and implementing an effective, mandatory continuing training system for graduates in the technical field.
- **Increase the effectiveness of teaching methods in** the technical field. Reduce the number of contact hours per week, while increasing the proportion of independent work.
- **Facilitate** participation in training in foreign languages, exchange programmes and **mobility**.
- **Encourage** and support **the launch of Master's courses in foreign languages** (mainly English) and/or correspondence **courses**.
- **Developing** regulations that consider the specialities of **interdisciplinary courses**.

The higher education institution, either independently or in collaboration with other higher education institutions, operates **a system of talent management and catch-up, as well as mentoring programmes,** such as academic student circles and professional colleges.

Framework strategy for lifelong learning policy 2014-2020

In 2014, the Hungarian National Social Inclusion Strategy II, the **Lifelong Learning Policy Framework Strategy**, the **Public Education Development Strategy** and the **Medium-Term Strategy against early school leaving without qualifications** were adopted. The EU's Europe 2020 strategy aims to increase school enrolment, promote early childhood education participation and reduce early school leaving without qualifications. The associated Action Plan outlines 65 actions for lifelong learning, developed through sectoral cooperation and ministerial proposals. The strategy was renewed in 2023 under the title of the ***National Social Inclusion Strategy 2030***, which incorporates the strategy for the development of public education. It focuses on ensuring consistent quality in education, strengthening the socialisation role of education, restoring the prestige of the teaching profession, promoting full employment, reversing demographic trends and fostering social inclusion.

Summary

The existing regulatory and strategic framework, specifically the Transition in Higher Education strategy addresses higher education with a particular emphasis on the technical field. However, it does not address green skills or set targets in the field of energy efficiency.

3.3 The need for incorporating new knowledge into legislation

To foster a modern and energy-efficient construction industry, it is necessary to integrate in legislation the knowledge and new technologies that reflect the current challenges. Achieving carbon neutrality can significantly rely on the integration of digitalisation, smart buildings and communities, circularity as well as consistent incorporation of green public procurement into strategic documents and legislation.

3.3.1 Digitalisation of the construction industry

There has been a notable shift towards accelerated digitalisation in the year 2020 in the Hungarian construction industry. Previously, the adoption of new technologies and innovations progressed slowly, despite the sector's continuous search for innovative approaches. Despite improvements in the construction industry's innovation potential, there are no Hungarian construction companies ranked among the EU's top 1000 most innovative companies indicating the need for significant development in our innovation capabilities.

The adaptation of foreign innovation practices has accelerated in areas such as integrated information systems, **Building Information Modelling** (BIM) and other digitalisation. BIM is gaining increasing significance as it provides a structured and systematic information platform that enhances collaboration among all stakeholders in the sector. A high level of integration of technology will be needed in the future.

The labour market survey[18] conducted by the National Federation of Hungarian Building Contractors (hereinafter: ÉVOSZ) also confirms that the COVID-19 epidemic has positive effects on the construction industry, **accelerating its digitalisation.** According to the surveyed companies, this situation also represents an opportunity for renewal in a difficult market. It contributes to a faster uptake of innovative solutions and to the upgrading of skilled workers and engineering skills, highlighting the knowledge-intensive nature of the construction sector. It also provides opportunity for businesses to reconsider how they can leverage digital technology to enhance their flexibility. Integrated data systems will be crucial in the digital age of construction, for enhancing business agility, facilitation efficient information flows and increasing productivity.

Technological advances are also transforming the construction industry, requiring **high levels of technological knowledge and digital skills** even at the lowest level. Technologies and processes based on robotisation, automation, virtual reality and augmented reality, the reduction of the environmental impact of buildings through LCA-based BIM integration, advanced investment management, energy-efficient technologies, materials and supporting

[18] ÉVOSZ: Survey on the impact of COVID-19 on the construction market, May 2021 https://evosz.hu/data/dokument/cikk1372.pdf / download date: 11.06.2023.
ÉVOSZ: "Opportunities for intensive capacity building of the construction workforce", Final Research Report 2021, GINOP-5.3.5-18-2018-00041
https://evosz.hu/data/dokument/cikk1373_HU.pdf / download date: 11.06.2023.

services all require competences that can only be met by a flexible, knowledge-based sector and economy.

In recent years, several strategies, proposals and laws have been introduced to address the digitalisation of the construction industry. Although these initiatives may not respond to all challenges faced by the construction industry, they aim to support the widespread adoption and effective use of digitalisation and digital tools. Three notable government documents are cited below:

1. the bill on **the regulation of public works**[19] , currently awaiting parliamentary approval which aims to monitor BIM-supported projects (paragraphs 11 and 36 below);
2. the **National Sustainable Construction Strategy**, which includes a measure (Table 7) to promote digital methods and processes as well as the adoption of international standards;
3. The **National Digitisation Strategy**, which emphasises improved modelling and simulation of the built and natural environment of cities.

Bill on the regulation of public construction investments (April 2023):

Article 11(1) " The minister shall establish a unified information system for the purpose of monitoring public construction investments, which includes operating a central information system for tracking the progress of public construction investment projects and creating a building information modelling (BIM) based technical tracking system for each public construction investment. The provisions for operating the monitoring information system shall be determined by the minister through a regulation authorized by this law."

Article 36 (1) "In the case of investments with an estimated value equal to or exceeding the EU public procurement threshold, the contracting authority shall require the use of a technical implementation system based on the building information model (BIM) throughout the entire life cycle of the investment."

(3) "Prior to the application of a BIM-based technical implementation system, a BIM-based implementation concept shall be prepared before the start of the design phase, covering in particular the plans, cost estimation, batching, spatial organisation and scheduling. During the preparation of the implementation concept, consideration shall be taken to ensure that the BIM-based technical implementation system allows for the carrying out of impact studies, the technical monitoring of implementation and the preparation of technical and financial reports as well as certificates of completion."

One identifiable problem is that currently **60% of construction industry standards are not available in Hungarian**. The Hungarian Standards Institution (hereinafter: MSZT) is a public body entrusted with exclusive authority in relation to national standardisation and related public tasks. Digital accessibility of standards in comparison to international standards, is outdated. It is recommended to provide additional government funding to the MSZT to expand the programme, modernise the online standards library based on German and Polish

[19] Item No:T/3677

models, translate a wider range of standards that are currently unavailable in Hungarian and accelerate the upgrading of more than 3200 standards with the involvement of experts.

National Sustainable Building Strategy 2021-2023

Sub-sector challenge	Problem definition	Weight (1-5)	Area of intervention	Measure	Proposed action	Related government decision
Optimisation of field logistics	Lack of up-to-date field logistics, production and installation management based on records and technical information available everywhere	5	building regulation, innovation, education, technical information and databases	Integration of digital methods, 3D BIM processes and VR (Virtual Reality) and AR (Augmented Reality) solutions into the education system	Measures of the adopted Building Economy Strategy 2019, GOT, Construction Action Group proposal	1398/2019 (VII.4.) Government Decree 1.3. a) Further government decision needed on training grants (BUILDING Programme)

7. Table: National Sustainable Building Strategy 2021-2023 measure on the integration of digitalization

National Digitisation Strategy 2022-2030

The strategy includes the digital development of public services under the title "Developing intelligent water, waste, environment and disaster management systems". The aim is to create a system using various sensors and remote sensing devices that is capable of conducting climate protection assessments, generating accurate surface and terrain models, and surveying urban ecosystems. With this data, it supports the registration of built and natural environments in cities and enables complex model calculations, spatial simulations, and the creation of various 3D and Building Information Models (BIM).

Summary

The modelling and simulation of relevant standards related to BIM and other digitally manageable data and spatial information are forward-looking initiatives supported by government strategies and programs. The construction industry and its stakeholders would greatly benefit from the Lechner Knowledge Centre's expertise in the integrated development of these areas, from e-construction, to property registration, utilising advanced survey and data management tools, standards, and digital solutions throughout the entire process.

3.3.2 Smart buildings and communities, e-mobility

Smart buildings

Smart buildings are primarily addressed by Directive 2010/31/EU, on the energy performance of buildings., which focuses on the energy efficiency of buildings.

In 2020, the Commission adopted a delegated act and an implementing act as follows:

- Delegated Regulation (EU) 2020/2155 complements Directive 2010/31/EU by establishing a voluntary common EU scheme for measuring the suitability of buildings to accommodate smart functions, defining a smart building indicator and a common methodology on the basis of which it should be calculated. The methodology consists of calculating the smart readiness indicator for buildings or building units and measuring their suitability to host smart functions.
- Implementing Regulation (EU) 2020/2156 sets out the technical details for the implementation of a voluntary common EU scheme for measuring the smart performance of buildings. This part covers aspects such as:

The **smart building simultaneously** adapts to the needs of the users such as. control of building services and lighting and the requirements utility network such as optimisation of consumption control, smart meters. This is supported by information and communication technologies and electronic systems such as building management system.

The use of various **smart building management solutions**, which can cover all building services and household electronics, can lead to significant energy savings due to accurate control. Systems can often be installed on a component-by-component basis (smart thermostat, automatic shading management, etc.) and can be used for staged renovation.

Key elements, savings opportunities:

Heating and cooling systems

- Weather-compensated heating temperature control (outdoor temperature, wind).
- Intelligent thermostat: self-learning, it considers the room's thermal characteristics to determine the time needed to heat/cool the room to a given temperature It also learns from presence detection to optimise energy consumption.
- Automatic operation of blinds and shutters in accordance with heating and cooling systems and depending on external influences (e.g. solar radiation intensity on a given façade, thermal protection at night under a given outdoor temperature).
- Monitoring and analysis of heating energy consumption based on thermal bridge and other data (benchmarking).
- Consideration of dew point temperatures in the operation of the cooling system.
- Window opening detection: heating/cooling system + intrusion protection.
- Consideration of the possibility of free cooling when operating the cooling system (e.g. if the outside temperature drops below the room temperature by 6 °C).

Ventilation systems

- Use of a heat recovery mechanical ventilation system.
- Use of a variable flow system: the fresh air flow rate changes automatically depending on the level ofCO_2 concentration or humidity.
- Recording and displaying indoor air quality parameters to users: indoor temperature, humidity, CO_2.
- Use of free cooling through HVAC system: operating in a mode with clean fresh air below a certain external temperature.

Lighting system

- LED lighting: longer life, adjustable lighting, up to 60% energy saving.
- Control the lighting intensity depending on the external illumination or user preference.

Smart measurement

- The smart meter can transmit and receive data.
- The data also cover the volume of consumption and the price of the service used.
- It provides real-time information on the use of the service, for both consumers and service providers.
- Consumers can accurately track their current consumption and change it based on collected data.

By 31 December 2019, the Commission adopted a legal act establishing a voluntary common EU scheme for measuring the readiness of buildings to adopt smart functionalities: the Smart Readiness Indicator (SRI), which is based on the assessment of the extent to which a building or building unit is able to adapt its functioning to the needs of its users and the grid, as well as to improve its energy efficiency and overall performance.

SRI encompasses 8 impact categories:

1. Energy savings
2. Grid and storage flexibility
3. On-site energy production
4. Comfort
5. Convenience
6. Well-being and health
7. Maintenance and fault prediction, detection and diagnosis
8. Information for users

The international methodology of SRI and pilot tests of its practical application are ongoing across Europe such as the CA EPBD- Concerted Action Energy Performance of Buildings projects, and several pan-European Union projects have been launched in parallel to define the challenges and establish closer integration with energy certificates. ÉMI is also participating as a member in one of the winning projects (TunES).

Smart Cities and Communities

While in the early 2000s the *"**ECOBUILDING**"* calls were characterised by building-level energy efficiency improvements and the development of building-level renewable energy use (e.g. SOLANOVA or DEMOHOUSE), in parallel efforts were launched for larger-scale, community-calls (**CONCERTO** I, II, III) and projects (e.g. Green Solar Cities, Staccato, PIMES). These projects generated community-scale energy efficient renovations and new constructions, large-scale utilization of renewable energy resource and integrated renewable-based energy generation projects by involving demonstration and follower cities.

Based on the successful practices of the 22 CONCERTO projects, the calls and projects for **Smart Cities and Communities** (e.g., Remourban, Atalier, POCITYF) were launched. These initiatives placed emphasis not only on energy efficiency and renewable energy sources but also on the "smartification" and decarbonization of transportation, as well as the introduction of the digital world. Citizen participation and collaboration also played a significant role. The growing number of "lighthouse" and "follower" cities resulted in numerous additional initiatives (e.g., Covenant of Mayors) and strategies (SEAP, SECAP, SUMP) across Europe and other continents. The previously mentioned SRI also becomes meaningful at a community level, enabling the adoption of new technologies such as smart energy grids, fifth-generation district heating, and waste heat utilization. Building on these examples, the **100 Climate Neutral and Smart Cities** initiative, launched under the European Bauhaus calls, aims to provide good examples of how to achieve climate neutrality by 2030.

E-mobility

Based on current trends in the economically advanced countries around the world, the share of electric vehicles in the automotive market is expected to reach 20-30% by 2030. Therefore, the proper quality and quantity of charging infrastructure are of paramount importance. In line with this, the amended EPBD directive also encourages the promotion of electric vehicle usage. In new buildings and during significant renovations of existing buildings, **suitable charging points must be provided** if the conditions specified in the directive are met.

In line with this, the **Jedlik Ányos Plan 2.0,** published in 2019, encompasses an update of the **National Electromobility Strategy**, the Jedlik Ányos Plan of 2015 and the subsequent regulatory framework. The strategy document sets out several goals to facilitate the deployment and increase the density of charging points. E-mobility in the built environment was ensured through the amendment of Government Decree 10/2016 (II.9.) - OTÉK (see Chapter 3.1.4 for more details), to ensure that aspects promoting the uptake of electric mobility in the built environment are mandatory.

The new requirement for electric charging points will also be established in the framework of the amendment of TNM Decree 7/2006 (V. 24) on the definition of the energy performance of buildings. The requirement will apply to new buildings and non-residential buildings undergoing major renovation with more than ten parking spaces.

Summary

Smart buildings, Smart Cities and Communities, and e-mobility place a greater emphasis on a more comprehensive approach to energy efficiency by implementing larger-scale climate-neutral or low-carbon energy sources/production, integrating mobility and the built environment, and implementing complex systems that better align with usage and resources. These initiatives also prioritize increasing stakeholder involvement, user participation, and engagement with the community. These strategies and solutions should be integrated into various levels of education and training programs.

3.3.3 Strategies for circular construction

Circular construction offers benefits beyond the three pillars of sustainability (economy, environment and society). Ibrahim Yahaya Wuni (2022)[20] categorised all the benefits of circular construction documented in the literature into six categories: environmental, social, economic, business, technological and regulatory.
The key challenge in transforming the Hungarian construction industry into a circular economy involves overcoming pitfalls, which requires:

- Knowledge sharing and innovation;
- Cooperation within and between the value chain;
- Building trust;
- Convincing consumers;
- Developing and introducing regulations and supporting incentives.

The goals of the construction industry's circular transition should be based on the findings of the SRSP/TSI project's GAP analysis titled "Introducing the Circular Economy and Addressing Waste Management Challenges

The achievable goals by 2027 in a life-cycle perspective are as follows [21] *:*

- Building material production phase:
  - Production of raw material: development of quality criteria and authorisation procedures for the incorporation of secondary raw material.
  - Develop a policy and strategic framework for sustainable raw materials management.
  - Taxation of primary materials and VAT reduction for secondary raw material .
- Design phase:
  - Strengthening the circular approach to planning.
  - Defining circular criteria for buildings - material selection vs. building performance.
  - Circular design guidelines for construction professionals.
- Construction phase:
  - Establish a public database on the use of building materials.
  - Measuring environmental impacts.
  - Integrating circularity into public procurement rules.
  - Develop technical guidelines for recycling.
- Use phase:
  - Develop an economic incentive scheme for the circular aspects of extending building lifespans.
  - Introduction of energy labelling.
- End of life phase:
  - Integrating circular principles into construction waste management.
  - Establishment of a construction and demolition waste (C&DW) database.
  - Waste (on-site) sorting and treatment.

[20] Ibrahim Yahaya Wuni: A systematic review of the critical success factors for implementing circular economy in construction projects, Sustainable Development Ahead-of-print(Ahead-of-print):1-35, November 2022, DOI:10.1002/sd.2449
[21] OECD (2022) GAP report

- Assessing waste according to its reuse potential.
- Take-back of building materials and products by manufacturers.

- Other horizontal objectives:
  - Knowledge base for circular construction.
  - Database to track material flows.
  - Digitalisation in the construction sector.
  - Strengthening the industrial symbiosis between construction actors.

To promote the circular transformation of the Hungarian construction industry:

- a domestic circular economy strategy is being developed based on the OECD recommendations;
- A concept for construction demolition waste is being developed;
- Draft legislation on construction demolition waste is under preparation;
- The Hungarian government has been authorized, under the Waste Act CLXXXV of 2012, to regulate:
  - activities related to the prevention of construction demolition waste;
  - detailed rules for the reuse of construction and demolition waste;
  - detailed rules for waste management activities related to construction and demolition waste;
  - the detailed rules for the use of excavated soil and other material in its natural state extracted during construction activities outside the excavation site.
- the Ministry of Energy responsible for waste management, has started to prepare a new technical concept and legislation, and the Construction and Demolition Waste Technical Working Group has been set up.

Summary

There is an urgent need for the development of the mentioned strategies and regulations as soon as possible.

3.3.4 Hungary's green public procurement strategy

Hungary's Green Public Procurement Strategy 2022-2027 sets a target to reach a **minimum o**f **30% public procurements in Hungary incorporating green criteria** by 2027.The percentage target for 2027 is considered as a general target for public procurement but the strategy also allows for higher, even up to 100%, targets in certain sector-specific requirements and for certain products or product groups.

It is important to underline that the strategy is not primarily about achieving a quantitative objective, but about spreading the use of green public procurement in a way that delivers real value for the environment, the state and the economy. During the implementation monitoring of the strategy, the Minister responsible for public procurements will track the achievement of the target, and during periodic reviews, proposals can be made to increase the target for the remaining period.

Overall, it can be concluded regarding the current public procurement regulatory environment that it enables the incorporation of green and environmental aspects into procurement

procedures in various ways. **However, the application of green public procurement depends primarily on the commitment and professional preparedness of the contracting authorities, beyond narrow obligations**. It is forward-thinking that, in addition to the opportunities provided by the legislative environment for the application of green criteria, several state actors have recognized the importance of green public procurement and have explored ways to promote it, supporting contracting authorities in this field. Alongside initiatives by state actors to promote knowledge of green public procurement, some municipalities have also started making changes to their procurement practices to "green" their procurement procedures.

Summary

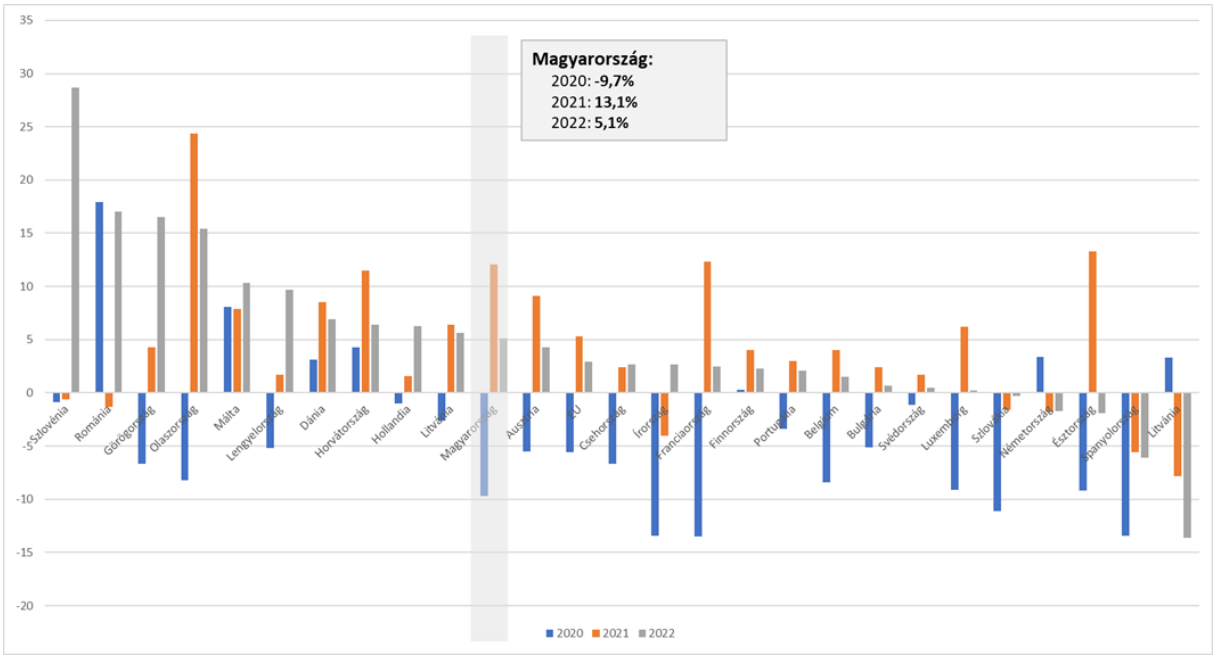
However, despite these efforts, the application of green environmental aspects is not yet widely spread in the procurement procedures of domestic contracting authorities. Where it does occur – based on information obtained from procedures conducted under national regulations – green criteria are primarily prescribed as necessary conditions for contract performance, and secondarily as evaluation criteria or as elements of the technical description.

4 KEY DATA ON THE BUILDING AND ENERGY SECTORS

In this Chapter, the national economic situation of the construction industry is presented, along with statistics on the building and energy sectors, covering the entire value chain of the construction industry, from design and construction to renovation and operation.

4.1 Construction industry

The Hungarian construction industry significantly contributes to the country's economy and has a strong presence within the European Union (Figure 7). However, the sector has faced challenges over the past three years, such as the economic downturn caused by the COVID-19 pandemic. Following a brief recovery, the Russian-Ukrainian conflict once again slowed down the industry's growth.



7. Figure: Change in construction output volume by country (compared to the previous year) (source: Eurostat)

The events and developments in the global economy over the past three years and geopolitical uncertainties have highlighted the vulnerability of the construction supply chain. **Experienced and persistent labour (skills) shortages have become one of the most pressing challenges for the construction sector**. This is forcing the industry to rethink its resources and their strategies concerning workforce. Furthermore, the increase in energy and resource prices has significantly increased the labour costs in the construction industry. This could become a structural issue in the medium term.

In 2023, these interconnected issues will be a major challenge for the construction sector. The most significant threats to the construction industry continue to be rising material and labour

costs, labour supply issues, high inflation and associated wage expectations, availability and significant price increases for construction materials, increased disruption in the global supply chain, energy supply uncertainty, increased competition as well as increased costs impacting production. As a result, construction costs are not expected to fall back to pre-Covid levels.
In line with European trends, a **decline in construction output is** also **expected in** Hungary in 2023, based on stock of orders and companies' opinion. In every subsector, a decrease in purchasing power, further price increases until mid-2023, and a decline in employment are anticipated. Employment will remain the biggest challenge in 2023. In addition to a shortage of skilled labour, rising prices for raw materials will also hampers the sector's performance. Furthermore, financing difficulties will be the key driver of industry trends. Further increases in company and construction costs may also lead to postponement of investments, while accelerating inflation and war-induced uncertainty may lead to a reduction in demand. Energy efficiency investments are in high demand due to rising energy prices, as the payback period for these investments significantly decreased. The demand for residential energy efficiency retrofits will continue to grow, while the demand for other housing renovations is expected to decline.

4.2 Building sector statistics

Buildings are the largest domestic emitter of CO_2 and one of the biggest energy consumers. In Hungary, approximately 40% of primary energy consumption occurs in buildings, with residential buildings accounting for nearly 60% of this share.[22] About 80% of the energy used in buildings is for heating, domestic hot water and cooking, mainly relying on natural gas. In terms of total final energy consumption, around 27% is attributed to residential buildings, while only 6% is consumed in non-residential buildings.

70% of the housing stock, comprising approximately 4.6 million dwellings, does not meet modern energy requirements, and the similar situation applies for public buildings.[23]
In Hungary, residential energy consumption, adjusted for climate differences, is among the ten highest compared to the EU average among the 27 EU countries. [24]

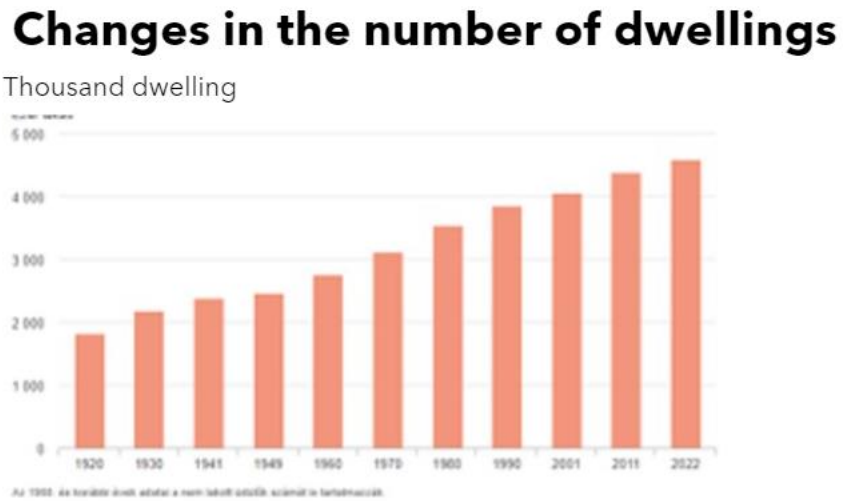
4.2.1 The building stock

Residential buildings

The Central Statistical Office (KSH) carried out the population census in 2022, which was postponed due to the Covid-19 epidemic, with preliminary results expected in the first quarter of 2023, therefore this study uses the available preliminary results.

The housing stock in Hungary is continuously growing (Figure 8). In 2022, there were 4.6 million dwellings in the country, representing a 4.6% increase over an 11-year period. During the years 2011 to 2022, approximately 171 thousand new dwellings were built, resulting in a current total of 4.581 million dwellings in Hungary. [25]

[22] National Energy Strategy for Buildings 2015
[23] National Energy Strategy 2030
[24] European Climate Fund, 2010
[25] Source : https://nepszamlalas2022.ksh.hu/



8. Figure: Evolution of the number of dwellings (1920-2022)
(Source : https://nepszamlalas2022.ksh.hu/)

However, this growth shows significant regional disparities (Table 8): except for Békés county, the number of dwellings increased in all counties, most notably in Győr-Moson-Sopron (+11.1%), Pest (+10.4%) and Somogy (+10.2%) counties. Generally, the counties in the Transdanubia region experienced a higher growth rate in the number of dwellings (2-11.1%) compared to the eastern part of the country (0-3.6%).

Spatial distribution of dwellings (%)	2011	2022
Budapest	20,6	20,7
cities with county rights	20,7	21,6
other cities	30,2	30,5
municipalities	28,5	27,2
	100,0	**100,0**

8. Table: Spatial distribution of dwellings in 2011 and 2022 (%) (Source: KSH)

The number of dwellings has increased most in rural towns over the past 11 years, it has hardly changed in villages. Approximately 73% of dwellings are located in cities, while 27% in rural areas.

The occupied dwellings
According to the 2022 Census, the **number of occupied dwellings** reached 3,981,000, which accounted for 87% of the total housing stock. 96.5% of the occupied dwellings were owned by private persons, which ration remained unchanged compared to the year 2011.

The distribution of the current building stock by year of construction and masonry material is shown in Table 9 below. 70% of the inhabited dwellings are made of brick or concrete, while 13% are panel buildings and 13% are built with adobe [KSH, Census 2022].

	Total	Brick, stone, manual walling element	Panel	Middle or large block, cast concrete	Adobe, mud	Wood, other
Total	**3 981 515**	**2 571 872**	**509 534**	**225 128**	**519 283**	**155 698**
Built before 1919	269 597	189 420			70 501	9 676
Built between 1919 and 1945	358 223	213 430			132 472	12 321
built between 1946 and 1960	462 759	289 737		5 029	151 768	16 225
built between 1961 and 1980	1 441 306	816 041	323 647	121 616	141 527	38 475
Built between 1981-2000	905 336	581 823	185 887	75 267	17 447	44 912
Built between 2001-2010	350 375	311 106		13 241	4 326	21 702
Built after 2010	193 919	170 315		9 975	1 242	12 387

9. Table: Masonry of dwellings by date of construction (Source: KSH, Census database 2022)[26]

In the last census, the coverage of solar panels, solar collectors, heat pumps and air conditioning were also surveyed. In the year 2022, 3.9% of dwellings were equipped with solar panels, 0.7% with solar collectors and 1.7% with heat pumps (Table 10). Interestingly, just over one-fourth of dwellings have air conditioning units, and this number is expected to increase in the future due to the impact of climate change.

	Total (pieces)	Total (%)
Total	**4 580 538**	**100,0%**
Equipped with solar panels	178 992	3,9%
Equipped with solar collector	30 213	0,7%
With heat pump	76 072	1,7%
Air conditioning	1 215 726	26,5%

10. Table: Total dwellings equipped with solar panels, solar collectors, heat pumps or air conditioning, (Source: KSH, Census database 2022[27]*)*

[26] https://nepszamlalas2022.ksh.hu/
[27] https://nepszamlalas2022.ksh.hu/

A background study was prepared for the National Building Energy Performance Strategy, in which the typology of residential buildings in Hungary was determined based on statistical data. The purpose was to calculate achievable energy savings by developing renovation packages [Csoknyai, 2013].

Criteria for the definition of building types:

- number of dwellings (1-3, 4-9 and over 10 units);
- construction period;
- construction technology (typical wall structure: adobe, masonry, prefabricated and other industrial);
- for detached houses, the size of the house (below 80m^2 floor area (single-storey) or above (two-storey).

A total of 15 types were identified: 7 detached houses, 2 medium sized (4-9 dwellings) condominiums and 6 larger (10 or more dwellings) condominiums. Nearly 25% of detached houses were built before 1945 and nearly 50% between 1946 and 1980, meaning that **nearly three quarters of family houses were built before 1980**. However, only about 8% of the total stock was built after 2001, according to the study conducted in 2013. The share of prefabricated and other manufactured housing in the housing stock is 42%. The share of condominium buildings built before 1945 is 14%. Approximately 16% of the housing stock is of the post-2001 building type.

When calculating the primary energy consumption of different types of buildings, it can be observed that **single-family houses built before 1980 have the highest values** (approximately 400-550 kWh/m2a). The least energy-efficient apartment buildings are those with 10 or more units built before 1945, excluding panel buildings, with approximately 350 kWh/m2a. Panel apartment buildings have a primary energy consumption of approximately 200-220 kWh/m2.[2] Two further renovation options were investigated: renovation to the cost-optimal level introduced in 2015 and renovation to the nearly zero energy level. In the cost-optimal renovation scenario, the primary energy consumption for family houses decreased to 110-140 kWh/m2a, and for apartment buildings to 80-100 kWh/m2a.

Public buildings

A study conducted in 2013, modelled the energy performance of the Hungarian public building stock [Magyar, 2013]. For the calculations, typical building types were defined, and the main organizing principle was the building's function and the construction period.
Building functions:

- Healthcare and social buildings
- Office buildings
- Commercial buildings
- Cultural buildings
- Educational buildings

Construction periods:

- before 1900
- 1901-1945
- 1946-1979

- 1980-1989
- After 1990

Taking into account the building functions, construction periods and the most important structural characteristics and the number of floors, further subgroups were established, resulting in the creation of building typology. These types serve the basis for the energy performance assessments. A total of 42 building types have been identified including 10 healthcare and social buildings, 10 office buildings, 4 commercial buildings, 8 cultural buildings and 10 educational buildings. For the building energy modelling, the typical building structures, mechanical installations and lighting characteristics were determined.

Among the examined building types, healthcare buildings have the highest primary energy consumption, with 5 out of the top 10 buildings belonging to this category. A two-storey social building with a basement built before 1900 has the worst energy performance, followed by a single-storey medical clinic with a single basement built between 1946 and 1979. The third highest is two-storey social homes with a basement built between 1901 and 1945, followed by the three-storey 'U' shaped hospital with a basement built before 1900 and the four-storey 'U' shaped hospital with a basement built between 1946 and 1979. The primary energy consumption of these types of buildings is approximately 300 kWh/m^{2,} but for buildings built before 1900 it can be even higher. The next 5 positions are occupied by office, commercial, educational and healthcare buildings with primary energy consumption ranging between 260-300kWh/m^2 a. The primary energy consumption of educational buildings is typically in the range 232-251 kWh/m a.[2]

The study also examined two renovation scenarios: renovation at the cost-optimal level introduced from 2015 and renovation at the nearly zero energy level. The cost-optimum renovation level is expected to achieve an average of 55% primary energy saving. Higher savings of approximately 70% were observed in buildings with significant solar energy utilization, typically those with large roof areas and 1-2 stories. The renovation model corresponding to nearly zero energy demand takes into account the 25% share of renewable energy required by regulations, resulting in an average of 63% reduction in primary energy demand for type buildings.[28]

4.2.2 Annual rate of construction and renovation

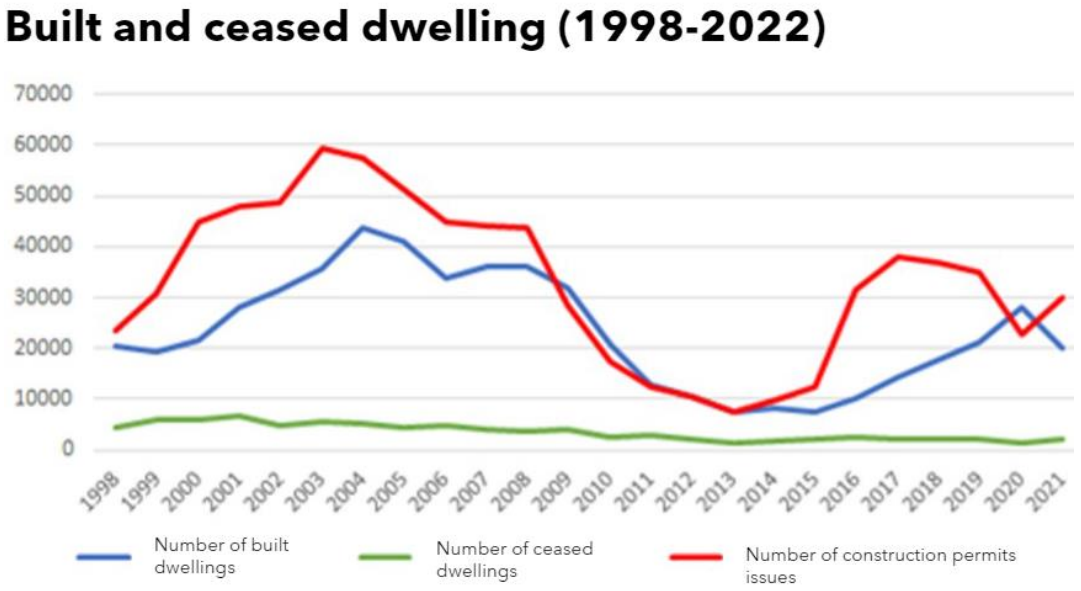
New construction

During the socialist planned economy, before the change of political transition in 1989, housing construction output was around 80 000 dwellings per year. However, during this period, the primary objective was to meet the quantitative demand. With the introduction of market economy and a decrease in state involvement, the number of annually constructed dwellings steadily declined.

Figure 9 shows that the intensive growth of **housing construction following the year 2001 reached its peak in 2004** (with nearly 44,000 dwellings), followed by a period of stagnation.

[28] Source:https://energy.ec.europa.eu/system/files/2019-03/hu_building_renov_2017_hu_updated_2018_0.pdf

Subsequently due to the cessation of incentives and the impact of economic crisis, the **number of new dwellings experienced a sharp decline,** reaching a record low of approximately 7,300 dwellings in 2013**.** It was followed by a slow recovery with around 28 000 dwellings built in 2020, but a further decline occurred due to the COVID-19 pandemic.



9. Figure: Built and ceased dwellings between 1998-2022 (Source: KSH)

Renovation

The current renovation rate of the Hungarian building stock is not available at the Central Statistical Office beyond the year 2016, so it needs to be estimated based on the literature. Therefore, according to a 2010 study titled "*Employment impacts of a large-scale deep building energy retrofit programme in Hungary*" **an annual renovation rate of 1.3% for the Hungarian building stock**, which corresponds to approximately 4.5 million square meters of floor area [Ürge-Vorsatz et al, 2010]. This is consistent with the results of other studies conducted in Hungary. For example, Novikova (2008) assumed a rate of 1%, a value also supported by the Long-Term Renovation Strategy. The renewal rate of the building stock shows an increasing trend, it is still relatively low.[29]

Between 2006 and 2016 maintenance work aimed at preserving the condition of dwellings was carried out in 85% of the homes. Interior painting was carried out in 81% of occupied dwellings, while external renovation took place in one-third of the dwellings. Flooring was replaced in 43% of the dwellings and mechanical installations in 27%. These maintenance works were most frequent in dwellings built between 1970 and 1980, as well as in dwellings with high comfort level and four or more rooms [KSH, Mikrocenzus 2016].

64% of **dwellings** have been **modernised** (Table 11 and 12). Among these, the most frequent works were those that resulted in energy savings. Window replacements were carried out in 38% of occupied dwellings, one in four homes underwent insulation, and 17% of the dwellings had their heating systems upgraded or began using renewable heating sources. [KSH, Mikrocenzus 2016].

[29] Long-term renewal strategy to meet the eligibility conditions for cohesion funding for the period 2021-2027 under Directive (EU) 2018/844

Occupied dwellings by type of renovation work carried out in the dwelling, 2016						
	replacement of mechanical equipment	installation of new meters	air-conditioning	insulation	modernisation of the heating system, use of renewable fuels	replacement of windows and doors
Number of dwellings	1 038 056	472 065	423 343	895 310	670 625	1 468 907
Share, in relation to total number of dwellings	26,93%	12,25%	10,98%	23,23%	17,40%	38,11%

11. Table: Occupied dwellings by type of renovation work carried out in the dwelling, 2016 (own edition, data source: KSH)

Percentage of occupied dwellings with renovation in the 10 years prior to 2016 (%)					
Renovation works	Budapest	Cities with county rights	Other cities	Municipalities	Total
Maintenance					
interior painting	77,5	80,8	81,0	82,9	80,7
replacement and repair coverings	45,5	46,0	40,7	39,6	42,5
exterior repair	22,9	32,9	29,8	29,8	29,0
replacement of mechanical installations	33,6	26,5	25,0	24,3	26,9
Modernisation					
installation of new meters	19,9	12,9	10,0	8,5	12,2
installation of air conditioning	17,5	13,2	10,4	4,9	11,0
installation of utilities	4,2	5,3	12,9	20,8	11,6
upgrade existing utilities	21,2	14,5	13,2	14,1	15,4
create new spaces	5,5	4,1	6,3	8,5	6,3
Modernisation resulted in energy savings					
thermal insulation	20,9	30,2	23,0	19,8	23,2
modernisation of heating system, use of renewable fuels	20,0	17,5	16,8	16,1	17,4
replacement of doors and windows	39,9	43,0	36,4	34,9	38,1

12. Table: Percentage of occupied dwellings with renovation in the 10 years prior to 2016 (Source: KSH, Mikrocenzus 2016)

4.2.3 Breakdown of the building stock by energy label and number of nearly zero energy buildings (NZEB)

In Hungary, energy **performance certificates are** mandatory since 2012 for the construction of new buildings as well as for existing buildings when they are sold or rented out. Energy performance certificates are issued by specialised companies operating under a regulated framework, based on detailed technical assessment and calculations. They are valid for 10 years. The calculated specific energy demand must be compared with the requirements set out in Decree No 7/2006 (V. 24) of the TMN, pursuant to Government Decree 176/2008, to obtain the energy performance classification of the property. In general, for residential and accommodation buildings have a total energy performance requirement value of 100 kWh/m^2 a, so that the ranges of calculated energy demand and the classification categories are almost fully compatible.

The current classification system has been in effect since 2016, when the energy classes changed. The current classification system categorises properties from JJ (extremely poor) to AA++ (minimal energy demand), with a total of 12 energy classes (Table 13). Only properties with a renewable energy rate of at least 25% can be classified BB or better.

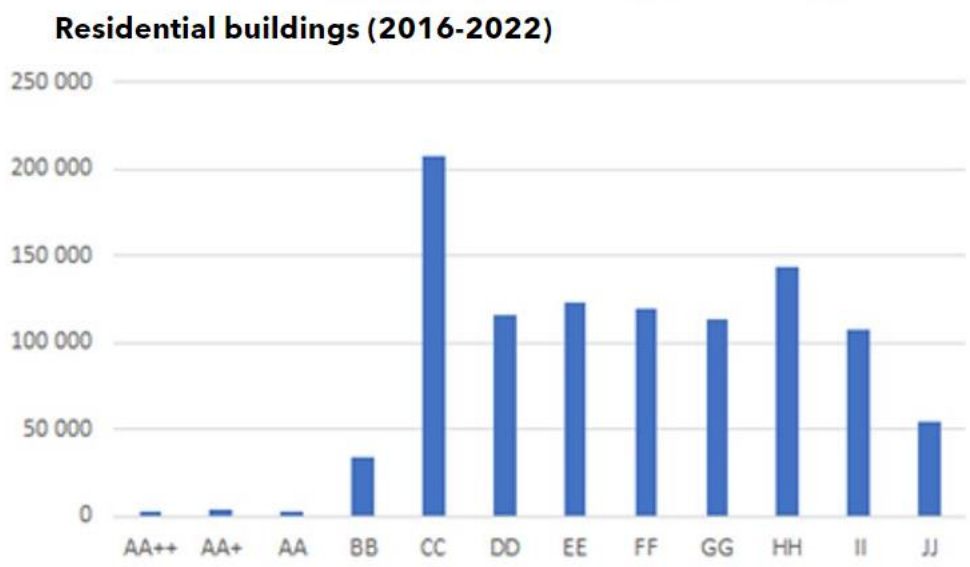
#	classification	The percentage ratio	Textual description of its quality class
1.	AA++	<40	Minimal energy demand
2.	AA+	40-60	Very high energy efficiency
3.	AA	61-80	Better than near-zero energy requirement
4.	BB	81-100	Meeting near-zero energy requirements
5.	CC	101-130	Modern
6.	DD	131-160	Close to modern
7.	EE	161-200	Better than average
8.	FF	201-250	Average
9.	GG	251-310	Close to average
10.	HH	311-400	Poor
11.	II	401-500	Bad
12.	JJ	>500	Extremely bad

13. Table: Energy performance of building classification according to Annex 3 of Government Decree 176/2008 (VI.30.)

The database of certified energy certificates is operated by the Lechner Knowledge Centre as part of the National Construction Register. The certificate can only be prepared by a **qualified professional with building energy certification authorization,** appointed by the property owner. The authorisations are issued and registered by the Hungarian Chamber of Engineers or the Hungarian Chamber of Architects (hereinafter: MÉK). The certification authorization can be obtained with a degree in engineering and at least one year of professional experience, after passing the qualification exam. After that, the certifiers are added to the publicly accessible Chamber's register.

Certification is regulated by Government Decree 176/2008, which has been amended several times. The most important changes include the introduction of an **electronic registration**

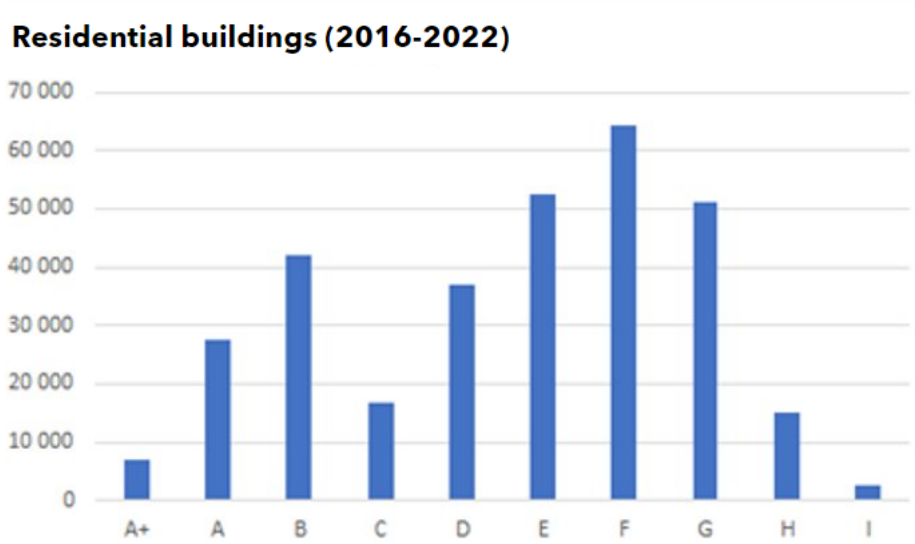
system and the verification system in 2013. The 'e-tanusitas' (e-certificate) website contained **1.343 million** certifications of **residential and accommodation buildings** between 2012 and 2022. This represents **29.2%** of the **residential building stock,** excluding possible duplications. As **around 94% of the certified properties** on the 'e-tanusitas' (e-certificate) site **are residential and accommodation buildings**, which are examined in more detail. There is limited certification data available for non-residential and non-accommodation type buildings.



10. Figure: Certification of residential and accommodation buildings, 2016-2022 (own editing, data source: https://entan.e-epites.hu/

Buildings with a performance level around the requirement value (TNM Decree 7/2006 on the definition of the energy performance of buildings), which are close **to zero energy demand**, are classified in category BB, and those with better performance are classified in categories AA, AA+, AA++. Buildings that meet 201-250% of the requirement value are considered "Average" by the certification scheme and are classified as FF, while the worst, JJ category, has an overall energy performance exceeding 500% of the requirement value.
Based on the classification (Figure 10 and 11) it can be stated:

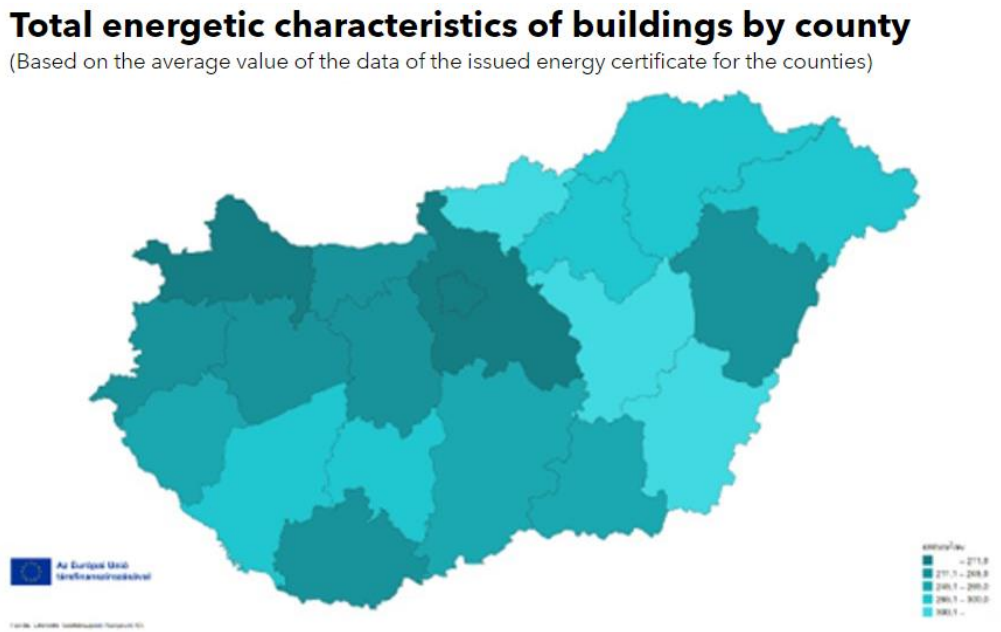
- **4.3% of residential buildings are** rated BB or better, i.e. **NZEB buildings,**
- CC or DD, modern or close to modern: 31.4%,
- EE, FF and GG representing average performance account for 34.5% of residential buildings,
- 29.7% of residential buildings are rated HH or worse.



11. Figure: Certification of residential and accommodation buildings, 2012-2015 (Data source: https://entan.e-epites.hu)

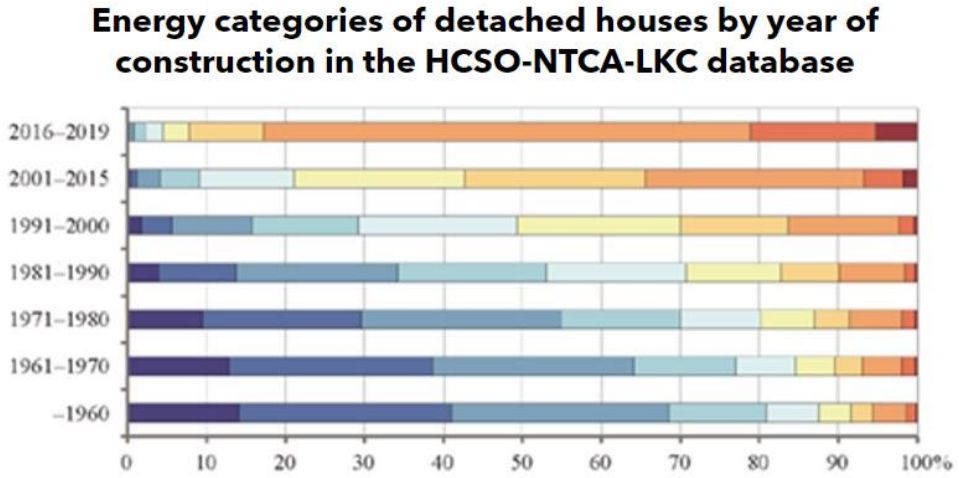
Unfortunately, **this does not give an accurate picture of the total building stock**, as indicated by a study conducted by BME-MNB study:

- it under-represents buildings with poor energy performance, as they are less marketable and therefore not certified.
- it overrepresents new buildings, due to the fact that energy certification is mandatory for all new buildings.
- in case of class CC or better, it is distorted by the appearance of additional requirements [Csoknyai, 2021].



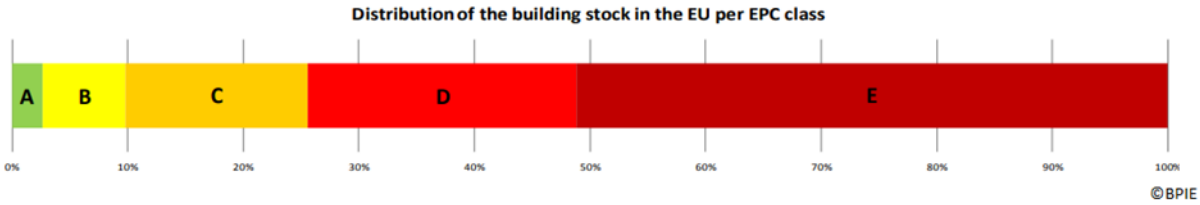
12. Figure: Aggregate energy performance of buildings by county, 2022 (KSH, 2022)

Based on averaged values of energy performance certificates issued in 2022 (for both new and existing buildings), the most energy-efficient buildings registered in 2022 are located in Győr-Moson-Sopron, Pest and Budapest counties, while the least energy-efficient buildings are located in Nógrád, Békés and Jász-Nagykun-Szolnok counties (Figure 12).



13. Figure: The relationship between energy characteristics and house prices (Source: Ertl A., Horváth Á., Mónus G., Sáfián F., Székely J. Statistical Review, Vol.99 No.10, 2021)

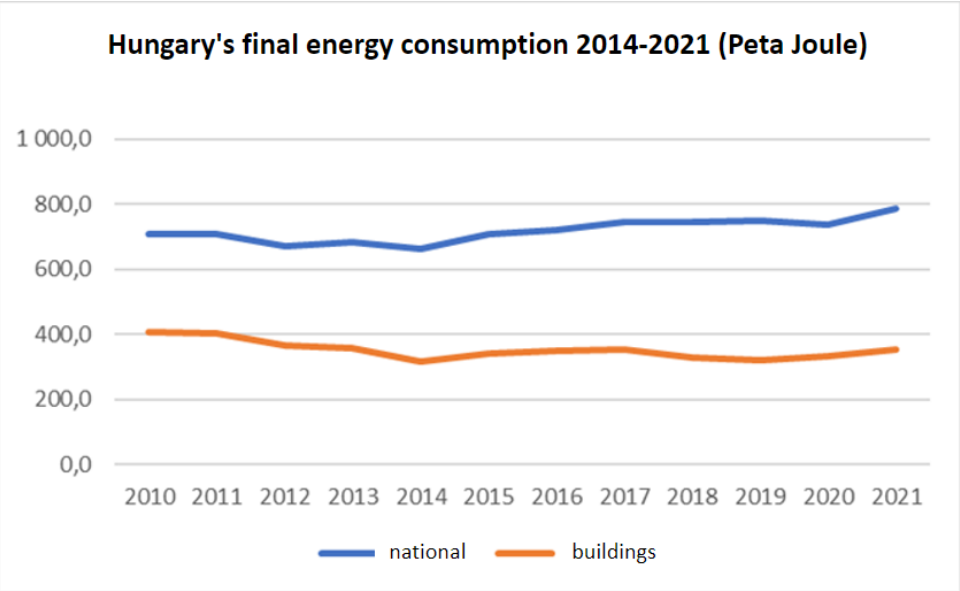
The content of the energy performance certificate can influence property (rental) prices in several ways. On the one hand, a unified and reliable certification system helps property owners/tenants to calculate more accurately the energy demand of the property and to compare it with the energy data of other properties. In addition, if owners can understand the potential for energy saving, they may be willing to pay a higher price for a property with better energy characteristics because its maintenance costs would be lower. These aspects have been further supported by the significant increase in energy prices in recent times (Figure 13). Single-family houses in the good energy category show a significant price increase of around 15-20 percent compared to the category labelled as average (FF) in the requirements framework [Ertl et al., 2021].



14. Figure: Distribution of the EU building stock by energy performance class (BPIE, 2018)

4.2.4 Statistics on energy consumption and renewable energy use in buildings

The **Hungarian Energy and Public Utility Regulatory Authority** (MEKH) is responsible for the unified national energy statistics, fulfilling its obligations under national and international legislation. Hungary's final energy consumption over the past years has been slightly increased as show on Figure 15 below.



15. Figure: Hungary's annual final energy consumption between 2010-2021 (PJ) (own editing, data source: KSH)

There is lack of dedicated data for the final energy consumption related to all buildings. However, based on available data sources the following can be estimated:**295 PJ, that is 39.5% of the national final energy consumption in 2018** [HTFS, 2018], according to another source it is 334.94 PJ, that is 45.5% [IEA, 2020]. For further information on renewable energy is available in Annex 5.

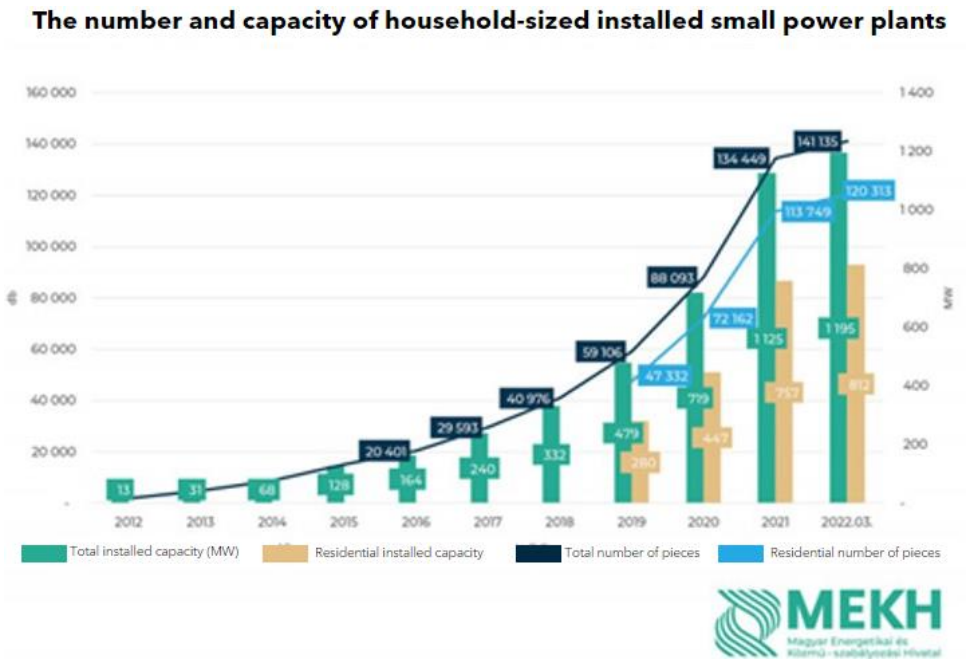
(PJ)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Heating and cooling	78,61	89,51	95,37	100,7	84,18	90,78	91,22	88,91	78,30	76,03	75,87
Electricity	10,15	8,96	8,54	8,99	10,21	10,51	10,50	11,10	12,57	15,48	18,57
Transport	8,03	7,73	7,22	6,99	9,14	8,42	9,00	8,16	9,35	9,76	13,05
Total gross final renewable energy consumption	96,780	106,20	111,13	116,74	103,53	109,71	110,71	108,16	100,22	101,26	107,49
Total gross final energy consumption	759,56	760,12	715,59	720,41	708,24	756,86	770,07	797,88	798,63	801,54	776,06

14. Table: Total gross final energy consumption and gross final renewable energy consumption, 2010-2020 in PJ (source: MEKH)

Solar energy

According to the National Energy Strategy 2030 (NES), the Government's target is that by 2030 at least 200,000 households will have a rooftop solar power plant with an average capacity of

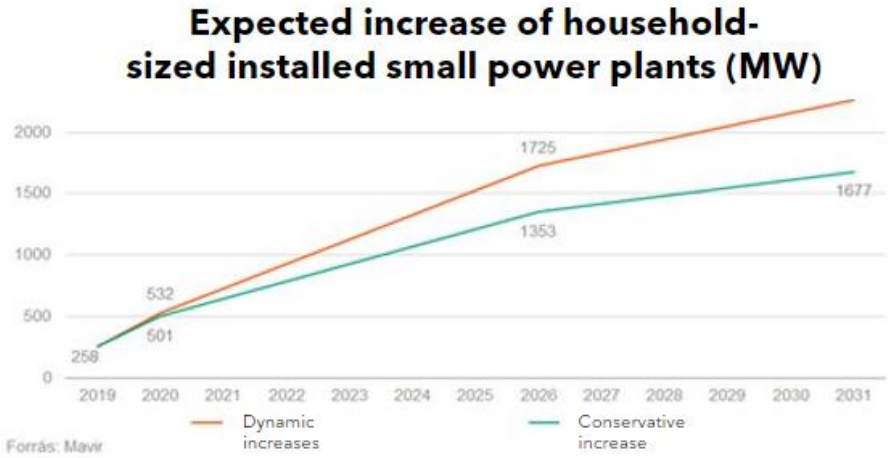
4 kW. Therefore, the goal is to have at least 800 MW of installed capacity by the end of the decade.



16. Figure: Number of household sized solar power plants and installed capacity in Hungary (source: MEKH)

In 2021, the installed capacity and the number of household sized small power plant increased at an accelerating pace (Figure 16). According to MEKH data, the total installed capacity of household-scale power plants increased from 720 MW at the end of 2020 to 1.127 MW by the end of 2021, representing a **record increase of 407 MW over the last ten years.**

Regarding the type of small household-scale power plants, installed PV panels continue to dominate, as **99.8% of users has chosen solar PV units**. The capacity of installed PV panels increased from 719 MW at the end of 2020 to 1.125 MW by the end of 2021 (Figure 17).



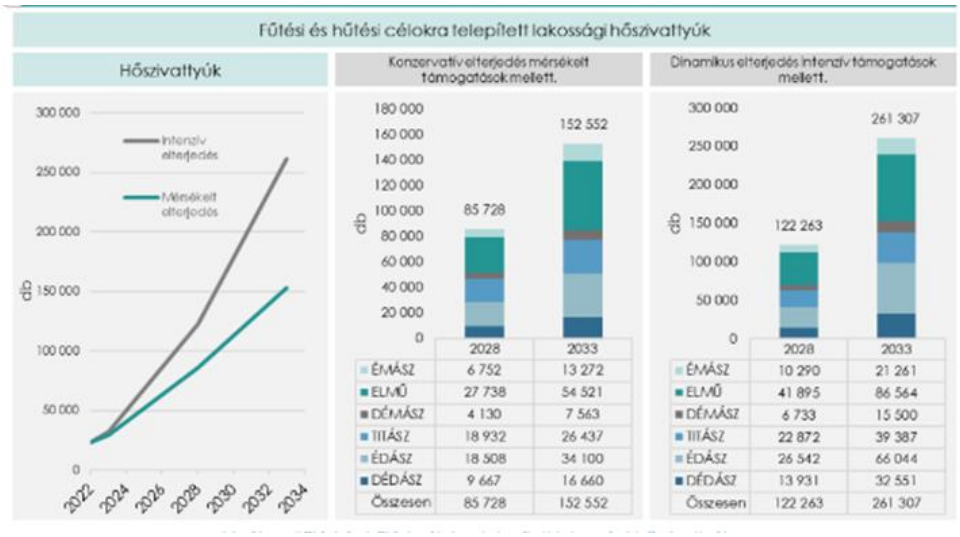
17. Figure: Projected growth of household sized solar PV (Source: Mavir)

At the end of 2021, 113 749 residential customers installed solar PV with a total capacity of 757 MW. **This means that we are more than halfway to the target in terms of number of units and 95% of the target in terms of capacity.**

However, it is important to note that based on relevant legislation, the possibility of grid feed-in for solar power systems was temporarily suspended in October 2022 due to expected grid developments. Additionally, according to a regulation issued by the MEKH in November, in line with European Union requirements, starting from 2024, none of the PV owners will have access to annual net metering. The essence of net metering is that if the owner feeds back as much electricity into the grid during the year as they consume, they do not have to pay for the electricity consumed, in other words, they do not have to pay an electricity bill.

Heat pumps

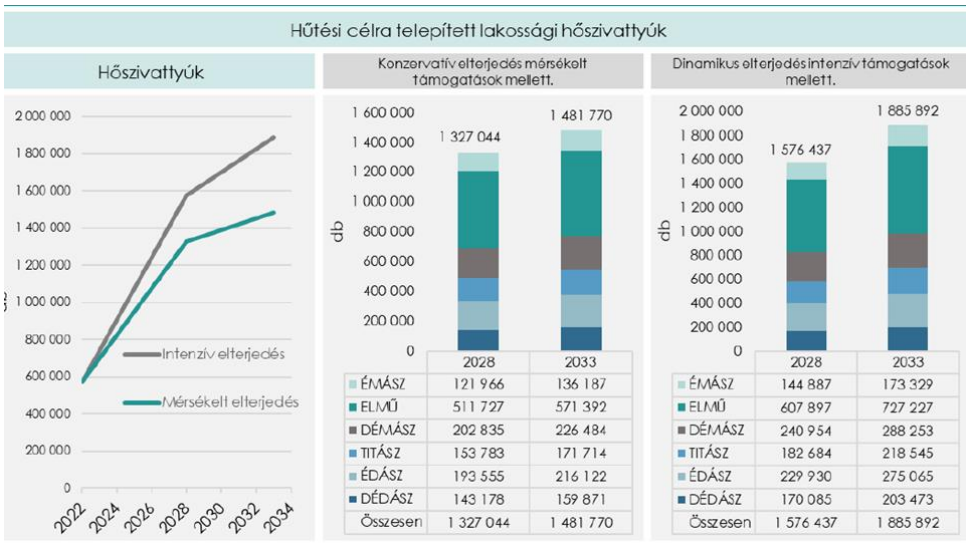
There are no exact available statistical data on the current distribution of heat pumps in Hungary. However, according to MAVIR's network development plans - based on experts' expectations - a wide spread of air-water technology systems fulfilling heating, cooling and domestic hot water requirements is expected in the residential sector. [MAVIR, 2021][30].
The prognosis shown in Figure 18. was based on the data available through the use of special tariffs in the distribution network, and then the number of residential machines installed in residential buildings with higher unit output, typically newly built, was estimated based on expert estimation.



18. Figure: Projected number of residential heat pumps installed for heating and cooling purposes (Source: MAVIR, 2021)

The current estimated number of heat pumps installed for residential heating and cooling purposes of around 24,000, according to the "moderate spread" forecast - with a GDP growth of 0.5% - will be 85,700 heat pumps by 2028, and then by 2033 this number almost doubles (152.5 thousand units). According to the "intensive spread" scenario, which assumes higher GDP growth (+2.0%) and significant targeted public subsidies, the experts expect the installation of 122,200 heat pumps by 2028 and 261,300 by 2033.

[30] https://www.mavir.hu/web/mavir/halozatfejlesztesi-tervek-2021-tol



19. Figure: Projected number of residential systems installed for cooling only (Source: MAVIR, 2021)

As for the number of air-conditioning systems installed only for cooling purposes, the experts also expected a different degree of growth: the current number of nearly 600,000 installed air-conditioning units will increase to 1,327,000 units by 2028, while 1,481.7 thousand units are expected by 2033, according to the "moderate spread" model. Assuming a dynamic spread, by 2028, 1,576.4 thousand air conditioners are expected, while by 2033, 1,885.8 thousand air conditioners will be installed (Figure 19).

Residential buildings

The Hungarian Energy Efficiency Institute (MEHI) states that **almost 65% of the total stock had an energy rating below nearly modern (DD) at the end of 2021.**

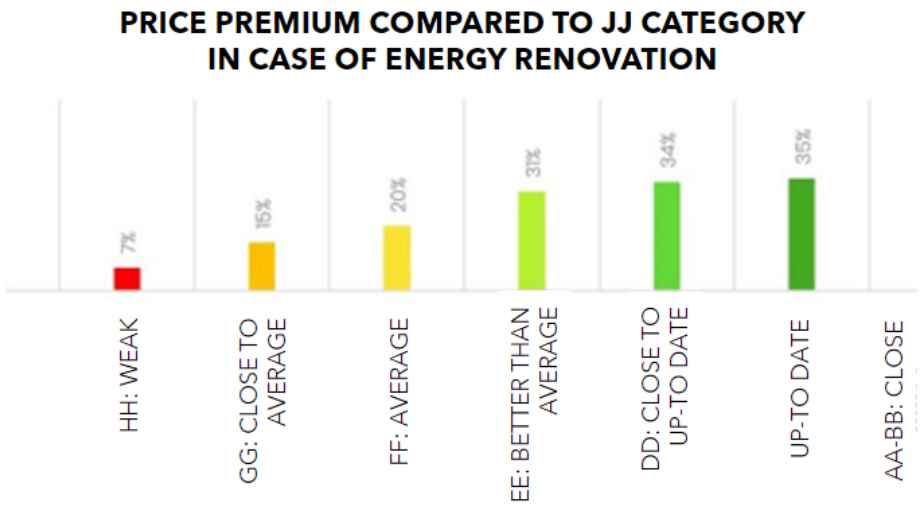
MEHI carried out a survey in autumn 2016 to assess the market for residential energy efficiency products and to map consumer behaviour. The survey assessed residential investments in the previous five years and investment plans for the near future. The analysis also provided an estimate of the size of the market for the main elements of residential energy efficiency retrofit in Hungary and the level of investment intentions over the next 5 years. The research found that **41% of Hungarians carried out energy efficiency investment in the 5 years preceding the survey and a quarter of them plan to do so in the next 5 years.** Improving energy efficiency was identified as the most important aspect for those living in rural family houses, but there were variations in attitudes among renovators towards different energy efficiency products [MEHI, 2016].

In 2021, MEHI carried out a study (Hungarian Renovation Wave) based on a representative residential survey. The study focused on the energy efficiency retrofit potential of residential buildings in Hungary and analysed the impact of various support measures. The study examined the renovation willingness of homeowners and assessed their sensitivity to the introduction of specific support and incentive tools. [MEHI, 2021].

The research found that the **number of investments in energy efficiency in buildings has increased in recent years**, but individual, partial renovations without a technical or energy

plan still predominate, resulting in insignificant energy savings. At the same time, there is a large residential energy efficiency market with an investment value of nearly HUF 3000 billion over the next five years. To fully exploit the potential for energy savings, a comprehensive system of subsidies to encourage investment should be introduced and linked to energy efficiency requirements. The study looked at six forms of support and incentives, including grants, VAT rebates, loans and one-stop-shop advice, and found that all of them have the potential to stimulate the economy but have different benefits. The study also found that incorporating energy efficiency requirements into subsidies can have a positive impact on economic recovery, energy and CO_2 savings [MEHI, 2021]

In a unique study led by MEHI, national experts have investigated how the value of residential property varies according to its energy efficiency rating, which is shown in Figure 20.



20 Figure: Price premium compared to JJ category in case of energy renovation (Source MEHI, 2021)

The research cites various studies and research showing that energy-efficient upgrades can significantly increase the value of a home and save homeowners significant amounts of money on utility bills. It also highlights the various government programs and incentives that can help homeowners finance energy-efficient retrofits. The article concludes by stressing the importance of considering energy efficiency in home renovation and encourages homeowners to explore their options for making their homes more energy efficient [Ertl et al., 2021].

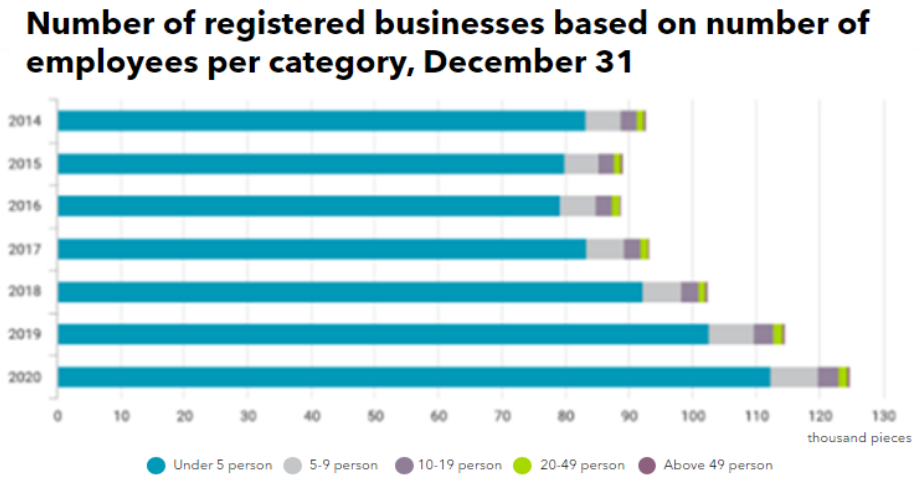
Summary

Only about 27% of the residential building stock has an energy performance certificate, and there is limited certification data available for non-residential and non-accommodation buildings regarding their energy performance.

4.3 Statistics of construction companies

The number of enterprises in the construction sector declined steadily between 2010 and 2013, in line with the fall in production. However, the rise from 2014 onwards was not halted by the sharp fall in construction output in 2016. The number of registered construction

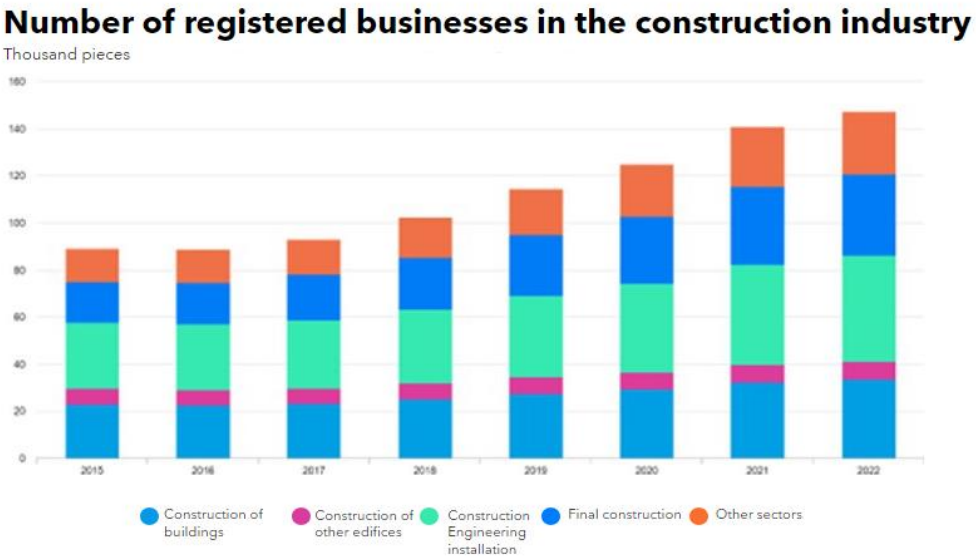
enterprises has been growing steadily since 2017, thanks to the dynamic growth of new start-ups. **At the end of 2022, there were 147.4 thousand** registered companies in the construction sector, which is 4.6% higher than the previous year (Figure 21). Most construction enterprises were registered in the subsectors of building installation and finishing construction with 45 thousand and 34 thousand respectively. [KSH, Situation of the construction sector 2022].



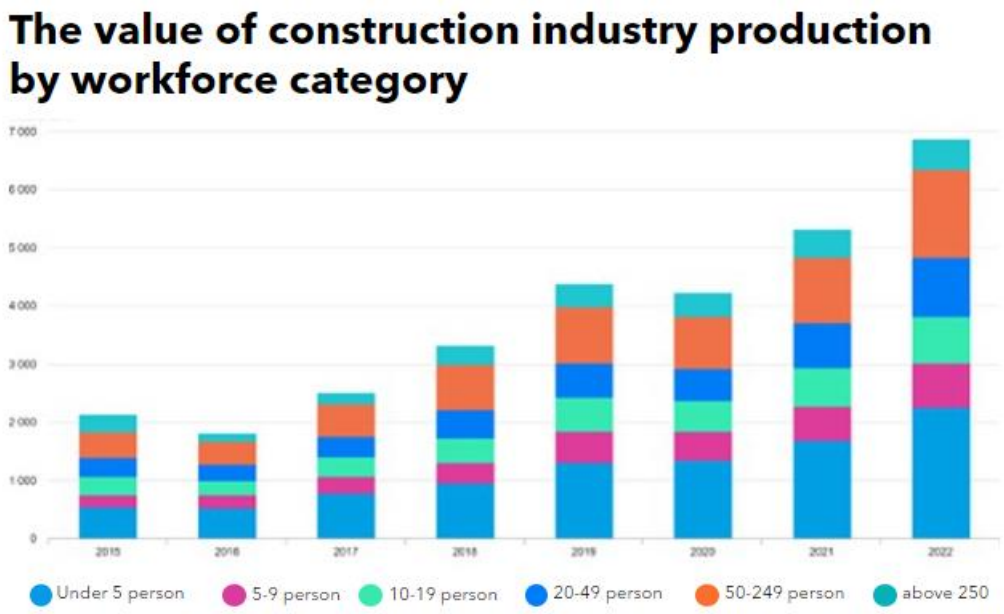
21. Figure: Number of registered enterprises, number of employees by category (Source: KSH)

The construction sector, like the national economy as a whole, is characterised by **a predominance of small and medium-sized enterprises:**

- In recent years, more than 90% of registered construction enterprises had less than 5 employees. Their share is particularly high in the specialised construction (93%), including the sub-sectors of building installation and finishing (92% and 96% respectively in 2020).
- The share of organisations with 50 or more employees is below 0.5%.



22. Figure: Number of registered enterprises in the sub-sectors of construction (2015-2022) [KSH, Construction Industry Situation, 2022]



23. Figure: Value of construction output, number of employees by category, 2015-2022 [KSH, Construction Industry Snapshot, 2022]

The vast majority of micro and small enterprises lack financial reserves and their liquidity situation is unsatisfactory. This also contributes to the low level of participation of enterprises in **training, innovation and other forms of social engagement.** Only a small number of construction enterprises were able to participate in the economic stimulus loan scheme [ÉVOSZ, 2023].

To change and improve this situation, one possibility is to prefer and support businesses operating in a **cooperative form**. In this regard, a legislative proposal has already been submitted in 2023 to facilitate this. [31]

Summary

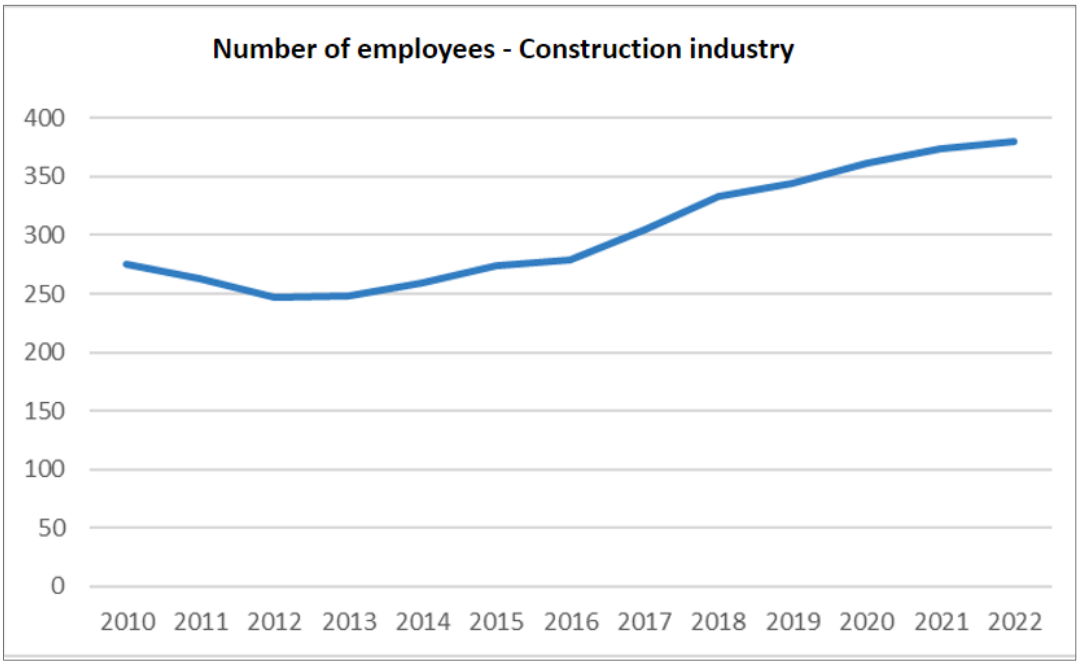
The sector has an excessively high proportion of micro and small businesses with a lack of capital and inadequate equipment, particularly in new constructions and complex energy renovations. An effective business qualification system, as well as larger, more comprehensive and financially strong enterprises, and entrepreneurial collaborations, including cooperative forms, are needed.

4.4 Data on building professionals

The construction sector is dominated by micro and small enterprises. Many of these operate without a corporate structure and culture within their microenvironment. Workers are not paid in proportion to their performance, and hourly wage employment is common. Efficiency is significantly below that of medium and large enterprises, making it difficult to introduce a sectoral wage scale of an acceptable scale. The construction sector has hired 100 000 people over the last four years. Unfortunately, this has been accompanied by a large influx of people

[31] Source : https://agrokep.vg.hu/kozelet/modosulhat-a-szovetkezeti-torveny-29885/

who are not accustomed to the discipline, order, and professionalism required in the construction industry. Furthermore, some of the workforce prefer to work under "softer" conditions. According to the Labour Force Survey, the number of people employed in the construction sector in 2022 was 380.4 thousand, representing 8.1% of the total number of people employed in the national economy (Figure 24.). 92.7% of construction workers were men and 7.3% were women. This gender ratio has been consistent for many years. [KSH, Situation of the construction sector 2022].

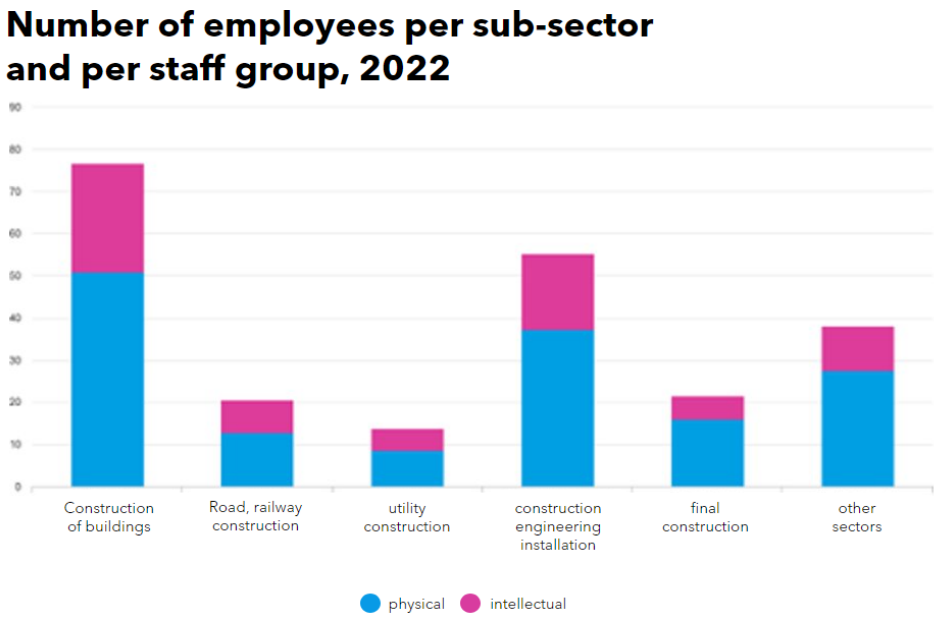


24. Figure: Number of persons employed in the construction sector (own editing, data source: KSH)

The tripartite structure of employment:

- employees in main occupation;
- the so-called "hired labour" (mostly in the form of contractors);
- informal/undeclared employees.

The number of employees in the construction sector has been rising since 2014, and this has not been halted by the significant drop in output in 2016 and 2020. In 2022 there were 226.1 thousand people working in the construction sector, which is 5.9% increase compared to previous year. Among the employed, 68% were engaged in physical occupations, totalling 153,000 individuals, while 73,000 were in intellectual occupations (Figure 25.). The number of both physical and intellectual employees increased in all three sectors of the construction industry.



25. Figure: Number of employees by sub-sector and by group of employees, 2022 (Source: KSH, Construction Industry Situation, 2022)

The third group is **grey or black-market workers**, who work in informal and unofficial employment arrangements. This phenomenon is not reflected in the number of officially registered employees, making it difficult to provide accurate data on them. According to a 2020 estimate by ÉVOSZ, the value of undeclared work in the construction sector was close to 1,000 billion forints in 2019, as the share of income in the sector generated by tax evasion is estimated at 20-25%[32] . Based on another official study from 2021, it is estimated every third construction workers are undeclared[33]. Based on the latest studies, ÉVOSZ estimates that there are approximately 40,000 completely undeclared workers, who are predominantly unskilled or semi-skilled laborers according to ÉVOSZ's experience [ÉVOSZ, 2023].

International trends in the construction industry show that the labour shortages in the sector in the European Union mean that employers have to compete with companies in other countries on a permanent basis.

The biggest employment challenge in 2023 will be to retain skilled workers and engineers while maintaining efficient employment in the face of declining job opportunities.

In 2022, the average gross monthly salary of those employed in the construction industry **were HUF 380,000** (HUF 310,000 for physical workers and HUF 521,000 for intellectual occupations), which amounts to 76% of the national average. Consequently, the **construction industry ranks among the lowest sectors in terms of average earnings within the national economy.** The lower average earnings in both physical and intellectual occupations, which were 12% and 7.3% lower, respectively, than the national average, contribute partially to this disparity, despite the high proportion of physical occupations (70% compared to the national average of 50%) in the industry.

[32] Source : https://www.vg.hu/vilaggazdasag-magyar-gazdasag/2020/02/a-megbizasok-negyede-adomentes-marad-2

[33] Source : https://hvg.hu/gazdasag/20210809_feketemunka_feketemunkas_epitoipar

In the construction of other structures sector, the highest average earnings were observed, exceeding the construction industry average by 33%. In this sector, employees in intellectual occupations earned 37% more, while those in physical occupations earned 24% more than the construction industry average. The wages in this sector were above the national average [KSH, Situation of the construction sector, 2022].

Foreign workers

According to data from the Central Statistical Office (KSH), the number of foreign employees in Hungary increased by 14% in 2022 compared to the previous year, reaching 81,000 individuals. Ukrainian workers contributed the most to this increase, with their number growing by 24% and 5,200 individuals within one year. In total, 26,400 Ukrainian workers were employed in Hungary in 2022. **The average number of foreign employees in the construction industry was 6,745 individuals, representing a 5% increase compared to 2021**. [KSH, Labour Market Situation, 2022]. Around 80% of foreign workers are skilled workers, and only 20% are in unskilled jobs[34]

Retirement

The number of retirements in the construction industry is around 25,000 per year. [ÉVOSZ, 2023].

Summary

The demand for new workforce in the construction industry varies depending on the sector, specialization, and regional distribution. In addition to new entrants from vocational training, another possible source is the training and further education of individuals with different professional qualifications, according to the assessment of their acquired knowledge. If foreign workers have qualifications that can be recognized within the European Union, along with professional language proficiency, they can be integrated into the Hungarian education and qualification system. The analysis and evaluation of these needs and trends can be facilitated by the Sectoral Skills Councils. Effective control measures and financial arrangements can be used to address the issue of undeclared work in the residential sector.

[34] https://mfor.hu/cikkek/makro/annyira-nincs-munkas-az-epitoiparban-hogy-mar-tanulokat-is-kulfoldrol-kene-hozni-a-vallalkozok-szerint.html

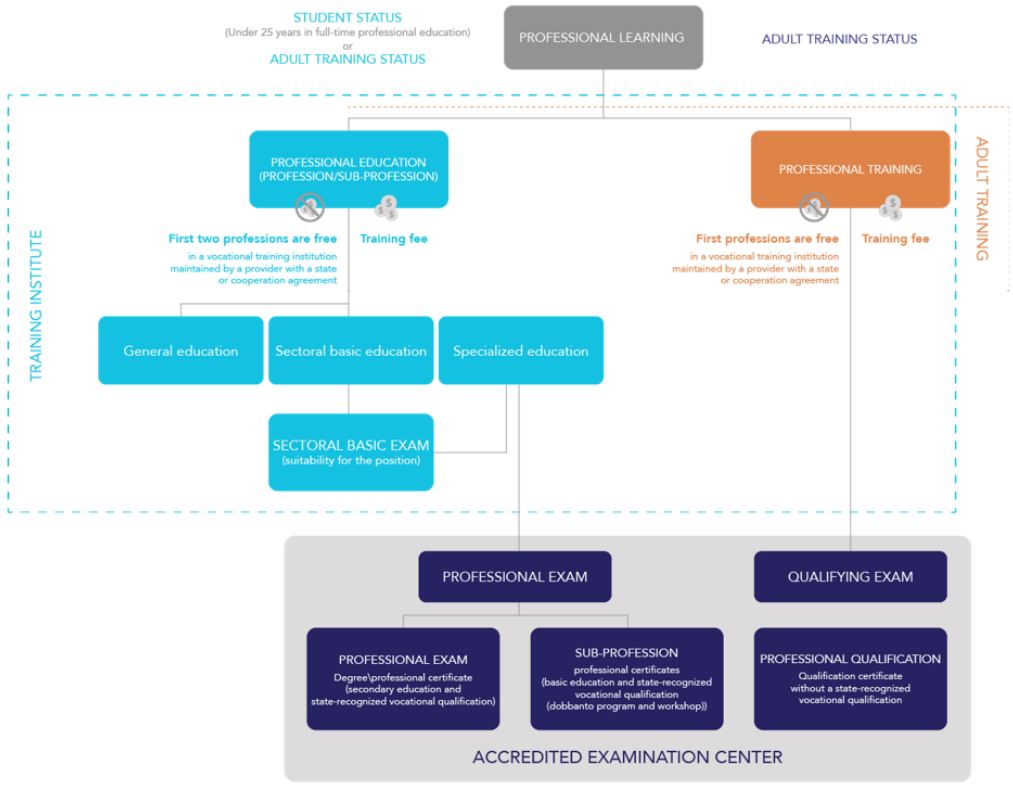
5 THE STATE OF VOCATIONAL TRAINING AND HIGHER EDUCATIONAL PROGRAMMES

Previously, in Chapter 3.2, the national training framework was presented. The purpose of this chapter is to provide an overview of the training programs related to the education and further education of all professionals involved in the building value chain, including vocational education and higher education within the formal education system, as well as training programs outside the formal education system (such as regulatory-based programs and voluntary certifications).

5.1 The national system for training construction professionals

5.1.1 Characteristics of the vocational training system-HuQF 3-5

Vocational education and training are the two pillars of our vocational education and training system which is shown in Figure 26.

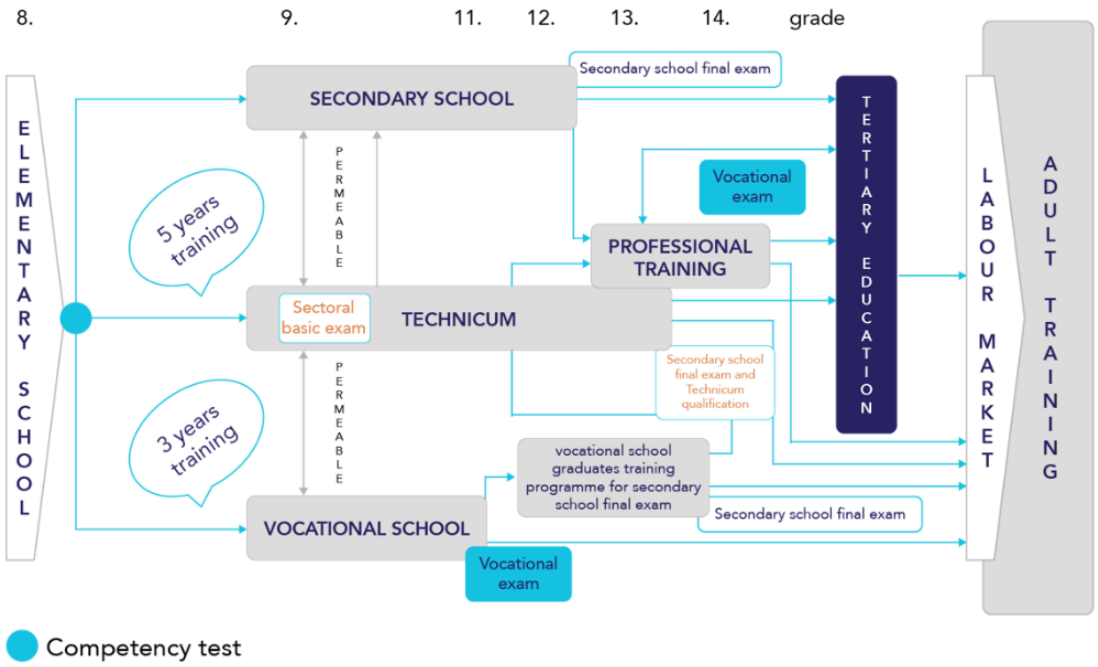


26. Figure: National vocational education and training system (revised figure, source: Kaibás, 2022)

Vocational education

Vocational education is integrated within the Hungarian school system and is offered through two types of vocational training institutions: technicums and vocational schools where it is possible to obtain a state-recognised profession. The Register of Vocational Occupations (SZJ) contains the list of vocations based on the **Annex to Government Decree 12/2020, which currently includes 179 professions**. The SZJ provides detailed information for each vocation,

including the sectoral classification, identification number (which indicates the Hungarian Qualification Framework level, Training Area, Sectoral Classification, and Occupational Classification Number), title of the profession, occupational direction, duration of vocational education, and the corresponding level of proficiency in the Digital Competence Framework.



27. Figure: Vocational training structure (revised figure, source: Kaibás, 2022)

Vocational education encompasses the instruction of basic sectoral knowledge, which typically taught during the first year of vocational schools and the first two years of technicums, completed by **a sectoral basic exam.** The exam is a prerequisite for progression and is incorporated into the final vocational exam upon completion of the education. Upon successfully completing the sectoral basic exam, students have the opportunity to select a specific vocation within their chosen sector and enter the dual training system. The sectoral basic exam also enables students to transfer between vocational schools and technicums, allowing for greater flexibility within the educational system.

Technicum

In the **five-year technicum** program**,** specific vocational training begins after the initial two years of sectoral basic training, alongside the study of general subjects. Starting from grade 11, students have the opportunity **to participate in dual vocational training**, which offers significant advantages in gaining practical experience in the real labour market. This is achieved partly through practical hands-on experience with the latest technologies and partly due to the possibility of students earning a wage through a VET employment contract. The five-year course concludes in a professional examination, which includes an interactive computer-based test and the completion of a project assignment. The professional examination serves as an advanced level school-leaving examination, eliminating the need for students to choose a fifth general knowledge subject in addition to Mathematics, Hungarian literature and grammar, History, and a foreign language. Upon successful completion of the technicum program, students are awarded a **technician's diploma** in addition to their secondary school diploma. This certificate qualifies them to work in middle-management

positions and may also facilitate their admission to higher education institutions if they choose to further their studies.

A new option in the field of secondary vocational education and training is the **certified technician training,** which can be offered by technicums with the approval of the Ministry. The programme is based on the cooperation between a technicum and a higher education institution - and dual partner company(ies). This training is particularly beneficial for individuals with good academic performance who have a clear view on they want to study at a higher education institution. The additional knowledge integrated in the training is primarily in the field of higher education fundamental knowledge. The additional training content is an extension of the specialized vocational training material within the five-year technicum after the sectoral basic training (from grade 11). A "certified technician" who obtains a grade of at least 4 in a professional examination will have a significant advantage, since the admission score for a specific course at the higher education institution can be calculated by multiplying the percentage of the professional examination by five.

In the field of construction, the following professions are **listed in the** new **Register of Vocational Occupations.** Vocations relevant to building energy are highlighted in red in Table 15.

REGISTER OF VOCATIONAL OCCUPATIONS according to Government Decree 12/2020 (II. 7.) of 12/2020 on the implementation of the Vocational Training Act, as amended by Government Decree 800/2021 (XII. 28.)						
		Vocation		**Duration of vocational education**		**Digital Compe-tence Framework-system level**
Sector	**level**	**Name**	**specialisation**	**with primary education**	**—with high school diploma**	
Electronics and electrical engineering	5	Automation technician	Automotive industry Energy and petrochemicals Building automation Production engineering	5 years	2 years	7
	5	Electrical technician for high current		5 years	2 years	7
	4	Electrician	Building electricity Electricity network Electrical apparatus and equipment	3 years	2 years	5
Construction	4	Carpenter		3 years	2 years	4
	4	Tinsmith		3 years	2 years	4
	4	Tiler		3 years	2 years	4
	4	Banker mason and cast stone maker		3 years	2 years	4
	4	Painter and decorator		3 years	2 years	4
	5	Bridge construction and maintenance technician		5 years	2 years	5
	4	Stonemason		3 years	2 years	4
	4	Mason		3 years	2 years	4

	5	Building construction technician		5 years	2 years	5
	5	Civil engineering technician		5 years	2 years	5
	4	Drywall specialist		3 years	2 years	4
	4	Structural engineer and fitter		3 years	2 years	4
	4	Insulation specialist		3 years	2 years	4
	4	Roofer		3 years	2 years	4
	4	Road construction and maintenance technician		3 years	2 years	4
	5	Road, railway construction and maintenance technician		5 years	2 years	5
Building Engineering	5	Building mechanical technician		5 years	2 years	6
	4	Cooling and ventilation system installer		3 years	2 years	5
	4	Central heating and gas network installer		3 years	2 years	5
	4	Water and sewerage installer		3 years	2 years	5
Wood - and furniture industry	4	Joiner		3 years	2 years	4
	5	Woodworking technician		5 years	2 years	5
	4	Upholsterer		3 years	2 years	4
Mechanical engineering	4	Construction, transport and construction machinery mechanic		3 years	2 years	4
	4	Building and construction locksmith		3 years	2 years	4
	4	Welding		3 years	2 years	4
Environment and water	4	Waste processing associate		3 years	2 years	4
	5	Environmental technician	Waste recovery, processing Administration Environment Nature conservation	5 years	2 years	6
	4	Water staff member		3 years	2 years	4
	5	Water technician	Regional water manager Municipal water manager Water engineering	5 years	2 years	6

15. Table: Vocations related to the built environment (HuQF 4-5) in the Register of Vocational Occupations (SZJ)

<u>Vocational schools</u>

Vocational training institution offer a **three-year program consisting of** one year of basic sectoral training followed by two years of vocational training. Similar to technicums, dual training is also available during these two years. Upon completion of the training, students can obtain a vocational certificate, which grants them a state-recognized professional qualification.

In some cases, both vocational school and technicums can be completed in a shorter period of time known as 'education without general knowledge subjects. This applies to individuals who already possess the necessary qualifications for the chosen vocation, such as completing the 10th grade for vocational school or holding a school-leaving certificate for technicums. In such cases, the training period is two years.

Vocational training

Vocational training is offered by vocational education and training institutions or adult training institutions, following the training programme in accordance with Act LXXVII of 2013 on Adult Education. This training provides individuals with the opportunity to obtain a vocational qualification. In order to address the needs of the labour market, certain activities and occupations may require qualifications that are no longer listed in the Register of Vocational Occupations but were previously included in the National Training Register.
These qualifications can usually be acquired over a shorter training period, often by taking into account their prior studies or professional experience. A certificate of completion of the vocational training is awarded, which allows the holder to take a qualifying examination at an accredited examination centre. Upon successful completion of the examination, a nationally recognised **certificate of professional competence** is awarded.

Adult training - vocational qualification

The regulation of adult training has undergone significant changes since 1 September 2020, with prioritizing the preparation for vocational qualification or partial vocations.

One branch of the new training structure is made up of vocations that can be learned in vocational education and training institutions (see vocational education and training), the other is made up of vocational qualifications that can be obtained in the framework of vocational training organised by vocational education and training or adult training institutions (adult training).

The state administrative body responsible for adult training utilizes the Adult Training Data Providing System (hereinafter referred to as FAR) to register adult training institutions and experts as well as to carry out its mandated tasks. As of 1 July 2020, adult training institutions have the ability to utilize FAR for initiating the notification and authorization of adult training activities in accordance with the provisions of the Adult Education Act.

Adult training institutions have the option to voluntarily provide data about their planned training courses to the state administrative body for adult training electronically. The responsible state administrative body publishes the details of the training courses offered by the adult training providers in a searchable list[35].

The list of vocational training courses preparing for a state-recognised vocational qualifications and the list of vocational qualifications available at independent examination centres are published on the website of the Innovative Training Support Center Plc (hereinafter: IKK). In the field of architecture and construction, the following vocational

[35] https://far.nive.hu/

qualifications (MKKR3) are available (highlighted in bold for those vocational qualifications that are considered relevant for the energy management of buildings):

Architecture and construction

- Architecture and urban planning
  - Cartographer
- Construction, building and civil engineering
  - Ornamental and historic buildings tinsmith
  - **Builder, installer and maintenance of flue-gas ducts**
  - **Facade constructor and fitter**
  - Industrial insulation tinsmith
  - Public road operation specialist
  - Maintenance technician of historic buildings
  - Historic buildings designer and decorator
  - Historic buildings restoration specialist
  - Window and shading fitter, installer
  - Reconstructional painter and decorator
  - Glazier
  - Railway maintenance specialist
  - Railway track worker
  - Water engineering and technology equipment mechanic
- Energy, electricity
  - **Gas and heat producing equipment mechanic**
  - **Cooling equipment operator**
  - **Cooling equipment, air-conditioner and heat pump mechanic**
  - Industrial oil and gas firing equipment operator
  - Boiler technician (over 12 t/h)
  - Boiler operator (max. 12 t/h)
  - **Facility energetics technician**
  - **Small renewable and other primary energy power plant installer of high-voltage**
  - **Electric distribution network installer, operator**

Adult training can also be used to learn **partial vocations of the** vocations listed in the Register of Vocational Occupations (MMKR 3), e.g.:

- Shuttering, scaffolding formworker, scaffolder
- House painter
- **Bricklayer**
- Machine plasterer
- Plasterboard installer
- Reinforcing steel installer
- Water insulation specialist
- **Heat and sound insulation specialist**
- **Flue-gas ducts installer**
- **Pipe network fitter**

The Education Training and Learning Outcomes Requirements (hereinafter "KKK") for each partial vocation are set out in the relevant vocation (e.g., formworker, scaffolder requirements are set out in the education training and learning outcomes requirements for the carpenter vocation).

Vocational qualifications and partial vocations have relatively shorter training periods, making them easier for adults to complete while working.

Education Training and Learning Outcomes Requirements

An important milestone for the acquisition of modern professional competences is the new approach to the definition of the Education Training and Learning Outcomes Qualification Requirements for the 174 vocations. The materials have been reviewed by the ministries responsible for the sector and the economic operators involved in the work of the Sector Skills Councils, so that the requirements are professionally sound, up-to-date and reflect the needs of the economy.

The Innovative Training Support Center Plc (IKK). website contains an ever-expanding list of Education Training and Learning Outcomes Requirements by sector. As a result of the cooperation based on the Vocational Education and Training 4.0 strategy, the Act LXXX of 2019 on Vocational Education and Training (hereinafter: VET Act) and the Government Decree 12/2020 (II. 7.) on the implementation of the VET Act (hereinafter: VET Decree).

According to the VET Act, "education and training learning outcomes requirements shall be prescribed for the vocations, ensuring the development and operation of a system of control, measurement and assessment, which shall be mandatory in vocational education and training. The training and outcome requirements may define, as a partial vocation, an autonomous and distinct part of the vocation which enables the acquisition of the competences required to perform at least one job. Unless otherwise provided for by law, the provisions laid down for the vocation shall also apply to the partial vocation."

Furthermore, "the education training and learning outcomes requirements shall be published as an official publication by the Minister responsible for vocational training on the website of the ministry under his/her responsibility, with the agreement of the member of the Government responsible for the sector concerned."

The content of the Training and Learning Outcomes Requirements is included in the VET Act in connection with the restructuring of the vocational education and training system and forms the basis for the programme curricula. They have been developed with the support of experts with a good knowledge of the Learning Outcomes Based Outcome Requirements. The content of the outcome requirements and the description of the examinations provide a sound basis for both the vocational training institution and the business organisations involved in dual training to reflect on and develop their own vocational training programmes.

Funding and scholarships

The Vocational Education and Training Act 2019 provides state support for two vocations and one vocational qualification. You can study one vocation in full-time education and the second vocation and vocational qualification can be obtained through adult training.

Students who are enrolled in a full-time free vocational education programme are entitled to a scholarship for their first vocational qualification. The amount of the scholarship is fixed in the basic sectoral education and depends on the academic results during the period of vocational training. After the sectoral basic exam, it is possible for students to learn the vocation in a dual training place with a vocational training work contract and receive a work permit. A part of the grant is paid as a career-starting allowance if the apprentice successfully completes the training and passes the professional examination. The grant is paid by the National Office for Vocational Education and Training.

Responsible authorities

The state administrative body responsible for vocational education and training is the **National Office for Vocational Education and Training and Adult Learning** (hereinafter: NSZFH The current system of the vocational education and training is regulated by Act LXXX of 2019 on vocational education and training (VET Act) and its implementing Government Decree No. 12/2020 (7.II.) VET Decree, and Act LXXVII. of 2013 on adult training (Adult Training Act) and its implementing Government Decree No. 11/2020 (II.7.). The VET Innovation Council, the Sector Skills Councils and the Chamber of Commerce are cooperating partners in its development and operation. The rapid pace of industrial and economic development requires flexibility in the vocational and adult education system, therefore the list of vocational qualifications is not defined by legislation. The output requirements for vocational qualifications are set out in the programme requirements, which can be proposed by anyone to the Minister responsible for adult education, training in response to market needs. The rules for its registration are laid down in Act LXXVII of 2013 on Adult Training, Government Decree 11/2020 (II. 7.) on its implementation and Decree 1/2023 (II. 28.) of the Ministry of Culture and Innovation. The proposal is commented on by the **Innovative Training Support Center** Plc, the **Sector Skills Council** and the **Hungarian Chamber of Commerce and Industry** as experts, and the authority involved in the registration process is the Adult Training Department of the State Secretariat for Innovation and Higher Education of the **Ministry of Culture and Innovation.** If approved, the Minister responsible for adult training will register the programme requirement, which, in addition to the content requirements, will also contain the conditions for organising the qualification examination and a description of the examination activities.

Accreditation scheme: bodies and training providers

The vocational training courses are completed with a state examination at Accredited Examination Centres. The IKK website provides the following information:

"To keep the economy competitive, it is essential for businesses to have a modern and skilled workforce. The focus in the overall development of the vocational education and training system is on well-defined outcomes requirements to ensure that training is responsive to labour market needs. Outcomes regulation justifies the creation of independent examination centres and standardised examination methods.

The professional examination for the acquisition of a vocation or the qualifying examination for the acquisition of a vocational qualification may be organised by an examination centre accredited under the Act on National Accreditation. The accrediting body shall accredit the examination centre on the basis of the national standard published by the Hungarian

Standards Institution. On the IKK website, the examination centres that have both accreditation and a successful certification exam are displayed.

Accreditation procedures and certification examinations are ongoing, so the list of accredited examination centres with certification exams will be continuously updated on the IKK website. The vocational education and training examination system was renewed in 2020, with accredited examination centres and the Innovative Training Support Centre Plc taking on the task of organising professional and vocational qualification examinations. Until 2025, during the transition period, professional examinations (including professional examinations for the acquisition of a partial vocation) may be organised by the state or by the vocational training institutions maintained by an operator with a cooperation agreement.

Individual and group candidates can apply electronically for the qualification examinations through the KRÉTA Electronic Examination Management Information System. The system allows to search for all currently advertised examinations even without registration. Students can apply for the advertised exams after registration.

Certification and accreditation framework

The Ministry of Innovation and Technology has established a system of **Sector Skills Councils** (hereinafter: ÁKT) and the **VET Innovation Council** (hereinafter: SZIT). The Sector Skills Councils, composed of representatives of companies, continuously monitor the development of the vocational training structure, economic, labour market and technical-technological processes in their respective fields. On this basis, they make proposals for the modernisation of the system of school-based vocational education and training, vocational qualifications and their professional content, and for the development of training in the short and medium term. Other adult education, post-graduate courses organised by a state-run and/or registered vocational education and training institution for more information are detailed in Chapter 5.2.

Statistical data

Some national enrolment data for the last 3 years. Unfortunately, no national database is available for the specific occupations mentioned earlier, as students can be recruited by sector, and the choice of vocation is made after the sectoral basic exam. Thus, national data for pupils enrolled in Grade 9 in the three sectors listed (construction, building engineering, electrical engineering-electronics) are included in Table 16.

Academic year	Technicum (MMKR 5)			Vocational School (MKKR 4)		
	Construction	Building-engineering	Electrical eng.	Construction	Building-engineering	Electrical eng.
2020	791	260	1354	1697	610	1043
2021	876	323	1392	1702	638	943
2022	901	367	1315	1809	637	1041

16. Table: National data on students enrolled in the 9th grade

National data show that the **number of students enrolled** in technicum in the **construction and building engineering sector is increasing year on year**. The same is true for the change in the number of students enrolled in the construction sector at vocational schools. For the **electrical engineering--electronics sector, we see a slight decrease in the number of entrants to technicum, while the number of entrants to vocational school in the building engineering and electrical engineering-electronics sectors stagnates.** These enrolment trends are good, considering that the number of students is decreasing year by year.

Profession (Construction)	Total construction students
Participants in sectoral basic training	1161
Carpenter	506
Tinsmith	94
Tiler	1201
Painter and decorator	1227
Stonemason	3
Mason	1206
Drywall specialist	163
Insulation specialist	209
Structural engineer and fitter	1
Roofer	123
Road construction worker	45
Participants in technicum	549
Total	**6488**
Out of total adult training	2464
Out of total student status	4024

17. Table: Number of students enrolled in the construction professions for the school year 2021/22 [source: ÉVOSZ]

The following table shows the enrolment figures of the Békéscsaba Center of Vocational Training (hereinafter: BSZC) for the 9th grade in the last three years in the professions concerned. For interest, the number of adult education students in the given year is also included.

Name of vocation	HuQF level	2020/2021		2021/2022		2022/2023	
		Full-time training	Education for adults	Full-time training	Education for adults	Full-time training	Education for adults
Building construction technician	5	59		67	16	70	
Road, railway construction and maintenance technician	5	3		12		12	29
Building mechanical technician	5	7	7	9	8	8	15
Electrical technician for high current	5	7	10	15	16	9	15
Carpenter	4	6	12	9	17	11	14
Tinsmith	4		12			1	
Tiler	4	14	8	17	18	15	14
Painter and decorator	4	12	5	19		15	
Mason	4	10		14		11	
Drywall specialist	4	1		1			15
Cooling and ventilation system installer	4	7		5	9	7	19
Central heating and gas network installer	4	9	7	8	8	10	
Water and sewerage installer	4	1		1	5	2	
Electrician	4	16	23	9	26	16	79
Total		**152**	**84**	**186**	**123**	**187**	**200**

18. Table: Data on enrolment in grade 9 at Békéscsaba Center of Vocational Training

Analysing the data (Table. 18), we see that while enrolment in full-time training (9th grade) in the listed vocations has increased by about 23% in the last three years, the **number of enrolments in adult education has increased by 222%**. For the 2022/2023 academic year, the number of adult education enrolments (200) exceeded the number of full-time enrolments (187). Adult education takes between 1 and 2 years to complete, while full-time students acquire a vocation in 3 or 5 years. This fact multiplies the proportion of adult learners who obtain a vocation in one period. The data shows that the Government's decision to support adult education (acquiring2 vocations and one vocational qualification for free) was well founded, as it is the only way to ensure that the labour market needs for skilled workers. In the year 2022/2023, the increase in the number of participants in adult education is particularly striking for the vocations of electrician and cooling and ventilation system installer, as the appropriate vocation is necessary to continue the activities related to these vocations. A prerequisite for the cooling and ventilation system installer vocation is to enrol in adult training for the cooling equipment, air-conditioner and heat pump mechanic vocational qualification with programme requirements.

Adult education jumped mainly in 2021 and 2022, when employers who were not dual training providers undertook to provide relevant vocational training for their own employees (which cost could be used to reduce the cost of social contributions). The IKK points out that "if the vocational training is provided by the employer to a person who is already in employment with the employer, in accordance with the provisions of Decree No. 12/2020 (II.7) § 248 (1) on the implementation of the Vocational Education and Training Act (VET Act), the parties

must amend the existing employment contract pursuant to § 248 (2) of the Szkr. in such a way that it complies with the conditions for the VET employment contract set out in § 250 of the VET Decree and provides the labour law guarantees for participation in vocational education and training that are also provided to the apprentice by the VET Act and the VET Decree. Given that the contracts are not to be judged by their title but by their content, for the purposes of claiming tax relief under § 17/A of LII. 2018 Act on Social Contribution Tax, the employment contract thus amended shall also be considered a VET employment contract and thus entitled to tax relief, regardless of whether the employer is registered in the register of dual training centres."[36] In terms of data, there is no national data available on the distribution of students by gender.

Characteristics of the vocational education and training system (training outcomes)

Based on the responses to a questionnaire sent to vocational trainers and graduating students by the Constructskills4LIFE consortium, the results are presented and evaluated below (scores a-h). The respondents' views reflect the extent to which the following topics are addressed by the current education system to achieve the energy and climate goals:

a.) skills for implementation of energy efficiency and renewable energy measures in buildings

As a result of the questionnaire survey, 82.2% of the responding trainers consider the teaching of building energy management very important (53.2%) or important (29%) for the effective performance of their current work, while 17.7% of the trainers consider the teaching of building energy management only partially important in their work.

In the questionnaire, the following answers were given to the question 'In the institution where you work, to what extent is the knowledge of designing near-zero energy buildings appear?'

- According to the trainers who responded, it is included in the training, but its thoroughness varies.
- According to the students, it also appears, but at a medium depth.

The current education system only tangentially addresses energy efficiency in buildings and renewable energy. It cannot be fully covered by one vocation and this is not the aim. In the current training system, the skills listed above can be acquired in the following vocations:

- Fluid exploitation technician (vocation, listed in SZJ)
- Building mechanical technician (vocation, listed in SZJ
- Cooling and ventilation system installer (vocation, listed in SZJ + Cooling equipment, air-conditioner and heat pump mechanic (vocational qualification, listed in PK) Central heating and gas network installer (vocation, listed in SZJ) + Gas and heat producing equipment mechanic(vocational qualification, listed in PK) + Flue-gas ducts installer (partial vocation, listed in SZJ)
- Small renewable and other primary energy power plant installer of high voltage (vocational qualification, listed in PK)

[36] Source : www.ikk.hu

b.) skills for delivering building deep renovation (including through modular and industrialised solutions)

As a result of the questionnaire research, it can be concluded that the topic of deep renovation is present in education, but at a roughly medium level, the responding students and teachers rate it similarly, with almost 30% saying it is less present, almost 30% saying it is present to a medium extent and almost 30% saying it is present in a high extent and in sufficient depth.
In today's education system, the following vocations, partial vocations and vocational qualifications are available to acquire the skills needed for the renovation of buildings:

- insulation specialist (vocation, listed in SZJ)
- Water insulation specialist (partial vocation, listed in SZJ)
- Heat and sound insulation specialist (partial vocation, listed in SZJ)
- Facade constructor and fitter (vocational qualification, listed in PK)
- Roofer (vocation, listed in SZJ)
- Cooling and ventilation system installer (vocation, listed in SZJ) + Cooling equipment, air-conditioner and heat pump mechanic (vocational qualification, listed in PK) + Air conditioning gas authority exam
- Central heating and gas network installer (vocation, listed in SZJ) + Gas and heat producing equipment mechanic (vocational qualification, listed in PK)
- Glazier (vocational qualification, listed in PK)
- Fenestration and sunscreen fitter, installer (vocational qualification, listed in PK)

Industrial insulation tinsmith

c.) skills for new and existing nearly Zero Energy Buildings (nZEBs) and bridging the gap towards Zero Emission Buildings (ZEBs)
As a result of the questionnaire survey, it can be concluded that the topic of near-zero energy buildings is covered in education, but at a roughly medium level, with a slight difference in the opinions of the students and teachers: almost 30% of students think it is covered less, almost 30% think it is covered moderately, almost 30% think it is covered in great depth, while teachers think it is covered slightly less.
The vocations and vocational qualifications listed for the previous question, extended:

- Building construction technician (vocation, listed in SZJ)
- Mason (vocation, listed in SZJ)

d.) skills for integration of renewable energy and efficient heating and cooling technologies, including in particular heat pumps roll-out; skills for installers to deliver heating and cooling upgrades as part of renovation projects
The previous questionnaire questions also cover this topic.

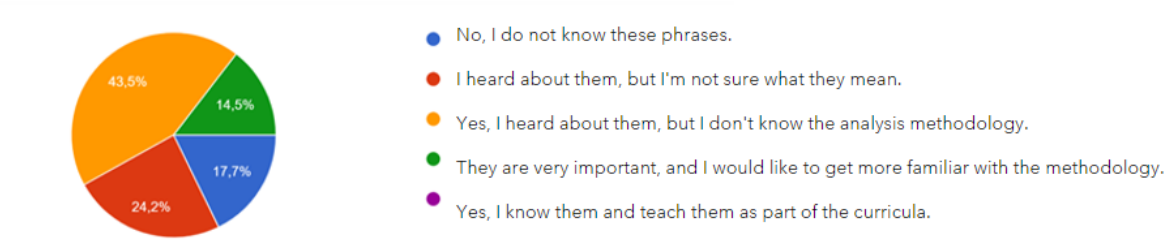
- Cooling and ventilation system installer (vocation, listed in SZJ) + Cooling equipment, air-conditioner and heat pump mechanic (vocational qualification, listed in PK) + Air conditioning gas authority exam
- Central heating and gas network installer (vocation, listed in SZJ) + Gas and heat producing equipment mechanic (vocational qualification, listed in PK)
- Electrician (vocation, listed in SZJ)

e.) skills related to whole life carbon (via the assessment of Global Warming Potential), circular construction and resource efficiency, and leveraging the Level(s) framework

The questionnaire survey shows that the topic of life cycle analysis does not appear significantly in vocational education and training, with similar responses from students and teachers.

The theme of the circular construction model is slightly present, but at a lower than medium level. For both topics, 25-30% of students answered, 'don't know'.

82.2% of the respondents representing VET teachers are familiar with or have heard about life cycle (cradle-to-grave) assessment methods, environmental life cycle assessment and/or life cycle cost analysis, but none of them teach it as part of the curriculum, as reflected in the answers to the previous question (Figure 28.). Expanding on the previous figure: 14.5% consider it very important and would like to know more about it and how to use it; 43.5% have heard of these analysis methods but do not know how to apply or use them; 24.2% have also heard of them but are not aware of what they mean; 17.7% are not familiar with these terms.



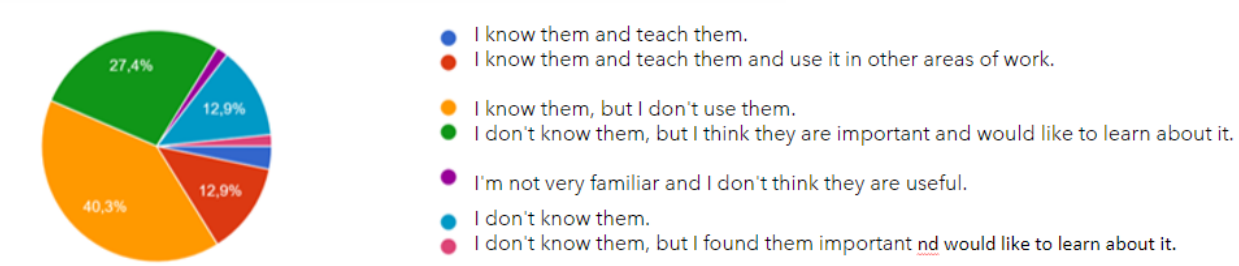
28. Figure: Results of the trainers' responses to the question "Are you familiar with or have you heard of environmental life cycle assessment and/or life cycle cost analysis?"

f.) digital skills supporting greater energy performance of buildings, in particular through an enhanced use of Building Information Modelling

The questionnaire survey assessed the use of building information modelling (BIM) and dynamic building simulation applications, and found that the responses of teachers and students differ slightly in **terms of BIM,** with 50% of teachers saying that it is not included in the curriculum, while students say that it is more likely to be included. **Dynamic building simulation** is not included in the curriculum at all according to teachers, while student responses are not really decisive, with almost equal proportions responding to all options. This is probably because the application and knowledge of these techniques varies from profession to profession.

Regarding trainers, 56.4% of the respondents have some knowledge of these digital techniques in construction, of which 3.2% know and train, 12.9% know, train and use them in their other work, and 40.3% know but do not use them (Figure 29.).

43.6% of respondents are not familiar with these techniques. Of these, 29.1% consider them important and would like to learn them, while 1.6% consider them unnecessary.



29. Figure: Results of the trainers' answers to the question "Do you know or have you heard of digital techniques in the construction industry (e.g. Building Information Modelling - BIM, Dynamic Building Simulation - Digital Twin, Building Management System?"

These skills can be acquired through the automation technician (building automation specialization) training.

g.) skills for upgrading the smartness of buildings for greater energy performance (based on the Smart Readiness Indicator), looking in particular at sensors, building controls and building management system

In the questionnaire, the themes of "smart buildings" and "smart cities and communities" show that both smart buildings and smart cities tend to be generally absent from VET. According to the students, it is moderately present.

The automation technician (building automation specialisation) training in the previous section is suitable for acquiring the necessary skills. It may be complemented by the Security systems technician (listed in PK) vocational qualification.

h.) skills needed for the energy upgrade of historical (heritage) buildings

According to the teachers' responses, the restoration of historic building tends to be given little or no attention in the teaching, while students feel that it is given more attention, with almost 30% of them saying that it is given and in sufficient depth, and only 20% saying that it is not given at all.

On the architectural side, the maintenance technician of historic buildings and historic buildings designer and decorator vocational qualifications are relevant, as both include in their job descriptions the possibility of incorporating modern materials:
"In addition to traditional building techniques and materials, he is constantly learning about new, innovative materials that can be used on historic buildings."

Summary

The current vocational education and training system includes, at its core, vocations and vocational qualifications that include knowledge that determines the energy efficiency of buildings. There are areas where competences cannot be covered by a single vocation, but where a PK vocational qualification is required to build on the basic vocation, sometimes even including an official examination (e.g. cooling and ventilation system installer (vocation, listed

in SZJ) +cooling equipment, air-conditioner and heat pump mechanic (vocational qualification, listed in P) + air conditioning gas authority exam).
According to the opinion of the teachers' respondents, the design of near-zero energy buildings, the use of renewable energy sources, building rehabilitation and deep renovation are covered in the training, but the scope and depth of these materials varies. Energy modernisation of historic buildings, circular building model, building information modelling, dynamic building simulation, smart buildings, life cycle analysis, building rating systems, smart cities and communities are not widely covered.

Around 25% of student respondents consider that they do not have enough information to answer this question. Knowledge materials on designing near-zero energy buildings, the circular building model, smart cities and communities are perceived to be covered in training, but the scope and depth of these materials varies. The use of renewable energy sources, building rehabilitation, deep renovation, energy modernisation of historic buildings, building information modelling are considered to be covered in the training, and their scope and depth are acceptable. Dynamic building simulation, intelligent/smart buildings, life cycle analysis, building rating systems are not covered to a large extent.

Compared to the teachers' responses, we see that students are more satisfied with the presentation and depth of these subjects. In the areas where they see the biggest gaps (dynamic building simulation, intelligent/smart buildings, life cycle analysis, building rating systems), the responses are in line with the instructors' opinions.

Existing instruments to monitor market developments

The vocational education and training system needs to adapt to the needs of the labour market, and to support this, **Sector Skills Councils have been established,** which have been operating under the guidance of the Hungarian Chamber of Commerce and Industry since 1 July 2018. Their work is regulated by Government Decree 213/2018 (22.XI.). Their tasks include comparing the programme requirements and curricular content of sectoral vocational qualifications with the current economic requirements and proposing rationalisation of the number of vocations taught.

The Sector Skills Councils continuously monitor the development of the vocational education and training structure in their respective sectors, economic, labour market and technical-technological developments, and, on this basis:

a) give an opinion in connection with the registration of the requirement for a vocational training programme,
b) make an elaborate proposal
    a. the register of vocational occupations,
    b. the duration of the vocational education, the education training and learning outcomes requirements and the professional content of the basic sectoral education,
    c. the development and content of a new vocational training textbook, and
c) prepares forecasts in order to plan and define the short and medium-term development directions and objectives of vocational education and training.

Sector Skills Councils relevant to the Situation Assessment Study:

- Construction
- Civil Engineering
- Electronics and electrical engineering
- Information technology and telecommunications
- Environment and water

In addition, the Ministry of Innovation and Technology established the **VETg Innovation Council** in 2018 to provide a common platform for cooperation between organisations involved in vocational education and training. The Council provides opinions on strategic issues and draft legislation, evaluates the effectiveness of vocational education and training and makes recommendations on curricula and programme requirements.

Career guidance

Experts have long called attention to the importance of proper career guidance. Among the many events, one of the most popular, though still insufficient, is the **"Stars of the Vocation" Festival.** Since 2008, the Hungarian Chamber of Commerce and Industry (hereinafter MKIK) has been organising the" Excellent Student of the Vocation" Competition (hereinafter SZKTV), extended by the National Vocational Studies Competition (hereinafter OSZTV). The national finals of the competitions take place in Budapest, at the annual three-day **"Stars of the Vocation" Festival**. In recent years, the festival has been organised in cooperation between the MKIK and the Hungarian Chamber of Agriculture (NAK).

The aim of the competitions is to increase the social recognition and attractiveness of practical, "physical" professions by promoting apprenticeships, under the slogan "Vocation in hand". In line with the economic and educational orientations of the Industry 4.0 programme, the Festival also aims to promote dual vocational training, nurture outstanding talent in vocational training, showcase vocational qualifications and the new Register of Vocational Occupations, and promote career choices for primary school pupils. The festival will also include sessions on the new Register of Vocational Occupations, entertainment and a programme of **EuroSkills** National Selection and **WorldSkills** International Competition demonstrations.

The main aim of the MKIK's career guidance activities, which have been running for several years, is to help people who are about to make a career choice to learn more about vocational education and training and the different vocations. Career guidance counsellors in the network of regional chambers of commerce and industry provide information on an ongoing basis, either through individual information sessions or group sessions. To help young people make career choices easier, MKIK has set up a website called Vocation World to make information more widely available.

5.1.2 Characteristics of the higher education system – HuQF 6-8

There are currently 62 higher education institutions in Hungary, ranging from small universities of applied sciences to research universities. In 2006, the European Union introduced a **new, modern higher education system**, known as **the Bologna Process.** It gives students the possibility to study in different European countries within a flexible framework, for example by establishing credit transfer between two countries (European Credit Transfer and Accumulation System - ECTS) or by creating a single diploma. The traditional college (3-year), university (5-year) and various doctoral programmes have been replaced by a new system where higher education is divided into three major stages: bachelor (BA, BSc), master (MA, MSc) and doctoral (Ph.D, DLA) programmes.

The first step in the new system is the **Bachelor's degree** (BA, BSc), which consists of 6-8 semester years of study and requires 180-240 credits to graduate. The second stage of the process builds on this: the **Master's degree** requires 60-120 credits over 2-4 semesters to obtain the degree. For some courses with a specific training portfolio (e.g. architecture), a master's degree can be obtained **in a** so-called "**split programme"** after 10-12 semesters of study, where 300-360 credits are required to obtain the degree.

Doctoral training, the post-master's training that prepares you for a doctorate: there are two types of doctorate, depending on the type of doctoral school: the classical "Doctor of Philosophy" (PhD) and the "Doctor of Liberal Arts" (DLA). Both types of degree are 6-8 semesters long and require 180 credits, including 20-40 credits in publication and teaching, to complete the degree, i.e. to start the doctoral process. In addition to the diploma, there are other requirements for the doctoral degree, typically substantial publication requirements.
To promote lifelong learning, the bachelor and master programmes are complemented by **professional engineering courses** for those already holding a degree. These courses allow students to deepen their knowledge in a specific area. Specialist engineering courses are 2-4 semesters long, with 60-120 credits.

Admission requirements for higher education ("entry requirements")

Under the previous legislation, the minimum score requirements were set centrally: 280 points for applicants for bachelor's and master's degrees, 240 points for applicants for higher education and 50 points for applicants for master's degrees, which were also included in the admission information.

However, from 2023, the legal minimum score will be abolished, and institutions will set the minimum score per subject themselves.

Admission scoring:

- Baccalaureate (school leaving exam) points (max. 200 points): it is up to the higher education institution to decide which two baccalaureate examinations to calculate the percentage of points for the baccalaureate and the level (basic or advanced) at which they must be passed.
- Academic points (max. 200 points): the academic point is made up of two parts: secondary school grades (100 points) and the average of the school-leaving exam (100 points). The admission information will specify which subjects (Hungarian language

and literature, mathematics, history and a foreign language), in addition to the compulsory subjects (Hungarian language and literature, mathematics, history and a foreign language), the institution will take into account the last two grades of the last two years of study in the admission procedure.

- Institutional points (max 100 points): the higher education institution (per field of study and per degree programme) may award institutional points on the basis of predefined performance under certain conditions and for certain titles. The admission information will indicate the value of this and the way in which it is justified (e.g. language examination, higher education diploma, national academic competition results, etc.)

In the past, there was no centrally set admission score for applicants to the Master's programme, which is determined by the institution.[37]

At the end of July 2022, after consultation with universities and student representatives, and based on public opinion surveys, a **decision in principle was taken to reform the higher education admissions system.** The aim is to strengthen the autonomy and responsibility of universities, so that institutions have a strong influence in the selection of students. The Education Office will be responsible for central coordination of the admissions process.

It is envisaged that the good practices that have benefited students in the past (e.g. access to university from vocational training, validation of the best of several scoring methods, scoring based on the diploma) will be maintained in the future and that access to higher education will be made easier for those who have previously studied or do not yet have a degree. Those starting their studies in September 2024 will be able to enter higher education under the new rules.[38]

Education and learning outcomes

The training and Learning Outcome Qualification Requirements (hereinafter KKK) are the set of knowledge, skills, abilities or competences and the knowledge that can be acquired to obtain a diploma in a given field.
Skills and competences of the engineering courses examined:

- architectural engineer
- architectural designer
- civil engineer;
- electrical engineer;
- mechanical engineer;
- engineering manager;
- environmental engineer.

Pursuant to Article 16/A of Act CCIV of 2011 on National Higher Education (hereinafter referred to as the Nftv.), *"The Minister shall publish the training and learning outcome*

[37]Source : https://emmiugyfelszolgalat.gov.hu/felveteli-ugyek/felveteli-rendszer/felveteli-rendszer
[38] Source : https://kormany.hu/hirek/nyilvanosak-a-2024-es-altalanos-felsooktatasi-felveteli-eljarasra-vonatkozo-intezmenyi-bemeneti-feltetelek

requirements - not including the training and outcome requirements for teacher training courses - as an official publication on the website of the Ministry headed by the Minister."
The number of credits required to obtain the degree, the field and duration of training, and the professional competences are specified. The competences are divided into the following groups: **knowledge, ability, attitude, autonomy and responsibility.** This was drawn up by university experts as a result of extensive social consultation.
In addition, Article 46 of the EU Directive 2005/36 contains the specifications that define the EU equivalence of the quality of architectural training. This article sets out the knowledge and skills that the institution must ensure the acquisition of during the training.
Bachelor's degree (BSc)
The BSc course is not essentially designed to train design professionals, but they can find employment in a wide range of fields that support designers (e.g. as construction managers or as designers' assistants). The aim is to train qualified (assistant) engineers who are **capable of carrying out construction, maintenance and operation, contracting and technical supervision tasks**.

Master's degree (MSc)
Regardless of the place of training, the MSc courses are essentially uniform in terms of the subject matter, and their aim is to produce **professionals who are qualified to work in the field of design.**

Funding and scholarships

The Higher Education Act 2011 introduced a new student financing scheme, which takes three forms:

- supported by a full scholarship;
- supported by a part-scholarship;
- self-financing.

Students can decide which form of funding they wish to take applying for admission. More than one form of funding per application can be indicated.

- **Full scholarships:** full scholarships are awarded to the best-performing applicants, based on their previous studies. The State fully funds a significant part of the costs of these students. The maximum duration of a scholarship is 12 semesters (sometimes 14 semesters).
- **Part-scholarship (partly state-funded):** applicants who do not reach the level required for a full scholarship, but fall just short of it, may be eligible for a part-scholarship. The state covers 50% of the study costs for these students.
- **Self-financing:** students can opt for self-financed training, where they pay the full cost of their studies.

Students on state scholarships and part-scholarships must undertake to work for an employer in Hungary for the same period as the scholarship within 20 years of graduating. If they fail to do so, they will have to repay the value of the scholarship. Paid childcare leave from previous employment in the home country and periods of unemployment with job-seeker's allowance are also counted as employment.

Once the publicly funded semesters have been exhausted, students can be reclassified as self-financed. The reclassification cannot be based on the student's weighted grade point average. The state also provides **other normative support**: dormitory support, housing support, textbook support, support for sports and cultural activities, scholarship support.

The government may establish **scholarships** to support students, teachers and researchers to improve the quality of education and research. The government determines the rules for awarding scholarships. The specific arrangements for grants and scholarships are determined by the institutions, taking into account the framework of the government decree. This gives institutions the flexibility to tailor their support to the needs of students and the specificities of their courses.

All students have access to a free-use **student loan with subsidised interest,** to be repaid after completion of studies. For those who take on the cost of their higher education, either on a part-scholarship or self-financed basis, the government provides an additional interest-free student loan.

Responsible authorities

The Nftv. regulates the operation of higher education institutions, the conditions for their establishment, the necessary requirements and the system of training. It also defines the powers of the state in the field of higher education, including the promotion of new training and teaching methods, solutions, organisational forms and the development of institutional networks. Finally, it lists the bodies responsible for monitoring the quality of training.

The **Education Office** (hereinafter referred to as OH) is responsible for the registration of higher education institutions and community higher education training centres, the commencement and modification of their activities, the maintenance of changes to the register and the removal of such institutions from the register.

The OH registers the Higher Education Planning Board, the Hungarian Rectors' Conference, the Hungarian Higher Education Accreditation Committee (MAB), the National Conference of Student Self-Governments, the National Association of Doctoral Students, the National Council of Scientific Students, the National Doctoral Council.

The **Higher Education Planning Board** is the body of the Minister responsible for education which provides advice and suggestions on higher education development issues. The Higher Education Planning Board gives its opinion on whether the inclusion of the subject in the higher education qualifications list is justified from a labour market perspective.

The **Hungarian Rectors' Conference** is a consultative, independent public body entitled to represent and defend the interests of higher education institutions, whose members are the heads of higher education institutions.

The **National Doctoral Council** is a public body composed of the presidents of the doctoral councils of higher education institutions, which takes a position on issues related to doctoral training and the awarding of degrees, and - in consultation with the National Association of Doctoral Students - determines the principles of the organisation of the complex examination.

The **Dual Training Council** is the body of the Minister responsible for coordinating science policy, which gives opinions and makes proposals on higher education development issues.

Accreditation bodies and training providers

In Hungary, the **Hungarian Accreditation Committee** for Higher Education (hereinafter referred to as MAB) is an independent, national expert body established to assess the quality of training, scientific research and artistic creation in higher education and the internal quality assurance of higher education institutions. The MAB is **involved as an expert in procedures relating to higher education institutions,** as provided for by law.

Certification and accreditation framework

The higher education institution draws up the **curriculum**, which includes the subject profiles, the credit numbers and the professors' profiles. After the approval of the curriculum by the Senate, the higher education institution initiates the establishment of the course by submitting the training and outcome requirement and the model curriculum to the Education Office and the training and outcome requirement to the MAB, in accordance with the Nftv.
The basic unit of training is **the subject**, which contains the competences defined for that subject. The aim of the subject is the achievement of the 4 main subject competences (Knowledge, Ability, Attitude, Autonomy and Responsibility) that the student will be able to achieve after completing the subject.

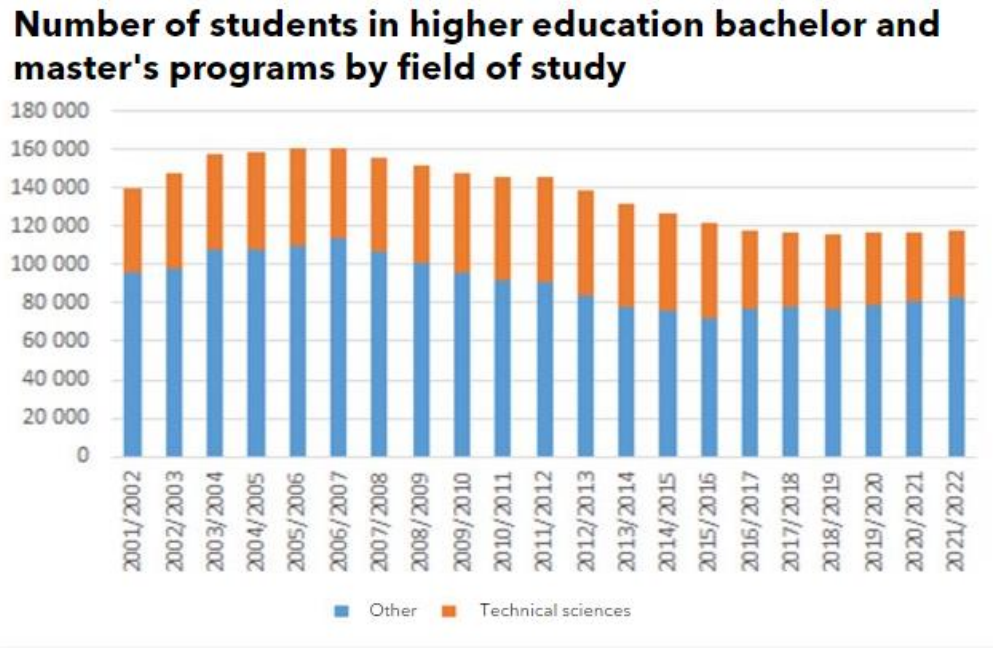
The MAB shall formulate its expert opinion in the procedures related to the operation of higher education institutions, the establishment of training courses, the establishment of doctoral schools and the launching of doctoral training, taking into account the Standards and Guidelines for Quality Assurance in the European Higher Education Area.

According to the Nftv., in certain procedures, the higher education institution may initiate that the MAB is replaced by an organisation proposed by the higher education institution, which is a full member of the European Association for Quality Assurance in Higher Education and registered in the European Quality Assurance Register for Higher Education, under certain specified conditions.

The **Hungarian Accreditation Committee** assesses **university teacher** applications within a uniform quality framework. Act CCIV of 2011 on The National Higher Education Act of 2011 sets out the conditions to be met for the appointment of university teachers. At the request of the institutions, the MAB assesses the teaching, scientific, artistic and sports achievements of applicants for university teaching positions, as required by the Nftv. In the evaluation process, the MAB applies independently developed criteria that take into account general and subject-specific characteristics, comply with the relevant legislation and make compliance easy to understand.

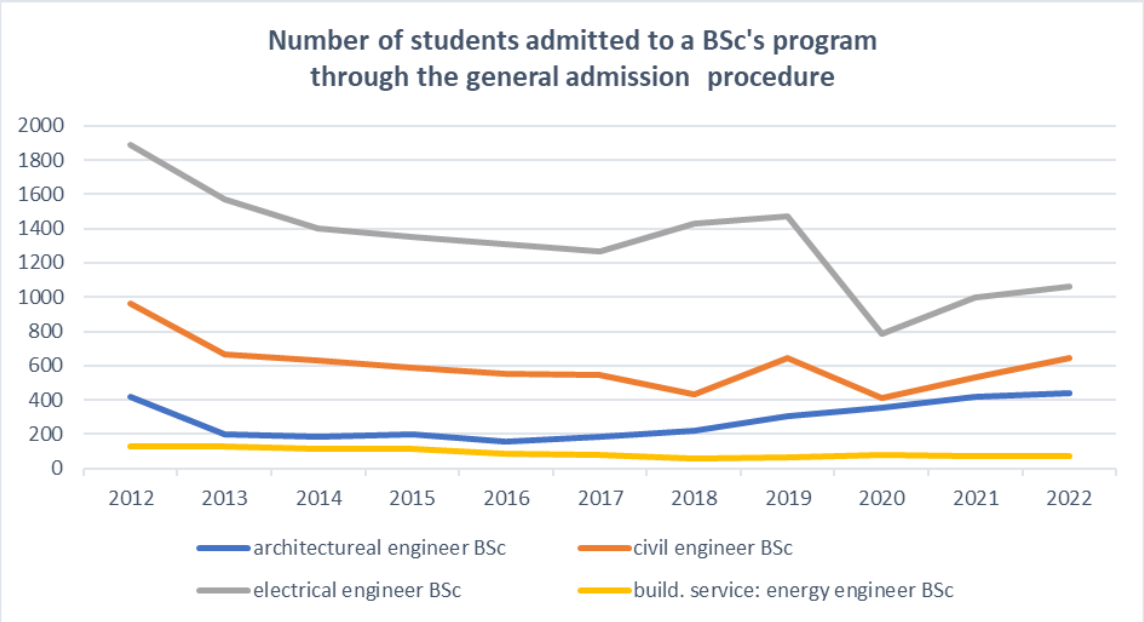
Statistical data

In Hungary, the number of students enrolled in higher education at bachelor's and master's level is **decreasing** between the academic years 2001/2002 and 2021/2022, mainly due to **demographic reasons**: **the number of children has been decreasing** since the 1980s (Figure 30).



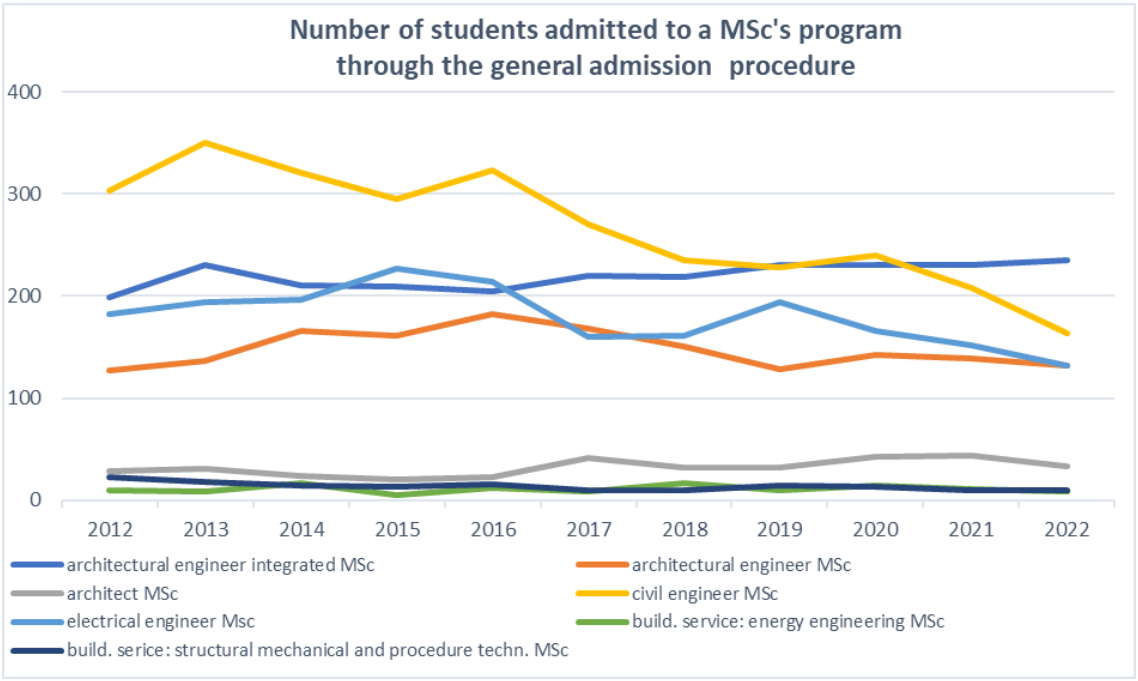
30. Figure: Number of students enrolled in bachelor's and master's degree programmes at tertiary level, by field of study (Own editing, data source: KSH)

Within this, the **average number of students studying engineering was 34.3%**, the highest in 2015/16 (40.9%), compared to 29.4% last year.



31. Figure: Number of students admitted to bachelor's degree courses in general admission (own editing, data source: KSH)

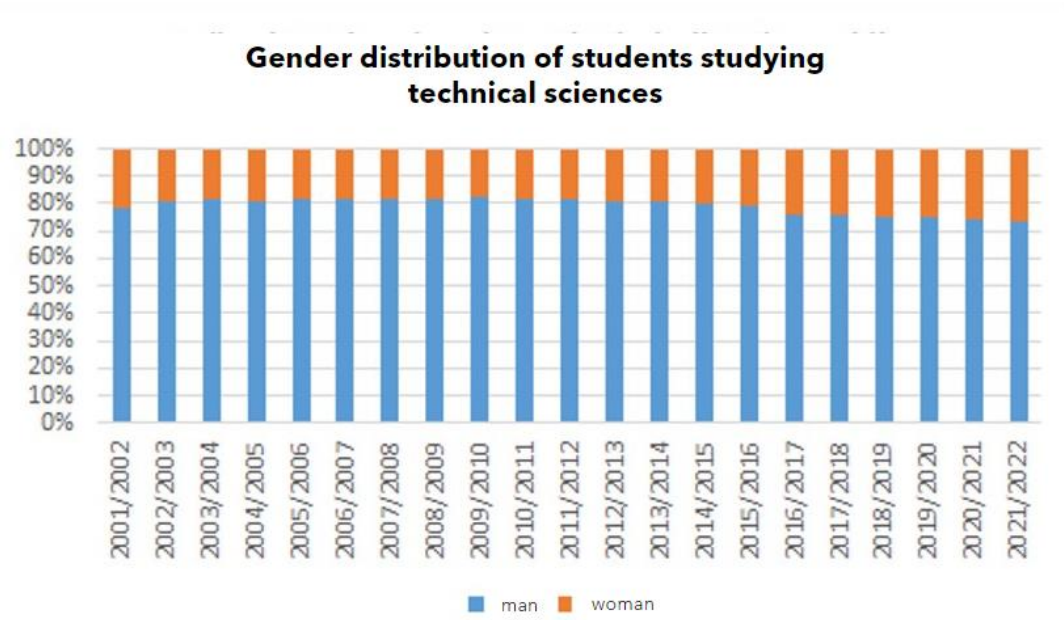
Looking at the Master of Science in Architecture (MSc) and the Bachelor of Architecture (MSc) programmes together, in general, the number of students enrolled in all programmes except Architecture has been **decreasing over the** last decade (Figure 31. and 32.). The main reason for this is also the steady decline in the number of children since the 1980s. No data are available on the number of young people who start their university studies abroad after graduation.



32. Figure: Number of students admitted to a Master's degree in general admission (own editing, data source: KSH)

The proportion of female students in engineering is slowly but steadily increasing from 17.7% in 2009/2010 to 26.6% last year (2022).

The proportion of women among students in architecture and architecture engineering has changed significantly over the past 30 years, from around 10-20% in the 1990s to well over 50% today (Figure 33.).



33. Figure: Distribution by sex of students studying engineering (2001-2021) (own editing., data source: KSH)

Table 19. below lists the accredited bachelor, master and doctoral programmes in Hungary, with their duration and the number of institutions. The average number of students who attended the courses over the last ten years is also shown.

Profession	Type of training	degree	HUQF level	duration of training (number of semesters)	number of training courses/year	Institution	number of students participating/year (2012-2022 average)	Financing*
Architectular engineer	architectural engineering intergated MSc program	Msc	7	10	3	BME, PTE, SZE	220	fs/ps/sf
	architectural engineering BSc	Bsc	6	7	5	BME, DE, OE. PTE, SZE	280	fs/ps/sf
	architectural engineering MSc	Msc	7	4	6	BME, DE, OE. PTE, SZE, SOE	148	fs/ps/sf
	architectural sciences doctoral training	DLA	8	8	3	BME, PTE, MOME		
	architectural sciences doctoral training	PhD	8	8	2	BME, PTE		
Civil engineer	civil engineering BSc	Bsc	6	8	6	BME, DE, NKE, OE, PTE, SIE	601	fs/ps/sf
	infrastructure civil engineering MSc	Msc	7	3	2	BME, SZIE	92	fs/ps/sf
	facilities engineer MSc	Msc	7	4	2	DE, SZIE	54	fs/ps/sf
	structural engineering MSc	Msc	7	3	4	BME, DE, PTE, SIE	124	fs/ps/sf
	Construction infomartion technology engineer MSc	Msc	7	3	1	BME	8	VAT/price/eachfs/ps/sf
	doctoral studies in civil engineering	PhD	8	8	2	BME, SZIE		
Electrical Engineer	electrical engineering BSc	Bsc	6	7	8	BME, DE, ME, OE, PE, PTE, SZIE, SZTE	1322	fs/ps/sf
	electrical engineering MSc	Msc	7	4	5	BME, DE, ME, OE, SIE	180	fs/ps/sf
Mechanical Engineer	energy engineer BSc	Bsc	6	7	2	BME, ME	91	fs/ps/sf
	energy engineering MSc	Msc	7	4	2	BME, ME	11	fs/ps/sf
	Building service Engineering for comfort spaces MSc	Msc	7	4	1	BME	13	fs/ps/sf
Interior Designer	interior and spatial designer MSc	MSc	7	3	1	METU		fs/ps/sf
Urban systems Engineer	Urban systems engineering MSc	MSc	7	4	3	DE, PTE, SZE		
Landscape architect	landscape architect	MSc	7	4	1	SZE		fs/ps/sf
Architect	architectural design MSc	MSc	7	4	1	METU, MOME, PTE, SOE		fs/ps/sf

* fs – full scholarship, ps – part scholarship, sf – self-financed

19. Table: Bachelor's and master's degrees, doctoral studies

The higher education institutions surveyed and their location:

- BME Budapest University of Technology and Economics (Budapest)
- EN University of Debrecen (Debrecen)
- ME University of Miskolc (Miskolc)
- METU Budapest Metropolitan University (Budapest)
- MOMEMoholy University of the Arts (Budapest)
- NKE National University of Public Service (Budapest)
- OE Óbuda University (Budapest)
- PTEUniversity of Pécs (Pécs)

Further specialised training

The professional training courses offered by higher education institutions are **professional engineering courses** organised by university faculties/departments, typically lasting 2-4 semesters. They do not start every year, usually every 2-3 years, but sometimes there are 5-7 years between courses on the same subject, depending on the number of applicants. Typical numbers are 15-25 participants per course.

Table 20. below lists the currently accredited professional engineering courses in Hungary that deal with building energy and environmental awareness.

Specialist area	Type of training	HUQF level	duration of training (number of semesters)	number of training courses/ year	Institution	funding
Energy	alternative energy specialist	6	2	2		sf
	alternative energy engineer	6	2	1	NJE	sf
	alternative-energy management consultant	6	4	1	SZIE	sf
	energy engineer	6	3	1	NYE	sf
	energy loss detection auditor	6	2	1	SZE	sf
	energy management specialist	6	2	1	BCE	sf
	energy management engineer	6	4	2	SOE, SZIE	sf
	professional engineer for energy production	6	4	1	BME	sf
	sustainable energy engineer	6	2	1	EDUTUS	sf
	sustainable development specialist	6	2	1	PE	sf
	geothermal engineer	6	4	1	ME	sf
	plant energy engineer	6	2	3	DE, PTE, SZIE	sf
	renewable energy specialist	6	3	1	EN	sf
	renewable energy specialist	6	3	1	SZTE	sf
	alternative energy management	6	3	1	SZIE	sf
	Energy management	7	4	4	SE	sf
	energy management consultant	4	4	1	SE	sf
	urban energy engineer	6	2	1	EN	sf
	solar energy recovery engineer	6	2	1	SZIE	sf
	building energy passive house design engineer	6	2	1	SZIE	sf
Environmentally aware	environmental civil engineer	6	4	1	BME	sf

	environmental management-environmental protection engineer	6	4	1	ECE	sf
	applied environmental engineer	6	4	1	PE	sf
	Technical and Sustainability Strategy Manager	6	2	1	EN	sf
	solar energy recovery engineer	6	2	1	SZIE	sf
	engineer specialising in the installation of solar systems	6	3	1	OE	sf
	environmental engineer	6	4	1	SZIE	sf
Support structure	structural design engineer	6	3	1	BME	sf
	structural design engineer	7	3	1	SOE	sf
	structural engineer for structural reconstruction	6	4	1	BME	sf
	structural engineering - glass and metal enclosures specialist engineer	6	3	1	BME	sf
Execution	construction engineer	6	4	1	BME	sf
	construction investment engineer	6	3	1	BME	sf
	construction materials manager engineer	6	4	1	PE	sf
	master builder professional engineer	6	2	1	DE, SZIE	sf
Other	building services engineer	6	2	1	NJE	sf
	building insulation engineer	6	4	1	BME	sf
	facilities exploration specialist	6	3	1	BME	sf
	facilities exploration engineer	6	2	1	SZIE	sf
	building renovation and maintenance engineer	6	4	1	BME	sf
	interior design engineer	6	4	1	BME	sf
	civil engineer	6	4	1	BME	sf
	technical property management engineer	6	4	1	EN	sf
	green area management engineer	6	4	1	NJE	sf
	architectural design engineer	6	4	1	BME	sf

Sf – self-financed

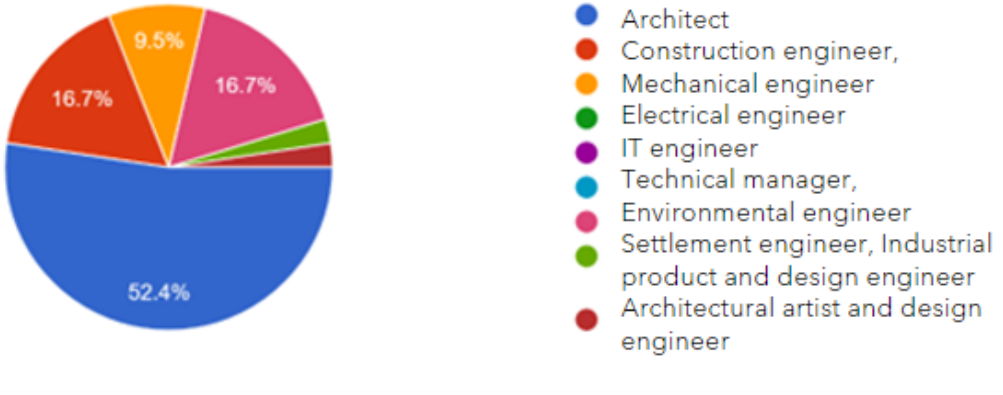
20. Table: Selection of accredited professional engineering courses in Hungary

Higher education institutions and their location:

- NJE Neumann János University (Kecskemét)
- NYE University of Nyíregyháza (Nyíregyháza)
- PE University of Pannonia (Veszprém)
- SOE University of Sopron (Sopron)
- EDUTUS University (Budapest - Tatabánya)

Characteristics of the higher education system (learning outputs)

Around half of the respondents to the questionnaires for higher education teachers were civil engineers, with additional responses from civil, mechanical and environmental engineers (Figure 34.). The vast majority of student responses (70%) came from the Faculty of Architecture (Figure 35.).



34. Figure: Distribution of responses from teachers in higher education institutions to the question "What type of students are you teaching?"

35. Figure: Distribution of responses from students in higher education institutions to the question "What training do\did you take part in?"

In the questionnaire, the following issues were addressed about the current education system:

1. design of nearly Zero Energy Buildings (NZEB) (architecture, mechanical and electrical engineering)
2. use of renewable energy sources
3. deep renovation, refurbishment (architecture, engineering and building services)
4. energy modernisation of heritage buildings
5. circular construction model (building materials, construction technologies, water management)
6. building information modelling (BIM)
7. dynamic building simulation
8. intelligent/smart buildings (building management system)
9. environmental life cycle analysis (global warming potential assessment)
10. building certification systems (LEED, BREAM, WELL)
11. smart cities and communities

Both the teacher and the student questionnaires asked the following questions related to the listed topics:

- To what extent is the knowledge of the below topics covered in education in order to achieve the 2030 building energy and climate targets?
- In the case of student work, what is the depth of knowledge covered in the subject areas listed below?

The extent to which a given subject is covered is assessed by the **nature of the subject**: if it is a compulsory subject or part of a compulsory subject, it is taught to all students. On the other hand, if a topic is included in an optional subject, it reaches only a subset of students. After the examination of the subject matter, it is a question of the **assessment of the knowledge transmitted**: the theoretical knowledge acquired is tested in the form of examinations and final papers in several courses, but its practical application is also of paramount importance, i.e. the extent to which it is reflected in the students' work at university. In the case of architects and civil engineers, this student work is typically the design of a building or part of a building, or the design of parts of a building. For environmental engineers, it is a case study, while for civil engineering students, it is typically a stand-alone case study and design of part of a building. For civil engineering students, a stand-alone simulation and/or sizing or case study.

The responses show that there are different opinions among teachers and students about the presence of the themes in teaching and student work. The discrepancy is due to several factors. Firstly, lecturers and students may have different perspectives on the presence of the subject. Instructors may prefer to evaluate it from the perspective of the curriculum and the structure of the subject, while students rely on their own experiences and expertise.

Secondly, the presence of the topic in the teaching and student work depends on the mode and layout of the specific course or subject. This difference of opinion can be important to improve the learning process and increase student satisfaction. It can help to develop teaching programmes and subjects to better match students' needs and to promote a deeper understanding of the topics.

The results of the 116 responses to the higher education questionnaire are presented below, by subject area. Detailed results of the questionnaire are presented in Annex 2.

a) for implementation of energy efficiency and renewable energy measures in buildings;

The majority of teachers (70%) believe that the topic is covered in compulsory or optional subjects. But only less than 50% of them think it is present in student work. On the other hand, about 50% of students think that they have received the material and applied it in their work. **Conclusion:** the presence of the topic in education and student work is variable and not uniform.

b) skills for delivering building deep renovation (including through modular and industrial solutions);

According to 70% of teachers, the topic is part of compulsory or optional subjects, while 50% of students said it was hardly present in their teaching and work.
Conclusion: there are different opinions among teachers and students about the presence of the topic in teaching and student work.

c) the skills for new and existing nearly Zero Energy Buildings (nZEBs) and bridging the gap towards Zero-Emission Buildings (ZEBs);

The subject is typically taught as a compulsory optional subject according to 50% of teachers, but only 40% of students say it is present in their coursework. 60% of students think that it is taught and mostly used in their work.
Conclusion: the unevenness in teaching and student work shows that the presentation and application of knowledge is not uniform.

d) **skills related to whole life carbon (via the assessment of Global Warming Potential assessment) circular construction and resource efficiency** Just under half of the teachers think that the topic is covered in an optional course or in students' work. Even fewer students recall it being part of their teaching.

Conclusion: the presence and embeddedness of knowledge in teaching and student work is unsatisfactory.

e) circular construction model (building materials, construction technologies, water management)

According to 60% of lecturers, it is not included or is only included as an optional subject and is not reflected in student work. 50% of students say that it is barely reflected in teaching as a subject or in their student work.
Conclusion: the knowledge presented in teaching and student work is disproportionate and insufficient.

f) digital skills to supporting greater energy performance of buildings, in particular through an enhanced use of Building Information Modelling;

According to 60% of teachers, the subject is only taught as an optional subject and is hardly included in student work. However, 70% of students think that the material is taught, although it is only slightly used in their work.
Conclusion: although the knowledge was imparted during the training, the students were less able to apply it effectively in practice.

g) dynamic building simulation;

The majority of teachers' responses indicate that it is not included in the curriculum or is optional. The same was reported in student responses.
Conclusion: a large majority of teachers and students agree that the knowledge is not adequately presented in the teaching.

h) skills for upgrading the smartness of buildings for greater energy performance (based on the Smart Readiness Indicator), looking in particular at sensors, building controls and building management system;

According to 70% of lecturers and 50% of students, the subject is barely covered in the curriculum and student work.

Conclusion: a large majority of teachers and students agree that the knowledge is not adequately presented in the teaching.

i) smart cities and communities

Around a quarter (25%) of teachers believe that the subject is not taught at all, while just over a quarter (30%) believe that it is only introduced as an optional subject. A further 27% believe that it is also taught as a compulsory subject. However, the vast majority of teachers (70%) believe that the subject is not included in student work. Two thirds of students say that the subject matter is present to some extent and nearly 50% say that they have been able to use it in their work.

Conclusion: the presence and application of knowledge varies.

j) skills for energy upgrade of historical (heritage) buildings.

According to 60% of teachers and 85% of students, it is not included at all or only as an optional subject, and therefore it is less represented in student work.

Conclusion: the significant difference of opinion between teachers and students suggests that the overall level of knowledge representation in teaching and student work is low.

Summary

Theoretical and practical training do not provide an even spread of knowledge. Online education, e-learning, on the other hand, has remained at a very low percentage following the reopening, despite the spread of the covid epidemic. Moreover, the percentage of project tasks that prepare students for real-life tasks is also low. There is a lack of uniformity in the availability of teaching aids for individual teaching materials, as well as a lack of clearly formulated teaching aids that define concepts precisely (e.g. environmental impact, environmental approach). There is also often a lack of consensus among academic stakeholders as to which architectural/structural solutions are considered 'environmentally friendly' and why. Building-level design is the most frequently cited task and self-dimensioning the least. In the case of TDKs, there are already some topics that deal with the further development of the listed knowledge, but not yet in a decisive proportion. In postgraduate post graduate courses, 66% of the topics related to the listed areas already appear, but only occasional opportunities for further training are available for lecturers at the university. Thus, environmentally conscious architecture is present in the education system, but further efforts are needed to raise awareness among students. There is little information and practical education on alternative materials and environmentally conscious construction. These topics are covered in some optional courses but are not yet included in the compulsory curriculum. It would be important to include these subjects in the compulsory curriculum with more emphasis on them (e.g. through more practical exercises and real-life projects), as well as more methodological knowledge and good practice examples of areas that can help to guide responses to the impacts of climate change.

Monitoring changes in market demand

For higher education, the Office for Education determines the level of specialist skills needed. However, it is important to note that higher education institutions have considerable autonomy in deciding which courses to offer. The **Higher Education Planning Board is a** body of the Minister for Education which provides advice and suggestions on higher education development issues. The Higher Education Planning Board gives an opinion on whether the inclusion of a course in the higher education qualifications list is justified from the point of view of the labour market and employment.

5.1.3 Existing measures to make the renovation and construction sectors more attractive to women and young talents

Below are some of the national or local programmes organised for young people, but these are not exhaustive:

- **BME Children's University** - summer camp for schoolchildren

The BME Children's University is a five-day event for 8-14 year olds at the Budapest University of Technology and Economics, where students can get an insight into university life during the week.

- **Discover the future at the University of Technology and Economics** - High School Scientific Student Conference

At the BME 2023 Autumn Scientific Student Conference (reffered as TDK), high school students also tested their skills and presented their research results. High school students from all faculties of the BME were offered TDK topics, so that high school students have the opportunity to deepen their knowledge in their chosen subject area and to conduct joint research with the invited consultant, which is valuable in itself and will be of great value for university admission and later on the labour market.

- **Researchers' Night**

Researchers' Night is a series of free events across Europe **to promote science and careers in research**. The last weekend of September each year is a chance to get a glimpse into the secrets of different scientific disciplines. Through entertaining and inspiring lectures, experiments, laboratory visits and playful activities, people of all ages can discover the many new findings of scientific research. The main aim of the event, initiated by the European Commission's Marie Skłodowska-Curie Actions, is to make the diverse work of researchers and developers attractive to young people.

- **Girls' Day**

The Women in Science Association organised the 12th edition of the Girls' Day programme for young people interested in science, technology and IT. The aim of the initiative is to give primary and secondary school students who are about to choose a career a taste of the jobs of the future by giving them the opportunity to visit a number of large companies, universities and research institutes across the country and gain an insight into the practical applications of engineering and science.

- **Profession Star Festival**

The aim of the competitions is to increase the social recognition and attractiveness of practice-intensive, "physical" professions by promoting apprenticeships, under the slogan "Apprenticeships in the hand". In line with the economic and educational orientations of the Industry 4.0 programme, one of the main objectives of the Festival is to promote career choices for primary school pupils.

- **"Open Days", "Open Doors"**

Vocational schools usually organise "open days" in October, November and December for primary school students and their parents who are about to choose a career. This is the most credible opportunity for the school to present itself, as it gives an opportunity to see the school's facilities and the conditions for vocational training. They can find out about the school's educational and training facilities, its participation in international programmes, scholarships, sporting activities, etc. Primary schools also organise parents' meetings on career choices, but these are less effective than school open days.

- **Career Fair**

In some counties (usually in the county seat), the County Government Offices organise a "Career Fair" in cooperation with the county chambers of commerce. In addition to secondary schools and vocational training institutions, higher education institutions and the largest employers also have stands there. Students from primary and secondary schools are invited to attend these events, where they can find out about labour market needs and training opportunities.

5.2 Courses and training schemes beyond professional training systems

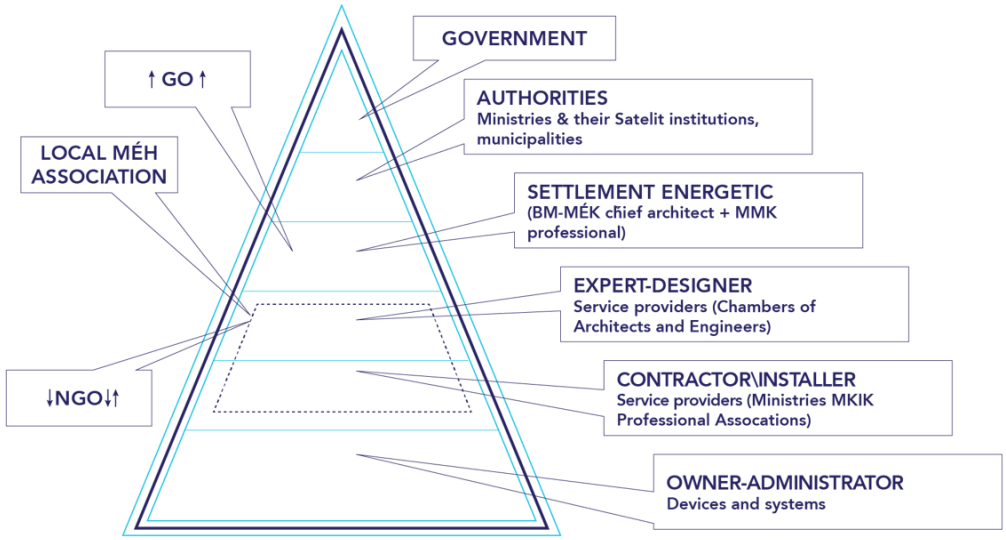
The present ConstructSkills4LIFE project examines the workforce supply of the construction industry in Hungary in the HuQF 1-8 structure and in the whole life cycle of the facilities, the relevant actors, the direct stakeholders, based on the following ideas regarding adult education and postgraduate:

- Incorporating **up-to-date knowledge of** new challenges into school-based training is time-consuming and knowledge is rapidly obsolete, hence new entrants to the labour market do not always have **up-to-date knowledge on** a permanent basis**,**
- When entering the labour market, none of the new entrants is yet suitable for independent, responsible, professional work, a few years of "practice" and appropriate training are needed **for independent activity**, and in essence, it becomes clear during the professional practice and further trainings who and **what they are suitable for.**
- Due to the lack of active replacement and the emigration of foreign workers, priority should be given to increasing the number of **new entrants**, retaining **current employees** and the number of "**career changers**" who can be attracted to the profession, and to the recognition of their acquired knowledge, with the corresponding development of related retraining and further training methods and systems.
- All market players need to adopt and promote a "personalised" **career path model of his/her own for building industry**.

- The system of career path development and further training (adult education, post-graduate training) may be **voluntary, official or** an **official type** qualification, but
    - Voluntary training is random, i.e. it depends on the employer, personal habitus, temperament and task,
    - Compulsory (official, regulatory) training, on the other hand, can provide up-to-date knowledge, lifelong learning, a career path and appropriate accountability.
- At the same time, in the HUQF 1-8/Built environment lifecycle structure, the **relevant (managing) persons and entities** responsible for building energy and environmental performance requirements can be identified in each profession, and the application and gradual development of their official, official type qualifications and eligibility requirements can result in **positive trends,**
- In addition, given that the employee concerned is not a legal person, the **professional and legal compliance of** the employing **company or institution** must also be examined.

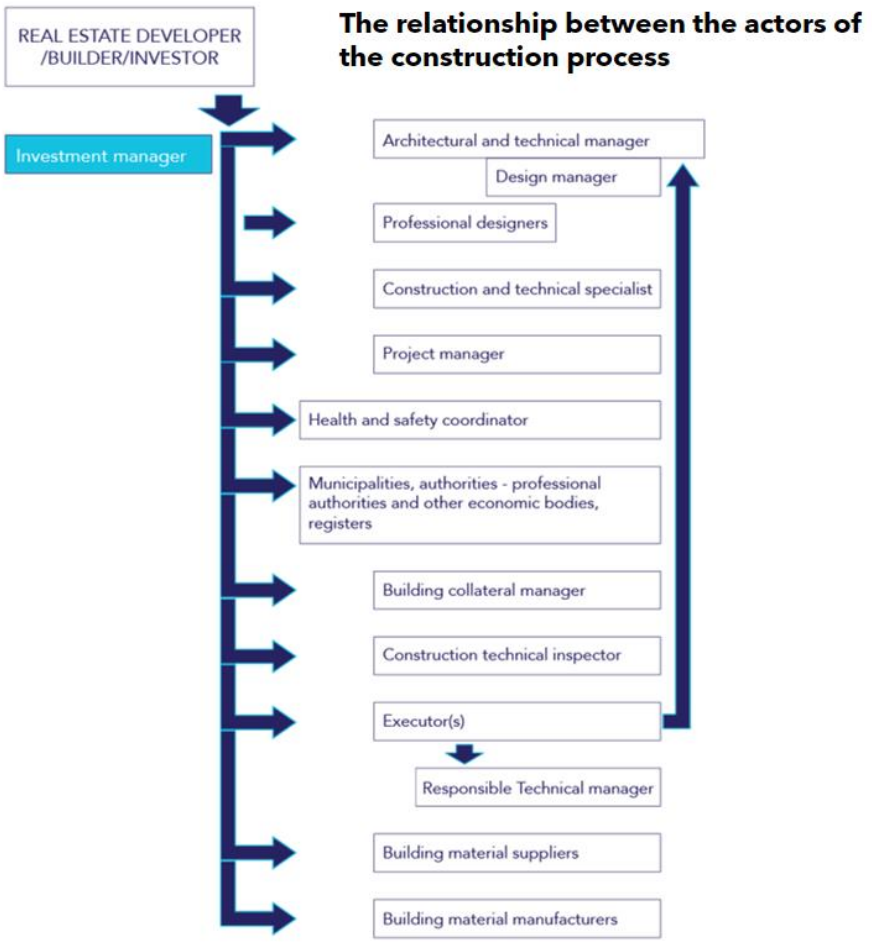
5.2.1 Key actors in the whole life cycle of the built environment

In Figure 36 below, a pyramid presents the important and responsible actors of our built environment in the energy transition, building energy and environmental protection, the main groups, institutions, persons of those interested in the construction industry, their hierarchy, showing the role of governmental (GO) and non-governmental (NGO) actors, while the pyramid shape can also convey the number of multiplicity. The local Hungarian Building Professionals' Cooperative (MÉH Szövetkezet) shows positioning the possibility of a cluster-like collaboration.



36. Figure: Pyramid of human resources structure in the construction industry (Source: MÉgKSz, Hungarian Construction Human Resources (MÉH) Structure/ZoltánAttila/2015)

The possible interrelationships and interdependencies of the relevant actors involved in the creation of the built environment, in the whole life cycle, in the construction and maintenance process are illustrated in Figure 37.



37. Figure: Relationship between the actors in the construction process (Source: TERC[39])

5.2.2 Main aspects of the adult education systems

The basic principles for the training and qualification of the potential professional entities involved in the ConstructSkills4LIFE project's training and qualification strategy, according to which we can examine the existing system of adult education, are broadly defined below. Our aim is to examine whether there are adequate training, qualification, entitlement and responsibility structures, legal and institutional systems that can be integrated into a future system, and which, if properly coordinated, will ensure an **adequate institutional and human resource** system in the long term.

Personnel training and qualification systems

In line with the principles described in the introduction to this chapter, the **structure and operation of the qualification and qualification system for** legal entities, companies and/or their employees and **workers** involved in any stage of the life cycle of our built environment, which will be developed in the course of this project, should serve the purpose and the expected result of ensuring that the provision of professionals who meet the energy performance requirements of our buildings, and the construction and maintenance of the buildings, are always available to those involved:

[39] https://www.terc.hu/documents/El%C5%91ad%C3%A1s.p

- a level of competence (expertise) appropriate to their field of specialisation;
- the professional qualifications and qualifications required for their specific activities, as well as the entitlements required by the relevant legislation, kept up to date through appropriate trainings;
- and have a quality assurance and accountability system linked to their activities.

Qualification, certification and registration of enterprises

As the employee, the employed professional, is not a legal entity, his employer, such as the enterprise or construction company must also meet certain **activity criteria,** i.e. it must have a scope of activity:

- legal compliance, activity registration;
- staff, work process descriptions and technical equipment, such as tools, machinery and auxiliary materials, appropriate to its field of activity,
- a reliable quality assurance system and administrative background, and;
- other activity-specific conditions and product-specific skills.

Taking into account the above basic principles and ideas, the project will examine the **current situation of domestic construction trainings and qualifications in the** following areas of construction and related activities and develop proposals for strategic modification and development measures.

Analysis of the construction process, life cycle of buildings, relevant milestones

a.) Investment preparation, project implementation
b.) Design - permission - tender design - expertise - review
c.) Construction - adjustment – putting into operation
d.) Commissioning – operation - maintenance - reconstruction
e.) Demolition - recycling - disposal
f.) Personnel and institutional conditions for adult education, training and qualifications

The companies involved in the construction, renovation and maintenance process directly responsible for energy compliance**, their professional personal and their activities, stakeholders of training and education:**

- Builder, investor (technical inspector):
  - drawing up a planning programme
- Designer (senior and section designers):
  - design studio tour
  - expertise
  - review
- Contractor (contractor, responsible technical manager, building inspector, installation manager, chief technician, etc.):
  - construction, commissioning, adjustment
  - test run, handover
- Operator, maintainer, owner:
  - facilities management-maintenance
- Training, education, further education, adult education, staff and business qualification stakeholders.

As an example, a past simplified proposal from the building services engineering profession for the eligibility, qualification and training structure to be examined, which can be applied and transferred to other relevant co-professions in the construction industry. Table 21 shows the matrix of professional competences, activities/qualifications in building services engineering.

	with continuous training	Research and development	Education	Design	Leader design	Specialist activity	Building energy audit	Official licensing and permitting	Project preparation	Construction preparation, implementation, and audit	Construction	Commissioning, installation	Quality assurance activity	Operation management	Service, maintenance	Sales
PhD	+	x	x	x	x	x	x	x	x	x	o	o	x	x	o	x
PhD	-	x	x	x	o	o	o	x	o	o	o	o	o	o	o	x
MSc – grad. eng.	+	x	x	x	x	x	x	x	x	x	o	x	x	x	o	x
MSc	-	x	(x)	x	o	o	o	x	o	o	o	o	o	o	o	x
BSc - engineer	+	x	x	(x)	o	(x)	o	x	x	x	o	x	x	o	o	x
BSc	-	o	o	o	o	o	o	o	o	x	o	(x)	o	x	x	x
technican 1	+	(x)	(x)	(x)	o	o	o	(x)	x	x	o	x	x	o	o	o
technican 2	-	o	o	o	o	o	o	o	o	(x)	o	(x)	o	x	o	o
skilled worker	+	o	o	(x)	o	o	o	o	o	o	x	(x)	(x)	o	x	o
skilled worker	-	o	o	o	o	o	o	o	o	o	x	(x)	o	o	x	o
semi-skilled worker	-	o	o	o	o	o	o	o	o	o	(x)	o	o	o	(x)	o
unskilled worker	-	o	o	o	o	o	o	o	o	o	(x)	o	o	o	(x)	o

x – entitled (x) – limited entitlement o – not entitled

21. Table: Matrix of professional competences, activities/qualifications in building services engineering - PROPOSAL

5.2.3 Current situation and assessment of adult learning

The previous chapters have presented the capabilities, facts and expectations related to adult education and qualifications in order to set well-founded, demanding and realistic goals for the training strategy to be formulated in the 2030 National Roadmap, which will be developed within the framework of the ConstructSkills4LIFE project, in consultation with the stakeholders of the renewed National (Construction Vocational Training) Platform.

A fundamental aspect is the **analysis of the demand and supply of training and qualifications**, their voluntary or compulsory nature, where, in addition to the evaluation and rethinking of basic, secondary and higher vocational training and qualifications, the two main entities, their vision, organic cooperation and coordination in the field of training, education, competence and quality development of those working in energy-related positions in the construction

industry, are the most important to be addressed in the framework of the ConstructSkills4LIFE project:

1. **Supply side - the supply of training and qualification opportunities:** organised training, compulsory qualifications, management of the related institutional system, including "outsiders" (manufacturers, practitioners), for all expected needs of educators, trainers, teachers (theoretical and practical, basic, secondary and higher). **The aim is to** ensure that training courses are properly structured, tailored to market needs in terms of size, level, content, methods, entitlement systems and institutional support.

2. **Demand side_- making those working in the construction industry, those involved in it, interested in further training:** thus, raising the demand of employees, workers, those active in the market and users, obliging them to further training, qualification; qualifying their employers, enterprises, operating their qualification systems, targeted coordination**.**
The aim is to raise awareness of the importance of career path building, the need to acquire skills ready for the day and the knowledge or lack of knowledge of the basic competences.
In this way, the two "market sides", groups of actors, can be motivated and facilitated to consciously serve and accept the continuously updated content of lifelong learning, which provides up-to-date competences. Many elements of this are already in place in the current system; it just needs to be reviewed, evaluated, made complete and consistent, supported by appropriate regulation and an institutional system to make it work.

The following list presents the current opportunities for further training and skills supply and demand in the construction industry, throughout its life cycle, through one or two typical examples and solutions, for reasons of completeness and not for reasons of exhaustiveness.
The draft act on the "**Regulation of Public Construction Investments**", which is currently being prepared and is about to be adopted, contains project-relevant, forward-looking proposals and references, the entry into force of which will allow the definition of appropriate methods and solutions, and the creation of a strategy and implementing regulations to match them.

Proposals of the draft act: *8. Training and education § 25*

*(1) Taking into account the proposal pursuant to Article 13(4)(g)***, the Minister shall, on the basis of the authorisation granted by this Act, determine by* ***decree*** *the conditions for the vocational training of participants in* ***public construction projects*** *under the* ***public, chamber of commerce and market training system.***

(2) The ***aim of the training*** *pursuant to paragraph (1)* ***is to acquire effective and professional skills*** *in complex investments****, to*** *acquire a skill-level understanding of the investment process, to acquire technological, financial, theoretical and practical project management skills in the field of construction.*
**** on the basis of a review of the system of state, chamber and market training for professionals involved in construction works, make a proposal for the* ***development of a new training system, the form and conditions of professional training,"***
The adult learning courses, voluntary and mandatory training opportunities, eligibility and qualification options, registration and accreditation systems described below provide a **snapshot of** the current state of available supply.

The recognition of the **acquired knowledge** required for entry to training, the recognition of qualifications, the professional content of each postgraduate and adult training, modules, micro-qualifications, the interconnection of the different courses, as discussed in other chapters of this SQA and in accordance with the principles and system of the **Train4Sustain project** and the continuous monitoring of technical progress, should be defined.

The training courses are described below, broken down into the following groups:

a. investment preparation - project management - project implementation
b. design – design documentation control - designer supervision - cost control
c. construction - adjustment – putting into operation
d. commissioning – operation - maintenance - reconstruction
e. adult education and training, teachers and trainers, institutions
f. qualification of enterprises

a.) investment preparation - project management - project implementation

The preparation and implementation of result-oriented **investments in the field of** energy performance of buildings, depending on their scale (from residential energy upgrades to large-scale investments) and financial resources, always requires a professional team and competent management, with the necessary expertise, overview, legal and financial knowledge.

- **Master School for Investment Management**

As of 1 November 2015, the public procurement legislation has introduced **the role of the investment manager.** According to the Government Decree 322/2015 (30.X.), the contracting authority may employ an investment manager for the implementation of the works, who, according to the legislation, must have a higher education degree in the relevant field of the works.

The master's degree postgraduate course was launched in spring 2019 by the Hungarian Chamber of Engineers and its cooperating professional organisations - the Hungarian Chamber of Architects, the National Federation of Hungarian Building Contractors, the Hungarian Association of Consulting Engineers and Architects, the Hungarian Project Management Association and ÉMI Non-Profit LLc. for Quality Control and Innovation in Building. So far, 5 training courses have been completed, with 30-50 students per course.[40]

- **Large investment project manager**

The aim of the course is to train professionals who are **able to** effectively manage the preparation, planning and implementation of large-scale investment projects, **building on the theoretical and practical knowledge base of project management.** To achieve this goal, the training pays particular attention to the establishment and development of relevant professional and managerial competences.

Two strategic partners of the training are the Óbuda Group and the Hungarian Project Management Association. Thanks to their involvement, students will gain knowledge that can be applied in everyday practice, and theoretical knowledge will be complemented by practical cases of large-scale investment (construction, transport, logistics) **project management.** The

[40] Source :-https://mernokvagyok.hu/blmi5/

strategic partners also contribute to the uniqueness of the training by delegating trainers, integrating case studies and inviting ad hoc guest speakers on specific topics.[41]

b.) design - design documentation control – designer supervision - cost control

The design phase, the designers' responsibility for the construction and renovation of the project is the most critical task during the whole period of project preparation and implementation. All those involved in the design (programme-approval-proposal-execution-implementation) and construction (design management-expertise) phases must have a valid chamber licence to undertake design tasks and must undergo continuous training. Minor institutional issues (updating and extending the scope of qualifications) and, essentially, updating of content need to be addressed.

- **Mandatory Chamber training**

Architects can practise their profession **with the rights** and privileges of the **Chamber** if registered within the Hungarian Chamber of Architects, other **engineers within the** Hungarian Chamber of Engineers, **.** For the members the legislator has divided the system of continuing training into two parts: professional and mandatory trainings. Within the Hungarian Chamber of Architects, the period of further training is 5 years, during which time completing the trainings is mandatory. Within the Hungarian Chamber of Engineers, one 6-hour training course must be completed once a year. **Concerning the energy and environmental trainings with the aim to achieve the climate objectives,** there are several conferences and lectures available each year which are organised by the chambers, non-profit organisations and market players (product manufacturers, distributors).

The Hungarian Chamber of Architects organises and conducts the mandatory training courses within its own authority, and the Professional Training Expert Panel decides on the point value of the professional training courses, thus the professional supervision is ensured to a certain extent. [42]

- **Training for professional organisations: sustainable architecture**

The Budapest Chamber of Architects, in cooperation with the Hungarian Green Building Council, has created a unique advanced training course entitled **Sustainable Architecture,** containing 12 video tutorials. The high quality of the training is ensured by nationally and internationally recognised professional lecturers, experts, university lecturers and sustainability specialists with theoretical and practical knowledge. The training material got included in the recommended training courses of the Hungarian Chamber of Architects. The curriculum is targeting such architects who wish to learn about the environmental approach in more detail and who already have a basic knowledge of the subject.[43]

- **University courses: building energy engineering**

The aim of the two-semester, BSc degree-based specialised engineering course is to familiarise graduates with the conceptual framework, design principles and practical solutions of the related disciplines (building construction, architectural design, building services engineering, electrical installations in buildings) in such depth that the designs of the individual disciplines

[41] Source : https://www.uni-corvinus.hu/post/landing-page/nagyberuhazasi-projektmenedzsment-szakkozgazdasz/
[42] Source/MÉK: ; /MMK: https://www.mmk.hu/kepzesek/szakmai-tovabbkepzes
[43] Source : https://magyarepitestechnika.hu/index.php/hirek/gondolkodasformalo-tovabbkepzesi-anyag-szuletett-epiteszeknek-a-fenntarthato-tervezesrol/

form a harmonised, coherent system, as well as the **energy, environmental, conservation and comfort** requirements of **building renovation, maintenance and operation.** They should also be able to assess the **environmental impact of buildings** throughout their life cycle, to apply appropriate mitigation and adaptation measures, to integrate the structural and functional integration of building structures and building services systems, and to contribute to the implementation of emission reduction and climate change policies. The course culminates in a thesis.[44]

- **University courses: building renovation**

The aim of the training is to prepare for the management of a growing number of **domestic building stock requiring** maintenance and **renovation interventions in order to** increase the value of the building in terms of its use and comfort. The specialised engineering course provides an introduction to the changes in the field of renovation, from urban-scale rehabilitation to the smallest structural detail, including the renovation of listed buildings, and also provides insight to the international and national achievements and challenges of the last decade.

After completing the **four semesters,** students pass **a state examination** in three subjects. Building physics is compulsory, while two other subjects selected from the courses on the reconstruction of building structures, the reconstruction of load-bearing structures and building construction management are part of the final examination, and at the same time a thesis is defended with continuous consultation.

The training is mainly recommended to civil and architectural engineering graduates. The knowledge acquired can be used in the **design, expertise, training, investment, operation, construction, technical development** works in the **field of building renovation and maintenance.**[45]

- **University courses: refrigeration engineer**

The aim of the training is to improve the knowledge of professionals who meet the entry requirements and to refresh their knowledge in the **field of refrigeration and heat pumps.** A deeper understanding of refrigeration will enable businesses operating in this field to improve their quality processes and their customers' satisfaction.

The objective of the Refrigeration Engineer specialisation is to train professionals with outstanding knowledge of refrigeration technology and up-to-date economic and legal information, who have **in-depth knowledge of the** comprehensive **domestic and international issues** of refrigeration and heat pump technology.[46]

- **University courses: specialisation in energy production**

The educational objective of the three branches of the specialisation in energy production is to train professionals with outstanding **energy strategy, technological knowledge and up-to-date economic and legal information, who** have in-depth knowledge of the comprehensive

[44] Source: https://www.felvi.hu/felveteli/szakok_kepzesek/szakleirasok/!Szakleirasok/index.php/szakterulet/8/S
[45] Source : https://epitesz.bme.hu/epuletfelujitasi-es-fenntartasi-szakiranyu-tovabbkepzes/
[46] Source : https://gpk.bme.hu/hu/cikkek/651

domestic and international issues in the fields of **heat and electricity, district heating and renewable energy.**[47]

c.) construction – adjustment - putting into operation

The construction process, its preparation, professional and careful commissioning and start-up are other critical tasks of the installation and renovation during the project implementation period. The role of the **responsible technical managers, the technical inspector, the installation supervisor and the senior installers, the "team leaders", is** crucial. Some of the contractors are qualified to take on construction management tasks based on their current Hungarian Chamber of Commerce and Industry (MKIK) status, and their continuous training is mandatory. Minor institutional issues (updating and extending the scope of qualifications) and mainly updating the content of the training must be addressed. There is no 'official' obligation to provide further training in terms of qualifications, professional or legal qualifications for persons working for individual companies or for subcontractors or agents engaged for this purpose; this is a matter for the person or his employer to decide and require.

- **Responsible technical manager, technical inspector**

Target group of the training programme: **engineers and technicians** who wish to work as technical managers or technical inspectors in the field of construction. The **aim of the training is to** provide introduction to the **legal framework for the** construction of general and specific types of works, in particular for the activities of technical supervisors and technical inspectors, to supplement professional knowledge of quality, **quality control** and **standards** (in particular the new regulations on the marketing and installation of construction products) and to familiarise the participants with the application of the **electronic construction logbook.**[48]

- **Continuing training for professional organisations: Building Science Associations - Construction Engineering Construction Manager Training**

In 2020, the Building Science Association (ÉTE) launched a **voluntary, postgraduate,** two-semester training course for **building services engineering supervisors.** It was designed to provide professional, high-quality construction and efficient operation. Therefore, the emphasis was placed on the modern requirements for design, construction and operation (e.g. competitive tendering, the undertaking, the technical content to be implemented, the certification system and requirements for the task to be performed for both design and construction). Consequently, the choice and development of the topics were aimed at filling gaps in technical knowledge. [49]

- **Hungarian Chamber of Commerce and Industry: post-secondary master's programmes**

The popularity of the **Craftsmens' Master's degree has** grown steadily in recent years. The positive change is partly due to the renewed prestige, partly to the statutory obligation, partly to its role in vocational training and partly to the recognition of the professional skills of those who work abroad. Its most important feature is the strong emphasis on **pedagogical and business management skills,** in addition to the development of professional skills. This

[47] Source : https://gpk.bme.hu/hu/cikkek/392
[48] Source:https://www.mti.bme.hu/tanfolyam/felelos-muszaki-vezetok-es-epitesi-muszaki-ellenorok-felkeszitese-a-szakmagyakorlasra-epiteskivitelezok-tovabbkepzese/
[49] Source : https://eptud.org/hirek/epuletgepesz-kivitelezes-vezeto-tanfolyam

master's degree is a prerequisite for starting and running a business in German-speaking countries, but not yet in Hungary. The continuous renewal of the Master's programme and examination ensures that the Master's title is of a higher level and market-shaping, providing professional knowledge that is outstanding among market players, while at the same time creating opportunities for the holder to pass on his/her **value-preserving traditions combined with modern technology** to the next generation, to ensure quality replacement and to gain new opportunities in the international arena. A master's examination can be organised in any profession in which the requirements for the master's examination have been published in a ministerial notice. The current Master's qualifications in construction are mason, roofer, gas and heating engineer, gas installation and pipe-laying, water and sewerage installer, electrician.[50]

- **Vocational training institutions: vocational qualifications**

Under the current Vocational Education and Training Act, it is possible to obtain a legally defined **vocational qualification as a** subsidised "**second profession**". For the vocational qualifications of particular relevance to the project, see section 5.2.1 Vocational training.

- **Training, staff qualification - installation, refrigerant handling**

The **National Climate Protection Authority** (NKVH, hereinafter referred to as the Authority) carries out training tasks, keeping in mind current technical and scientific requirements, as it aims to make the **knowledge of professionals marketable.** The Authority shall ensure the **training, qualification and examination of natural persons** who carry out or wish to carry out activities related to fluorinated greenhouse gases. Pursuant to Regulation (EC) No 1005/2009, Regulation (EU) No 517/2014, Commission Implementing Regulation 2015/2067 and NFM Regulation No 60/2016 (28.12.2016), **persons carrying out activities in the field of installed refrigeration, air conditioning and heat pump equipment,** as well as in the vehicle air conditioning and transport refrigeration sectors, **shall obtain a qualification** before starting their activities. Legislation ensures that the maintenance and servicing of equipment is **carried out by appropriately qualified and competent professionals.**

In order to achieve this effectively, the Authority **has concluded training agreements** with vocational training centres for the performance of training tasks from 2016 onwards. Currently, 18 vocational training centres are involved in the provision of training. The aim of the training courses is to provide the candidate with the professional and environmental protection knowledge, acquired in the Hungarian vocational training system - in the field of refrigeration technology or other training - that enables him/her to keep in mind the climate protection goals in his/her daily work, including - using new technologies - the proper management and economical use of climate gases, while using the available IT system (Climate Gas Database) on a daily basis. [51]

- **Climate gas training, staff training - Carbon dioxide systems - installation, refrigerant handling**

The National Climate Protection Authority has concluded agreements with **vocational training institutions and professional organisations** for the organisation of training courses required

[50] Source : https://mkik.hu/a-mestervizsgaztatas-bemutatasa
[51] Source : https://nkvh.kormany.hu/klimagaz-kepzesek

for employee qualifications, in addition to its own internal training. One of the subjects covered is the use of alternative refrigerants (e.g. carbon dioxide, ammonia, etc.). [52]

- **Training, staff qualification - official training**

According to the provisions of the Decree No.40/2017 (4.XII.) of the **Ministry of National Economy (NGM),** those who will be required to participate in the training of Electrical Safety Inspectors, whose duties will include the inspection of the electrical safety of work areas, buildings, structures and other facilities, open spaces, the visual and instrumental inspection of the design and proper technical condition of the protection against electric shock and the standard condition of the work areas, buildings, structures and other facilities, open spaces, in accordance with the relevant standards and legislation and documentation, and the documentation of the inspection results.

Official training is also required by law for workers in the following jobs with a significant technical safety impact:

- Gas and heating equipment installer
- Gas fitter
- Technical and safety inspector for connection piping and user equipment (gas industry).[53]

d.) commissioning -operation - maintenance - reconstruction

- **Digitalisation for facility managers**

The **BME Engineering Training Institute (BME_MTI)** continuously organises and launches **voluntary and mandatory** training courses **to support the qualification of the Chamber.** Electronic Document Management Foundation is an interactive training course for practising facility managers, covering the concept and understanding of electronic document management, information sharing and collaboration, electronic signatures, workflow management, project management, integration with other systems and procurement aspects of document management systems. [54]

- **Energy certification**

Energy certification has a specific status: it is not linked to membership of a chamber, but chambers keep a register of certifiers; previously only this was mandatory, but from 2020, further vocational training will be required. A preparatory course is offered, for example, by the BME's Institute for Engineering Training. [55]

- **Air conditioning and heating inspector**

These EPBD-related entitlements are granted by the Hungarian Chamber of Engineers to engineers with the appropriate qualifications and experience. Energy auditors must be registered in the register maintained by the National Climate Protection Authority, which is

[52] Source : https://nkvh.kormany.hu/a-huto-es-klimatechnikai-vallalkozasok-szovetsege-altal-szervezett-szendioxid-alkalmazasa-hutorendszerekben-elnevezesu-kepzes

[53] Source : https://mkeh.gov.hu/piacfelugyeleti_muszaki/Kisfeszultsegi_villamossagi_termekek_LVD
https://mkeh.gov.hu/piacfelugyeleti_muszaki/Gazfogyaszto_keszulekek_GAD

[54] Source:**https://www.mti.bme.hu/tanfolyam/az-elektronikus-dokumentummenedzsment-alapjai-tovabbkepzes-nem-csak-gyakorlo-letesitmenygazdaknak-4-oras-interaktiv-tovabbkepzes/**

[55] Source : https://www.mti.bme.hu/tanfolyam/epuletenergetikai-tanusito-kamarai-jogosultsagi-vizsgara-felkeszito-tanfolyam/

kept by the Chamber of Engineers. The Chamber also organises training courses for inspectors and examinations.

- **FH** - Energy audit of heat generating equipment
- **FL** - Energy audit of air conditioning systems

Based on the earliest Directive 2002/91/EC, the current Government Decree 264/2008 (XI.6.) **on the energy audit of heat generating equipment and air conditioning systems** was issued. The Regulation has been unchanged since 1 October 2009 and has not followed the amendments of the Directive or the changes in the national legislation related to the professional practice. It has been replaced by the new legislative regime which entered into force on 1 January 2022, as detailed below.[56]

Government Decree 666/2020 (XII. 28.) on the Energy Review provides that from 1 January 2022 the National Climate Protection Authority shall keep the records specified in Chapter VIII/A of Act LVII of 2015 **on Energy Efficiency as** a separate part of the Climate Gas Database. In order to **achieve the reduction of the amount of energy** needed to meet the energy demand related to the normal use of buildings, the IT module supporting the energy audit of heating and air-conditioning systems and their combined ventilation systems has been created through the IT development of the Climate Gas Database. From 2022 onwards, the Authority will be responsible for the development and operation of an IT registration interface in the Climate Gas database, which will be managed by the Authority, with the aim of improving the energy efficiency of buildings and monitoring the implementation of **recommendations and energy efficiency investments included in the building inspection report by** a specialist. The audit reports recorded in the register will serve as a basis for further energy efficiency decisions.[57]

- **Energy auditor**

The energy efficiency activities of the Hungarian Energy and Public Utility Regulatory Authority (hereinafter: MEKH) go beyond the tasks of the authorities. It regularly organises forums and training courses and ensures that energy efficiency-related tasks can be carried out by **qualified professionals.** The Office also attaches great importance to informing consumers and promoting the conscious and economical use of energy.

MEKH is responsible for maintaining **the registers of** energy auditors and auditing organisations, specialist advisers and specialist adviser organisations, and participates in ensuring the professional competence of auditors and specialist advisers. The Energy Efficiency Act requires large companies to carry out energy audits every four years. The Agency is responsible for establishing the register of large companies and for the official control of the companies concerned. In the context of the energy efficiency obligations of public institutions, the Office's activities were further extended in 2019 with tasks supporting the work of the **National Network of Energy Experts.** MEKH will ensure the provision of the experts needed to carry out this task, as well as the collection of energy condition characteristics and energy consumption data for the more than 10,000 buildings owned and used by public institutions, and the development of basic online systems.[58]

[56] Source : https://www.mmk.hu/informaciok/hirek/legkondicionalok-felulvizsgalata-20211130
[57] Source : https://nkvh.kormany.hu/epuletenergetikai-felulvizsgalat
[58] Source : https://mekh.hu/kiemelt-cel-az-energiahatekonysag-novelese

- **Other voluntary programmes: renovation of apartment buildings**

The Hungarian Green Building Association's (HuGBC) **Retrofit HUB project** approaches the benefits of energy renovation and energy modernisation in condominiums from the perspectives of resilience, adaptation and energy efficiency to offset climate impacts. It has launched a series of 3 suitable programmes offering theoretical and practical knowledge to encourage and support domestic condominium renovation. [59]

- **Other voluntary schemes: certified property managers**

The Site Manager pan-European Certification, managed by the Hungarian Facility Management Association supports service delivery and ensures internationally comparable quality. It takes into account transparent tendering processes and supports all requirements of public procurement procedures by allowing the measurement and improvement of service quality and the skills of the people providing it.

The Site Manager qualification is designed for people who are already working in this role in facilities engineering departments or service companies, either as an internal site manager at a tenant's site or as an external site manager for service providers. The competences required to obtain the certificate are based on the European standard EN 15221-4 (technical and infrastructural knowledge, legal knowledge and compliance, organisational, business and commercial knowledge, knowledge of workplace and related strategies, construction and renovation, social and methodological knowledge).[60] The BME Engineering Training Institute also organises courses to prepare for the above certification[61]

e.) adult education and training, teachers and trainers, institutions

At the same time, in addition to the appropriate content and methodological requirements of further and postgraduate education systems, **the appropriate infrastructure of institutions** and the **appropriate professional qualifications and continuous training of staff providing training and education play a** key role. The existence and proper functioning of a **system of institutional and personal accreditation** to support this, and the operation of **institutionalised bodies dealing with** broad-based professional advisory **skills development strategies** to plan and support the updating of professional content, training methods and infrastructure are essential 'prerequisites' for all this. Examples and solutions already in place and working well need to be reviewed and their systems, operations, activities and services adapted to the training strategy.

- ***University (institution) accreditation, registration:***

For more information, see Chapter 5.1.2 Characteristics of the higher education system.

- ***University teacher accreditation, registration:***

For more information, see Chapter 5.1.2 Characteristics of the higher education system.

[59] Source from https://www.hugbc.hu/projektek/retrofithub
[60] Source from https://eurofm.org/about-fm/site-manager-certification/
[61] Source : https://www.mti.bme.hu/tanfolyam/letesitmenyfelelos-property-manager-minosito-vizsgara-felkeszito-tanfolyam-eurofm-pan-european-site-manager-certification/

- ***Register of vocational training providers:***

The Hungarian Chamber of Commerce and Industry **training and examination for practical trainers** concerns professionals and trainers employed as practical who work with students in an out-of-school (external) practical training place in the dual training. This training provides an opportunity for practitioners and trainers to develop their skills in dealing with certain problematic situations with students, while at the same time gaining quality knowledge that can be used to raise the quality of practical training. The training will equip practitioners with up-to-date knowledge that they can use in their day-to-day work.[62]

- ***Registration system of adult education institutions:***

The adult education state administrative body uses the Adult Education Data System (FAR) **to register adult educators and experts** and to perform the tasks falling within its competence. From 1 July 2020, adult educators can initiate the notification and authorisation of adult education activities under the Adult Education Data System. For information purposes, adult educators may provide voluntary data on their planned training courses to the adult education administrative body by electronic means. The adult education administrative body shall publish the details of the training courses made public by adult education providers in a searchable list. The register of adult education providers is also public and is published on the website of the adult education public administration body.[63]

- ***Register of adult education programme specialists:***

Pursuant to Paragraph (4) of Article 30 of Act LXXVII of 2013 on Adult Education (hereinafter: Fktv.), the Hungarian Chamber of Commerce and Industry keeps a register of persons authorised to carry out adult education programme expert activities.

The register of adult education programme experts is a public official register, with the exception of data on natural person identification and address identification. Data from the register other than public data pursuant to the Act on the Protection of the Rights of Persons with regard to the Performance of Professional Activities may be provided solely for the purpose of verifying the right to perform the activities of experts.[64]

f.) Qualification of enterprises

- ***Hungarian Chamber of Architects, Hungarian Chamber of Engineers: Companies for design-expert-certification tasks***

Pursuant to the provisions of the Chamber of Commerce Act and the Government Decree 266/2013 (VII.11.) on professional activities in the field of construction and construction-related activities, a **company may only carry out design, expert, technical inspection, responsible technical manager, or energy certification activities subject to professional authorisation** if:

- a member or employee who is a personal contributor and who holds a **valid licence in the** relevant field,
- the activity is **carried out by** that person,

[62] Source : https://mkik.hu/kamarai-gyakorlati-oktatoi-kepzes-es-vizsga

[63] Source : https://far.nive.hu/. https://far.nive.hu/publikus-adatok/felnottkepzok-nyilvantartasa

[64] Source : https://mkik.hu/felnottkepzesi-programszakertoi-nyilvantartas

- and the company fulfils its **registration** obligations under the Chamber of Commerce Act.

For the purposes of the registration obligation, a company is **defined as a** commercial company, a budgetary body, a sole trader and a sole proprietorship. [65]

- ***Hungarian Chamber of Commerce and Industry: construction companies***

Anyone wishing to carry out **construction work** as a commercial economic activity in Hungary must meet the **conditions laid down** in the relevant government decree and must **notify the body** keeping the register of such an intention. The Hungarian Chamber of Commerce and Industry maintains (MKIK) the register of persons entitled to engage in the activity of contractor construction and verifies the eligibility to engage in the activity of contractor construction in accordance with the Act on the General Conditions for Starting and Continuing the Activity of Service Providers. The construction activity **may**, with certain exceptions, only be **carried out under the direction of a responsible technical manager** who has the appropriate qualifications and other conditions for the specialisation of the construction activity and has direct authority over the persons carrying out the construction activity. A construction activity as defined in the Government Decree may be carried out by **a qualified skilled worker** without the supervision of a responsible technical manager, provided that the conditions laid down in the Decree are met. All contractors **and sole proprietors wishing to engage in contracting activities must** notify the MKIK, which maintains the register of contractors, of their intention to do so. Furthermore, all service providers from EEA member states with the right of free provision of services are obliged to notify the HCCI of their contractor activities in the framework of **cross-border service provision.**[66]

- ***Hungarian Chamber of Commerce and Industry: Registration and control of secondary and tertiary dual training institutions***

Its aim is to carry out a nationally standardised inspection of **practical training in** business organisations by a professional **authority**, which will determine whether the given site or workplace is suitable for the practical training of the given qualification. Those involved in the inspection: regional chambers as operators; organisations providing training or involved in training; experts carrying out the inspection: a chambers expert and a school representative appointed by the management of the contact school.

The MKIK aims to be a driving force in the relationship between business and higher education. Through the tasks it undertakes, it channels the needs of the economy into the trainings provided by higher education institutions and shares the experience gained in higher education institutions with economic actors. It will give priority to the promotion of dual higher education and contribute to its operation, including through the certification of participating companies.[67]

[65] Source : https://www.mmk.hu/ugyintezes/cegek
[66] Source : https://mkik.hu/altalanos-tajekoztato-2
[67] Source : https://mkik.hu/kepzohelyek-ellenorzese

Funding and scholarships

To cover the costs of their participation in higher education, adults - like full-time students - are entitled to a state-regulated, low-interest student loan, which they repay after completing their studies [§ 29/A of Government Decree 1/2012 (I. 20.) on the student loan system].
Adult learning can be financed in different ways. Below is a summary of the funding options for adult learning courses:

- **Individual funding**: this means a self-financed course, where the participant has to pay the course fees and other costs.
- **Training with public support**: this includes training supported by the Jobcentre and training funded by EU tenders. The State may provide aid for the acquisition of a licence to carry out adult education activities, for training organised as part of adult education activities, for the improvement of the technical conditions of adult education providers and for the organisation of training of high economic priority.
- **Employer funding**: employers can take over the funding of the course, supporting their own employees' learning. In this case, companies provide the training fees from their own resources.
- **Scholarships to fund adult education**: these are provided by the adult education provider and can be claimed under conditions set by the state. The scholarship is linked to certain training courses and criteria and usually covers part of the cost of the training.

The detailed rules on the financing of adult education are contained in the Adult Education Act, Act LXXVII of 2013 on Adult Education and the related government decrees. Under Act LXXX of 2019 on Vocational Education and Training, training outside the school system may also receive support from the state as a contribution to vocational education and training from the National Employment Fund or the training part of the Economic Protection Employment Fund, as well as from EU funds.[68]

Summary

The analyses and findings of the previous chapters, the examples of adult education, qualification, certification, accreditation and registration systems presented in this chapter also clearly show **the chaotic "order" of** supply and demand of adult education and postgraduate trainings, its contingency, its questionability, and its building-energy adequacy, thus the need for a targeted re-evaluation and systematisation of the current methods/systems is rightly raised. While on the **supply side,** in addition to the content and methodology issues, the potential training providers and their trainers need to be kept up to date and constantly "in tune" with the needs, on the **demand side,** a strategic vision needs to be outlined to "attract" the interest of potential users of training and qualification systems in the hope of an optimised functioning of a more coherent system.

During the elaboration of all this, from the viewpoints of both sides, **special attention should be paid** to the assessment and evaluation of acquired knowledge, the hierarchy of continuing vocational training, adult education, postgraduate training, degrees obtained and qualifications, because there is overlap and confusion in many places in the interpretation of

[68] Source:https://eurydice.eacea.ec.europa.eu/hu/national-education-systems/hungary/magyarorszaga-felnottoktatas-es-felnottkepzes-finanszirozasa

the current legislation and the market field. In this context, **it is necessary to formulate new basic assumptions** on the questions of the TEÁOR (Unified Sectoral Classification System for Activities)-FEOR (Unified Classification System for Occupations) and a Carrier Path Model for construction professions, the possibility of introducing a kind of "professional passport" (EuroPass). The results of the **Train4Sustain** project (CEN CWA 17939, Skills Registry, Skills Passport?) and the recently introduced **micro-certification** method and system could be a good professional[69,70]

The project barely deals with the (perhaps one of the most important) segment of adult education, while the **"lay" investors, partners, operators** (residents, condominiums, etc.) are the most important social entities from the point of view of building energy and environmental impact. It is also proposed to formulate the basic principles for this **'professional communication'** when drawing up the Project 2030 strategy.

5.2.4 EU-funded national-level skills initiatives

In the construction sector, programmes and training courses dedicated to construction operators typically focus on basic skills such as the use of digital tools or the acquisition of business development funds. These are included through the development of the curriculum. The entry of socially disadvantaged groups into the labour market is also supported through smaller-scale projects. These projects tend to focus less on skills and occupations that are in short supply in the construction industry. The ERASMUS PLUS programme for the period of 2021-2027 puts a strong emphasis on the green and digital transition. The programme supports the priorities of the European educational area outlined in the Digital Education Action Plan and the European Skills Agenda. Table 22 lists some of the previous ERASMUS projects targeting construction operators supported by EU funding.

Name	Time frame	Funding program	Partners	Main results
BIMZEED project	2018-2020	ERASMUS+	ÉMI, Óbuda University	BIM training materials for near-zero energy building design
SkillCo project	2018-2020	ERASMUS+	ÉVOSZ	Training materials to develop competence gaps
WeRSkills project	2020-2022	ERASMUS+	ÉVOSZ	Develop training materials for competency competitions

22. Table: Lists some of the previous ERASMUS projects targeting construction operators supported by EU funding

[70] Source: https://www.cencenelec.eu/media/CEN-CENELEC/CWAs/RI/cwa17939_2022.pdf; https://train4sustain.eu/ ; https://www.fvsz.hu/uj-trendek-a-tanusitasban-a-mikrotanusitvanyok/

6 RELEVANT PROJECTSON CONSTRUCTION AND BUILDING SKILLS

This chapter, presents and analyse projects that can help actors in the domestic construction industry identify initiatives that supports the classification of professional qualifications and skills. Within these projects, training materials for knowledge and skills development were developed along with good practices for capacity building, retraining and workforce evolution.

6.1 Projects relevant to skills development

The following chapter discusses the main EU and nationally funded projects that are relevant to the preparation of the Hungarian roadmap and strategy. The projects presented contain knowledge, tools and methodologies which, either by using them as an example or by using them in ongoing services, could be used to improve the skills and training of the workforce in the next decade. The projects highlighting the most important achievements are listed in Table 23.

Project name	Duration	Funding program	Participants	Key results
Prof/trac	2015-18	H2020	ISSO	NZEB skills for white collar workers
NEWCOM	2017-20	H2020	ÉMI	NZEB skills for blue-collar workers
TRAIN4SUSTAIN	2020-22	H2020	Geonardo	Knowledge about sustainable energy
CEN-CE	2018-20	H2020	REHVA	HVAC Skills Development Programme
HP4ALL	2020-23	H2020	EHPA (Hungarian member)	Expertise for heat pumps
BusGoCircular	2021-24	H2020	ÉMI	The circular skills
TRAINBUD	2014-17	IEE	ÉMI	Training on energy efficiency, renewable energy
BIMzeED	2018-22	ERASMUS+	ÉMI	BIM and NZEB relation

23. Table: List of projects targeting the most important achievements

The Prof/trac project has analysed educational materials from several countries to develop a set of qualification requirements for the design and construction of NZEB buildings applicable in EU Member States. Based on this, **training materials** have been developed that are available online, and along with setting up national contact points to ensure a more efficient transfer and uptake of information.
The NEWCOM project has developed online learning materials on **roofing, building ventilation and building services.** The knowledge and skills assessed as desirable by building professionals were used as the basis for the development of the learning materials.

In the framework of the TRAIN4SUSTAIN project, a CEN standard has been developed **to describe the skills and competences that** designers and builders can use to achieve sustainable built environment and climate goals. Services based on the draft standard are available online for professionals and educational organisations.

The CEN-CE project has developed a certification service to **test and assess the ability of building services engineering professionals** to contribute to the 2050 climate goals by using the latest energy-efficient technologies and practices.

Under the HP4ALL project, a qualification scheme has been developed to define **the skills of heat pump professionals**, ensuring the uptake of clean and energy efficient cooling and heating systems.

In the framework of the BUSGoCircular project, a Train the Trainers curriculum has been developed to help spread **circularity-based solutions** and provide knowledge that can be used in vocational training.

6.1.1 Projects to make the renovation and construction sector more attractive to women

Table 24 below shows a list of identified EU-funded projects, good practices, initiatives, strategies, promotional and educational activities in Member States working towards increasing the participation of women in the construction industry:

Project name	Funding program	Participants	Key results
WomanCanBuild	Erasmus+	Spain, Germany, Portugal, Belgium, France, Italy	Action Plan to tackle horizontal and vertical gender segregation in the construction sector. Skills development for women.
Woman and Construction	European Social Fund	Habitat au Quotidien, France	Skills development and training exclusively for women.
BEEYONDERS	Horizon Europe	Croatia, Denmark, Finland, France, Italy, Spain Netherlands	The project aims to improve the efficiency, safety and quality of the construction industry and reduce the environmental impact of construction works.

FEMCON	Marie Curie Individual Fellowships	Spain, Denmark, Ireland, Germany	creating innovative vocational education and training tools for women working in the construction sector or considering a career in the sector.
WOMEN-CORE	FP6-SOCIETY	Spain, Germany, Denmark, Czech Republic, United Kingdom, United Kingdom	To increase the participation of women scientists in European construction research by: increasing knowledge and influence of women in construction research.

24. Table: List of EU funded projects and initiatives fostering the increase the participation of women in the construction industry

6.1.2 Projects to retrain workers and professionals previously or currently employed in fossil fuel-related sectors and regions

This chapter presents relevant projects and initiatives that can help to rethink training and employment in certain regions of the country and for the people living there.

One of the main challenges of regional transition (considering the social aspects) is the development of a new economic model that can serve as an alternative to the lignite industry. A sector with high employment needs. In 2021, the coal sector employed 208,000 workers in Europe, with 76% of them employed in the mining sector.[71] However, a significant number of these jobs are anticipated to vanish over the next ten years, encompassing both direct coal operations and associated activities.

The utilization of traditional restructuring approaches, with combined the integration of excellence and innovation in retraining programmes should be recognized as one a key driver for the future. Employment should be supported by developing and acquiring new skills through the creation of specifically targeted education programmes. With careful planning, the future of a coal production and processing can be organised on the basis of its post-mining potential, in the context of wider socio-economic transformation, by aligning skills policies and human capital development interventions.

The transition away from coal not only transforms the region's economy but also presents a challenge for its workforce to adapt to these changing circumstances. It is important to acknowledge that successful economic restructuring in a coal-producing region may not necessarily guarantee full employment for former coal workers. Sector, skills and location (region) are three dimensions along which these workers must make choices to adapt to new economic conditions. Three dimensions—sector, skills, and location (region)—are essential for these workers to navigate in order to adapt to the new economic landscape. New employment and business opportunities in the construction sector must be considered with prioritizing maximum socio-economic development. Thus, re-employment opportunities, reutilization of skills, and the repurposing of closed mines for alternative energy sources such

[71] Source : https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/eu-coal-peat-and-oil-shale-regions-updated-analysis-challenges-ahead-2021-03-16_en

as, geothermal energy, solar energy or hydropower applications should be harnessed to provide jobs and socio-economic benefits for post-mining communities.

The specific regions mentioned in the National Recovery and Resilience Plan (HU-NRRP), namely North-East and South-West Hungary, are/were partly coal-intensive regions, with mining and coal-intensive industries, and a large number of socially segregated people living in their areas.

Opportunities - energy and land use:

- soil improvement - related sector: forestry and agriculture
- RES applications - related sectors: energy and construction

Job lending and retraining opportunities:

- educational and community programmes to regenerate the built environment
- demolition and renovation projects, on-site training
- skills, education on renewable energy technologies (RES)

Needs:

- Interactions between training providers, businesses and policy makers
- Providing opportunities to participate
- Providing mobility, also known as transport infrastructure (train, bus)

6.2 Introducing the EU Construction Blueprint project

The Construction Blueprint with partners from 12 countries has identified and documented a variety of good practices and innovative initiatives, at both regional and national level. These initiatives focus on addressing skills gaps in key areas such as energy efficiency, digitalization, circular economy, and health and safety at work. The primary objective of the project is to enhance the skills and retraining of construction workers across the European Union. that address skills gaps in the areas of energy efficiency, digitalisation, circular economy or health and safety at work. The main objective of the Construction Blueprint project is to improve the skills and retraining of construction workers in the European Union. The project consortium has designed and developed a series of vocational training and educational curricula.

These curricula are specifically tailored to address the needs of workers and/or students with qualifications at levels 3-5 of the European Qualifications Framework. The curricula encompass training modules in the areas of energy efficiency, circular economy, construction, and digitalization.

While the **vocational training curricula (modules)** listed below are common at European level, each participating country in the project has adapted the programs to suit their specific national needs.

- **Energy Efficiency NZEB/Energy Efficiency for Construction** (EERC 4) programme - skilled workers

The programme aims to increase students' knowledge of the principles and practices used in the construction/renovation of low/near-zero energy buildings. This expanded knowledge will

enable workers with this knowledge to apply their existing skills to implement appropriate energy efficient techniques and standards.

Modules and their objectives:

1. **Introduction**

To explain the intended outcomes and the conditions of participation in the course; to apply good safety, health and hygiene practices; to understand the rules of the centre and explain the meaning of equal conditions.

2. **European and national drivers**

To equip students with the basic knowledge to list and describe the key policy and legislative incentives for construction workers behind the transition to near-zero energy buildings (NZEB).

3. **Energy and buildings**

Equipping students with the knowledge and skills to understand how heat moves inside and outside buildings and how to measure it.

4. **Building structure 1: Air tightness**

To equip students with the basic knowledge and skills necessary for construction workers to understand and become familiar with the importance of air and wind sealing and the implementation of measures to reduce heat loss.

5. **Building structure 2: Insulation and thermal bridging**

To equip students with the basic knowledge and skills necessary to enable construction workers to understand and become familiar with the importance of continuous insulation and the implementation of measures to prevent heat loss.

6. **Heating and cooling services**

Acquire the basic knowledge needed to understand the principles of energy efficient space heating and cooling and domestic hot water.

7. **Ventilation**

To provide students with the basic knowledge needed to understand the principles of controlled ventilation systems.

8. **Adapting to the climate**

To equip students with the basic knowledge and skills needed to understand the principles and importance of healthy, comfortable buildings.

9. **Collaboration and communication**

They are necessary for mutual understanding and cooperation on the ground, and for understanding the quality of NZEB buildings through effective communication.

10. **Renewable energy sources**

Providing construction workers with the basic knowledge they need to understand the principles and benefits of renewable energy.

11. Lighting and low power

Equip students with the basic knowledge needed to understand acceptable light levels and lighting ICT.

12. Smart controllers and meters

Acquire the basic knowledge and skills needed to understand intelligent control and smart metering.

13. Measuring performance

Acquire the basic knowledge necessary to understand the principles of acceptable U-values and achieve compliance using EAP energy assessment procedures.

14. Smart cities and neighbourhoods

Acquire the basic knowledge needed to understand the principles of smart cities and energy communities.

- **Circular economy guidelines for the construction industry** (EEA 5) programme - everyone at this level and above

The aim of the programme is to increase students' knowledge of the principles and techniques of the circular economy and the practices used in the construction industry. This improved knowledge will enable construction workers to apply their existing skills to achieve relevant green circular measures and standards.

List of modules:

1. **European and national drivers**
    a. The principles of the EU's circular economy
    b. Green policy in the construction sector
    c. National regulation
2. **Introduction to the circular economy**
    a. Introduction to sustainability
    b. Carbon dioxide in the built environment
    c. Principles of the circular economy Circular economy and construction
    d. Circular interventions
    e. Sustainable development goals
    f. Green certification schemes and circularity
3. **Waste and resource management**
    a. Waste management
    b. Demolition and pre-development audits
    c. Demolition, reuse, recycling, reuse, recycling
4. **Adaptive materials and systems**
    a. Circular materials and systems in buildings
    b. Construction techniques for circularity
5. **Water management**

a. Water management plan
b. Water management on site

6. **Lean construction LEAN and modular construction**
   a. Modular design
7. **Life cycle analysis**
   a. Introduction to life cycle analysis
   b. Life cycle Analysis and Level(s)
   c. Building certificates
8. **Life cycle costing**
   a. Introduction to LCC
   b. LCC Strategy
9. **Cooperation and communication**
   a. Cooperation
   b. Roles and responsibilities Communication tools
10. **Green public procurement**
    a. Introduction to green public procurement
    b. Public procurement procedures and circular procurement
    c. Certificates and eco-labels
11. **Construction certificate**
    a. Environmental Product Declaration (EPD)
    b. Product Environmental Footprint (PEF)
    c. Eco-labels
12. **Use of circular construction equipment**
    a. Building circular devices (LCA & LCC)
    b. Computational methodology

- **Digitalisation in Construction programme** (HUQF level was not specified)

The aim of the programme is to increase students' knowledge of digital tools and techniques and to learn digital techniques and practices used in the construction sector. The modules covered are:

1. **European and national drivers**
   a. EU digitalisation policy
   b. National digitisation
2. **Introduction to digital tools**
   a. Communication tools
3. **Introduction to digital technologies**
   a. On-site technologies
   b. Off-site technologies
4. **Data protection**
   a. Cybersecurity
   b. Digital data management and storage
5. **Introduction to BIM**
   a. The basics of BIM
   b. BIM principles
   c. BIM applications and software
6. **The use of BIM in the construction industry**

a. BIM objects
b. Levels of development
c. Using BIM in the different phases

7. **BIM and cooperation**
   a. Access to information via the cloud
   b. Access to information via mobile devices (apps, QR, etc.)
   c. BIM review and problem solving
   d. Quantification and collision detection
8. **Roles and knowledge transfer**
   a. Roles
   b. BIM and file structure
   c. Digital workflows
   d. Systems thinking
9. **Introduction to quality control**
   a. Quality control and audits
   b. Compliance of the building
10. **Quality checks on the spot**
    a. Structural checks
    b. Technical building inspections
11. **Automation and artificial intelligence**
    a. Automation
    b. Artificial intelligence and 3D printing
    c. Wearable devices and augmented reality
    d. Intelligent control
12. **Construction 2030**
    a. Quantum computing and blockchain
    b. The digital future
    c. Decisions for the future
13. **Tools for energy efficiency**
    a. Energy efficiency devices
    b. Energy simulation tools
14. **EA Circular economy tools**
    a. Sustainable construction
    b. BIM checks for the LCA
    c. BIM checks for LCC
15. **Introduction to digital passports**
    a. Digital logs
    b. Digital construction passports
    c. Digital building passports for renovation

Although Hungary did not participate in this project, in order to fill the gaps, **these topics were included in the ConstructSkills4LIFE project questionnaires**, which were designed to find out whether they are taught in the higher education and vocational training institutions under study, and if so, to what extent.

7 SKILL GAPS BETWEEN THE CURRENT SITUATION AND THE NEEDS FOR 2030

The composition of final energy use in Hungary will need to undergo significant changes in order to achieve the climate neutrality goal outlined in the National Clean Development Strategy 2020-2050. In Hungary, the Long-Term Renewal Strategy sets operational objectives with targets: to achieve a 20% saving in the energy use of the domestic residential building stock by 2030, and a 60% reduction in carbon dioxide emissions related to the energy use of buildings by 2040 (compared to the average level in 2018-2020). Finally, the third objective is to reach nearly zero energy requirement in 90% of buildings by 2050.

By implementing the measures set out in the strategies, the target of achieving an **annual renovation rate of 3% of the** total housing stock **by 2030 can be achieved.** To complement this, the objective is to **reinforce the 5% annual renovation rate for public buildings** over the same period. Thus, **one of the most important objectives is to renovate the existing housing stock in a comprehensive manner to improve energy performance from the current 1% per year to 3% per year.** This means that energy efficiency and the use of renewable energy should be included integrated in the training of skilled workers in the construction sector Including both secondary and higher education programs to ensure that future professionals are equipped with the necessary knowledge and skills. Particular attention should be paid to the reconstruction and renovation of buildings, as these require more specialized expertise compared to the construction of new buildings.

The aim is to develop and introduce adult education programmes for the training of qualified professionals working in the construction industry. Adult education programs should be developed and implemented to provide training for qualified professionals in the construction industry. These programs should focus on energy-efficient solutions, renewable energy and natural resource management solutions in architecture, building services and building services installations, and their application in building renovation projects. To support these initiatives, a review of higher education curricula is also necessary to ensure that graduates are equipped with the fundamental knowledge and skills to design and implement energy-efficient and sustainable buildings when entering the market.

The success of the programme must be reinforced not only for students, but also for teachers and trainers. The training of trainers and professional development of educators are crucial for the whole process. Efforts should be made to enhance the attractiveness of careers as teachers and trainers, creating an environment that encourages and supports their involvement in sustainable building education.

During the research conducted by the ConstructSKills4LIFE consortium, a comprehensive survey was carried out to assess the alignment between the needs of the construction industry and the skills provided by vocational training and higher education institutions. This survey employed questionnaires and interviews to gather valuable insights.

view. By examining these aspects, the consortium sought to gain a better understanding of the current state of skills supply and demand within the construction sector. The consortium also used the vocational training and higher education questionnaires to map the content of training in the given field of study, in relation to the aim of this research. he results of this survey provided valuable insights on the effectiveness of the existing training programs through the vocational training and higher education questionnaires. It serves as a foundation for further discussions and actions aimed at bridging the identified gaps and enhancing the alignment between skills training and industry needs.

7.1 Evolution of the labour force

Based on the results of the questionnaires, higher education and vocational training statistics, the experts' interviews and the relevant publications and research, an estimation can be made regarding the number of professionals entering the labour market, the identification of typical shortage occupations, and the trends in meeting the 2030 targets.

7.1.1 The impact on employment of a large-scale complex building renovation programme for energy saving in Hungary

The study titled "The impact of a large-scale, energy-saving, complex building renovation program on employment in Hungary" [Ürge-Vorsatz et al., 2010] is a significant comprehensive study that focuses on labour market, financial, climate, and energy efficiency objectives of Hungary. The model's integrated approach to socio-economic impacts makes the main conclusions noteworthy from a legislative-financial point of view, despite the fact that: 1. it assumes a fixed EUR-HUF exchange rate for the whole model run (90 years!) 2. it assumes a rate of decline in the investment cost of deep renovations (no inflationary effects are taken into account) 3. its main conclusions are modelled and drawn for 2020 (although the model is run until 2100).

A large-scale, complex deep renovation programme, in addition to delivering significant energy savings, requires a large and skilled workforce. The study examined 5 scenarios: a business-as-usual, a sub-optimal and 3 deep renovation programmes, differing in the pace of renovation and the level of energy efficiency (see Table 25 below).

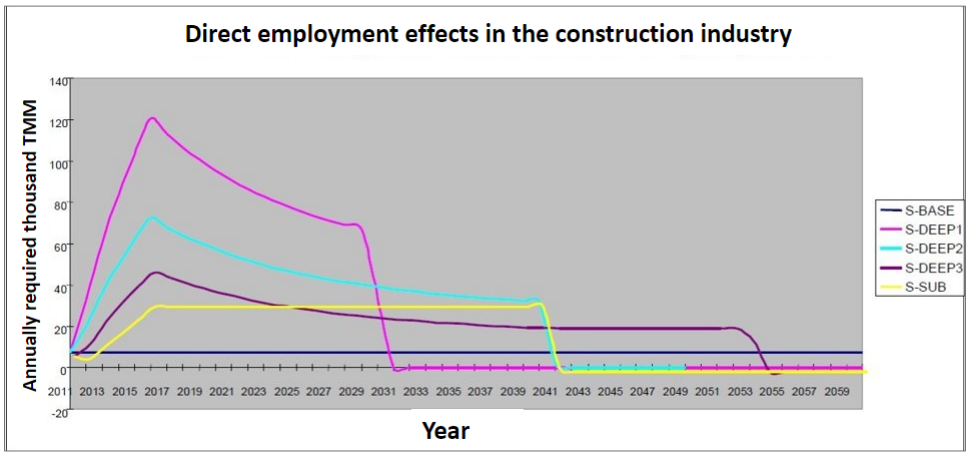
The assumption of the model is that **the experience gained** during deep renovations, after learning and mastering new technologies, **will make the renovation process more efficient** and as a partial result, the costs and labour requirements will be reduced. The impact of renovation programmes on employment varies over time in the long term. The research has also shown that the model is **highly sensitive to** this **"learning factor"**, and that changes in this factor have a significant impact on the results.

In line with the domestic strategies presented, this status quo analysis considers the S-DEEP2 scenario of a 3% annual building renovation rate. The S-DEEP2 scenario **assumes a 3.4% annual building renovation rate, which is approximately 12 million m^2 per year, and with this medium implementation rate, the total housing stock would take about 30 years to renovate**.

Name	Scenario	Renovation dynamic % of total floor area	Energy savings per buildings	Duration of renovation
S-BASE	Base scenario: no surplus renovation	1,3% - 4,5 million m^2 or 60000 houses per year	10%	75-77 yrs
S-DEEP1	**Complex, deep renovation, fast pace**	**5,4% - 20 million m2 or 250000 houses per year**	**80-90%**	**17-18 yrs**
S-DEEP2	Complex, deep renovation, medium pace	3,4% - 12 million m^2 or 150000 houses per year	80-90%	26-28 yrs
S-DEEP3	**Complex, deep renovation, moderate pace**	**2,3% - 8 million m2 or 100000 houses per year**	**80-90%**	**39-41 yrs**
S-SUB	Sub-optimal renovation, medium pace	3,4% - 12 million m^2 or 150000 houses per year	30-40%	26-28 yrs

25. Table: Scenarios examined in the study "The impact of a large-scale, energy-saving, complex building renovation programme on employment in Hungary" (Source: Ürge-Vorsatz et al., 2010)

The sub-optimal renovation scenario aims at lower energy savings but preserves the renovated status quo for about 30-40 years (lock-in effect), which in the long run hinders the achievement of energy savings targets.



38. Figure: Evolution of direct employment effects in construction (Source: Ürge-Vorsatz et al., 2010)

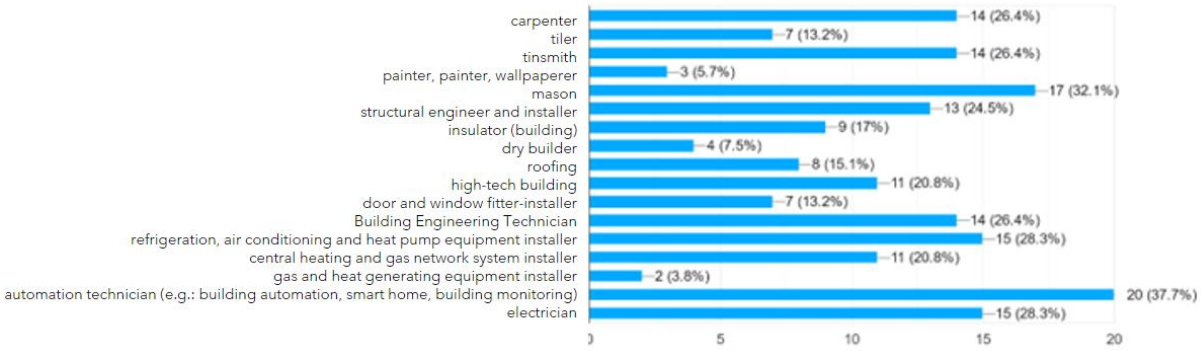
Assuming noteworthy public renovation programmes, the following conclusions can be drawn after 10 years from the starting point, considering the above-mentioned S_DEEP2 scenario (Figure 38.):

- **Employment:** full-time workforce 16 000 graduates, 26 000 skilled workers, 13 000 unskilled workers per year. In total, 55 000 professionals could be employed;
- **Investment:** the annual investment needs are quite high (€2104 million, 5% of GDP, in 2009), but the model suggests that they will fall to a minimum after 3 decades;
- **Cost savings:** our energy costs would decrease slightly over 30 years, and then stop decreasing;
- **Energy and CO_2 savings:** 80-90% of energy can be saved after 3 decades.

It is also interesting to note that deep renovations require proportionally more graduates.

7.1.2 Results of the questionnaire survey

There is a notable shortage of skilled workers in construction companies, so the questionnaires were used to identify **what kind of professionals should be trained more** from the companies' perspective (Figure 39). The responses indicate that skilled trades where training is most needed are: **automation technician** (37% of respondents), **bricklayer** (32% of respondents), **HVAC installer and electrician** (28% of respondents). This is closely followed by carpenters, tinsmiths and building services technicians (24%), so an increase in the number of these professionals would also be desirable.

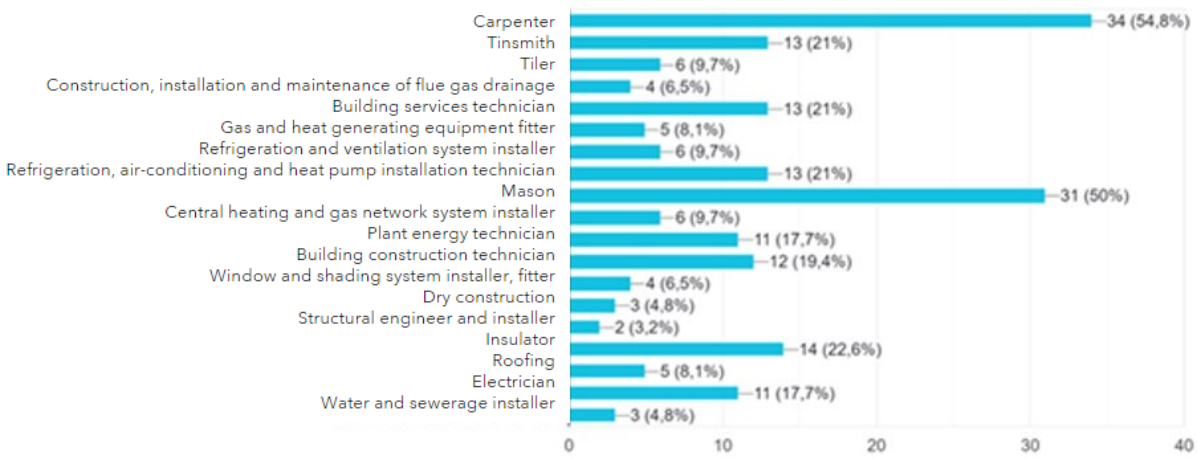


39. Figure: Responses to the questionnaire for construction enterprises "Which of the three professions listed below do you think should be trained MORE professionals?"

Skills shortages have become common in the sector over the last decade (the shortage has decreased somewhat in recent years according to the interviews), so the absence of prominent data or specific profession in the answers may reflect labour market conditions.

The professions most frequently mentioned in the responses of the vocational sector trainers (Figure 40.) were **carpentry** (55% of respondents), **masonry** (50% of respondents) and **insulation specialist** (23% of respondents). These were closely followed by tinsmith, building services technician and refrigeration, air conditioning and heat pump installer. From these professions, insulators, building services technicians and refrigeration, air conditioning and heat pump installers typically have a high impact on building energy renovation. It is important to note, however, that the occupation "Automation technician (Building automation specialisation)" was not included in the vocational training questionnaire and therefore could not be included in the "three shortage occupations", of which more should be trained. However, this profession is also chosen by few students in further education.

For those trades that were identified by less than 10% of the vocational training respondents, there are likely to be enough skilled workers in the labour market (tiler, chimney fitter, gas and heating and cooling and ventilation system installer, technical installer of locks and shutters, drywall, structural, roofing and plumbing).



40. Figure: VET trainers' response to the question "Which of the following do you think are the THREE professions that should be trained MORE?"

7.1.3 Interviews with construction companies

According to the interviews conducted, the phenomenon of professionals migrating abroad is still observed, although it is less significant today compared to the recent past. The reasons behind this migration were mainly related to wages, but several people also mentioned the lack of appreciation as a motivation for emigration. The country is slowly catching up with other European Member States in terms of wages and improved working conditions that can help to further mitigate this phenomenon.

Regarding the shortage of professionals, among the skilled workers, those working in construction industry such as **bricklayers, carpenters, roofers** were typically highlighted, and the profession of electrician was also mentioned specifically by several respondents. In the field of engineering, those with specialised knowledge in the field of building energy were clearly emphasised as missing. The vast majority of respondents said that the presence of foreign workers was either not typical or not relevant. According to those who have met foreign workers, those from countries east of Hungary (Romania (mainly Transylvania), Ukraine, Turkey) tend to have lower professional qualifications.

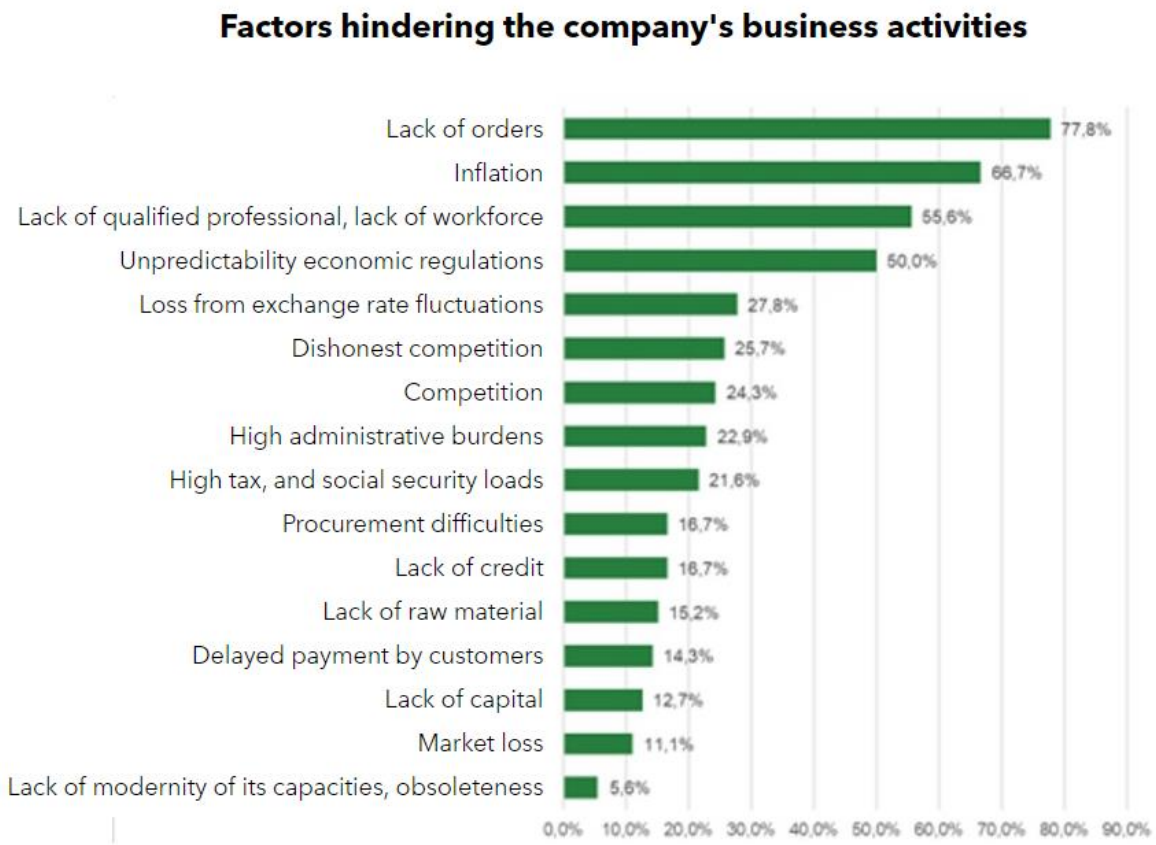
7.1.4 ÉVOSZ: Key problems in the construction sector

The National Federation of Hungarian Building Contractors (hereinafter: ÉVOSZ) was founded in October 1989 and its members include not only the largest construction companies in Hungary, but also a number of small and medium-sized enterprises. ÉVOSZ regularly carries out economic surveys, publishes annual reports and opinions on the current situation of the construction industry and the tasks proposed. Their basic assumptions for 2023 are set out in thematic detail in a document entitled "*Key problems in the construction sector in 2023 and proposals for their solution*" [ÉVOSZ, 2022]. Its findings, which are relevant for the present project, are detailed below.

All basic professions in the field of construction can be classified as shortage occupations throughout the country**. The main difficulties in** the **construction industry are the lack of skilled workers** (both in engineering and in skilled trades) **and the lack of modern machinery**

and technology. Employment difficulties will also be the main challenge in 2023: the construction labour market in 2023 will continue to be heavily affected by the **intensive labour outflow of** 2008-2014, the ageing of the skilled workforce and difficulties in generational change, as well as the low number of professionals leaving the school system. According to the study, the number of **people retiring from** the profession is expected to exceed the number entering the construction labour market by around 20 000 in the years 2022-2024. They stress the need to pay more attention to the domestic employment of foreign skilled workers from outside the EU.

A new ÉVOSZ survey conducted in 2023 assessed the changes in market conditions in 2022 and the expectations of companies for 2023. In contrast to previous years, the vast majority of respondents (77.8%) cited **a lack of new customers as the main obstacle to their activities,** due to the war in our neighbourhood and its economic consequences (Figure 41.). Obviously closely related to this, **inflation was** not far behind as an obstacle, cited by 66.7%. The **shortage of skilled labour, which was the** most important factor affecting businesses in the previous survey in 2022, has dropped to third place this year, with 55.6% of firms citing it as a barrier to doing business. Unpredictability of economic regulation was cited by half of respondents, while exchange rate volatility was cited by nearly a third as a major obstacle.



41. Figure: Factors affecting firms' business activity, 2023 (Source: ÉVOSZ, 2023)

Only slightly more than half of the responding firms (55.6%) said that they had the right number and mix of skilled workers to fulfil their orders. The **greatest shortages** were reported in **skilled trades** (carpenters, electricians, building technicians, locksmiths), but **there is** also **a shortage of engineers** (architects, mechanical and electrical engineers). Only 28% of respondents expect to increase the average number of employees in the next six months [ÉVOSZ, 2023].

7.1.5 Budapest Chamber of Commerce and Industry survey

The results of the above-mentioned ÉVOSZ research are also supported by a non-representative survey conducted by the Budapest Chamber of Commerce and Industry (hereinafter: BKIK) in 2022, which shows that around 42% of enterprises in the construction industry have a permanent vacancy, mostly a shortage of skilled manual workers. The main problem is a lack of skilled workers in the right quantity and skills, and the wages offered. The survey found that **carpenters and masons are the hardest to find, followed by electricians.**

"*Labour shortages are a common problem in the Hungarian labour market in several sectors. In the construction sector, it is currently such that the market could employ an additional 100,000 people on top of current capacity needs. At the same time, the sector is also facing challenges in retaining its workforce: the flow of labour from east to west has intensified, so companies now have to compete in an international labour market, and therefore have to expect an increase in the wages of skilled workers,*" said László Koji, vice-president of the BKIK.[72]

7.1.6 Conclusions drawn from education statistical data

Vocational education and training

As a first step, data on enrolment in vocational education and training were collected. The students enrolled in sectoral basic training are students in grades 9 and 10 who are still in the process of choosing a profession.

Finding data on vocational education and training enrolments and qualifications is a difficult task, because there is no database in Hungary that can be accessed. In the present status quo analysis, we use the data included in the publication titled "The future of vocational training and adult education in the construction industry", compiled by the Hungarian Chamber of Commerce and Industry (MKIK) and ÉVOSZ in 2020. The data in the tables below (Table 26 and 27) have been collected using the Public Education Registration and Study System (hereinafter: KRÉTA).

[72] Source : https://www.hrportal.hu/hr/szazezer-ember-hianyzik-az-epitoiparbol-20220421.html

Vocational school headcount data KRÉTA 16 October 2020.	
Vocation (Listed in Register of Vocational Occupations professions)	**year 9**
Construction	
Carpenter	179
Tinsmith	1
Tiler	343
Banker mason and cast stone maker	3
Painter and decorator	701
Stonemason	1
Mason	635
Drywall specialist	18
Structural engineer and fitter	1
Insulation specialist	7
Roofer	0
Road construction and maintenance technician	0
Building Engineering	
Cooling and ventilation system installer	121
Central heating and gas network installer	484
Water and sewerage installer	61
Wood and furniture industry	
Joiner	817
Upholsterer	76
Electronics and electrical engineering	
Electrician	1033
Mechanical engineering	
Building and construction locksmith	150
Welding	1282
Total	**5913**

Table 26: Number of students enrolled in vocational schools in 2020/21 (with red highlighting the most important fields of study for energy efficiency (Data source: MKIK, ÉVOSZ, 2020)

The enrolment of pupils for the 2020/21 school year shows an increase, with 5,913 pupils in Year 9, as shown in the table above, 33% higher than the number of pupils in Year 10, i.e. pupils enrolled 1 year earlier. It is encouraging to note that the enrolment in the architect occupational group exceeded the 2019/2020 figure by 52.3% [MKIK-ÉVOSZ, 2020].

Technicum headcount data KRÉTA 16 October 2020.		
Sector (students choose a vocation after basic sectoral education)	Basic training	
	language preparation	year 9
Electronics and electrical engineering	205	1 231
Construction	224	757
Building Engineering	0	284
Wood and furniture industry	0	206
Mechanical engineering	0	1 149
Total	**429**	**3 627**

Table 27: Number of students enrolled in technical schools for 2020/21 (Data source: MKIK, ÉVOSZ, 2020)

Looking at the enrolment data of previous years, it can be seen that the focus of vocational education is beginning to shift somewhat from vocational schools towards technicum [MKIK-ÉVOSZ, 2020], as was also observed in the data of the Békéscsaba Center of Vocational Training Centre in Chapter 5.1.1.

It is important to stress, however, that a significant proportion of technicum graduates do not immediately enter the labour market because they continue their studies in higher education. According to national data, covering all VET programmes, **66.3% of VET graduates enter the labour market directly, while another 33.7% of students are mostly in further education** (higher education or adult education), have children or other status, and some are registered jobseekers. Four-fifths (83.2%) of those in adult education and training are directly employed, on average within a week of leaving [NSZFH, 2023].

The figures above reflect enrolment figures, but it is possible that a student may change career while studying, be required to repeat a year because of poor results or leave without a qualification. According to the Industry 4.0 Background Study, the number of early school leavers has fallen significantly in recent years, but it is still a serious problem. Indeed, according to a 2017 figure, **12% of young people leave school without qualifications**[73]. In this study, we also calculate this drop-out rate of 12%.

Higher education

Below are the statistics of graduates in the occupations and higher education institutions covered by the study, using publicly available data from the website of the Education Office.

[73] *Source : https://ikk.hu/files/Szakkepzes_4.0_II.pdf*

Education	Diploma	Average number of diploma holders (persons) in 2017-19 academic years
architect	BSc	215
electrical engineer	BSc	33
civil engineer	BSc	835
environmental engineer	BSc	102
energy engineer	BSc	406
technical manager	BSc	724
	total	**1777**

Table 28: Average number of graduates with a bachelor's degree from a higher education institution relevant to building energy in the 3 academic years 2017-19 (own editing, source: https://dari.oktatas.hu/firstat.index)

Tables 28 and 29 do not include the graduation data for the academic year 2020/21, as due to the Covid-19 pandemic, the government introduced **a language exam amnesty in** 2020 and 2021, exempting those who passed the final exam by 31 August 2020 and 2021 from the language exam requirement for graduation. Accordingly, the number of students graduating in 2021 will be significantly different from previous years, as they will be students who were not able to obtain a diploma due to a lack of language exams. National data for the school year 2021/22 are not yet available.

Education	Diploma	Average number of diploma holders (persons) in 2017-19 academic years
architectural engineer	MSc	347
architect	MSc	25
structural engineer architect	MSc	23
architect with a degree in real estate development		4
urban engineer	MSc	30
electrical engineer	MSc	350
energy engineer	MSc	37
mechanical engineer for building services and process engineering	MSc	24
infrastructure civil engineer	MSc	104
environmental engineer	MSc	120
Facilities engine	MSc	35
structural engineer	MSc	125
technical manager	MSc	170
	total	**1395**

Table 29: Average number of graduates with a Master's degree from a higher education institution relevant to building energy in the 3 academic years 2017-19 (own editing, source: https://dari.oktatas.hu/firstat.index)

Education	Certificate	Number of doctorate graduates (persons), average for academic years 2017-19
Architectural sciences	PhD/DLA	9
Architecture	DLA	11
Civil engineering sciences	PhD	11
Electrical engineering sciences	PhD	10
Mechanical engineering sciences	PhD	19
Environmental science	PhD	34
Total		**94**

Table 30: Average number of doctoral graduates from higher education institutions relevant to building energy in the 3 academic years 2017-19 (own editing, source: https://dari.oktatas.hu/firstat.index)

As regards doctoral courses, there is no data available on the number of courses within each discipline, excluding architecture and civil engineering, dealing with the built environment, circular economy, etc. and only building energy and building services engineering are part of mechanical engineering, therefore the number of students in these courses is estimated by experts as being uniformly divided in three.

Aggregated statistical data

The table below (Table 31) shows the aggregated data on vocational training and tertiary education attainment by HUQF level categories for the number of **new graduates and entrants into the construction sector each year:**

HuQF level		Number of graduates	Number of women
HuQF 1-2	unskilled worker, unskilled worker	2 800*	negligible*
HuQF 3-5	skilled worker, technician	5 930**	no data
HuQF 6	assistant engineer	2 501	740 (30%)
HuQF 7	engineer	1 395	484 (35%)
HuQF 8	research engineer	42	12 (34%)
Total		**12 688**	

* based on expert approximation

** Reduced by 12% drop-out rate (career drop-out without qualifications) and 30% further education

Table 31: Number of new graduates (new entrants) in construction per year by HUQF levels (own editing)

Summary

Summarising the questionnaires, interviews and studies published by professional organisations, it can be concluded that the shortage of skilled workers is still present in almost all areas of the domestic construction industry. There is a consensus that **carpenters and electricians are the** most in short supply in Hungary**, followed by bricklayers and building technicians (technicians).**

Among these professions, building services engineers, masons and electricians are of great importance for achieving the energy performance targets of buildings. These professions can be learned in 3-4-5 years in vocational schools and technical colleges, and with additional work experience, young people who are enrolled in September 2023 will enter the labour market in 4-5-6 years, i.e. they will be able to work independently in summer 2027 at the earliest.
The education of graduates is even slower, with 10 semesters of study for design engineers, followed by 2 years of compulsory training to become self-employed. This means that a student starting his studies in September 2023 will not be able to start working independently until mid-2029 at the earliest.

For all these reasons, increased attention needs to be paid to the up-skilling of existing professionals, as well as to the requalification of those working in other professions and the learning of a second profession.

Components determining the number of people employed in construction by 2023 (and their trends):

- In Hungary, the construction industry employs around 380,000 people, and the trend is increasing, based on data from previous years. [KSH, 2022]
- Number of retirees: around 25,000 per year [ÉVOSZ, 2023], with a trend that is slowly increasing for demographic reasons.
- Emigration/return: 2019 was the first year that more people settled in than emigrated: even out[74] .
- The number of new graduates and **new entrants to the** construction sector each year, rounded up from the above table, is 12 700 (3.3% of the nearly 380 000 people employed in construction).
- Retraining of workers from other occupations: no data available.
- Number of foreign workers employed: 6 700, an increase of 5% compared to the previous year. [KSH, 2022]

Based on the above data, it can be concluded that **the number of people working in the construction sector is not increasing as much as needed,** based on the current situation and the foreseeable trends for the future, so the shortage of skilled workers in Hungary will not ease in the short term. In the view of the consortium experts and on the basis of the research studied, the **following options are possible to** achieve the 2030 targets:

- Re-employing retired professionals;
- Requalification of non-construction workers;
- Increasing construction efficiency: using modern machinery and technologies;
- Automation of construction processes, etc.

[74] Source: tps://magyarepitok.hu/iparagi-hirek/2021/11/hazaternek-a-magyarepitok-az-epitoiparba-immar-ket-eve-tart-a-positive-process

7.2 Skill gaps

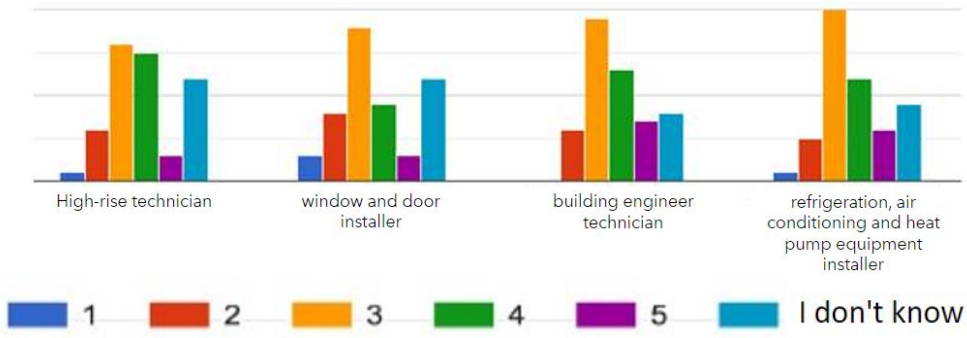
Examining the demand for professionals, an important question is whether the skills of professionals enable the design, implementation and renovation of efficient energy-efficient buildings. The conclusion can be drawn from the survey on the existing skills of professionals that there is a need for improvement in these professions.

7.2.1 Results of the questionnaire survey

In the questionnaire, the consortium sought to assess the level of preparedness of professionals listed in carrying out effective building energy efficiency construction and renovation projects upon completion of their school-based training.

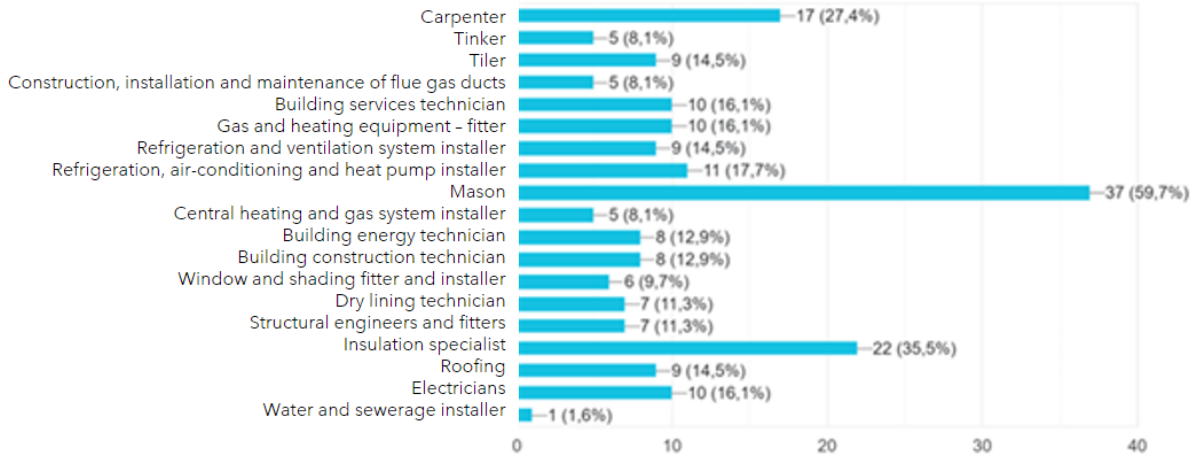
According to the aggregated opinion of respondents from construction companies, the following training courses received relatively poor ratings: tiler, tinsmith, and mason. Slightly below average ratings were given to carpenters, painters, plasterers, structural fitters, insulators, drywallers, and roofers. (The ratings ranged from 1, indicating not at all adequate, to 5, indicating fully adequate quality.)

Respondents said they rated the following five occupational specialisations as medium or better: building construction technician, building services technician, and HVAC and heat pump installer, gas and heat equipment installer er and automation technician (Figure 42.). The other occupations in the list were rated medium.



42. Figure: Questionnaire responses from construction companies to the question: 'How well do you think the following professionals are prepared to carry out efficient building energy efficiency construction and renovation projects upon completion of their school-based training? Please rate on a scale of 1 to 5: 1 if not at all adequate, 5 if fully adequate."

According to the opinions of teachers and students in vocational training institutions, , masonry, carpentry and insulation received the highest ratings among the listed occupations, similar to the shortage occupations mentioned earlier. On the other hand, the profession of plumber received the lowest number of ratings, while the remaining professions in the list were rated somewhere in the middle (Figure 43.).



43. Figure: VET trainers' questionnaire responses to the question "Which of the following THREE professions do you think the SKILLS of the VET trainers should be significantly improved? Please select three from the list below."

The ConstructSkills4LIFE project focuses on priority target groups identified by many respondents who believe that these professions require additional training and skills improvement. The following professions have been identified as priority areas for further investigation and potential development:

1) according to construction respondents: mason;

2) based on the respondents of the training centers: mason, carpenter, insulation specialist.

7.2.2 Interviews with construction companies

Questions asked during the interviews included: 'What do you think about the qualifications/skills of recent graduates? Do you see any trends in this over the last decade?" Based on the responses received to these questions, the professional **and practical experience of recent vocational students is typically inadequate.**

According to the feedback received, design engineers generally possess adequate theoretical knowledge, but they lack practical experience. There is a prevailing trend in vocational education and training where the skills of graduates are becoming weaker. However, respondents highlighted that there can be positive exceptions at the local level, particularly when apprentices follow family traditions and inherit practical skills. Respondents emphasized that staying up to date with professional knowledge is best achieved through foreign language textbooks, as the availability of up-to-date Hungarian literature is limited. Proficiency in English and sometimes German were identified as the main required languages. The industry sector attempts to address this gap through training, education, and translation. However, it was cautioned that relying solely on internet sources for learning can be risky.

Almost all respondents are in favour of making the **implementation of activities conditional on eligibility.** Several interviewees mention that there are schemes or government regulations (266/2013 (VII.11.)) that could be used as a basis to strengthen the conditions for practising

the profession. One striking opinion is: *"Where I see the problem is that there are so many mavericks in the construction industry because any person can establish a construction company. I would stipulate that only those who have a master's title, or a responsible technical manager qualification should be able to set up a construction company. There are a lot of people who do not take guarantees, and this has a bad effect on the perception of other honest builders. In any case, it should be linked to some kind of professional qualification!"*

7.2.3 Competence map

In this chapter, we compare the levels of competences required in each profession with the gaps identified earlier and summarise the new skills that need to be taught to achieve the 2030 goals in vocational education and training as well as in higher education. A similar logic can be followed in the case of present market participants and those already qualified, however, the content of actual course and further training needs should be based on acquired knowledge.

Vocational training (HuQF 3-5)

The table below (Table 32) lists the professions that have a significant impact on the energy efficiency and sustainability of buildings. We indicate the areas of expertise and depth of competence that we believe these professionals should have. In secondary schools, it is mainly the professionals involved in the construction of buildings who are trained, and it is in this context that we have examined the topics covered by our study (which were also explored in the questionnaire surveys).

The conclusions summarised in sub-section 5.1.1 "Characteristics of the VET system", compared with the above competence map, show which topics need more knowledge to be transferred to students in VET institutions. Outputs of the current education system:

- approximately equivalent in terms of the knowledge on renewable energy devices
- **medium,** for **building renovation and energy upgrading of listed** and **near-zero energy buildings;**
- **few,** in the fields of **circularity,** digitalisation (BIM) and **smart buildings.**

Competence map - HuQF 3-5 market practitioner			Relevant topics - level of competence expected										
Type of qualification	Field of expertise	Level	Exploration of near-zero energy buildings	installation of renewable energy devices	deep renovation -description	gutting of listed buildings - explanation	circular construction model	building information modelling (e.g. BIM)	dynamic building simulation	smart solutions and buildings	life cycle analysis (e.g. LCA)	building certification systems	smart cities and communities
PROFESSIONS (List of professions)		**HuQF**											
Electronics and electrical engineering	Automation technician	5											
	Electrician	4											
Construction	Mason	4											
	Building construction technician	5											
	Structural engineer and fitter	4											
	Insulating	4											
Building engineering	Building services technician	5											
	Refrigeration and ventilation system installer	4											
	Central heating and gas network installer	4											
	Water and sewerage installer	4											
SUB-PROFESSIONS OF PROFESSIONS													
Construction	Mason	3											
	Heat and sound insulator	3											
Building engineering	Flue gas drainage fitter	3											
	Plumber	3											
SPECIFICATION (Programme requirement)													
Construction, building and civil engineering	Construction, installation and maintenance of flue-gas ducts	3											
	Façade construction and installation	3											
	Window and shading fitter, installer	3											
Energy, electrical branch	Gas and heat generating equipment - fitter	3											
	Refrigeration equipment operator	3											
	Installation technician for refrigeration, air conditioning and heat pumps	3											
	Plant energetic	3											
	Small renewable and other primary energy power plant installer of high-voltage	3											
	Electric distribution network installer, operator	3											

Legend: **Competence level** informed knows competent

Table 32: Expected competence levels of professionals

Higher education (EQF 6-7)

In the table below (Table 33), we show, for each of the professions studied, the areas and depth of competence that we believe graduates should have.

Competency map - HuQF 6-7 market practitioner			Relevant topics - level of competence expected										
Education	Field of expertise	HuQF	DESIGN of near-zero energy buildings	PLANNING of renewable energy devices	deep renovation PLANNING	renovation of listed buildings DESIGN	circular construction model	building information modelling (e.g. BIM)	dynamic building simulation	smart solutions and buildings	life cycle analysis (e.g. LCA)	building certification systems	smart cities and communities
BSc	architect	6											
	electrical engineer	6											
	energy engineer	6											
	civil engineer	6											
	environmental engineer	6											
MSc	architectural engineer	7											
	structural engineer architect	7											
	urban engineer	7											
	electrical engineer	7											
	energy engineer	7											
	mechanical engineer for building services and process	7											
	civil engineer	7											
	environmental engineer	7											
	facilities engineer	7											
	infrastructure civil engineer	7											

Legend: **Competence level** informed knows competent

Table 33: Expected levels of competence for graduates

Further, the lessons summarised in sub-section 5.1.2 "Characteristics of the higher education system", compared with the above competence map, show which topics need more knowledge to be transferred to students in higher education institutions. The output of the current education system:

- Existing education **nearly matches: renewable energy, near-zero energy building design, digitalisation** (BIM)

The most prominent subjects in education are related to the use of renewable energy sources and the design of near-zero energy buildings (both in architecture, mechanical engineering and building electricity). It is important to note that the composition and emphasis of the subjects will depend on the educational institution and the educational programme.

- Existing education **is scarce: building renovation, energy upgrading of listed buildings, environmental life cycle analysis - circularity, building rating systems, smart buildings and smart cities**.

On these topics, both teachers and students perceived significant gaps in the delivery of knowledge and in its practical application. Therefore, a more detailed presentation of these subjects in the training structure, at subject level, is of particular importance.

1. **Building renovation and refurbishment:** knowledge of restoration techniques and materials, application of energy-efficient solutions for renovation of existing buildings, environmental impact analysis and sustainability considerations.
2. **Energetic retrofitting of historic buildings:** understanding the specific needs and constraints of historic buildings, developing energy efficiency solutions that respect the original character of the buildings, balancing conservation and sustainability.
3. **Environmental life-cycle analysis and circular economy:** life-cycle analysis and assessment of buildings and infrastructure, modelling of sustainable material use and

material flows, application of circular economy principles and methods in design and construction processes.

4. **Building certification systems (LEED, BREEAM, WELL):** knowledge of different certification systems and standards, application of certification processes and methods, applying sustainability criteria and performance assessment systems.
5. **Smart buildings and smart cities:** design and deployment of smart building management systems, application of IoT (Internet of Things) technologies and data collection methods in the development of buildings and cities, energy efficient and sustainable infrastructure.

7.3 Qualification needs

High-quality education requires qualified and continuously trained professionals, a teaching staff, an adequate supply of tools and literature, and a well-functioning system of supporting institutions. These factors will be assessed below, both in vocational education and training and in higher education.

7.3.1 Vocational education and training

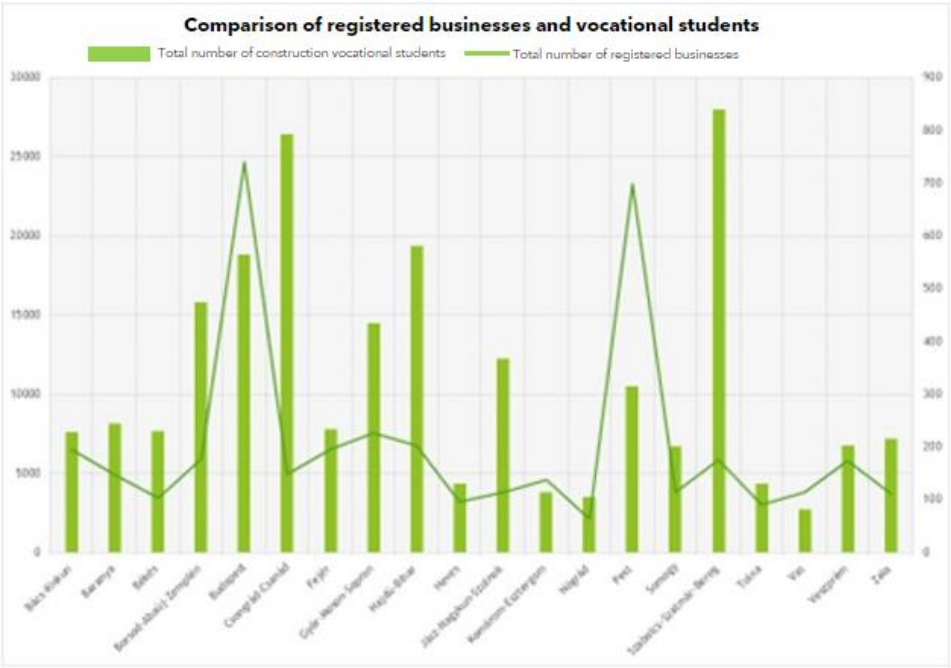
The qualitative assessment of vocational education and training, the analysis of the capacities and qualification situation of the participating teachers and trainers was partly based on questionnaire surveys answered by trainers and students, on the knowledge gained from interviews with trainers and construction companies, and partly on direct contacts with the actors concerned.

Teachers

80% of the respondents who teach in vocational education and training are in general satisfied with the quality of the teaching staff, but what they see as a possible issue is **the ageing of the teaching profession** and the lack of high-quality replacement. Moreover, attracting high quality professionals requires sufficient financial resources.

Trainers with a comprehensive knowledge of industrial, design and construction practice are needed: *"To be a good trainer, you need to have a full range of professional knowledge and be a practitioner. To see that those who are only in school become complacent and are not exposed to new materials, technologies and machines. An instructor has to keep training himself. Of course, this knowledge is not enough, because you need the ability to transfer this knowledge to the l students."*

Dual training shows a mixed picture, functioning well in cities and counties where industry is widespread. In many counties in Hungary, there is a mismatch between the number of educational institutions and the number of enterprises, meaning that in many cities there are numerous dual training sites (companies) where the number of students is low or vice versa (as shown on Figure 44.).

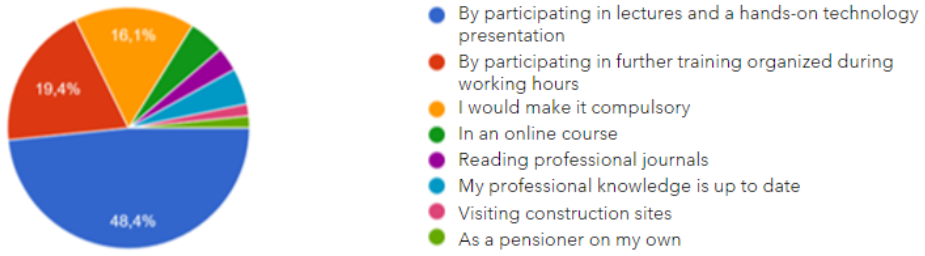


44. Figure: Comparison between the number of enterprises registered in dual training and the number of apprentices per county (Source: ÉVOSZ)

In interviews with construction companies, dual training as a form of education is generally seen as a good thing, but opinions differ on its real benefits in the current context. One respondent, who has himself been a dual training provider for 10 years, said *"There are three ways to motivate young people. One is money and there was a good step in this direction with the current scholarship system. The other is the real conditions in the company. I can tell by looking at the students that they enjoy working on the construction site more than when they are working in the workshop. This also increases their motivation. The third is the influence of peers to each other. These three things are the most important influencing factors: the money, the fact that the kids are doing real work, and the peer-to-peer influence."*

Training, and upskilling of trainers

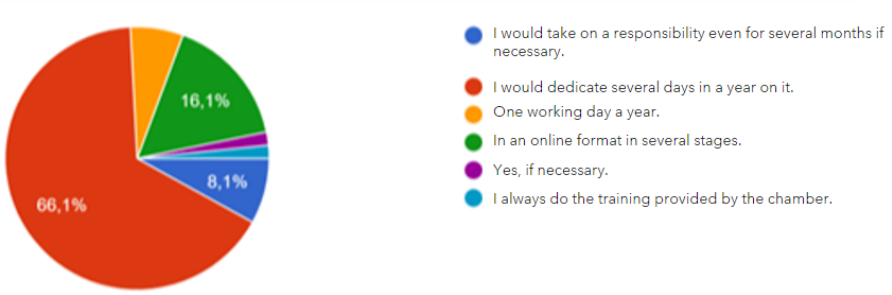
It is essential for trainers to have up-to-date knowledge, which is why they need continuous training and f upgrading The Vocational Education and Training Act of 2019 gives vocational school teachers the opportunity to spend a certain amount of time in a factory environment as further training, where they will be exposed to the latest technologies. This **requires closer cooperation between companies and training institutions.**



45. Figure: Responses to the question "How would you improve your professional knowledge?"

48.4% of respondents would prefer **practice-oriented training**, as well as organised trainings supported during working hours (19.4%) or making such trainings compulsory (16.1%). 4.8% would take an online course, while 3.2% would train themselves by reading professional journals. 4.8% consider that their professional knowledge is up to date and therefore does not need to be improved (Figure 45.).

A suggestion was made to visit construction sites as a method, and to develop autonomously, as well as to attend training courses organised by the Chamber.



46. Figure: Responses to the question "If you would like to improve your knowledge, how much time would you spend on such a presentation/training/further training?"

The most supported **training** (66.1% of respondents) is **annual training, which can take several days,** but there is also a demand for online training in short bursts (Figure 46.).

The Békéscsaba Center of Vocational Training (BSZC), which is participating as a partner in this project, pays special attention to the further training of its teachers, many of whom go abroad to learn the latest technologies, which is also financially supported by the BSZC. Currently, one of their main areas of interest is the future applicability of Artificial Intelligence (AI) in the construction industry. Unfortunately, no data is available from the other vocational training institutions on their training strategies for their trainers.

Learning materials, teaching materials, tools

For vocations with a large number of students, there are good textbooks and digital learning materials available. **However, in vocations with a small number of** trainees, **the supply of textbooks is insufficient** (e.g. tinsmith). The literature and teaching resources need to be constantly updated, but the financial support for this is very low.

Engaging with material manufacturers and distributors is considered a good practice for schools, teachers, and students. This approach allows them to participate in training courses and demonstrations organized by these entities or invite them to schools for educational purposes. Such interactions provide valuable opportunities to learn about new and modern materials and technologies. Material manufacturers and distributors often provide up-to-date and well-prepared professional materials like catalogues and online resources that can be utilized by schools in their training courses. However, it is observed through everyday teaching experience that students tend to spend less time actively using books, and their reading comprehension skills may vary.

Summary

Experiences from vocational training abroad have demonstrated a strong emphasis on controlling the training process. In Hungary, there is a trend towards strengthening output regulation, as the Programme Curricula (PTT) are currently only recommendations and not mandatory. The development of training programs should primarily be determined by Education Training and Learning Outcomes Requirements (KKK). If there is a need to upgrade skills in a particular profession, Sector Skills Councils can facilitate this process more efficiently. With this approach, the KKKs would no longer need to be specified in legislation, as is the case for vocational and examination requirements for the OKJ vocational qualifications. Instead, they can be published on the IKK website. It is worth noting that schools have the possibility to expand their training programs independently without changing the KKK, but this can make it challenging for employers to assess the competences of graduates in a specific vocation. Recommendations should be considered to modify the KKK in relevant vocations to address these challenges and ensure alignment between training programs and employer expectations.

7.3.2 Higher education

The consortium assessed the topic below based on the aggregated results of the interviews with academics from higher education institutions and construction companies, as well as the responses to the questionnaires.

Educators

An analysis of the current functioning of the higher education system shows that environmental education is not only a matter of building the educational system. The functioning of the system is also influenced by the individual knowledge and experience of the trainers. While student autonomy is achieved close collaboration between students and instructors is crucial. In addition to knowledge transfer, trainers can also shape students' attitudes during individual consultations.

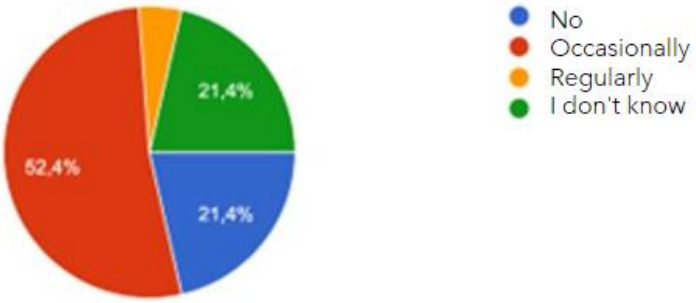
Data on the ageing of the teaching workforce are often not publicly available or easily accessible. However, in general, the age composition of the teaching workforce in higher education is variable and many factors influence the rate of ageing. Universities and colleges generally seek to retain experienced academics and provide career opportunities for older professors. Information regarding the age distribution of the teaching workforce is often not readily available or easily accessible. However, the age composition of the teaching workforce in higher education tends to vary, and multiple factors influence the rate of ageing. Universities and colleges generally strive to retain experienced academics and create career opportunities for older professors.

In previous years, the retirement age in Hungary has gradually increased. In the period before 2021, the retirement age for women was generally between 62 and 64, while for men it was 65. For teachers and lecturers, the retirement age is generally set in the public sector and in labour law frameworks. It is important to note that the decision to retire is a personal choice and depends on the circumstances. Not all teachers or trainers retire as soon as they reach retirement age. Many remain active, continue their careers, work part-time or choose other

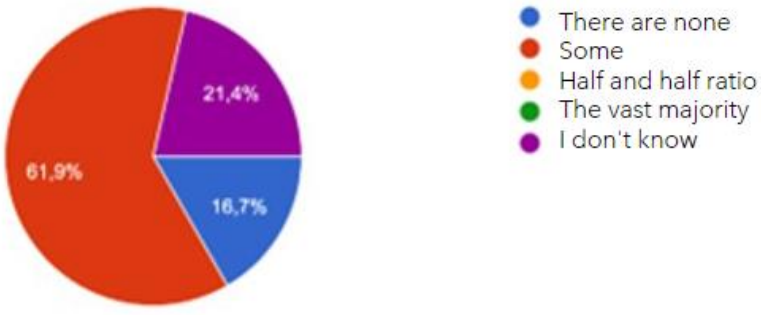
forms of work. Higher education institutions generally have strategies and programmes to further motivate teachers, attract talent and engage new generations in the academic world. The renewal of teaching bodies and the involvement of young academics are of particular importance for the quality of education and the continuity of research activity.

Training, upskilling of trainers

We estimate that around 50% of engineering trainers are practising engineers, who are required to attend mandatory training courses to maintain their design competence. In line with this, more than half of the trainers in the questionnaire responded that they have occasional training opportunities in their respective subject areas, and only a few trainers have any qualified (further) training (Figure 47 and 48).



47. Figure: Teacher responses to the higher education questionnaire on the question "Is there any training available for teachers in the subject area?"



48. Figure: Faculty responses to the question "Do you have colleagues in your faculty who design certified (e.g. Passive House) buildings?"

Respondents to the construction questionnaire are generally satisfied with **the theoretical knowledge of trainers**, but in many cases, there is a lack of practical knowledge. Continuous training of trainers is (would be) an important element to raise or maintain the professional level of education. In the Consortium's view, motivating trainers, valuing their work, training them and promoting the integration of practical (market-based) knowledge are necessary to improve the background of education.

In Hungary, continuing studies in higher education is generally supported and encouraged. However, the specific forms of support and opportunities vary according to institutions, programmes and funding sources. Below are some important forms of support in Hungary:

Continuing education programmes: Hungarian higher education institutions offer a wide range of continuing education programmes aimed at improving professional knowledge and skills. These programmes usually have flexible timetables and allow students to study while working.

Flexible learning opportunities: Hungarian higher education institutions strive to provide flexible learning opportunities for students applying for further education. This may include evening or weekend courses, online learning or distance learning opportunities that allow students to study while working.

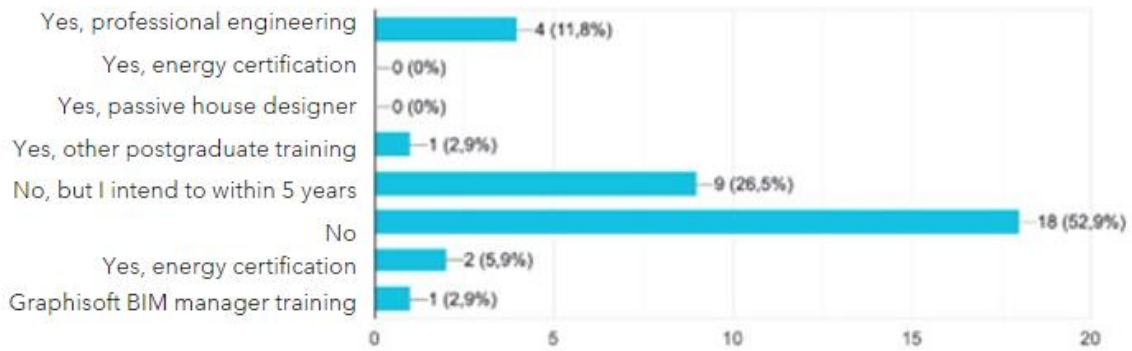
Careers advice and career centres: Hungarian higher education institutions often have careers advice and career centres to help with exploring further education opportunities, career planning and job research.

In addition, several national and EU funds may be available to support training in Hungary. For example, the **National Talent Programme** provides opportunities for talented students and the **Research Careers Programme** focuses on research and development.

Learning materials, teaching aid, tools

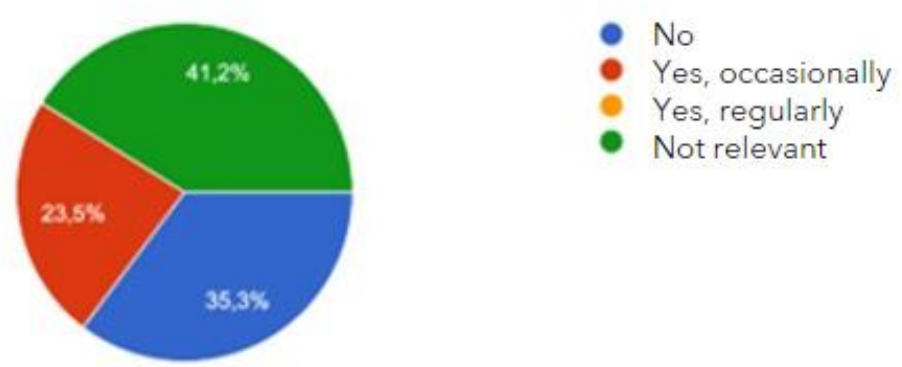
Education must constantly adapt to new technologies and sustainability solutions to prepare students for the future. Alongside IT literacy, the need for sustainability in education is becoming increasingly important. Keeping up to date in academic research and education is essential because there are many influencing factors in a daily changing environment. Artificial Intelligence is an excellent example demonstrating the relevance of new technologies and sustainability solutions in education.

It is important for university lecturers to highlight research results in a given field and to provide students with up-to-date scientific knowledge. Conducting research and measurements that can be linked to the subject matter will help to underpin the curriculum and scientific knowledge. In addition, experience and results from professional practice are also an important element of the knowledge imparted.



49. Figure: Student responses to the higher education questionnaire for the question "Have you completed any postgraduate training - related to the topic - after your university studies?"

There is a lack of communication between higher education institutions and faculties, and a lack of information sharing between departments within the university. There is no common position on the issues, which is reflected in the teaching materials. **There is only a 'word of mouth' dissemination of professional good practice, without any scientific basis.** There is a significant lack of written materials and university handbooks summarising the most up-to-date knowledge on the subject.



50. Figure: Student responses to the higher education questionnaire on the following question "Since graduation, have you participated in (international) forums and conferences related to the topic?"

Education system

An assessment of the current education system has shown that the quality of education is not in line with current challenges, and it is **not clear what is being implemented in the training courses**. Achieving a balance between vocational training and higher education is crucial in the field of education. With a shrinking population and declining enrolment in educational institutions, it is important to address the overcrowding issue in university courses. Presently, a large number of students enrol in university, but only around 20% possess the necessary skills and competences to succeed in their chosen fields.

To prevent a decline in the quality of higher education, there should be a greater focus on high-quality vocational education and training that appeals to students. This emphasis on vocational training can help alleviate the growing shortage of skilled labour and bridge the gap in the workforce.

Furthermore, wage discrepancies between different professions can create tensions and further complicate the goal of achieving a balanced labour market. Addressing these wage tensions is essential for fostering a more harmonious and equitable labour market.

The higher education system has observed a trend towards specialization and narrowing of fields, which can sometimes result in a lack of comprehensive insights and general engineering knowledge among students. It is crucial to recognize the importance of general engineering knowledge as it provides individuals with systemic insight necessary in the workplace, beyond specialized expertise. System thinking enables individuals to connect different areas and perspectives, allowing them to grasp the bigger picture, identify interactions, impacts, and potential consequences. This holistic approach is vital for effective planning, decision-making, and problem-solving. Additionally, incorporating a **market-oriented approach** in universities is essential. As the economic and technological landscape evolves rapidly, universities should adapt to market processes and demands. However, academic systems often struggle to keep pace with these changes and can be slow and inflexible in responding to industry needs. This

can hinder innovation, the development of practical skills, and the preparation of students for the real working environment.

To address these challenges, it is important for higher education institutions to strike a balance between specialization and general knowledge, embrace a market-oriented perspective, and foster a culture of adaptability and responsiveness to meet the evolving demands of industries and the workforce.

Summary

The education system in higher education institutions and the role of trainers are confronted with various challenges. The personal experience and knowledge of trainers play an important role in shaping students' attitudes and ensuring the quality of training. Ageing staff is a problem, but institutions are making efforts to retain and motivate experienced trainers while involving the younger generation.

Upgrading the skills of trainers is a priority to maintain or elevate professional standards. The lack of practical knowledge is especially pronounced in the construction sector and could be improved through training and the integration of market-based experience. Higher education institutions provide support for further training, flexible learning opportunities and career guidance. Curricula should be up-to-date with new technologies and sustainability solutions, and trainers should refer to the latest research findings. However, information sharing and communication between university faculties is poor.

The current state of the education system does not align with existing challenges. Finding the right balance between vocational education and training while focusing on high quality vocational education and training, is essential to meet labour market demands Alongside an increasing focus on specialisations, the significance of general engineering knowledge cannot be overlooked, as it is crucial for systemic insight and success in the workplace. In summary, higher education institutions and trainers need to make improvements in several areas to enhance the quality of training and adapt to current market needs.

7.3.3 Courses and training programmes beyond vocational training systems

The analysis of the institutional system of courses beyond professional training systems, as well as the capacity and qualifications of trainers involved in continuing education, was conducted using a combination of data from questionnaire surveys, interviews, and direct engagement with market players. An overview of the current range of training programmes and qualification systems is given in Chapter 5.1, while the sub-chapters 5.2 and their final conclusions of this Status Qua Analysis contains the foundation of the necessary suggestions and proposals for the roadmap.

The following chapter, presents the **institutional system for the further training** in the construction industry, its typical solutions, pointing out the shortcomings and the system tasks to be solved. This section, similarly to Chapter 5.2.3, will analyse only the typical solutions and structures, so that the results of the exploration of the **discrepancies** between the strategic vision of the project and the current system can be used to produce a realistic National

Roadmap with a set of proposals ensuring the appropriate fit between the institutional and legal framework.

Project preparation - project management - project implementation

The activities and responsibilities of market players in the investment process are meticulously outlined and described in the relevant legislation, although not necessarily exhaustively. Each element of the investment process identifies the specific actors involved, and their required knowledge and qualifications have been defined to ensure their competency and market presence. These qualifications are typically associated with mandatory accreditation, certification, or entitlement schemes, creating a framework for ongoing knowledge acquisition and maintenance of professional status.

Regarding the staff of training institutions involved in continuing education, they fulfil their compliance, accreditation, and ongoing training obligations in various ways, depending on the specific training levels and content requirements dictated by different legislations. The key stakeholders in the overall institutional system are both governmental and non-governmental institutions. Establishing a strategic mapping and optimization of their relationships, activities, and responsibilities becomes a fundamental task and objective in the development of strategic methods and instruments.

Design - design control - design management - cost control

The respective legislation is equally careful in defining the relevant activities and responsibilities of design functions among market players. The participants involved in all elements and areas of expertise of the planning process are clearly identified, and a mandatory system of accreditation, qualifications and authorisations by the competent Chambers is in place for their activities and market presence. Thus, in this segment, the system of acquiring knowledge and maintaining eligibility can be ensured and guaranteed.

The staff of the training and educational institutions involved in continuing training meet their obligations and expectations in different ways, according to the level of training and content requirements, based on different legislation, in terms of compliance, accreditation, continuing training and updating of knowledge, but here the **product and application-oriented training** offer of the manufacturers' distributors, providing basically up-to-date knowledge, should be given special attention.

Governmental and non-governmental institutions and actors are the **key players in the operation** of the whole institutional system, and optimising their cooperation and collaboration is a fundamental task and objective in defining strategic methods and instruments. The institutional infrastructure of the commercial and manufacturing sectors should be given priority.

Construction-adjustment – putting into operation

The relevant activities and responsibilities of the market actors are largely defined by the related legislation, so the participants in several areas of the process are named, and their activities linked to the mandatory accreditation, qualification and entitlement system of the competent Chambers. Also in this segment, the system for acquiring up-to-date knowledge

and maintaining qualifications can be guaranteed, but there are also several responsible jobs that cannot be defined without mandatory qualifications.

The staff of the training institutes involved in the further training will meet the obligations to maintain eligibility as described above, although again, priority should be given to the product-oriented, installation-operation-regulation training offered by the manufacturers' distributors, which provides basic up-to-date knowledge.

The main actors in the operation of the institutional system are also governmental and non-governmental actors, and in addition to those mentioned above, the role of public or regulatory qualification systems and the institutional infrastructure of distributors and manufacturers can be of particular importance.

Commissioning- operation – maintenance - reconstruction

Two entities can be identified in the **maintenance process**, one is the **professional building society** and the other is the **owners and/or operators.** The **professional actors** can be interpreted as described in the previous point, with the proviso that the scope of the relevant actors, and hence their responsibilities, is not fully defined in the legislation. The 'society' of operators and the **lay public** require specific training, communication and persuasion strategies.

With regard to further training, the staff of the training and educational institutions involved in the further training of the **professional society**, the institutional system can be evaluated and managed in the same way as described above, but the typically lay **operating society** can only be "addressed" with the specific institutional system, financial and media background.
The main actors in the operation of the related institutional system are basically governmental and non-governmental actors, but while in the case of the professional society the above-mentioned can be interpreted, the "educators" of the lay society are faced with significantly different, marketing tasks and methods, which must and can involve the actors of the professional society.

Adult education and training, teachers and trainers, institutions

As discussed in the previous chapters, in addition to the appropriate content and methodology of continuing and postgraduate education systems, the **appropriate infrastructure and networking of institutions** and the **appropriate professional qualifications and continuous training of the staff providing training and education** play a key role. The existence and proper functioning of a supporting **institutional and personnel accreditation** system is an indispensable 'must', as is the operation of broad-based professional advisory **bodies** (institutionalised **skill development strategies**) which plan and support the updating of professional content, training methods and infrastructures. There are already good examples and solutions, the adequacy of which should be reviewed, and their systems, operation, activities and services adapted as set out in the training strategy.

Qualification of enterprises

In the construction industry, in any life cycle of buildings, in any profession, a qualified blue-collar or white-collar professional is not a legal **person but a natural person, bringing** only his "competence" to a given business. He will be marketable if he is 'backed' by a **legal entity**, a

'qualified' enterprise which, as in the case of training institutions, meets the legal, economic and qualification requirements appropriate to its scope and volume of activity and has an appropriate employee-contractor structure. This predestines the setting up and operation of a well-structured **business registration and certification** system for the whole construction sector, based on similar or identical principles. Some traces of this are already present in voluntary and mandatory versions, so structuring and harmonising it is a strategic objective.

Professional courses - supply-side content and quantity issues

Based on the conclusions and findings of the previous chapters, **courses and training programmes beyond the** professional **training systems** should essentially focus on new and innovative approaches, methods and good practice. It was necessary to state that due to the heterogeneous professional qualifications, acquired knowledge, different levels and structures of competence of the players and new entrants in the construction market, the detailed development of the thematic content of individual further training courses, segmented by professions, could only be done on a scale far exceeding the size of the current Status Quo Analysis. Therefore, we have developed a **competence map**, which serves as a guide to determine the expected and levels of competencies for each category within the European Qualification Framework (Table 34). This map also incorporates additional relevant stakeholders such as the general public (homeowners) and government, ensuring a comprehensive approach showing an **information- knowledge- competency** hierarchy. Any further training courses to be developed in a targeted manner, tailored to a specific person, specialisation, EQF level and providing the expected qualification can be designed and thematised in a systematic way, based on the above, and developed in a modular way according to the **Train4Sustain** method and/or as micro-credentials for specific needs.

Strategic competence map - typical competence level expected							
Interested in the construction industry	**specialist EQF level**					**social sector**	
Relevant topics	1-2	3-4	5-6	7	8	Population	government
near-zero energy buildings							
renewable energy use							
deep renovation							
renovation of listed buildings							
circular construction model							
building information modelling (BIM)							
dynamic building simulation							
smart buildings, building management system							
life cycle analysis							
building certification systems							
smart cities							

Legend: **Competence level** informed knows competent

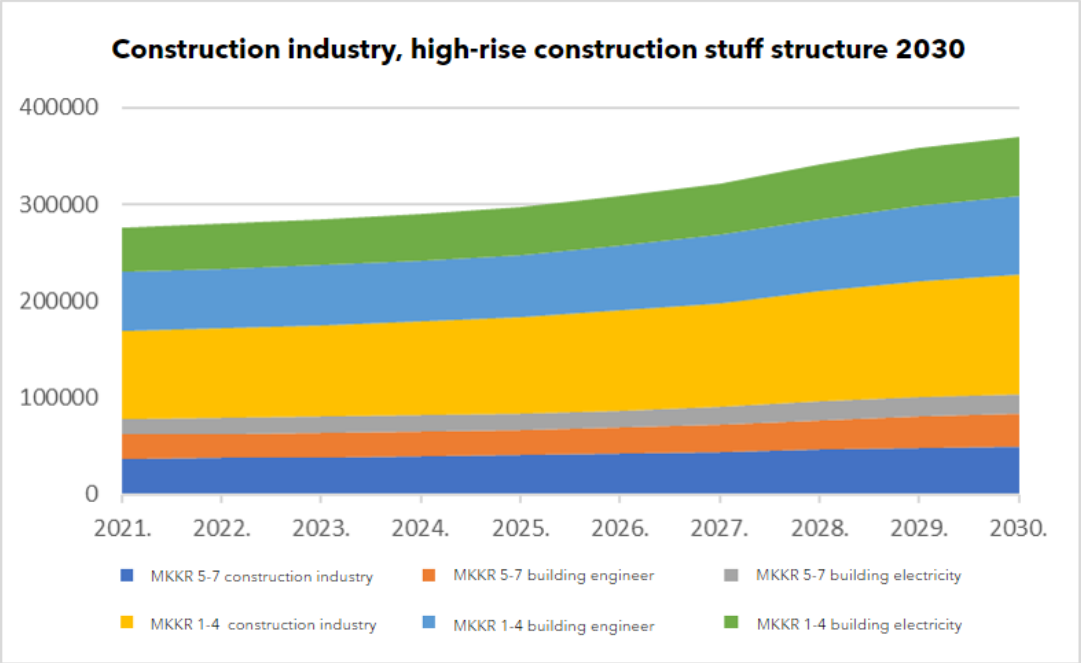
Table 34: Content competence map of courses and training programmes beyond vocational training systems (own editing)

The development, organisation and delivery of specific courses and training can be carried out in accordance with the findings in subparagraphs of this chapter of the Analysis. Strategic planning, timely and appropriate territorial availability can be ensured by the **coordinated and programmed activities** of the institutions, trainers, governmental and professional organisations and market actors to be involved. In order to achieve the optimum results and training offer in line with labour market requirements, the development of topics, the training of trainers, the conditions for training should/can be ensured by government guidelines, the involvement of **authorities** (eligibility, qualifications), **professional interest groups** (professional, qualification requirements) and **market players** (dual training, product-specific further training).

Professional courses - quantitative demand side issues

The expected changes in the construction industry, the number of **people employed in building construction,** the number of people entering and leaving the market, and the professional composition of the construction industry have been discussed in previous chapters of the current Analysis from several perspectives. The multitude of available data and strategic objectives, government and stakeholder statistics, facts and plans, and the occasional inaccuracies and contradictions in the data, make it difficult to determine the correct figures, even in terms of magnitude. The starting data for the values estimated here, the factors on which the estimates are based, are as follows:

- **Facts and figures** from recent years, data from the National Statistical Office, expected nature of changes (see Chapter 4.3 and 4.4);
- **Actual and projected number**s of entrants from formal education and training (see Chapter 7.1);
- **Estimates of career** drop-outs - completers and those working abroad (see Chapter 7.1);
- **New entrants** to adult and retraining, foreign workers;
- **Expected development** and staffing requirements of the construction industry.



51. Figure: Projected evolution of the number of professionals in the construction sector (own editing, data source: KSH)

Apart from occasional hectic economic fluctuations (energy and construction material prices, subsidies, etc.), exceptional events (new epidemics, reconstruction of Ukraine and other labour drain, etc.), and based on employment data from previous years (see Chapter 4.4) in **the construction sector,** the **gross employment figures are estimated at an overall increase of 30-35% over 10 years**, with a shift in the structure of the workforce by occupation and EQF levels **towards the intellectual and low-skilled.** Further structural reallocations are expected in the three main specialisations (construction, building services engineering, electrical building service engineering). At the same time, this figure can be used as a starting point for defining the demand for **courses and training programmes beyond the** vocational **training systems and the** supply to be adapted to it. This demand is essentially determined by the following factors:

- **Need for mandatory training programmes** (linked to qualifications, entitlements, activities),
- **Product-oriented training** of manufacturers, manufacturer-distributor interest,
- **Training programmes** offered by voluntary, training and educational institutions, professional organisations, conferences, professional lectures and their promotion,
- Activities such as seminars, training courses, free services (for professionals, operators, the general public), organised by voluntary, state-supported or by competent chambers and professional organisations.

In terms of participation, the most effective training courses are those linked to eligibility requirements followed by a professional practice condition and/or product-oriented training courses. However, in the absence of an appropriate stakeholder system, voluntary and state-subsidised courses are the worst performing and thus difficult to evaluate. In general, it can be estimated that all professionals working in the construction sector should participate in **at least 3-10 days of professional training per year,** depending on their level of EQF and their eligibility, in order to maintain and develop their professional level. The culture of this is not yet fully accepted, although compulsory micro- and macro-qualifications, and qualifying training courses, could go a long way to getting professionals into the habit of lifelong learning. If we take an average of 5 days per year (the rest voluntary, online) for self-learning purposes, this means approximately 1.5 million course-days, based on the number of people employed in the construction industry today, or 100-150 thousand courses per course, with 10-15 people per course. This is the direction that should and can be taken in the strategy formulation, examining each sector, discipline and EQF level, by restructuring the relevant interest systems, rethinking and fine-tuning the institutional system. Once the vision and strategy are in place, it will be possible to develop the **appropriate balance between supply and demand** with a professional rigour and at the level expected by the 21st century's business world.

Qualification needs

In the relevant chapters of the analysis, the system of **mandatory** (chamber, official, quasi-official, ad hoc) activity and professional qualifications of persons and staff, which are present in all life cycles of our built environment and at all levels of the EQF are presented. **Voluntary** qualification initiatives exist, but typically, because of their commitment, they are a 'game' for the more committed practitioners, because if there is no central expectation of merit and only a few obtain them, those who do not will be at an economic advantage and in a better competitive position.

In other chapters of this current analysis, the professions, qualifications and occupations that are critical from the viewpoint of building energy and environmental protection, for which the introduction of compulsory qualifications and lifelong learning as a condition for professional practice is indispensable, have been identified. A good example of this can be the professional qualification system of the Chamber of Architects and the Chamber of Engineers (although continuing education programs and their authorization systems need to be updated), the Master's training of the Chamber of Commerce and Industry, the non-harmonized official, quasi-official qualifications of several institutions (HVAC installers, electricians, gas installer etc.). However, these **should operate in a well-structured uniform system with full professional coverage** and be enforced at the level of legislation and authorities to enforce, exercise acquired rights and filter out the crooks.

Summary

The question of **courses and training programmes beyond training systems is** a complex issue and not an easy one to tackle. It is heavily influenced by economic and professional trends in the construction industry, the human and professional attitudes of potential participants or their employers, financial and time constraints, the training and education market players in the profession, and the attitudes, approaches, demands and sensitivities of society towards new knowledge. It is a market sector and is therefore determined by supply and demand. **Supply** is the availability of high-quality courses and competent trainers, while **demand** is the willingness of students to enrol. Currently leave room for improvement.

Even more critical is the attitude of the user community, especially the general public, the lay user society, whose information, "training" and support is at least as important as keeping the professional community at the right technical level.

7.3.4 Skills gaps between the current situation and the needs up to 2030

The conditions for achieving the energy efficiency targets set for 2030 can be formulated realistically, because no significant changes are expected during this period. The calculation includes flexible methods to embed expected changes, that might occur. The key factor driving these changes is the **decrease in the volume of new constructions and the significant increase in the proportion of (deep) renovation tasks**. In case of new buildings, the conditions for meeting the building energy objectives are in place today. The expertise of the engineers and contractors, the design conditions, regulations, technologies and building materials are suitable for creating facilities that meet the requirements, even if today the work is hampered by a labour shortage. It is a more difficult task to determine the needs related to the (deep) renovation of buildings, where planning, implementation, and technologies are more complex tasks require multiple areas of expertise. Apart from labour shortages, the lack of professional skills makes it impossible to meet the requirements of deep renovation tasks using the current conditions.

Calculation regarding the number of workforces required to meet the objectives considering **refurbishment of residential buildings** is described as follows:

Baseline data:

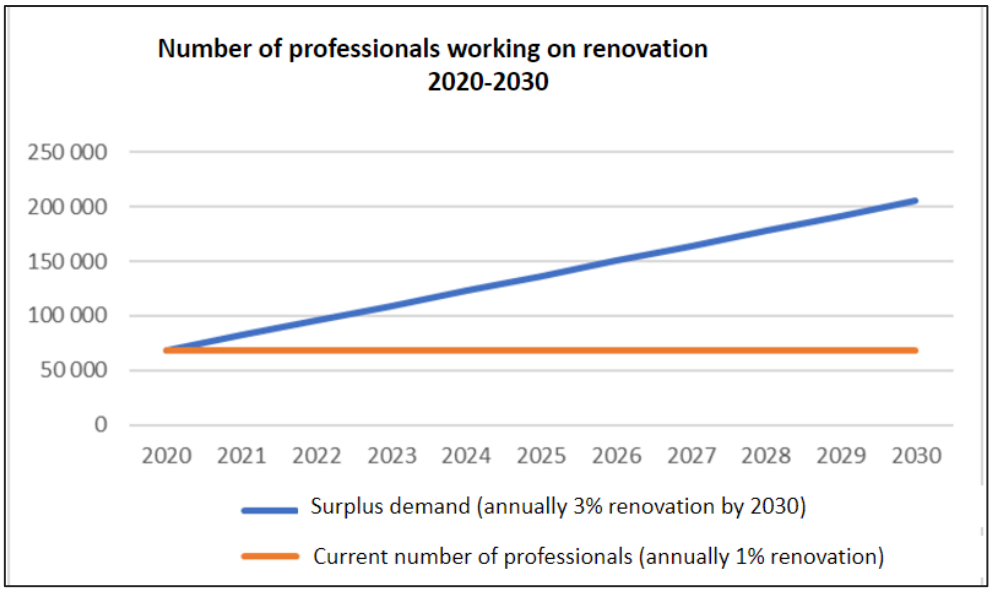
- There are currently 380,000 workers in the construction sector, considering all subsectors [KSH data];
- Within all the tasks of the construction industry, residential buildings (new construction and renovation) represent about 20% [ÉVOSZ, 2022];
- Renovation is a demanding job for a professional, and can be automated to a small extent (expert assumption);
- Currently, the renovation rate of residential buildings is about 1% per year [Ürge-Vorsatz et al, 2010];
- Based on the average of recent years, there are 12,600 new entrants per year who work in building industry (SQA calculation, see Chapter 7.1).

Calculation:

- Based on expert estimate, the above-mentioned 20% of work can be performed by approximately 30% of professionals, which amounts to approximately 114,000 workers;
- According to expert approximation, it is assumed that about 60% of construction work is related to renovation,
- Therefore, out of the 114,000 professionals, approximately 60% which is **68,400 workers are engaged in renovation of residential buildings annually, resulting in an annual renovation rate of about 1%** at present.

Conclusion:

- To achieve the strategic goal of 3% annual renovation rate of residential buildings by 2030, **an additional 136,000 skilled professionals will be needed** in ten years' time in the construction industry, specifically working on building renovations. This means that an annual influx of 13,600 new entrants to the market is needed, considering the continued work of individuals reaching retirement age.
- The current number of new entrants to the market is 12,600. Based on expert assumptions, 70% of these new entrants will be involved in (residential) renovation, which amounts to 8,800 individuals;
- The difference between the required number of new entrants and the number of current graduates is **the additional demand, which is 4,800 people per year**.



52. Figure: Number of professionals working on building renovations [based on expert estimation]

Based on the above calculation, there is an additional demand of approximately 4,800 individuals annually for the construction industry's HuQF levels 1-8 training programs, which accounts for approximately 30% of the current capacity. Taking into account the proportions of graduates from current training programs, Table 35. summarizes the number of current graduates and the additional demand in vocational training and higher education.

HuQF level	New graduates per year (pers.)	Additional demand (pers.)
HuQF 1-5	8 730	2 600
HuQF 6-8	3 940	1 200
together	**12 670**	**4 800**

Table 35: The number of new graduates (new entrants) employed in the construction industry each year and the additional demand required to achieve the strategic renovation goal, by HuQF categories [based on expert estimation]

The projected increase in the number of workforce in the construction industry (primarily regarding skilled and unskilled labour) cannot realistically be ensured from the domestic labour market. The solution lies in the retraining and further training of foreign, generally less skilled labour, along with increased supervision during their work.

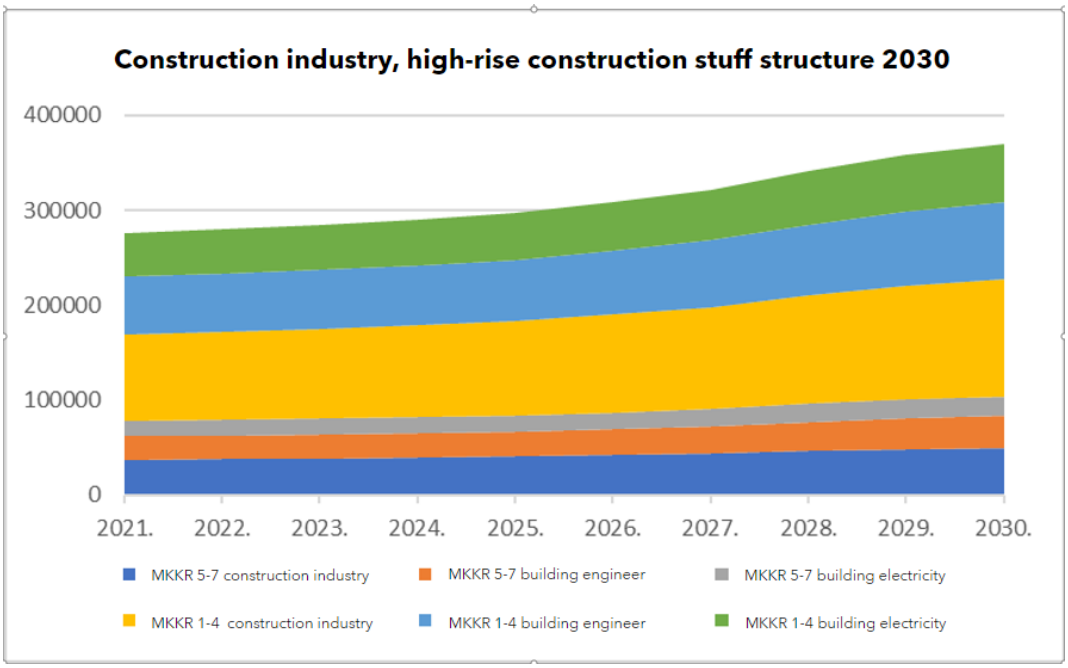
The content aspects of meeting the energy objectives

The aspects of the fulfilment of the energy objectives are multifaceted, because the actors of different fields of expertise and different qualifications differ even depending on the time they entered the profession, and at the same time, even in the case of a short-term vision, intensive technological/technical changes must also be taken into account. (A good example is that during the last years when there were suddenly a large number of requests for installing solar panels and heat pumps).

In formulating the needs, it must be accepted as a given that:

- changing the content requirements related to building energy cannot be implemented in the school system's education in the foreseeable short period of time,
- the fulfilment of the building energy requirements does not depend on the implementing actors of the specialized fields (assistant workers, skilled workers), but on the expertise of the engineers who manage the work.

The estimated number of staff changes considering the whole building stock:
The number, structure and necessary development trends of the total number of professionals in the construction has been detailed in Figure 51. That includes the estimated data and staffing trends of current market players, new entrants, and those retrained. The change in the staff development needs of new entrants (those completing training/education in the school system) can be estimated according to the figure below:



53. Figure: Number of new entrants to the construction labour market considering HuQF levels (based on expert estimation)

Taking these into account, the actors of the energy objectives are those who manage the planning and implementation (HuQF 4-7) and their knowledge should/can be **ensured by continuous, regular (life-long) training**. This scope also includes the continuous training of teachers (HuQF 5-7-8) at VET and higher education institutions.
In order to fulfil the 2030 objectives, the personal and quantitative requirements for continuing education can be estimated.

The number of further training courses about the relevant topics (1 day course/year)					
Relevant topics	**professionals HuQF levels**				
	1 - 2	3 - 4	5 - 6	7	8
nearly zero energy buildins		600	400	300	2
renewable enrgy sources	5 500	2 000	800	300	
deep renovation		4 000	1 200	600	4
refurbishment of heritage buildings			200	300	
circular building modell		800	400	200	6
building information modelling (BIM)		4 000	1 000	800	
dinamic building simulation			200	50	1
smart devices and building		2 000	600		3
life cycle assessment		100	100	100	2
building classification systems		500	1 000	400	4
smart cities and communities				50	2
together	**5 500**	**14 000**	**5 900**	**3 100**	**24**

36. Table: The qualification needs of construction industry: the number of qualification courses per HuQF level and relevant topic (expert estimation and compilation based on relevant KSH data)

Table 36. describes that **a total of 28,524 one-day courses per year**, providing further training courses according to the relevant topics shown in the table and do not take into account the data and needs of other legal, professional and product-oriented further training. The content and the duration of the courses according to the table above must be adapted to the actual needs of the group. They must be organized by target groups, some topics can be combined and half-, one-day and two-days theoretical and/or practical courses. It is necessary to develop a further system for this in the Roadmap, and it is recommended to develop it for a case study.

7.4 Monitoring needs

This chapter describes tools for monitoring the evolution of skills needs and possible gaps in vocational education training and higher education.

7.4.1 Vocational education and training

The following is a brief description of the domestic systems in place to monitor demand:

- Vocational Education and Training Career Tracking System;
- County Development and Training Committee;
- Sector Skills Council.

The National Office of Vocational Education and Training and Adult Learning (NSZFH), as the body responsible for career tracking in vocational education and training and adult training, administers the **Vocational Education and Training Career Tracking System**, which was established at the end of 2021. The aim of developing the career tracking system is to provide information on the career paths of students who have completed vocational education and training, with a focus on their labour market placement and further education. The system facilitates the tracking in two ways: firstly, by integrating and anonymous linking of administrative data and, secondly, by a questionnaire survey on tracking issues. Administrative records are channelled **from seven different data controllers**, with the following sources and contents:

- National Office for Vocational Education and Training and Adult Learning's Vocational Information System (VIS), Data Reporting System of Adult Training (FAR), Examination database (training and examination data);
- Higher Education Information System of the National Board of Education (higher education enrolment data);
- National Health Insurance Fund (evidence of disability, work abroad and posting);
- Ministry of Economic Development National Employment Service (job search data);
- National Tax and Customs Administration (employment characteristics, income data, labour market characteristics);
- Government Office for Pest County (vocational education and training and adult training examination data);
- Student Loan Centre Ltd. (information on student loans).

However, the compilation of the present assessment study also faced difficulties in collecting statistical data on vocational education and training (enrolment and completion), as there is currently no easily and publicly accessible database on enrolment by occupation. This would be essential for a fast and efficient monitoring system.

Based on the provisions of Act CLXXXVII of 2011 on vocational education and training, the regional chambers of commerce and industry operate **County Development and Training Committees** (hereinafter: MFKB), whose basic task is to coordinate vocational education and training with the needs of the labour market. The Committees develop enrolment rates and training orientations for a given county by drawing up proposals for the structure of the vocational education and training system, based specifically on the needs of the economy. By the end of March each year before the end of the academic year, they draw up a recommendation for training pathways and enrolment rates for vocational education and training, taking into account the needs of the labour market and the demand for skilled labour from enterprises. Based on the so-called "vocational structure proposals" of the MFKBs, a government decree is issued, prepared by the ministry of vocational education and training and adult training.

The MFKB also supports the preparation of vocational studies, in addition to proposals on the structure of vocational education and training as well as the elaboration and continuous updating of the county's vocational training development concept. The representatives of the seven-person MFKBs are delegated by the national employers' and employees' associations represented in the National Economic and Social Council, and their organisations, the regional economic chambers, the government office and the county assembly.

The main tasks of MFKBs include:

- elaboration of the development concept for school-based vocational education and training, which will be part of the county/capital regional development concept and programme,
- developing proposals for a vocational qualification (shortage vocational qualification) that qualifies for the scholarship provided for in the Government Decree on the scholarship for vocational school studies in the county concerned,

- assisting in the preparation of proposals for the decentralised part of the training budget and other vocational education and training proposals relating to the development of school-based vocational education and training,
- proposing the interdepartmental support and priorities of the decentralised support, participating in the call for proposals and evaluation,
- proposing the winners of the decentralised support and the amount of money they will receive.

The Hungarian Chamber of Commerce and Industry (hereinafter MKIK) currently operates **Sector Skills Councils** (hereinafter ÁKT) in 19 sectors, whose role is to ensure that the formulation of business needs to the labour market and employer needs for training content, to strengthen the functioning of the demand-driven vocational education and training system. For more information to track changes in market demand, see Chapter 5.1.2.

7.4.2 Higher education

Under the current system, the Hungarian Accreditation Committee (hereinafter: MAB) evaluates and accredits the training programmes and institutional operations of higher education institutions. This includes assessing the content, structure and quality of training programmes, as well as institutional conditions, resources and quality management systems. The MAB can award certification to higher education institutions and their training programmes to show that they meet quality standards. The MAB can advise institutions on quality assurance and quality improvement. It helps institutions to meet quality standards and improve their training programmes and institutional operations.

The following factors can contribute to better monitoring of training:

1. **Independent and objective supervision:** to increase the effectiveness of training, it is important that supervision is carried out by independent and objective professionals. This can guarantee the impartiality and credibility of quality control.
2. **Well-defined quality indicators and benchmarking systems:** for effective monitoring, it is important to define and apply quality indicators and benchmarking systems that allow for objective evaluation and comparison of training.
3. **Regular and comprehensive evaluation:** regular and comprehensive evaluations are needed to monitor the effectiveness of training. This allows monitoring of training outcomes, student satisfaction and output indicators.
4. **Involving student feedback:** for effective supervision, it is important to include student feedback. Regular feedback from students helps educational institutions to assess progress and identify areas for improvement.
5. **Professional and industry partnerships: it** is important to build and strengthen professional and industry partnerships in order to better supervise educational institutions. Partnerships can help educational institutions to better respond to changing labour market needs and ensure that training is relevant to the real work environment.
6. **Continuous monitoring and feedback:** to increase the effectiveness of training, it is important that monitoring is continuous and feedback is timely. This allows for a rapid response and the introduction of necessary improvements.

7. **Regular review and update:** Regular review and update of training programmes is essential for effective supervision. This ensures the relevance and competitiveness of training in a rapidly changing economic and technological environment.

For more information on the MAB, see Chapter 5.1.2 Certification and accreditation framework.

Summary

In this chapter, the ConstructSkills4LIFE consortia have conducted an assessment of various factors, including the number of professionals entering the labour market, skill shortages, and the preparedness of professionals. The analysis is based on a range of data sources, such as questionnaires, national labour market statistics, higher education and vocational training statistics, expert interviews, as well as relevant publications and research findings. By comparing the expected competence levels in each profession on a competence map with the identified shortcomings, we summarized the new skills that need to be incorporated into vocational training and higher education to accomplish the objectives set for 2030. Furthermore, we have evaluated the current vocational training and higher education system by considering aspects such as the teaching staff, availability of adequate equipment and literature, and the effectiveness of support system. Finally, we presented tools for monitoring the market trends and potential gaps in skill requirements relevant to the educational system.

8 BARRIERS

This chapter aims to identify and analyse the barriers related to the skills of construction professionals that may hinder the achievement of the 2030 energy and climate targets for the construction sector in Hungary.

To successfully achieve the 2030 building energy targets set by the European Union and Hungary, it is crucial to have an adequate number of qualified professionals in the construction industry. In order to develop appropriate proposals for the future, it is necessary for the ConstructSkills4LIFE consortium to assess the current state of higher education and vocational training, as well as identify obstacles and challenges based on the feedback received from construction companies.

A SWOT analysis has been conducted to summarize the research findings, incorporating the results of the questionnaires, expert group round table discussions, and insights from experts' interviews. This analysis provides a comprehensive overview of the strengths, weaknesses, opportunities, and threats related to the skills and training landscape in the construction sector.

During the preparation of this analysis, separate SWOT analyses were performed for each respondent group, including construction companies, vocational training institutions, and higher education institutions. This approach ensures that the perspectives of these distinct groups are considered. The SWOT analysis tables for each respondent group can be found in the annex of this document (Annex 6).

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SWOT		Useful (+)	Harmful (-)
		to achieve the goal	to achieve the goal
INTERNAL FACTORS	characteristics of the organisation	**STRENGTHS**	**WEAKNESSES**
		· The adoption of a **"professional/engineering"** mindset increasingly observed at small and medium-sized enterprises · **BIM is becoming more widespread in** business, vocational training and higher education · Certain employers show **strong support for continuous learning and professional development** · **State support for training**: two professions and one vocational qualification in vocational training centres and 12 semesters in higher education institutions (i.e. 1 MSc. degree), plus a scholarship scheme and a vocational training work contract · A significant number of university lecturers are practitioners and therefore also attend **mandatory training courses organized by professional chambers** · The **development of digital learning materials has started**, which do not cover a complete subject but smaller units (micromodules) · International experience, **training sharing, transfer**, Build Up Skills experiences, good practice: high quality training plans, training materials and modules have been developed and are available in the context of EU projects (Trainbud, Newcom, BIMzeED, BUS-GoCircular, Train4sustain, IS-SusCon, etc.) · Measures in existing building energy **strategies supporting higher education** (e.g. National Smart Specialisation Strategy (s3), 2021-2027) · **Professional engineering courses are of high quality** and provide up-to-date knowledge	· **Qualification gaps** (market, businesses) · Lack of motivation, disinterest and **basic skills of** students · Lack of Life Long Learning: lack of **training for trainers**, lack of **lifelong learning** for **practitioners**, lack of mandatory continuing training · Inconsistent quality of **theoretical and practical knowledge** transfer in dual training system · Introduction of BSc in higher education led to **a decline in quality** · University systems are **slower to respond to** change, training areas are not aligned. · Lack of **literature and teaching** materials · There is insufficient emphasis on design-construction-maintenance-circularity issues and knowledge **related to renovation in** both academic and vocational education · Lack of **collaboration skills**, teamwork · Large **disparities in the conditions** and equipment of **practical training** due to lack of funding

		OPPORTUNITIES	THREATS
EXTERNAL FACTORS	characteristics of the environment	· "**Accredited" teachers/trainers**, professional **knowledge centres** · **Strengthening communication** with construction companies · A good opportunity to **organise** and publicise various **competitions and contests**, generating more media coverage · Vocational school, university **career guidance and job fair** · **Responsible involvement of** dedicated **professional associations** in the operation of training/qualification systems · Introduction of modern **didactic methods** (blended learning, gamification, short videos) to better communicate with young people · Linking existing **research teams** · Dual training, a **living environment** to encourage professional collaboration · digitisation: **free educational versions of** programmes (like Archicad)	· Lack of a **structured postgraduate training and qualification system** at construction level as well as a system to monitor and control it · **Curricula are** quickly **outdated**, not updated or updated late · **Poorly funded**, low-quality vocational and higher education · **Low level of foreign language skills**, no language exam required for the diploma · Concept (mis)interpretation: **different interpretations of basic concepts** (e.g. environmental awareness) · Risks of **learning online** (unedited material) · Government programmes: Frequent changes in the **legislative framework** (e.g. vocational training) · The role of the **black economy is** still very high in housing renovation · **Skilled workers leave** the company earlier if trained · **Price is the customer's priority,** so building energy and other considerations are slidelined

In summary, the consortium identified the challenges that hinder the design and development of training programmes focused on energy efficient and circular architectural solutions using renewable energy sources. These challenges, recognised as important by the project consortium's team of experts are **categorised** below **into thematic clusters** as listed below**.** Some of these barriers have been previously mentioned in earlier chapters of this study, whole others are based on the interviews and discussions held by the expert groups. The categorization of the challenges based on their nature, whether they pertain to training, economics, professional policies, or human resource shortages. It is worth noting that many of the gaps and challenges identified in the Build Up Skills Hungary (BUSH) project a decade ago still persists today. Therefore, the challenges previously identified and still present are referred to as "*BUSH challenges*".

Structural, policy challenges

- **Delays in adopting EU strategies:** The Circularity Strategy has not yet been formulated, the EPBD recast has not yet been transposed into the domestic strategy context, causing delays.
- **Shortcoming of the higher education strategy:** While building energy strategies emphasise the importance of education and training, the higher education strategy lacks specific objectives for energy efficiency and circularity, despite prioritizing the technical field.
- **Emigration of professionals:** Unfortunately, the emigration of design engineers and craftsmen has been a major problem for the domestic construction industry for several decades (BUSH challenge).
- **Changes in the regulatory environment: F**requent changes in government programmes and legislation lead to a lack of long-term predictability (BUSH challenge).
- **Lack of a post-graduate training system:** Lack of a structured post-graduate training and qualification system at the construction industry level and of a system to monitor it.
- **Administrative overhead:** Dual training involves a significant administrative overhead for the companies hosting and training the students.

Challenges related to training programmes

- **Literature and teaching support materials:** The curriculum quickly becomes outdated due to the continuous technological development. Not all subjects are available in Hungarian, leading students to rely on internet resources that may not be proofread. There is a lack of digital textbooks and notes.
- **Low foreign language skills:** Language exams are no longer a prerequisite for graduation, resulting in a decline in foreign language proficiency, despite the availability of literature in foreign languages.
- **Curricula gaps:** Principles related to circularity and sustainability are not effectively incorporated into the curriculum.
- **Reconstruction and renovation:** Design, construction, and maintenance aspects of renovation are not adequately emphasized in higher education and in vocational education and training. This partly explains why the energy modernization of listed and monumental buildings often lacks professional appropriateness and requires additional specialized knowledge.

- **Further training of trainers:** Training of trainers in vocational education is not adequately addressed (BUSH challenge). The situation is somewhat better in higher education due to the mandatory continuing training required by the Chamber of Engineers for professional practice.
- **Dual training:** While dual training facilitates practical experience, a significant challenge is the lack of consistency in theoretical and practical knowledge levels.

Human resource-related barriers

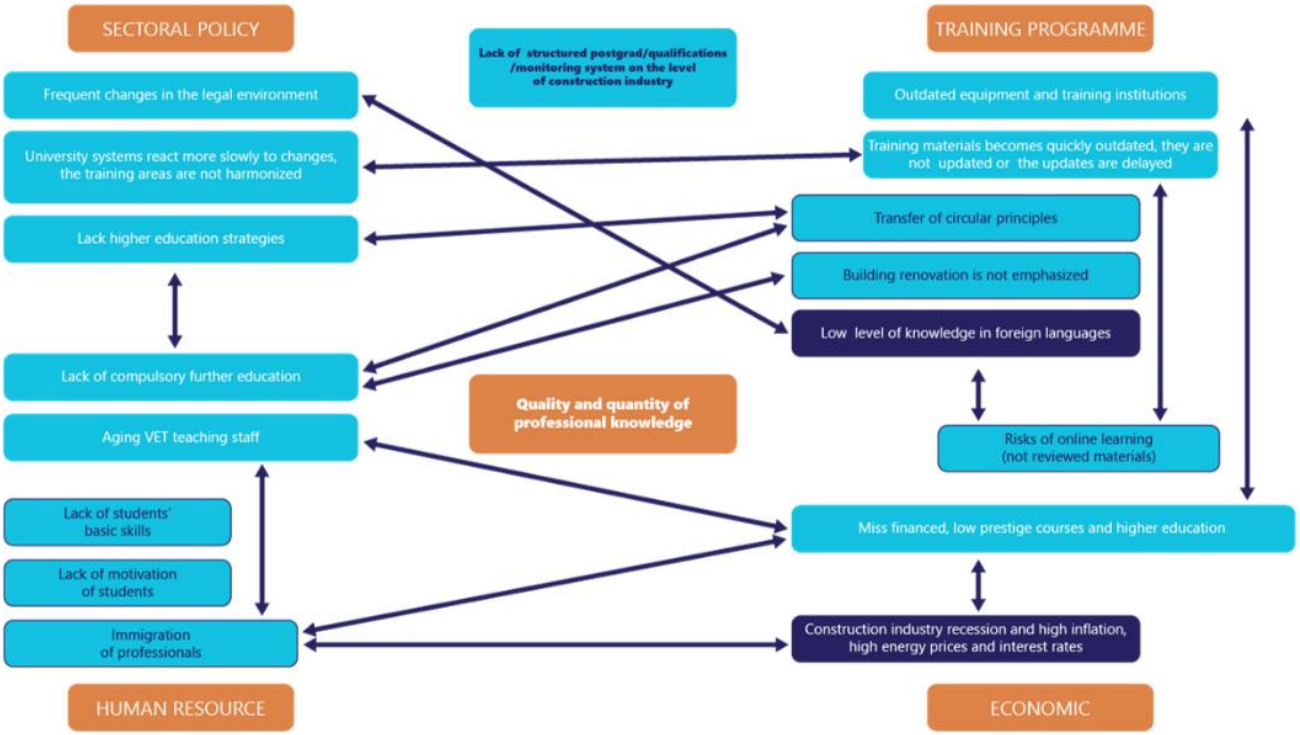
- **Lack of** basic knowledge and **skills among students** (BUSH challenge): We see deficiencies in the following areas for those entering tertiary education: manual dexterity, drawing skills, oral presentation skills, literary and writing skills, as well as self-awareness. These are not adequately addressed and remedied within in tertiary education, and deficiencies persist.
- **Career orientation:** Vocational education and training lacks the acquisition of human knowledge, social and sociological skills and interpersonal relations. As a result, career orientation is less conscious, and more instinctive based on emotions, where profitability plays a major role.
- **Low prestige:** Vocational qualifications have low prestige, so even students with lower skills also prefer to pursue higher education.
- **Shortage of professionals: E**ngineering education at the higher education level is essentially uniform in terms of curriculum, with the aim of producing professionals suitable for design work. Consequently, the number of engineers available for construction, operation and maintenance is limited.
- The **communication problem:** Today's students (Generation Z) are already immersed in the world of digital technologies, and it is unthinkable for them to live without the internet, mobile phones and other digital and communication tools. These young people need to be communicated with and taught differently.
- **Aging faculty:** In vocational training centres, due to low funding and prestige, young replacements do not arrive to replace retiring instructors.

Economic barriers

- **Lost working time**: Due to longer and time-consuming training programs, employees are forced to take time off work, which can have a negative impact on their work performance and business productivity.
- **Employee training:** Due to inflationary uncertainty businesses have fewer resources or budgets to allocate for employee training and upskilling. As a result, the professional knowledge and skills of employees may become outdated, hindering the growth and competitiveness of businesses.
- **Underfunding:** Insufficient funding and lack of government support for vocational education and training as well as for higher education an pose significant obstacles to ensuring quality education. Underfunded educational institutions struggle to provide adequate infrastructure, teaching and research resources and up-to-date teaching materials (BUSH challenge).

However, the aforementioned barriers do not exist independently, but are closely interlinked and interact with each other. Therefore, in order to bring about change in the system, it is

necessary to address all the issues comprehensively in order to find effective solutions. This is illustrated in the figure below:



54. Figure: Linkage system of challenges (own editing)

9 CONCLUSIONS

This study aims to provide an assessment of the situation of the training capacities and needs for energy efficiency, environmental optimisation and the institutional framework for the whole life cycle of our built environment, in order to support the achievement of the EU and national 2030 targets.

In addition to improving the energy performance of buildings throughout their life cycle, there is a need for skilled design engineers and construction workers proficiently carry out their roles while considering sustainability principles and utilizing constantly evolving technologies. The current vocational training and higher education system and the adult training system were examined to identify gaps. Although the vocational education and training system has recently undergone significant changes and is striving to meet market needs by offering more flexible adult education, there remains a gap in the training provided to construction workers and professionals in the field of circularity and energy efficiency considering the whole life cycle of buildings.

Following the grouping of the challenges listed in the study, the proposals that could form the basis for the updated National Roadmap to be developed in the framework of the ConstructSkills4LIFE project are summarised in the following groups. The proposals have been formulated in consultation with experts, expert groups incorporating responses from interviewees.

Policy and strategy recommendations

- **Develop a regulatory framework** that supports and encourages the spread of circular economy models and practices. This includes strengthening environmental regulations, encouraging the recycling and recovery of materials, developing waste management systems and promoting sustainable production and consumption models.
- **Conduct a comprehensive review and update of the higher education strategy to align with the targets set for 2030 or 2050**. Focus on sustainability, environmental awareness and low carbon technologies. Update and expand university courses to respond to new challenges and technologies.
- **Review and analysis of university curricula** in relation to climate change and sustainability. It is important to examine the extent to which climate change and sustainability are integrated into individual degree programmes and what opportunities they offer students to prepare for sustainable development. Based on the data, institutions can adapt curricula and training programmes to better reflect the challenges of climate change and sustainability.
- The following are some **strategic suggestions** on how higher education institutions can respond to the construction market training needs and develop more competitive training programmes:
    - **Labour market analysis:** Universities should carry out regular labour market analyses, which may include assessing labour supply and demand, monitoring labour market trends and changes, and gathering feedback from employers and employees.

- **Survey on employer expectations:** Engage with local construction companies and professionals to understand employer expectations and challenges in the industry.
- **Alumni tracking:** Monitor the career progress of graduates (e.g. employment success rate, satisfaction surveys, and professional development) to map the positions and fields in which graduates are placed and the skills and knowledge they need to succeed in their careers.
- **Cooperation with the industry:** Public and educational institutions should develop strong links with construction companies and professional organisations (e.g. developing curricula and training programmes, organising apprenticeships and internships, and organising employer forums and events).

- **Energy certification and education** can play a central role in promoting the sustainability of public buildings and public institutions. Some suggestions on this topic are as follows:
  - **Mandatory energy certificates:** A mandatory energy certification scheme for public buildings and public institutions could be introduced. This measure will allow the energy efficiency of buildings to be assessed and ranked.
  - **Display of certificates:** Mandatory energy performance certificates may be displayed in buildings and public buildings to increase public visibility. This helps building occupants and the public to be better informed about the energy efficiency of buildings and its importance.
  - **Educational programmes and information campaigns:** Institutions can organise educational programmes and awareness campaigns on energy efficiency and sustainability.
  - **Free energy audits:** Institutions can support free energy audits in their buildings to identify energy efficiency opportunities and make recommendations to improve sustainability.
  - **Partnerships and incentives: I**nstitutions can establish partnerships with local energy providers and sustainability organizations, as well as provide incentives for energy efficiency investments, thereby encouraging a drive for change.
- Following the European model and with continued EU support, the **institution of Sectoral Dialogue Committees** has been established as a platform for sectoral consultation. We propose to further develop and strengthen this institutional framework of these committees through review. The newly formed Construction Sectoral Dialogue Committee in 2022 should be filled with up-to-date content and activities to enhance its effectiveness [ÉVOSZ proposal].

Proposals regarding training programmes

Following the structure of the study the proposals are divided into three categories: vocational education and higher education within the school system as well as training and education outside the school system. For funding proposals related to training, see the subsection Economic and financial proposals.

Vocational training

- **Training of trainers:** Mandatory annual training or professional consultations in cooperation with dual partners, with financing provided for this purpose.

- **Reduced administrative obligations** would be required for dual partners to participate in training.
- **Development of dual training sites:** Ensuring adequate resources for further training, development of machinery, improvement of IT to promote high quality training.
- **Improvement of the Education Training and Learning Outcome Requirements and Programme Requirements**: Revision of training and output requirements and program requirements, possibly creating new program requirements.
- **"Micro-certificates" for energy efficiency training**: The establishment of standardised training programmes to provide and certify same competences.

The majority of additional proposals can be grouped around two ideas. **The first is** the need for some degree of **"stability" in the legal framework** for vocational training, for predictability and planning purposes. The legislative background might need to include sectoral standards to develop a new continuing training system. **The second** is the question of **financing**, which, in addition to teachers' salaries, require greater attention to the continuous development of the technical conditions for vocational training (ICT tools , software, digital teaching materials, provision of materials used in training). Adult education and training are likely to increase significantly in the future (currently the state subsidises the acquisition of two trades and one qualification by trainees if the training is provided by the centres' vocational training institutions). Adequate resources should be provided for this purpose from the budget.

Higher education

- **Improve the flow of information:** There should be a continuous and efficient flow of information among the different actors within the university. This should be formulated in a faculty strategy and implemented in practice. It is recommended to establish communication channels and platforms that allow effective communication and exchange of information among students, teachers, researchers and administrative staff.
- **Considering state demands**: Universities should take account of public needs and societal changes in the design and development of their training programmes. To achieve this, maintaining contact with government agencies and professional organizations and consulting with them regularly on labour market needs and trends is essential.
- **A more flexible and dynamic university structure:** Universities need to prepare for the changing labour market and technological environment and become more flexible in their training programmes and organisational structures. The introduction of interdisciplinary programmes and more flexible courses is recommended, allowing students to acquire a broader range of skills and adapt to the changing work environment. Additionally, universities should also encourage mobility of teachers and trainers as well as international cooperation to exchange experience and best practice.

Training and education outside the school system

Taking into account the previous findings, non-formal education and qualifications **could be a key policy guideline for the development of a strategy**:

- **Reviewing qualification schemes:** It is necessary to clarify the existing and necessary hierarchical structure of professions in the construction industry through the definition of mandatory and voluntary activity-related qualification schemes.

- **Review of the relationship between qualifications and entitlements:** Assessing and evaluating the conditions of activity and employment of the workforce, the hierarchies of work areas, the responsibility systems and the professional qualifications, compulsory qualifications, further training and voluntary training as well as assessing the recognizability and evaluation of knowledge and experiences gained through further training and professional practice.
- **Exploring the expansion possibilities of mandatory** (regulatory and/or statutory) **qualifications**: Examining the cooperation between the institutional system and stakeholders operating the entire life cycle of buildings, with particular focus on possible proposed mandatory qualifications and management roles for those who have a significant influence on the energy and environmentally conscious implementation and operation of state or Eu funded new or renovated buildings.
- **Developing a career model for the construction industry:** Collaboration with professional organisations and chambers of commerce, is necessary to explore the possibility of introducing a career model to ensure that construction professionals are interested in lifelong learning and skills development.
- The modernisation of the **Hungarian Standard Industrial Classification of All Economic Activities**[75] (TEÁOR), the revision of the **Standard National Classification of Occupations**[76] (FEOR) are necessary to align with the new and renewed sub-professions, professions, qualifications, entitlements, field of activities and occupations.
- **New skills and certification tracking system:** Promoting the adoption and implementation of a comprehensive system for mandatory training, qualification, registration, and the use of a professional passport" (EuroPass, Skillsregistry), covering the whole field of energy-related construction professions, based on the results of the Train4Sustain project.

Proposals related to human resources

- **Awareness-raising:** Cooperation between educational institutions, industry organisations and businesses is crucial in developing and implementing awareness-raising programmes and initiatives (e.g. conferences, training, awareness-raising campaigns and communication programmes). Environmental conscious education should start with campaigns in kindergartens and primary schools and extended to the public and private building owners.
- **Appropriate career guidance:** Construction companies should be more actively involved in career guidance. This may involve introducing students to real work environments, offering internships, organising visits to construction project sites and hosting contractor forums. Such initiatives help students to get a realistic understanding of the construction trades and working conditions.
- **Talent management:** Universities and businesses should provide support to identify and develop talented students in the construction industry. This could include professional mentoring, scholarship programmes, research opportunities and

[75] Tevékenységek Egységes Ágazati Osztályozási Rendszere (TEÁOR) in Hungarian based on the statistical classification of economic activities (NACE)

[76] Foglalkozások Egységes Osztályozási Rendszere (FEOR) used in Hungary based on the Intarnational Standard Classification of Occupations (ISCO)

professional competitions. Such programmes help to develop talented students and recognise professional excellence.

- **Involving women:** Greater emphasis should be placed on the involvement and empowerment of women in the construction industry. Educational institutions and construction companies should support women's participation in construction training and career paths (e.g. mentoring programmes - creating women's networks, introducing female role models and awareness campaigns on career opportunities for women in construction).
- **Retraining workers in fossil fuel-related sectors:** Educational and training institutions should develop training programmes that enable workers to acquire the skills needed for new sustainable construction methods and technologies. In addition, support should be provided to help workers upskill and adapt to a changing work environment.
- **Awareness-raising and communication for the general public:** Adult education should delve deeper into addressing the tasks, responsibilities, and knowledge gaps of "non-professionals" acting as investors, building owners, and operators (e.g., the general public, representatives of condominiums). As they are the most significant societal entities in terms of building energy efficiency and environmental impact, their education and awareness are crucial.
- **Continuing and postgraduate trainings:** Business leaders should be encouraged to take an interest in the continuing education of their employees. If the manager of the enterprise is motivated for continuous professional development and there is a good work ethic within the organisation, they can ensure that employees acquire the necessary expertise at a professional level.

Economic, financial recommendations

- **Support for the development of new teaching materials for new training curricula:** Universities and educational institutions should provide support for the development supplementary materials for new training curricula. This could include the development of digital learning materials, textbooks, online courses and other educational resources. Such support enables universities to keep up with the changing working environment and technology and offer students fresh and learning materials.
- **Improving funding for education:** Adequate funding is essential for educational institutions to effectively operate their training programmes and research activities. It is recommended to increase public funding for institutions (e.g. to modernise outdated equipment) and for trainers (e.g. to support continuing training). It is also recommended to strengthen cooperation between industry, commerce and government bodies to increase financial resources.
- **Support for digitisation**: Ensuring access to tools, software and digital learning materials required for vocational training and qualification registers as well as continuous improvement of the technical conditions for vocational training (ICT tools, software, digital learning materials, materials used in training).
- **Wages:** The average monthly wage in the construction sector is substantially below the average in the private sector, reaching only 74% of it. As a result, the sector still lacks the prestige necessary for attracting workers. In the short term, increasing wages can have an inflationary effect, but in the long run, it can improve the quality of work, contribute to the formation of a stable skilled workforce, and promote legal employment.

10 CLOSING REMARKS

The findings, conclusions, and summaries derived from questionnaires, interviews and literature review conducted in the present Status Qua Analysis report serve as valuable sources of information and a solid foundation for the development of a construction training strategy and a human resource management system for the year 2030, which are the main objectives and tasks of the project. Additionally, these findings are crucial for the revision of the National Roadmap, which was formulated almost a decade ago, and for the development of a new roadmap that is tailored to address the current challenges in the construction industry. When formulating the strategy, it is necessary to begin with the analysis of the global ideas, guidelines, plans and targets to be achieved in 2050. This analysis should then be narrowed down to encompass the energy usage and environmental protection targets set by the European Union, followed by those specific to Hungary. The focus should be on **understanding the impact** of the construction industry on the built environment and the various stakeholders involved in its implementation and maintenance.

By incorporating the findings from the Status Quo Analysis and actively involving the stakeholders from the National Platform, the strategy can be developed by considering, the current state of affairs, national specificities, interests and achieved objectives. This comprehensive approach ensures that the strategy takes into account the relevant factors and aligns with the needs and priorities of the construction industry in Hungary.

At the same time, **the following facts** should be taken into account when setting and formulating the strategic objectives:

- Research & development, science are constantly evolving, and practical experience are continuously expanding. While concrete results may not be immediately visible, it is possible to identify trends and themes at present. The practical application of knowledge is a prerequisite for achieving the objectives, making it essential to disseminate knowledge as widely as possible.
- Access to knowledge (supply)has become increasingly easier due to the technical background already in place. However, access to relevant actors and effective communication remains primarily marketing-oriented, lacking consistency and strategic planning.

A basic principle in setting up the strategy is that **the relevant actors** need to be identified in order to achieve the set-out objectives:

- The key stakeholders in achieving the strategic objectives are the people for whom the goals are set. Without their active involvement, no significant results can be achieved. It is important to recognize that the responsibility for realizing these goals should not solely rest on scientists, engineers, or politicians. Instead, the solution should be sought by the individuals and groups directly impacted by the objectives, and the owners or operators of the buildings should be actively engaged in the process.
- To achieve the objectives, the professional skills and knowledge are expected from the professionals. However, professionals''role is twofold: Firstly, they should effectively communicate with non-professional communities such as legislators, politicians, investors, and other relevant actors. Secondly, professionals need to carry out their

own work responsibly and to a high standard. In order to achieve the set out strategic objectives, it is proposed to develop an (institutional) system that is suitable:

- Shaping Social Consciousness, to make the elements formulated as objectives a general demand,
- Continuous Professional Development and up to date knowledge:
- Building and Developing Links between professional and non-professional actors in order to meet needs as effectively as possible.

The **approach and system** proposed above for the development of the National Roadmap should include:

- The importance of shaping social awareness should indeed be highlighted and broadly defined within the development of the National Roadmap. While it may not be directly and extensively addressed within the roadmap itself, emphasizing the significance of social awareness should be fundamental.
- A "living" National Platform that can serve as the initiator of contacts with professional actors, facilitating communication and collaboration. It can also act as the catalyst for professional training and knowledge promotion.
- A structured repository of knowledge should be established. This repository should be regularly updated and adaptable to changing professional knowledge needs, aligning with current competence requirements.
- To foster the proper use of the knowledge repository the institutional system of continued training and education needs to be thoroughly rethought to ensure lifelong learning and accessible knowledge materials support the professional activities of market actors.
- To effectively monitor the processes and results, a well-functioning, digitally-based system of process and results monitoring should be implemented. This system would integrate with the overall structure, monitor compliance, and ensure that skills are properly utilized, with measurable results.
- Finally, practical applicability can be demonstrated through a sample project focused on the energy renovation of public buildings or the residential sector in Hungary. This project should include factual solutions, methods, and content, showcasing tangible progress and serving as a model.

A **National Roadmap** on Construction Human Resource Management, thoughtfully designed and developed along these lines, can provide the basis for the creation of the human resources needed **to achieve the 2030 targets** for construction, energy rationalisation and decarbonisation, initially, and then, with necessary and continuous adjustments, the 2050 targets for construction, energy rationalisation and decarbonisation.

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GLOSSARY

Betűszavak, rövidítések /acronyms		
AI	Mesterséges Intelligencia	Artificial Intelligence
ÁKT	Ágazati Készségtanács	Sector Skills Councils
AR	Kiterjesztetett valóság	Augmented Reality
BIM	épületinformációs modellezés	Building Information Modelling
BSc	alapdiploma	Bachelor's degree
BUSH	Build Up Skills Hungary projekt	Build Up Skills Hungary project
CINEA	Európai Éghajlat-, Infrastruktúra- és Környezetvédelmi Végrehajtó Ügynökség	European Climate, Infrastructure and Environment Executive Agency
CPR	Építési termékek	Construction Products
EKKR/EQF	Európai Képesítési Keretrendszer	European Qualification Framework
EKR	Energiahatékonysági kötelezettségi rendszer	Energy Efficiency Obligation Scheme
EPBD	Európai Épületenergetikai Irányelv	European Performance of Buildings Directive
EPD	Környezetvédelmi terméknyilatkozat	Environmental Product Declaration
EQF/EKKR	Európai Képesítési Keretrendszer	European Qualifications Framework
EU	Európai Unió	European Union
ÉKM	Építési és Közlekedési Minisztérium	Ministry of Construction and Transport
Étv	Építési törvény	Construction Act
ÉVOSZ	Építési Vállalkozók Országos Szakszövetsége	National Federation of Hungarian Building Contractors
FAR	Felnőttképzés Adatszolgáltatási Rendszere	Adult Training Data System
FEOR	Foglalkozások Egységes Osztályozási Rendszere	Hungarian Standard Classification of Occupations
Fktv.	Felnőttképzési törvény	Adult Education Act
GHG/ÜHG	Üvegházhatású gázok	Greenhouse gases
HMKE	Háztartási méretű kiserőmű	Household sized small power plant
HuGBC	Magyar Környezettudatos Építés Egyesülete	Hungary Green Building Council
HTFS	Hosszú Távú Felújítási Stratégia	Long-Term Renovation Strategy
IKT/ICT	Információs és kommunikációs technológiák	Information and communication technologies
IKK	Innovatív Képzéstámogató Központ	Innovative Training Support Centre Plc.
KKK	Képzési és Kimeneti Követelmények	Education Training and Learning Outcomes Qualification Requirements
KKV/SME	Kis- és középvállalkozás	Small and medium-sized enterprises
KRÉTA	Köznevelési Regisztrációs és Tanulmányi Alaprendszer	Public Education Registration and Study System
KSH/HCSO	Központi Statisztikai Hivatal	Hungarian Central Statistical Office
LCA	Életciklus elemzés	Life Cycle Analysis
LCC	Életciklus költség elemzés	Life Cycle Cost Analysis
MAB	Magyar Felsőoktatási Akkreditációs Bizottság	Hungarian Accreditation Committee

MAVIR	Magyar Villamosenergia-ipari Átviteli Rendszerirányító Zrt.	Hungarian Independent Transmission System Operator Company
MEHI	Magyar Energiahatékonysági Intézet	Hungarian Energy Efficiency Institute
MEKH	Magyar Energetikai és Közmű-szabályozási Hivatal	Hungarian Energy and Public Utility Regulatory Authority
METAR	Megújuló Támogatási Rendszer	Renewable Support Scheme
MÉK	Magyar Építész Kamara	Hungarian Chamber of Architects
MKIK	Magyar Kereskedelmi és Ipar Kamara	Hungarian Chamber of Commerce and Industry
MKKR/HuQF	Magyar Képesítési Keretrendszer	Hungarian Qualifications Framework
MMK	Magyar Mérnöki Kamara	Hungarian Chamber of Engineers
MNyA	Másodnyersanyag	Secondary raw material
MFKB	Megyei Fejlesztési és Képzési Bizottság	County Development and Training Committee
MSc	mesterdiploma	Master's degree
MSZT	Magyar Szabványügyi Testület	Hungarian Standards Institution
NATÉR	Nemzeti Éghajlatváltozási Tájékoztató Rendszer	National Climate Change Information System
NEKT	Nemzeti Energia és Klímaterv	National Energy and Climate Plan
NÉeS	Nemzeti Épületenergetikai Stratégia	National Energy Strategy for Buildings
NFTv	Nemzeti felnőttképzési törvény	Act on Adult Education
NKVH	Nemzeti Klímavédelmi Hatóság	National Climate Protection Authority
NGO	nem kormányzati szervezetek	Non-Governmental Organization
NRRP	Nemzeti Helyreállítási és Alkalmazkodási Terv	National Recovery and Resilience Plan
NSZFH	Nemzeti Szakképzési és Felnőttképzési Hivatal	National Office for Vocational Education and Training and Adult Learning
nZEB	Közel nulla energia felhasználású épület	Nearly zero energy building
OECD	Gazdasági Együttműködési és Fejlesztési Szervezet	Organisation for Economic Co-operation and Development
OH	Oktatási Hivatal	Education Office
OKJ	Országos Képzési Jegyzék	National Training Register
OTÉK	Országos Településrendezési és Építési Követelmények	National Spatial Planning and Building Requirements
PEF	Termék környezeti lábnyoma	Environmental footprint of the product
PK	Programkövetelmény	Programme requirements
PTT	Programtanterv	Curriculum
RED	Megújuló energia irányelv	Renewable Energy Directive
RES	Megújuló energiaforrás	Renewable Energy Source
SRI	Okosépület-mutató	Smart Readiness Indicator
SZIR	Szakképzés Információs Rendszere	Vocational Training Information System
SZIT	Szakképzési Innovációs Tanács	Vocational Training Innovation Council
SZJ	Szakma Jegyzék	Register of vocational occupations
SZPR	Szakképzési Pályakövetési Rendszer	Vocational Education and Training Career Tracking System
TEÁOR	Tevékenységek Egységes Ágazati Osztályozási Rendszere	Hungarian Standard Statistical Classification of Economic Activities
TDK	Tudományos Diákkör	scientific student research projects

TNM	Tárca Nélküli Miniszter	Ministry without portfolio
VET	Szakképzés	Vocational Education and Training
VR	Virtuális valóság	Virtual Reality

TERMINOLOGY

Traditionally, **vocational training** in the construction industry has been understood as training in practical vocations, usually preparing students for a variety of vocations that do not require tertiary qualifications, from primary to secondary education. At present, school-based training is provided as initial training (vocational training) and continuing training (apprenticeship) as adult education.

Vocational training: school system

Professional training:

In Hungary, the term **adult education** generally refers to the training, retraining and further training of young people and adults after compulsory schooling, which are basically training outside the school system.

Adult education in the school system is also known as adult learning. It is structured according to the school structure: lower (EQF 1-2), middle (EQF 3-5) and upper (EQF 6-8) levels, with evening and correspondence courses.

Further training can be general, linguistic or vocational, depending on its purpose. It includes training for the unemployed and jobseekers (young people or adults starting a career), training for employment, training and retraining for those wishing to obtain a vocational qualification or already holding a vocational qualification, and vocational training for those in employment.

Higher education is higher education at university level, building on secondary education. It can start with a BSc, continue with a MSc, or end with a PhD or DLA.
For the purpose of this assessment study, **post-graduate training is** defined as further education and training after the above diplomas (even in a different profession, leading to a second degree).

ANNEX 1- Questionnaires

1.1 Questionnaire for construction companies, professionals

Survey on the skills of construction professionals

Questionnaire for companies

The EU-funded ConstructSkills4Life project aims to map the readiness of construction professionals to meet the EU and national 2030 building energy and climate targets for the renovation and operation of new buildings, taking into account the needs of market actors.

The present questionnaire aims to assess the skills, knowledge and possible gaps acquired during education and training in the building sector by identifying the necessary actions and needs for change.

1. What is your position in your current company, the company where you work?

- ☐ Managing director
- ☐ Professional consultant
- ☐ Design engineer
- ☐ technician
- ☐ construction manager
- ☐ other

2. In your opinion, how important are the following professions for the energy performance of buildings when renovating or constructing new ones?

Please rate on a scale of 1 to 5: 1 if you do not consider it important at all, 5 if you consider it very important.

1) carpenter
2) tiler
3) tinsmith
4) painter, plasterer, wallpaperer
5) mason
6) structural engineer and fitter
7) insulator (building)
8) drywall builder
9) roofing
10) building construction technician
11) window and door installer
12) building services technician
13) refrigeration, air-conditioning and heat pump installer
14) central heating and gas system installer
15) gas and heat generating equipment installer

16) automation technician (building automation)
17) electrician

3. In your opinion, how well prepared are the following professionals to carry out efficient building energy construction and renovation when completing their school-based training? Please rate on a scale of 1 to 5: 1 if not at all adequate, 5 if fully adequate.

1) carpenter
2) tiler
3) tinsmith
4) painter, plasterer, wallpaperer
5) mason
6) structural engineer and fitter
7) insulator (building)
8) drywall builder
9) roofing
10) building construction technician
11) window and door installer
12) building services technician
13) refrigeration, air-conditioning and heat pump installer
14) central heating and gas system installer
15) gas and heat generating equipment installer
16) automation technician (building automation)
17) electrician

4. Which of the following do you think are the THREE professions that should be trained MORE professionals? Please select three from the list below!

1) carpenters
2) tiler
3) tinsmith
4) painter, plasterer, wallpaperer
5) mason
6) structural engineer and fitter
7) insulator (building)
8) drywall builder
9) roofing
10) building construction technician
11) window and door installer
12) building services technician
13) refrigeration, air conditioning and heat pump installer
14) central heating and gas system installer
15) gas and heat generating equipment installer
16) automation technician (building automation)
17) electrician

5. What do you think are the main problems that prevent the training of properly qualified professionals? If there are other barriers, please describe.

☐ lot of theoretical content, little practical
☐ no or little training available at regional level
☐ too expensive training/course fees
☐ other

6. Does the company support the further education or training of people in employment and is the development of human resources included in the company's policy/strategic plans? Multiple choice.

☐ yes
☐ no
☐ included
☐ not included
☐ don’t know

7. What kind of training (in terms of topics) does the company support/provide most of its professionals? You can tick more than one answer.

☐ new technologies
☐ new method, technique
☐ soft skill e.g.: communication, language skills
☐ environment, sustainability, energy
☐ material knowledge/use
☐ other

8. Is there a QUALITY/reliable training (a few hours or 1 day training) or professional training service readily available, e.g.: adult education? You can choose more than one answer.

☐ Short supply, both in training and adult education (design)
☐ wide range, both training and adult education (planning)
☐ reasonable supply, both training and adult education (planning)
☐ better/good supply of quality training (design)
☐ better/good supply of quality adult education (design)
☐ limited supply, both training and adult education (design)
☐ wide range of both training and adult education (delivery)
☐ reasonable supply, both training and adult education (implementation)
☐ better/good supply of quality training (delivery)
☐ better/good quality adult education on offer (delivery)
☐ narrow range of both training and adult education (delivery)
☐ wide range of both training and adult education (operation)
☐ reasonable offer, both in training and adult education (operation)
☐ better/good offer of quality training (operation)
☐ better/good quality adult learning on offer (operation)

9. What is your preferred training and teaching method for further training and retraining?

☐ e-learning/distance learning
☐ prefer practical
☐ more theoretical
☐ other

10. If you have time, please give your opinion on the subject. Which professions/training (qualifications) do you consider important to design, construct and operate high quality, sustainable and energy efficient buildings?

    .....

11. During construction, which member of staff is typically assigned the role of "lead installer", "construction/installation manager" or "project manager"?

☐ The company have guidelines for this e.g.: eligibility/degree/qualification
☐ No company guidelines, the most experienced colleague leads the project
☐ I don't know, I am unsure of the answer/not my competence

12. In the life cycles of your facilities, in which professional areas and for which stakeholders do you consider it necessary to maintain, update or establish mandatory certification and training systems?

.....

13. The company where you work\employed are there any?:

Answer options: yes, no, don't know

☐ Energy Specialist (able to carry out building energy assessments and or design)?
☐ Building sustainability professional (knowledgeable in LCA/LCC, environmental/green or any sustainability certification scheme)?
☐ BIM technician, manager or BIM design/development engineer?
☐ Construction professional who works/may work on buildings with NZEB (BB) certification or above?
☐ Professional designing, repairing/installing or operating advanced building services systems (smart or IoT solutions)?
☐ Circular economy aspects of the construction industry

14. Were you able to recruit/employ the above professionals, if relevant, with experience from the labour market or directly from 'fresh' graduates of schooling? Answer options: yes, no, don't know.

☐ Labour market
☐ Recent graduate

15. Which/which qualifications are lacking in the company (where you work) and why do you think it is important to have them (e.g. to have a market advantage among competitors)?

Answer from options of question 13 (i. Building energy specialist ii. Building sustainability specialist iii. BIM technician, manager or BIM design/development engineer iv. Construction specialist working/working on buildings rated NZEB (BB) or above v. Specialist designing, repairing/installing or operating advanced building services systems (smart or IoT solutions) vi. Circular economics in construction) and/or may be added above (up to a maximum of 3 specialists/specialty):

……..

16. May we interview you (by phone, online or in person) on the above topics? If yes, please provide your contact details! The information you provide will be kept separate from the answers to the questionnaire.

……..

The survey is part of the research of the ConstructSkills4LIFE project for scientific purposes. The personal data you provide will be processed by ÉMI Nonprofit Ltd. exclusively in connection with the ConstructSkills4LIFE project and will not be disclosed to third parties, except to project partners, if necessary. Information related to individuals in the survey will be treated anonymously, only aggregated data will be published. The data will be processed in accordance with the EU General Data Protection Regulation GDPR and Act CXII of 2011 on the Right to Information Self-Determination and Freedom of Information, which are available at www.naih.hu.

You have the right to request access to, modification or deletion of your data in accordance with the GDPR by sending an email to constructskills4life@emi.hu

1.2 Questionnaire for vocational training institutions

Survey on the skills of construction professionals

Questionnaire for teachers, students and young professionals in vocational training institutions

The EU-funded ConstructSkills4Life project aims to map the readiness of construction professionals to meet the EU and national 2030 building energy and climate targets for building renovation and new construction.

This questionnaire aims to assess the skills, knowledge and possible gaps acquired during the training. The questionnaire takes approximately 5 minutes to complete.

1. Please choose which target group you belong to!
   - ☐ Working in a vocational training institution, adult education institution: manager, instructor, teacher, vocational trainer
   - ☐ student or trainee in a vocational or adult education establishment

Questionnaire for trainers

VET/PET provider: manager, teacher, teacher, vocational teacher

2. Do you have a degree in construction or building services engineering?
   - ☐ I do not have either qualification.
   - ☐ I do not have any of these qualifications, but I work in an educational institution in these fields.
   - ☐ Yes, I have a qualification in building construction.
   - ☐ Yes, I have a qualification in building services engineering.
   - ☐ Yes, I have qualifications in both construction and building services engineering.

3. If you have qualifications in construction and/or building services engineering, please indicate the level(s) of your qualification(s) (university, college, university of applied sciences, apprenticeship, etc.).

   .....

4. What kind of apprenticeship do you teach?

.....

5. Do you agree that there is a need to increase sustainability awareness in the domestic construction industry?
   - ☐ There is a strong need to increase the use of renewable energy and energy efficient technologies.
   - ☐ There is a need for a slight increase in the use of renewable energy and energy efficient technologies.
   - ☐ No need to increase.
   - ☐ Sustainability is not important for the construction industry.

6. Do you consider yourself environmentally conscious?

   - ☐ Yes, I always pay attention, I try to minimise my impact on the environment.
   - ☐ I am somewhat environmentally conscious.
   - ☐ Only in certain things, e.g. I don't litter or waste.
   - ☐ I do not consider myself environmentally conscious.
   - ☐ I am not interested in being environmentally conscious in my daily life.

7. How important do you consider knowledge about environmental awareness to be in order to do your current job effectively*? Please rate on a scale of 1 to 5. Mark 1 if you do not consider it important at all, 5 if you consider it very important.*

8. How important do you consider building energy education to be for the effective performance of your current job? *Please rate on a scale of 1 to 5. Mark 1 if you do not consider it important at all, 5 if you consider it very important.*

9. Do you know or have you heard of circular economy and recycling of construction materials?
   - ☐ No, I am not familiar with these terms.
   - ☐ have heard of them somewhere, but I am not sure what they mean.
   - ☐ Yes, I've heard of them, but they are less relevant in the current economic climate, where the cheapest price at any given time is the deciding factor.

☐ I think they are important, but they are not part of the educational material.

☐ I consider it very important and I teach it as part of the curriculum.

10. Are you familiar with or have you heard of life cycle (cradle-to-grave) assessment methods, environmental life cycle assessment and/or life cycle cost analysis?
    ☐ No, I am not familiar with these terms.
    ☐ I have heard of them but I am not sure what they mean.
    ☐ Yes, I have heard of them, but I am not familiar with the methods of analysis.
    ☐ I think they are very important and I would like to learn about them so that they can be used to objectively base decisions.
    ☐ I know them and I teach them as part of the curriculum.

11. Are you familiar with or have you heard of digital techniques in the construction industry (e.g. Building Information Modelling-BIM, Dynamic Building Simulation-DigitalTwin, Building Management System)?
    ☐ I know and teach them
    ☐ I know, teach and use it in other work.
    ☐ I know but do not use it.
    ☐ I do not know it, but I consider it important and would like to learn about it.
    ☐ I do not really know it and consider it unnecessary.
    ☐ I do not know it

12. In the institution where you work, to what extent are the below listed environmental and building energy knowledge materials being implemented to achieve the 2030 building energy and climate goals? *Please rate on a scale of 1 to 5! Mark 1 for low coverage and 5 for high coverage and thoroughness. 6 - don't know*
    ☐ design for near-zero energy building (NZEB) (architecture, mechanical and electrical engineering)
    ☐ use of renewable energy sources
    ☐ building renovation, refurbishment (architecture, engineering and building services)
    ☐ energy modernisation of listed buildings

- ☐ Circular building model (building materials, construction techniques, water management)
- ☐ building information modelling (BIM)
- ☐ dynamic building simulation
- ☐ intelligent/smart buildings (building management system)
- ☐ life cycle analysis (global warming potential assessment)
- ☐ building certification systems (LEED, BREAM, WELL)
- ☐ smart cities and communities

13. How important do you think the following professions are when implementing a new building or renovating a building to improve its energy performance? *Please rate on a scale of 1 to 5. Please mark 1 if you do not consider it important at all and 5 if you consider it very important. 6 - don't know*

- ☐ Carpenter
- ☐ Tinsmith
- ☐ Tiler
- ☐ Construction, installation and maintenance of flue gas ducts
- ☐ Building services technician
- ☐ Gas and heat generating equipment - fitter
- ☐ Refrigeration and ventilation system installer
- ☐ Refrigeration, air-conditioning and heat pump installation technician
- ☐ Mason
- ☐ Central heating and gas network system installer
- ☐ Plant energy technician
- ☐ Building construction technician
- ☐ Window and shading system installer, fitter
- ☐ Dry construction
- ☐ Structural engineer and installer
- ☐ Insulator
- ☐ Roofing
- ☐ Electrician
- ☐ Water and sewerage installer

14. How well qualified do you think the following professionals are when implementing a new building or renovating a building to improve its energy performance? *Please rate on a scale of 1 to 5. Mark 1 if not at all adequate, 5 if fully adequate. 6 - don't know.*

- ☐ Carpentry
- ☐ Tinsmith
- ☐ Tiler
- ☐ Construction, installation and maintenance of flue gas ducts
- ☐ Building services technician
- ☐ Gas and heat generating equipment - fitter
- ☐ Refrigeration and ventilation system installer
- ☐ Refrigeration, air-conditioning and heat pump installation technician
- ☐ Mason
- ☐ Central heating and gas network system installer
- ☐ Plant energy technician
- ☐ Building construction technician
- ☐ Window and shading system installer, fitter
- ☐ Dry construction
- ☐ Structural engineer and installer
- ☐ Insulator
- ☐ Roofing
- ☐ Electrician
- ☐ Water and sewerage installer

15. Which of the following do you think are the THREE professions that should train MORE professionals?

Please select three from the list below!

- ☐ Carpentry
- ☐ Tinker
- ☐ Tiler
- ☐ Construction, installation and maintenance of flue-gas ducts
- ☐ Building services technician
- ☐ Gas and heat generating equipment - fitter
- ☐ Refrigeration and ventilation system installer
- ☐ Installation technician for refrigeration, air conditioning and heat pumps
- ☐ Mason
- ☐ Central heating and gas network systems engineer

- ☐ Plant energetic
- ☐ Building construction technician
- ☐ Window and shading fitter, installer
- ☐ Drywall
- ☐ Structural engineer and fitter
- ☐ Insulating
- ☐ Roofing
- ☐ Electrician
- ☐ Water and sewerage system installer

16. Which of the following THREE professions do you think the COMPETENCE of people in these professions should be significantly improved?

Please select three from the list below!

- ☐ Carpentry
- ☐ Tinker
- ☐ Tiler
- ☐ Construction, installation and maintenance of flue-gas ducts
- ☐ Building services technician
- ☐ Gas and heat generating equipment - fitter
- ☐ Refrigeration and ventilation system installer
- ☐ Installation technician for refrigeration, air conditioning and heat pumps
- ☐ Mason
- ☐ Central heating and gas network systems engineer
- ☐ Plant energetic
- ☐ Building construction technician
- ☐ Window and shading fitter, installer
- ☐ Drywall
- ☐ Structural engineer and fitter
- ☐ Insulating
- ☐ Roofing
- ☐ Electrician
- ☐ Water and sewerage system installer

17. What do you think are the main obstacles to training well-prepared professionals?

.....

18. How would you improve your professional skills?
    - ☐ Participation in lectures and hands-on technology demonstrations.
    - ☐ By attending training courses organised during working hours.
    - ☐ I would make it compulsory to attend professional training at regular intervals.
    - ☐ Online course.
    - ☐ By reading specialist journals.
    - ☐ My professional knowledge is up to date, no need to upgrade.
    - ☐ Other

19. If you would like to improve your knowledge, how much time would you dedicate to such a demonstration/training/further training?

☐ If necessary, I would even take on a job for several months.
☐ I would even dedicate several days a year to this.
☐ One working day per year.
☐ Online in several short instalments.
☐ Other

Please provide your name and contact details (email, phone) if we can interview you on this topic.
The data provided will be treated separately from the answers to the questionnaire.
.....

Student questionnaire
a student or young person in vocational training or adult education

2. Are you a construction or building services engineer?

☐ I have no such qualifications, I am currently studying construction.
☐ I have no such qualifications, I am currently studying building services engineering.
☐ Yes, I have a qualification in construction.
☐ Yes, I am a qualified building technician.
☐ Yes, I have qualifications in both construction and building services engineering.

3. If you have a degree in construction and/or building services engineering, please indicate the level(s) of your qualification(s) (university, college, OKJ, skilled worker, etc.).
.....

4. 4. What kind of training are you currently undergoing?
.....

5. Do you agree that there is a need to increase sustainability awareness in the domestic construction industry?

☐ The use of renewable energy and energy efficient technologies needs to be greatly increased.
☐ There is some need to increase the use of renewable energy and energy efficient technologies.
☐ No need to increase.
☐ Sustainability is not important for the construction industry.

6. Do you consider yourself environmentally conscious?
☐ Yes, I am always careful to minimise my impact on the environment.
☐ I am somewhat environmentally conscious.
☐ Only in certain things, like not littering and not wasting.
☐ I do not consider myself environmentally conscious.
☐ I am not interested in environmental awareness in everyday life.

7. How important do you consider environmental awareness to be for the success of your future work?

Rate on a scale of 1 to 5! Mark 1 if you do not consider it important at all, 5 if you consider it very important.

8. How important do you consider building energy education to be for the success of your future work?
Rate on a scale of 1 to 5! Mark 1 if you think it is not important at all, 5 if you think it is very important.

9. Do you know or have you heard about circular economy and recycling of construction materials?

☐ No, I don't know these terms.
☐ I've heard of them somewhere, but I'm not sure what they mean.
☐ Yes, I've heard of them, but in the current economic climate, where the cheapest price at any given time is the deciding factor, they are less likely to prevail.
☐ I consider them important, but they are not part of the educational material.
☐ I consider it very important, and in my future work I will try to influence the client in this direction.

10. Do you know or have you heard of life cycle (cradle to grave) assessment methods, environmental life cycle assessment and/or life cycle cost analysis?

☐ No, I don't know these terms.
☐ I've heard of them, but I'm not sure what they mean.
☐ Yes, I have heard of these, but I am not familiar with the methods of analysis.
☐ I think it is very important and I would like to learn about these methods so that they can be used to objectively base decisions.
☐ I know, it's part of the curriculum.

11. Are you familiar with or have you heard of digital techniques in the construction industry (e.g. Building Information Modelling-BIM, Dynamic Building Simulation-DigitalTwin, Building Management System)?

☐ I know and use it.
☐ I know it, but I don't use it.
☐ I do not know it, but I think it is important and I would like to learn about it.
☐ I don't really know it and I find it unnecessary.
☐ I do not know.

12. At the institution where you are studying, to what extent are the following environmental and building energy-related subjects covered in order to achieve the 2030 building energy and climate goals?
Rate on a scale of 1 to 5! Mark 1 for low coverage and 5 for high coverage and thoroughness. 6 - I don't know
☐ design of near-zero energy buildings (NZEB) (architecture, mechanical and electrical engineering)
☐ use of renewable energy sources

- ☐ building renovation, refurbishment (architecture, engineering and building services)
- ☐ energy modernisation of listed buildings
- ☐ circular construction model (building materials, construction techno-logies, water management)
- ☐ building information modelling (BIM)
- ☐ dynamic building simulation
- ☐ intelligent/smart buildings (building management system)
- ☐ life cycle analysis (global warming potential assessment)
- ☐ building certification systems (LEED, BREAM, WELL)
- ☐ smart cities and communities

13. How important do you think the following professions are when implementing a new building or renovating a building for energy efficiency?
Rate on a scale of 1 to 5! Mark 1 if you do not consider it important at all, 5 if you consider it very important. 6 - don't know
- ☐ Carpentry
- ☐ Tinker
- ☐ Tiler
- ☐ Construction, installation and maintenance of flue-gas ducts
- ☐ Building services technician
- ☐ Gas and heat generating equipment - fitter
- ☐ Refrigeration and ventilation system installer
- ☐ Installation technician for refrigeration, air conditioning and heat pumps
- ☐ Mason
- ☐ Central heating and gas network systems engineer
- ☐ Plant energetic
- ☐ Building construction technician
- ☐ Window and shading fitter, installer
- ☐ Drywall
- ☐ Structural engineer and fitter
- ☐ Insulating
- ☐ Roofing
- ☐ Electrician
- ☐ Water and sewerage system installer

14. How well qualified do you think the following professionals are when implementing a new building or renovating a building to improve its energy performance?
Rate on a scale of 1 to 5! Mark 1 if not at all appropriate, 5 if fully appropriate! 6 - don't know
- ☐ Carpentry
- ☐ Tinker
- ☐ Tiler
- ☐ Construction, installation and maintenance of flue-gas ducts
- ☐ Building services technician
- ☐ Gas and heat generating equipment - fitter
- ☐ Refrigeration and ventilation system installer
- ☐ Installation technician for refrigeration, air conditioning and heat pumps

- ☐ Mason
- ☐ Central heating and gas network systems engineer
- ☐ Plant energetic
- ☐ Building construction technician
- ☐ Window and shading fitter, installer
- ☐ Drywall
- ☐ Structural engineer and fitter
- ☐ Insulating
- ☐ Roofing
- ☐ Electrician
- ☐ Water and sewerage system installer

15. Which of the following do you think are the THREE professions that should train MORE professionals?
Please select three from the list below!

- ☐ Carpentry
- ☐ Tinker
- ☐ Tiler
- ☐ Construction, installation and maintenance of flue-gas ducts
- ☐ Building services technician
- ☐ Gas and heat generating equipment - fitter
- ☐ Refrigeration and ventilation system installer
- ☐ Installation technician for refrigeration, air conditioning and heat pumps
- ☐ Mason
- ☐ Central heating and gas network systems engineer
- ☐ Plant energetic
- ☐ Building construction technician
- ☐ Window and shading fitter, installer
- ☐ Drywall
- ☐ Structural engineer and fitter
- ☐ Insulating
- ☐ Roofing
- ☐ Electrician
- ☐ Water and sewerage system installer

16. Which of the following THREE professions do you think the COMPETENCE of people in these professions should be significantly improved?
Please select three from the list below!

- ☐ Carpentry
- ☐ Tinker
- ☐ Tiler
- ☐ Construction, installation and maintenance of flue-gas ducts
- ☐ Building services technician
- ☐ Gas and heat generating equipment - fitter
- ☐ Refrigeration and ventilation system installer
- ☐ Installation technician for refrigeration, air conditioning and heat pumps
- ☐ Mason

- ☐ Central heating and gas network systems engineer
- ☐ Plant energetic
- ☐ Building construction technician
- ☐ Window and shading fitter, installer
- ☐ Drywall
- ☐ Structural engineer and fitter
- ☐ Insulating
- ☐ Roofing
- ☐ Electrician
- ☐ Water and sewerage system installer

17. What do you think are the main obstacles to training well-prepared professionals?
.....

18. How would you improve your professional skills?
- ☐ Participation in lectures and hands-on technology demonstrations.
- ☐ Only in a school/apprenticeship context.
- ☐ I would make it compulsory to attend professional training at regular intervals.
- ☐ Online course.
- ☐ By reading specialist journals.
- ☐ My professional knowledge is up to date, no need to upgrade.
- ☐ Other

The survey is part of the research of the ConstructSkills4LIFE project and is conducted for scientific purposes. The personal data you provide will be processed by ÉMI Nonprofit Ltd. **only** in connection with the ConstructSkills4LIFE project and will not be disclosed to third parties, except to project partners, if necessary. Information related to individuals in the survey will be treated anonymously, only aggregated data will be published. The data will be processed in accordance with the EU General Data Protection Regulation GDPR and Act CXII of 2011 on the Right to Information Self-Determination and Freedom of Information, which are available at **www.naih.hu.**

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1.3 Questionnaire for higher education institutions

Survey on the skills of construction professionals
Questionnaire for higher education teachers, students and young people starting their careers

The EU-funded ConstructSkills4Life project aims to map the skills of construction professionals needed to meet the EU and national **2030 building energy and climate targets** for building renovation and new construction.
This questionnaire **aims to assess the skills, knowledge and possible gaps acquired during your university education.**
The questionnaire takes approximately 5 minutes to complete.

The status of the filler?

- ☐ instructor
- ☐ student, young person

Teacher questionnaire

1. What kind of students are you teaching?
   Please fill in a new questionnaire if you teach in more than one course.
   - ☐ Architectural Engineer
   - ☐ Civil Engineer
   - ☐ Mechanical Engineer
   - ☐ Electrical Engineer
   - ☐ IT Engineer
   - ☐ Technical Manager
   - ☐ Environmental Engineer
   - ☐ Other

2. Please indicate the level of training you currently provide?
If you teach at more than one level, please fill in a new questionnaire.

- ☐ Bachelor's (BSc) and/or Master's (MSc)
- ☐ postgraduate training
- ☐ doctoral studies (Phd and/or DLA)

3. To what extent is the knowledge of the below topics covered in education in order to achieve the 2030 building energy and climate goals?
   1 - does not appear at all; 2 - appears, e.g. as an optional subject; 3 - appears as part of a compulsory subject; 4 - appears compulsory (compulsory subject)
   Please rate each factor!
   - ☐ design of near-zero energy buildings (NZEB) (architecture, mechanical and electrical engineering)
   - ☐ use of renewable energy sources
   - ☐ building renovation, refurbishment (architecture, engineering and building services)
   - ☐ energy modernisation of listed buildings

- ☐ circular construction model (building materials, construction techno-logies, water management)
- ☐ building information modelling (BIM)
- ☐ dynamic building simulation
- ☐ intelligent/smart buildings (building management system)
- ☐ life cycle analysis (global warming potential assessment)
- ☐ building certification systems (LEED, BREAM, WELL)
- ☐ smart cities and communities

4. How is the knowledge delivered?
There are several answers!

- ☐ presentation
- ☐ Practice
- ☐ guided simulation
- ☐ guided scaling exercise
- ☐ case study analysis
- ☐ study tour
- ☐ building visit
- ☐ e-learning
- ☐ online training
- ☐ Other

5. Do they come with notes or supporting materials?

- ☐ not
- ☐ to some
- ☐ most of them
- ☐ for all
- ☐ I don't know

6. How will it be reported?
There are several answers!

- ☐ building-level design task
- ☐ design of part of a building
- ☐ detailed design task
- ☐ self-simulation
- ☐ self-scaling
- ☐ stand-alone case study
- ☐ other

7. In the case of student work, to what depth is the knowledge covered in the subject areas listed below?
1 - does not appear at all 5 - must appear
Please rate each factor!

- ☐ design of near-zero energy buildings (NZEB) (architecture, mechanical and electrical engineering)
- ☐ use of renewable energy sources
- ☐ building renovation, refurbishment (architecture, engineering and building services)
- ☐ energy modernisation of listed buildings
- ☐ circular construction model (building materials, construction techno-logies, water management)
- ☐ building information modelling (BIM)
- ☐ dynamic building simulation
- ☐ intelligent/smart buildings (building management system)
- ☐ life cycle analysis (global warming potential assessment)
- ☐ building certification systems (LEED, BREAM, WELL)
- ☐ smart cities and communities

8. Do the faculty produce TDK theses on the above topics?

- ☐ not
- ☐ occasionally
- ☐ many times
- ☐ I don't know

9. Is there any postgraduate training on the subject at the faculty?

- ☐ none
- ☐ is
- ☐ accreditation is in progress
- ☐ I don't know

10. Are there any published doctoral theses in the department related to the topics listed above?

- ☐ there are none
- ☐ some
- ☐ half and half
- ☐ overwhelmingly
- ☐ I don't know

11. Are there any lecturers on the faculty who have obtained their academic degrees in any of the above subjects?

- ☐ there are none
- ☐ some
- ☐ half and half
- ☐ overwhelmingly
- ☐ I don't know

12. Is there training available for trainers in the subject area?

- ☐ none
- ☐ occasionally
- ☐ regularly
- ☐ I don't know

13. Are there colleagues on the faculty who design certified (e.g. passive house) buildings?

1. there are none
2. some
3. half and half
4. overwhelmingly
5. I don't know

14. Please explain the other specificities of your teaching in the higher education institution related to the topic.
.....

Please provide your name and contact details (e-mail, phone) if we can interview you on this topic.
The data provided will be treated separately from the answers to the questionnaire.

Student questionnaire

1. What kind of training are you/was you taking part in?

- ☐ Architectural Engineer
- ☐ Civil Engineer
- ☐ Mechanical Engineer
- ☐ Electrical Engineer
- ☐ IT Engineer
- ☐ Technical Manager
- ☐ Environmental Engineer
- ☐ Other

2. Please indicate which student status you currently hold.

- ☐ University student, Bachelor of Science (BsC)
- ☐ University student, Master's degree (MsC)
- ☐ postgraduate student
- ☐ graduate, not student
- ☐ doctoral studies (Phd/DLA)

3. Please rate the depth of knowledge you remember having acquired during your university studies on the topics listed below.
1 - does not appear at all 5 - must appear
Please rate each factor!

- ☐ design of near-zero energy buildings (NZEB) (architecture, mechanical and electrical engineering)
- ☐ use of renewable energy sources
- ☐ building renovation, refurbishment (architecture, engineering and building services)
- ☐ energy modernisation of listed buildings
- ☐ circular construction model (building materials, construction techno-logies, water management)
- ☐ building information modelling (BIM)
- ☐ dynamic building simulation
- ☐ intelligent/smart buildings (building management system)
- ☐ life cycle analysis (global warming potential assessment)
- ☐ building certification systems (LEED, BREAM, WELL)
- ☐ smart cities and communities

4. How is/was the knowledge delivered?
There are several answers!

- ☐ presentation
- ☐ Practice
- ☐ guided simulation
- ☐ guided scaling exercise
- ☐ case study analysis
- ☐ study tour
- ☐ building visit
- ☐ e-learning
- ☐ online training
- ☐ Other

5. In what form is/was it reported?
There are several answers!

- ☐ building-level design task
- ☐ design of part of a building
- ☐ detailed design task
- ☐ self-simulation
- ☐ self-scaling
- ☐ stand-alone case study
- ☐ other

6. In your student work, to what depth is the knowledge covered in the subject areas listed below?
1 - not published at all 5 - required to be published
Please rate each topic!

- ☐ designing a near-zero energy building (NZEB) (architecture, mechanical and electrical engineering)
- ☐ use of renewable energy sources

- ☐ building renovation, refurbishment (architecture, engineering and building services)
- ☐ energy modernisation of listed buildings
- ☐ circular construction model (building materials, construction techno-logies, water management)
- ☐ building information modelling (BIM)
- ☐ dynamic building simulation
- ☐ intelligent/smart buildings (building management system)
- ☐ life cycle analysis (global warming potential assessment)
- ☐ building certification systems (LEED, BREAM, WELL)
- ☐ smart cities and communities

7. Did you produce any work on the above topics during your studies, beyond the compulsory education?
There are several answers!

- ☐ yes, TDK/OTDK thesis
- ☐ yes, conference or other presentation
- ☐ yes, journal article
- ☐ not
- ☐ other

8. Do you know if there are any postgraduate courses in the faculty/department dealing with the above topics?

- ☐ is
- ☐ none
- ☐ I don't know

9. Did you do any postgraduate training - related to the subject - after your university studies?
There are several answers!

- ☐ yes, professional engineering
- ☐ yes, energy certification
- ☐ yes, passive house designer
- ☐ yes, other postgraduate training
- ☐ no, but I intend to within 5 years
- ☐ not
- ☐ other

10. What postgraduate training related to this topic would you like to undertake?
.....

11. Since graduating, have you participated in (international) forums and conferences related to the subject?

- ☐ not

☐ yes, occasionally
☐ yes, regularly
☐ not relevant

12. Have you obtained any qualified designation related to the subject?
E.g. passive house designer, energy certification, etc.

☐ yes
☐ not
☐ no, but I intend to within 5 years

13. Please describe any other experiences you have had with the teaching of this subject at your higher education institution.
.....

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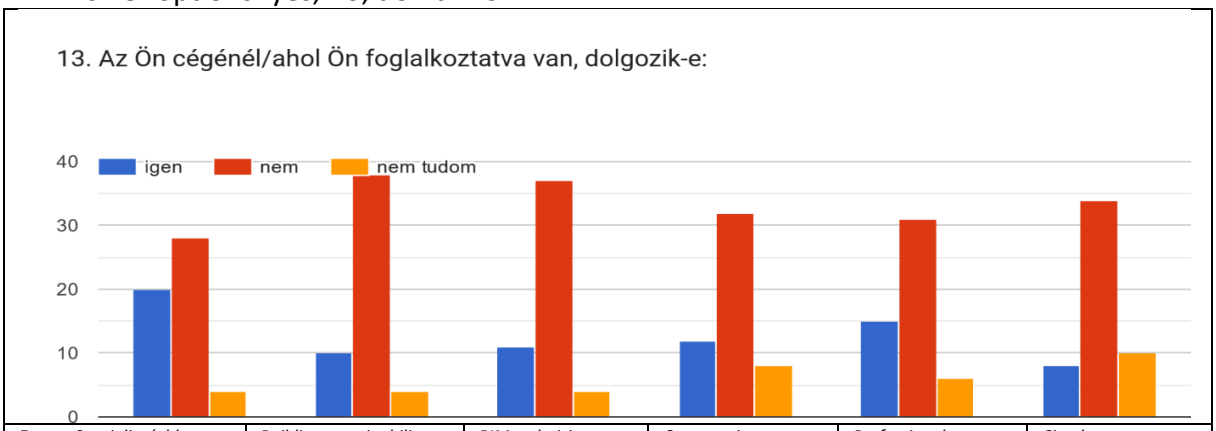
Annex 2 – Results of questionnaires

2.1 Detailed results of the construction companies and professionals questionnaire

13.) The company where you work\employed are there any?:

Answer options: yes, no, don't know

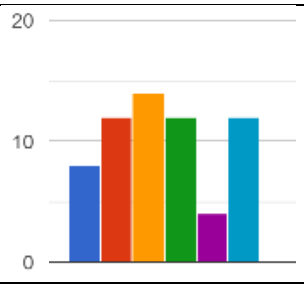
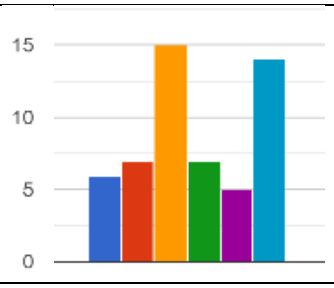


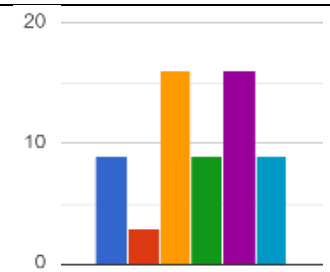
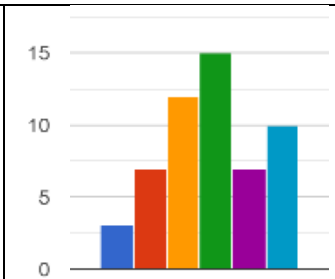
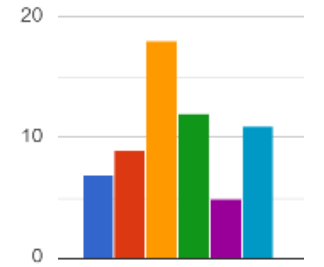
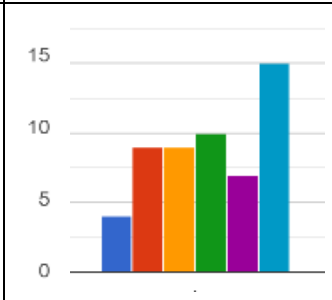
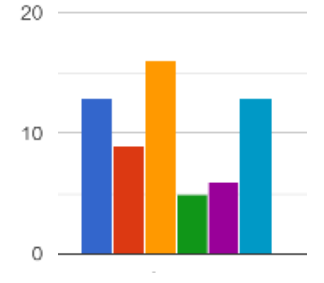
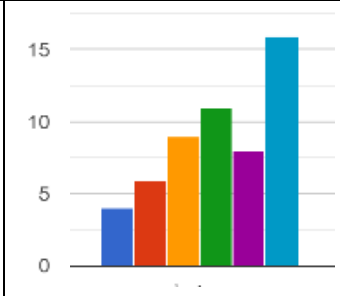
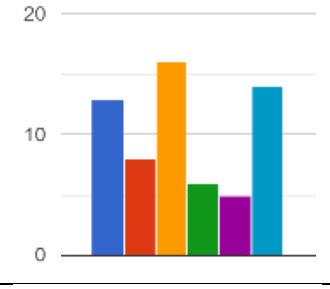
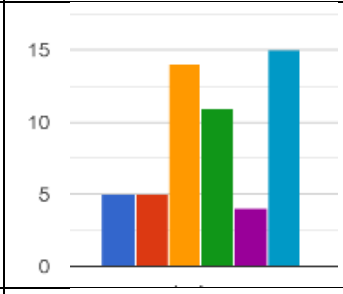
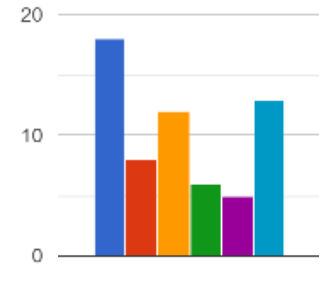
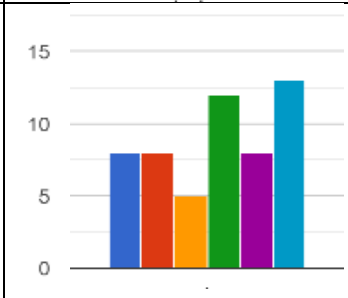
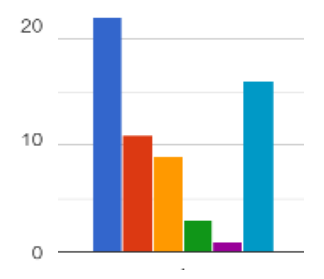
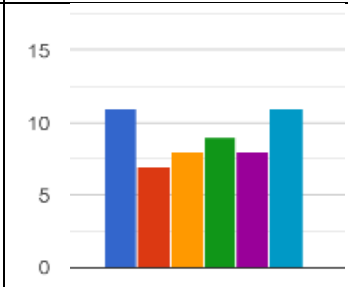
Energy Specialist (able to carry out building energy assessments and or design)?	*Building sustainability professional (knowledgeable in LCA/LCC, environmental/green or any sustainability certification scheme)?*	*BIM technician, manager or BIM design/development engineer?*	*Construction professional who works/may work on buildings with NZEB (BB) certification or above?*	*Professional designing, repairing/installing or operating advanced building services systems (smart or IoT solutions)?*	*Circular economy aspects of the construction industry*

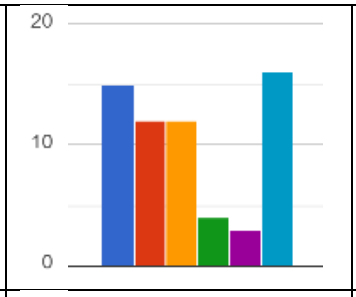
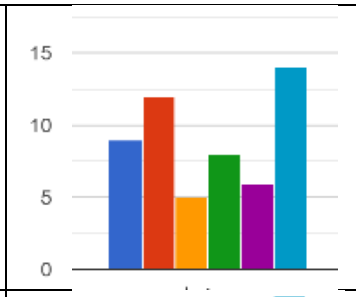
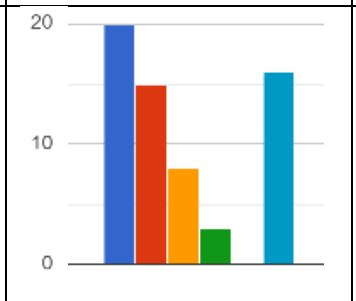
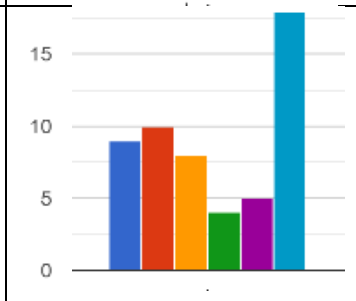
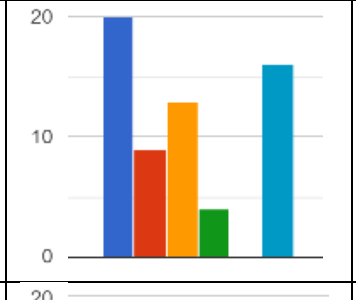
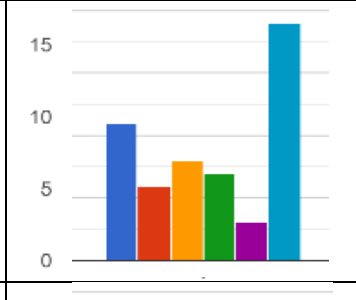
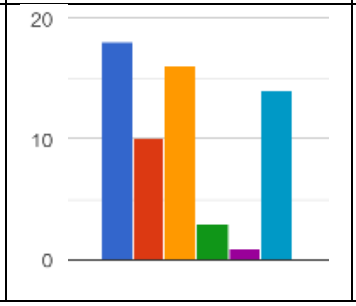
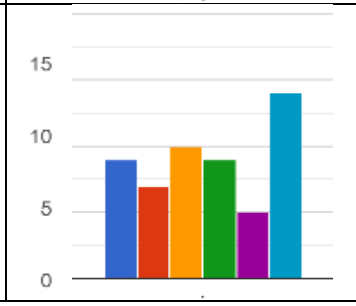
2.2 Detailed results of the vocational training questionnaire

12) In the institution where you work/study, to what extent are the following environmental awareness and building energy knowledge materials presented in order to achieve the 2030 building energy and climate goals?
Rate on a scale of 1 to 5! Mark 1 for low coverage and 5 for high coverage and thoroughness.

6 - I don't know

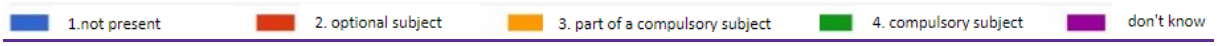
#	Topic	Teacher answers	Student answers
1	Designing a near-zero energy building (NZEB) (architecture, mechanical and electrical engineering)		

2	Use of renewable energy sources		
3	Building rehabilitation, refurbishment (architecture, engineering and building services)		
4	Energy modernisation of listed buildings		
5	Circular construction model (building materials, construction technologies, water management)		
6	Building Information Modelling (BIM)		
7	Dynamic building simulation		

8	Intelligent/smart buildings (building management system)		
9	Life cycle analysis (global warming potential assessment)		
10	Building certification systems (LEED, BREAM, WELL)		
11	Smart cities and communities		

2.3 Higher education questionnaire results by section

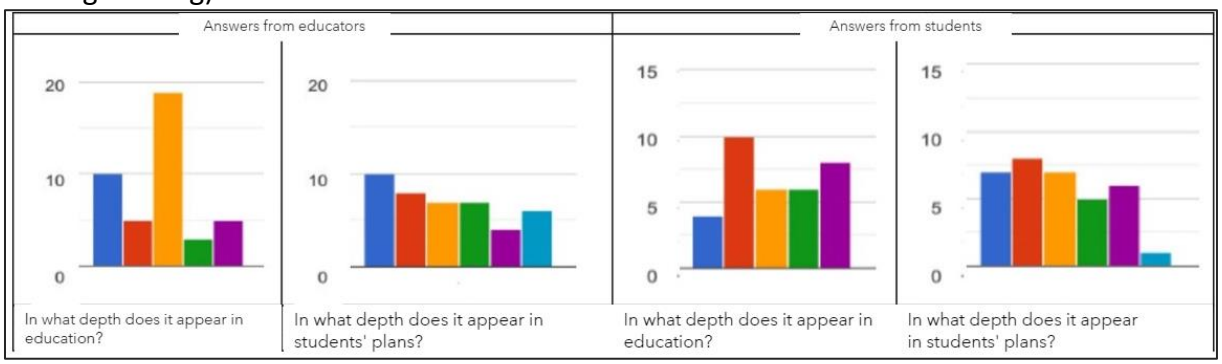
Legend_1: Teacher responses to the first graph:



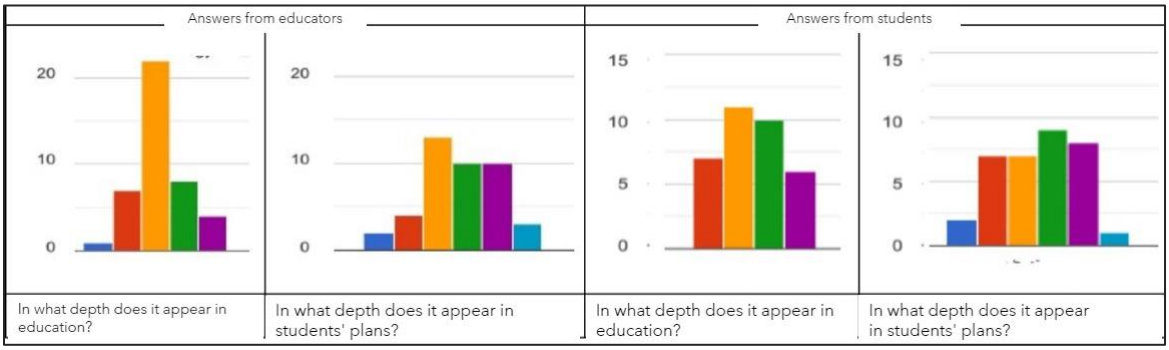
Legend_2: Teacher responses to second and student responses graphs:

1: does not appear at all - 5: required to appear

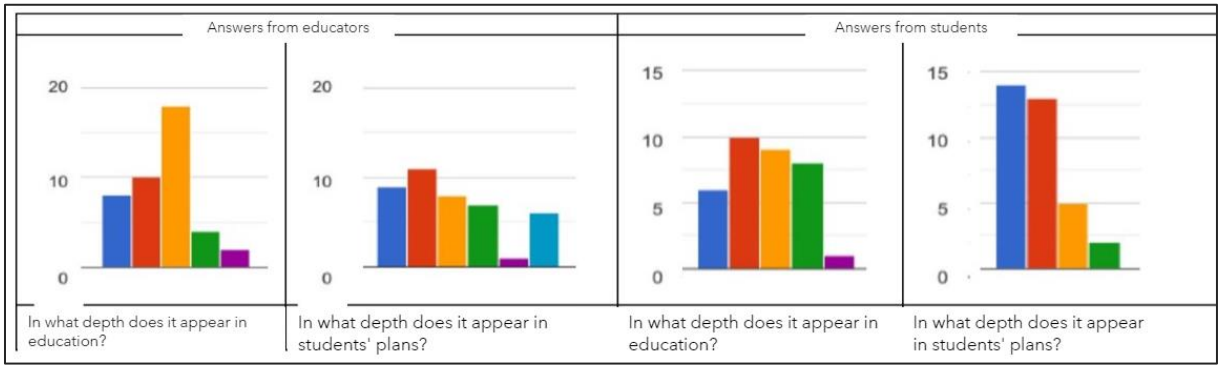
1) Designing a near-zero energy building (NZEB) (architecture, mechanical and electrical engineering)



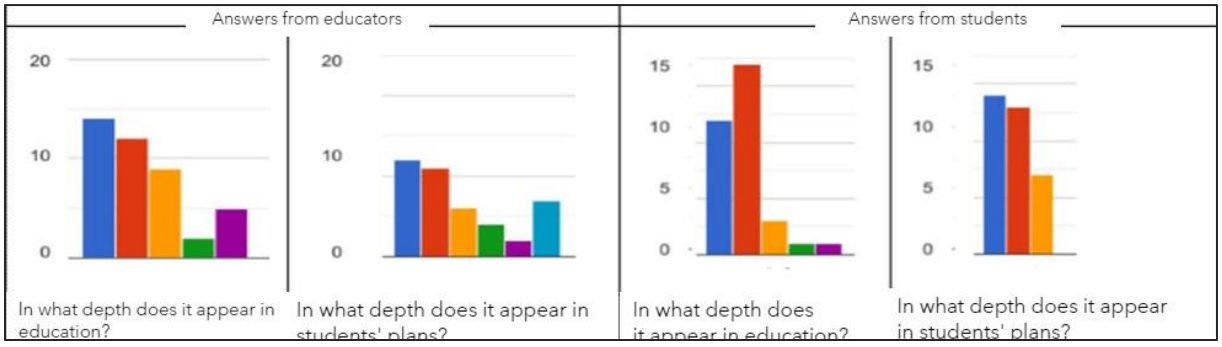
2) Use of renewable energy sources



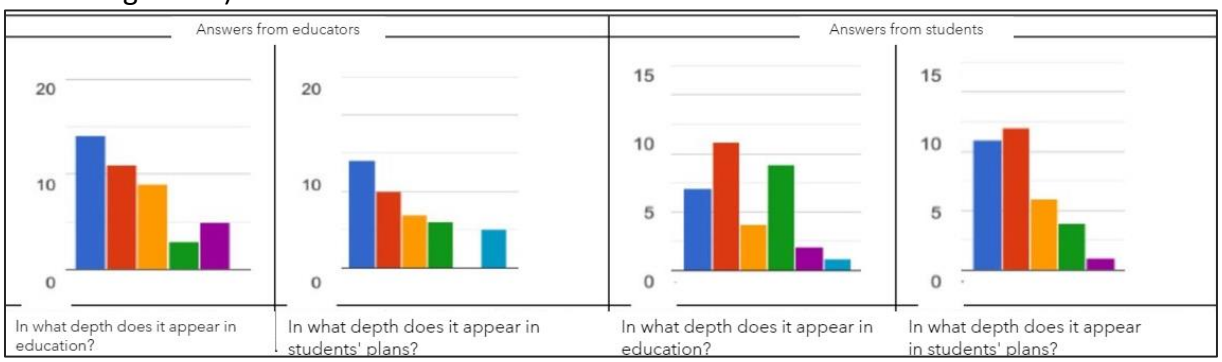
3) Building rehabilitation, deep renovation (architecture, engineering and building services)



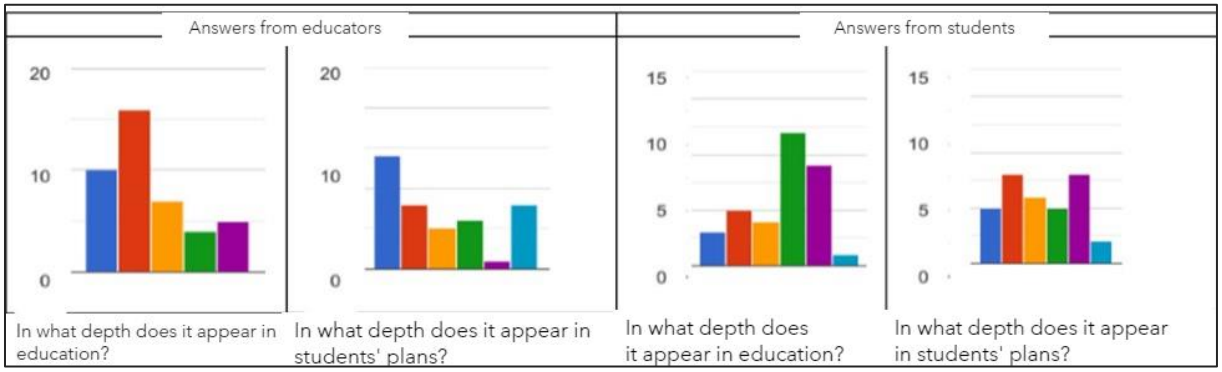
4) Energy modernisation of listed buildings



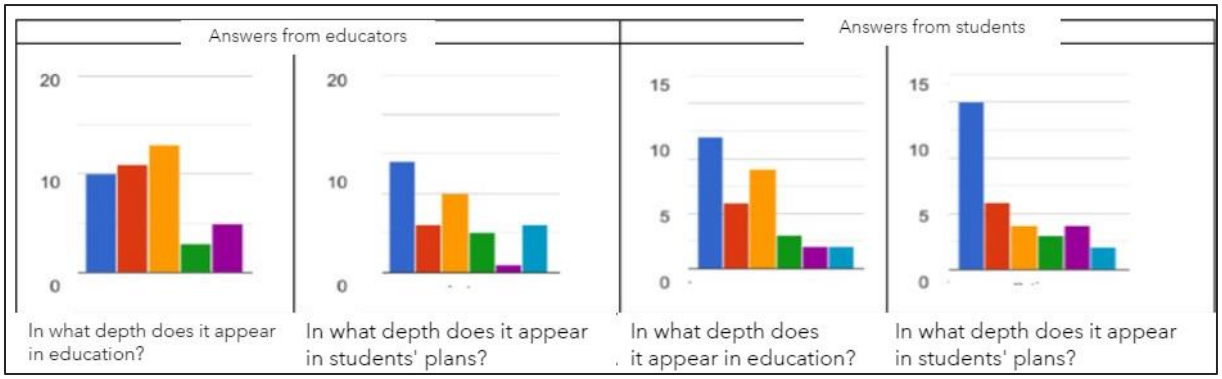
5) Circular construction model (building materials, construction technologies, water management)



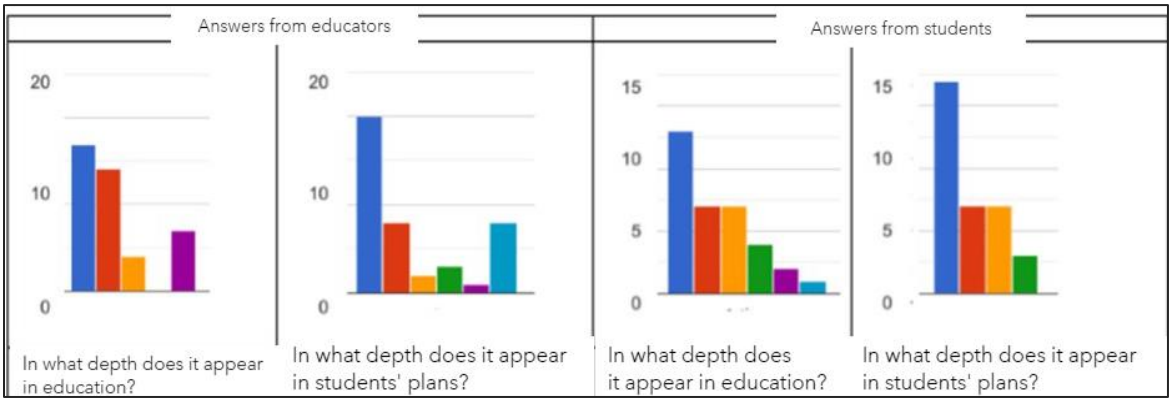
6) Building Information Modelling (BIM)



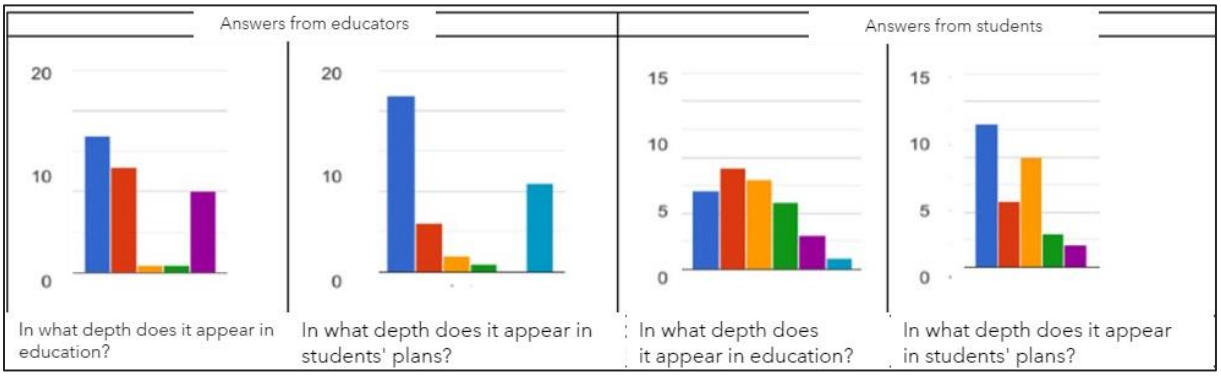
7) Environmental life cycle analysis (global warming potential assessment)



8) Dynamic building simulation



9) Intelligent/smart buildings (building management system)



Annex 3 – Themes for interviews

3.1 Construction companies interview questions

Interview subject:
Name:
Workplace:
Position:
Availability:
Time of the interview:
Interviewed by:
Interview method: telephone / online / face-to-face
Interview responses are public: yes/no

1) A brief description of the project and its objectives.
2.) Completing the questionnaire
3.) Interview questions

Labour market:

1. Do you think there is a problem of brain drain abroad? What are the reasons behind this phenomenon and how should it be addressed?
2. In your opinion, which are the areas most affected by the skills shortage? What do you estimate the extent of this shortage to be?
3. In your profession, in your field of activity, to what extent are foreign (migrant) workers present? What is your experience of their qualifications?
4. What do you think about the qualifications/skills of recent graduates? Do you see any trends in this over the last decade?

Training

5. Do you think that the training covers systems thinking, energy efficiency principles and the application of renewable energy use?

Sustainability topics:

- designing a near-zero energy building (NZEB)
- use of renewable energy sources
- building rehabilitation, deep renovation
- energy modernisation of listed buildings
- circular construction model (building materials, construction technologies, water management)
- building information modelling (BIM)
- dynamic building simulation
- intelligent/smart buildings (building management system)
- life cycle analysis (global warming potential assessment)
- building certification systems (LEED, BREAM, WELL)
- smart cities and communities

6. What do you think about the textbooks and teaching materials available? How can you ensure the availability of up-to-date professional materials?
7. What do you think about dual training? What are your experiences in terms of student motivation and results?

8. How do you perceive the quality of the teaching staff and the professionalism of vocational education and training in the construction sector?

Strategy, legal environment

9. What policy and governmental measures would you propose to ensure that the background and development of the sector and training is secured?
10. Would you consider it necessary to make certain activities subject to an authorisation (e.g. installation of solar panels)?
11. Other comments on this topic?
12. **SWOT analysis of domestic construction training**

discussion topics:

- dual training, student outcomes
- quality of vocational training, higher education
- migrant workers (skills)
- labour emigration
- the role of professional organisations and chambers
- operation
- financial and moral respect for professionals
- changes in the legal environment

SWOT		**USEFUL (+)**	**HARMFUL (-)**
		to achieve the goal	to achieve the goal
INTERNAL FACTORS	characteristics of the	**STRENGTHS** • social... • economic... • legal... • human resources..	**WEAKNESSES** • social... • economic... • legal... • human resources..
EXTERNAL FACTORS	characteristics of the	**OPPORTUNITIES** • home.. • international, EU..	**THREATS** • home.. • international, EU..

3.2 Vocational training interview topics

Interview subject(s):
Name:
Position:
Availability:

1.) Do you think that the training covers systems thinking, energy efficiency principles and the application of renewable energy use?
Sustainability topics:

- designing a near-zero energy building (NZEB)
- use of renewable energy sources
- building rehabilitation, deep renovation

- energy modernisation of listed buildings
- circular construction model (building materials, construction technologies, water management)
- building information modelling (BIM)
- dynamic building simulation
- intelligent/smart buildings (building management system)
- life cycle analysis (global warming potential assessment)
- building certification systems (LEED, BREAM, WELL)
- smart cities and communities

2) What is your opinion about the available textbooks and teaching materials? How can you ensure that professional materials are up to date?
3) What is your opinion on dual training? What are your experiences in terms of student motivation and results?
4) What is your view on the quality of teachers and the professionalism of vocational education and training in the construction sector?
Strategy, legal environment
5.) What policy and governmental measures would you propose to ensure that the background and development of the sector and training is secured?
6.) Would you consider it necessary to make certain activities subject to authorisation (e.g. installation of solar panels)?
7) Any other comments on the subject?
8) SWOT analysis of domestic construction training (fill in the table)

3.3 Higher education interview topics

Interview subject(s):
Name:
Position:
Availability:

1) Project presentation, objectives: SQA and Roadmap
2) As the interviewee has already filled in the questionnaire, which focuses mainly on the current state of higher education, the questions go beyond this:

- What do you think about the student's achievements/skills? Do you see a trend over the last decade?
- Future plans for the institution? Possible changes to the curriculum depending on strategies (e.g. building renovation, NZEB, LCA, etc.)? Changes in teaching methodology (e.g. e-learning, online training)?
- How is the cooperation with other faculties at the teacher/student level?
- Does your institution offer dual training? If so, what are their experiences in terms of student motivation and results?

3.) Overall assessment, proposals
4.) Possibilities for further cooperation?
5) SWOT analysis of domestic construction training (fill in the table)

Annex 4 - Relevant legislation

EU legislation, directives

Regulation (EU) No 1025/2012	on European standardisation
Regulation (EU) No 157/2014	on the conditions for publishing the declaration of performance of construction products on the website,
Directive 2001/95/EC	on general product safety
Regulation (EU) No 305/2011	laying down harmonised conditions for the marketing of construction products
Regulation (EU) No 568/2014	amending Annex V to Regulation (EU) No 305/2011 of the European Parliament and of the Council as regards the assessment and verification of constancy of performance of construction products
Regulation (EU) No 574/2014	amending Annex III to Regulation (EU) No 305/2011 of the European Parliament and of the Council as regards the model for the declaration of performance for construction products
Regulation (EC) No 765/2008	setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93
Decision No 768/2008/EC	on a common framework for the marketing of products and repealing Council Decision 93/465/EEC
DIRECTIVE 2012/27/EU	DIRECTIVE 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC
DIRECTIVE 2010/31/EU	DIRECTIVE 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings

Laws

Act CXVI of 1996	on nuclear energy
Act LVIII of 1996	professional associations of design and professional engineers and architects
Act CXLI of 1997.	on the land register
Act LXXVIII of 1997	on the shaping and protection of the built environment
Act CLXXXV of 2012 Act CLXXXV of 2012 Act CLXXXV of 2012	about waste

Government regulations

122/2015 (V. 26.) Government Decree	on the implementation of the Energy Efficiency Act
Government Decree 155/2016 (VI. 13.)	simple notification of the construction of a residential building
Government Decree 176/2008 (VI. 30.)	on the certification of the energy performance of buildings
Government Decree 181/2003 (XI. 5.)	on compulsory guarantees in relation to the construction of housing
Government Decree No 191/2009 (IX. 15.)	on construction works
Government Decree 194/2009 (IX. 15.)	laying down detailed rules for the integrated administration of procedures for the execution of works and designating the authorities involved

253/1997 (XII. 20.) Government Decree	on national planning and building requirements
Government Decree 264/2008 (XI.6.)	on the energy audit of heat generators and air-conditioning systems
Government Decree 266/2013 (VII. 11.)	on professional activities in the field of construction and construction-related professions
Government Decree No 275/2013 (VII. 16.)	detailed rules for the design and installation of construction products in construction works and the verification of performance in this respect
Government Decree 312/2012 (XI.8.)	on procedures and controls by the building and construction supervision authorities and on the provision of services by the building authorities
313/2012 (XI. 8.) Government Decree	on the Building Documentation and Information Centre and the National Register of Building
322/2015 (X. 30.) Government Decree	on the detailed rules for the procurement of works, design and engineering services for works
Government Decree 343/2006 (XII. 23.)	on the designation and operating conditions of building construction and building control authorities
373/2022 (IX.30) Government Decree	on the basic rules and responsible institutions for the implementation of the Hungary Recovery and Resilience Plan
Government Decree 402/2021 (VII. 8.)	on the registration procedure and other measures to be taken in relation to exports of raw materials and products of strategic importance for the security of supply of the construction sector with a view to economic recovery
Government Decree 403/2021.(VII. 8.)	on measures to be taken in relation to the transport of raw materials and products of strategic importance for the security of supply of the construction industry in order to restart the economy
Government Decree 487/2013 (XII. 17.)	on detailed rules for the examination and training in the field of construction for civil servants and government officials employed by the building, building inspection and heritage protection authorities

Ministerial Regulations

Decree 7/2006 (24.V.) TNM	determining the energy performance of buildings
25/2015 (V. 26.) NFM Decree on information to promote energy efficiency	25/2015 (V. 26.) NFM Decree on information to promote energy efficiency

Government decisions

Government Decision 1540/2016 (X. 13.)	alleviating the difficulties caused by the lack of technical specifications in the field of construction
Government Decision 1567/2015 (IX. 4.)	on the action plan for the restructuring of the construction sector and related tasks
Government Decision 1567/2015 (IX. 4.)	on the action plan for the restructuring of the construction sector and related tasks
Government Decision 1906/2020 (XII. 15.)	on competitiveness measures related to the implementation of investments
Government Decision 1337/2021 (VI. 1.)	on a medium-term strategy and action plan for improving the efficiency and performance of the construction industry and the sustainable development of the built environment
Government Decision 1619/2021 (IX)	on the government action plan for the implementation of the Hungarian National Social Inclusion Strategy 2030 for the years 2021-2024
Government Decision 1849/2014 (XII. 30.) on	Government Decision 1849/2014 (XII. 30.) on energy efficient procurement

energy-efficient
procurement

Annex 5- Further explanatory content

5.1 Planned energy classification of the technical building system

	A	B	C	D	E
1	efficiency of heating system by classification $(E_{F,nren} / Q_{F,net}) / (E_{F,nren,REF} / Q_{F,net,REF})$				
2	bad	poor	fair	good	excellent
3	130%<...	105<...≤130%	95<...≤105%	70<...≤95%	≤70%
4	efficiency of heating and ventilation system by classification $[(E_{F,nren} + E_{LT,nren}) / Q_{F,net}] / [(E_{F,nren,REF} + E_{LT,nren,REF}) / Q_{F,net,REF}]$				
5	bad	poor	fair	good	excellent
6	120%<...	105<...≤120%	90<...≤105%	55<...≤90%	≤55%
7	efficiency of domestic hot water system by classification $E_{HMV,nren} / E_{HMV,nren,REF}$				
8	bad	poor	fair	good	excellent
9	120%<...	105<...≤120%	90<...≤105%	50<...≤90%	≤50%
10	efficiency of cooling and air conditioning system by classification $(E_{H,nren} / Q_{H,net}) / (E_{H,nren,REF} / Q_{H,net,REF})$				
11	bad	poor	fair	good	excellent
12	125%<...	110<...≤125%	95<...≤110%	80<...≤95%	≤80%
13	efficiency built-in lightning (ignore in case of residential buildings) $E_{V,nren} / E_{V,nren,REF}$				
14	bad	poor	fair	good	excellent
15	800%<...	250<...≤800%	115<...≤250%	85<...≤115%	≤85%

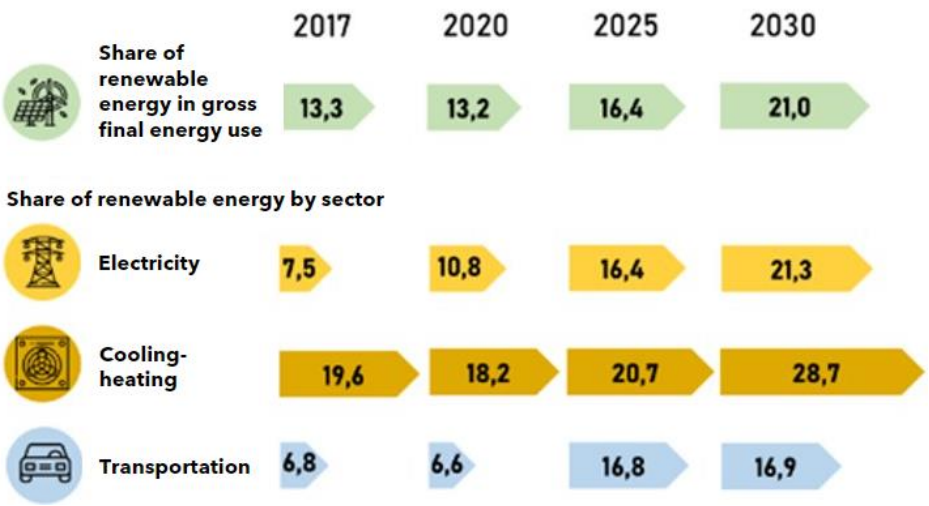
Table 37:Planned energy classification of the technical building system based on

Renewable energy in Hungary

In accordance with Regulation (EU) No 2018/1999 on the governance of the Energy Union and climate policy, Member States are required to submit a national energy and climate plan (NECP) for a ten-year period. The first NREAPs cover the period 2021-2030, in which Member States were required to pay particular attention to targets for renewable energy, energy efficiency and electricity interconnection, among others, by 2030.

According to the assessment of the NECs (COM(2020) 564 final), on the basis of ongoing and planned measures, the share of renewable energy could reach 33.1-33.7 percent at EU level by 2030, exceeding the target of at least 32 percent by 2030. The heating and cooling sector is the largest contributor to the absolute consumption of renewable energy, with a total of 102.9 Mtoe (million tonnes of oil equivalent) in 2018. This was closely followed by renewable electricity (90.3 Mtoe) and transport (25.1 Mtoe). The figures show a marked shift in the electricity sector towards renewables, as cumulative solar and wind capacity in the EU increased from 110 GW in 2010 to 261 GW in 2018. This has been driven by a reduction in the cost of electricity from solar and wind (nearly 75% and 50% respectively between 2009 and 2018, depending on the market) and the competitive nature of support schemes (COM(2020)952final).

According to Act XLIV of 2020 on Climate Protection, Hungary plans to achieve a share of renewable energy sources in gross final energy consumption of at least 21 percent by 2030. The planned shares by sector within this target are illustrated in Figure 55.



55. Figure: Planned share of renewable energy in Hungary (%) [Source: Infoszolg/ITM 2020]

The Hungarian Energy and Public Utilities Regulatory Office (MEKH) announced the first METÁR (Renewable Energy Support Scheme) tender in September 2019, aiming to support electricity generation using renewable energy sources.

This tender was two and a half times oversubscribed and 72 winning tenders were submitted. The average bid price of the winning bidders was 24.8 HUF/kWh (small category) and 21.69 HUF/kWh (large category) [MEKH 2021]. As a result of the tender, 93,000 households will be able to cover their total electricity needs and the country will avoid 75,000 tonnes of carbon dioxide emissions [MEKH 2020]. The winning bidders in the first tender will receive a total of HUF 229 million in subsidies over 15 years for the newly generated electricity of 193 GW/year [MEKH 2021].

The next tender was launched in July 2020 and was five and a half times oversubscribed. The majority of bidders applied to build a solar power plant, but there were also bids for geothermal and landfill gas power plants. In the second METÁR tender, the lowest bid price was 16.18 HUF/kWh, the highest 26.65 HUF/kWh and the average bid price weighted by the quantity requested was 20.66 HUF/kWh [MEKH2021].

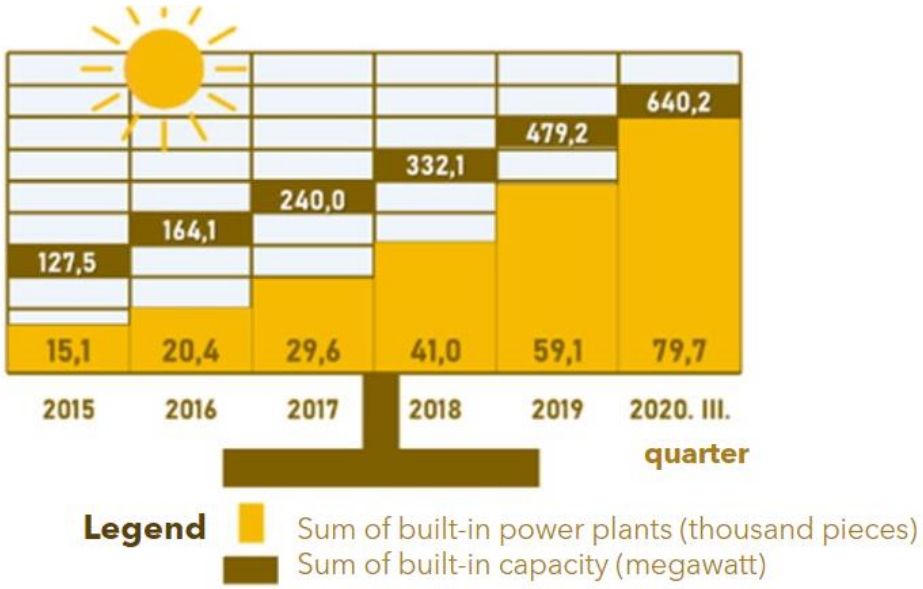


Figure 56: Number and capacity of small household power plants (SSHP) [Source: Infoszolg/MEKH 2020]

Four new METÁR tenders have been published until August 2022, with the aim of supporting between 300 and 500 GWh of renewable energy per year. The new National Energy Strategy, published in January 2020, aims to have at least 200,000 households with an average of 4 kW of roof-mounted solar panels by 2030.[77] These laws and strategies set the macro-level direction for vocational training in the construction sector in Hungary.

[77] Forrás: https://www.parlament.hu/documents/10181/39233854/Infojegyzet_2021_25_megujulo_energia.pdf/ac8a31f3-cbb9-fe8f-faaf-12c5767a30e6?t=1619161603958

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5.2 EQF levels and training and output requirements

	Knowledge	Skills	Responsibility and autonomy
	In the context of EQF, knowledge is described as theoretical and/or factual.	**In the context of EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments).**	**In the context of the EQF responsibility and autonomy is described as the ability of the learner to apply knowledge and skills autonomously and with responsibility**
1.	basic general knowledge	basic skills required to carry out simple tasks	work or study under direct supervision in a structured context
2.	basic factual knowledge of a field of work or study	basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools	work or study under supervision with some autonomy
3.	knowledge of facts, principles, processes and general concepts, in a field of work or study	a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information	take responsibility for completion of tasks in work or study adapt own behaviour to circumstances in solving problems
4.	factual and theoretical knowledge in broad contexts within a field of work or study	a range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities
5.	comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	a comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems	exercise management and supervision in contexts of work or study activities where there is unpredictable change review and develop performance of self and others
6.	advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study	manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts take responsibility for managing professional development of individuals and groups
7.	highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research critical awareness of knowledge issues in a field and at the interface between different fields	specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields	manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams
8.	knowledge at the most advanced frontier of a field of work or study and at the interface between fields	the most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice	demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research

38. Table: EQF levels: training and output requirements

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5.3 DigComp 2.1 Digital Competency Framework - Description of the competency levels

Foundation		**Intermediate**	
1.	**2.**	**3.**	**4.**
At basic level and with guidance, I can:	At basic level and with autonomy and appropriate guidance where needed, I can:	On my own and solving straightforward problems, I can	Independently, according to my own needs, and solving well-defined and non-routine problems, I can:
- identify appropriate simple communication means for a given context, and -select simple digital technologies to interact.	- identify appropriate simple communication means for a given context, and - select simple digital technologies to interact.	- select well-defined and routine appropriate digital communication means for a given context, and - perform well-defined and routine interactions with digital technologies.	- select a variety of appropriate digital communication means for a given context and, - select a variety of digital technologies to interact.
Advanced		**Highly specialised**	
5.	**6.**	**7.**	**8.**
As well as guiding others, I can:	At advanced level, according to my own needs and those of others, and in complex contexts, I can:	At highly specialised level, I can:	At the most advanced and specialised level, I can:
- use a variety of digital technologies in order to interact, - show others the most appropriate digital communication means for a given context	- adapt a variety of digital technologies for the most appropriate interaction, and - adapt the most appropriate communication means for a given context.	- create solutions to complex problems with limited definition that are related to interacting through digital technologies and digital communication means. - integrate my knowledge to contribute to professional practices and knowledge and to guide others in the interaction through digital technologies.	- create solutions to solve complex problems with many interacting factors that are related to interacting through digital technologies and digital communication means - propose new ideas and processes to the field.

39. Table: Digital Competency Framework – Competency Levels

Annex 6 - SWOT tables

6.1 Based on responses from VET teachers and students

SWOT		USEFUL (+)	HARMFUL (-)
		to achieve the goal	to achieve the goal
INTERNAL FACTORS	characteristics of the organisation	**STRENGTHS**	**WEAKNESSES**
		• Digital curriculum: not a complete subject, but the development of smaller units • The creation of vocational training centres facilitates cross craft • Dual training also helps professions to work together • Since companies are also financially interested, more people are taking on students (dual training) • Competition as learning (Professional star) • Good textbooks and digital learning materials are produced for professions with a large number of students	• vocational education and training: for adult education, the picture is mixed for trainees in digital education • Low knowledge of building materials • Examining board: cannot include trainers in training, only independent members • Dual training: lack of uniformity in the transfer of theoretical knowledge (a major disadvantage, especially in the field of technical training) , works well in cities with a strong industrial background • Textbooks are lacking for trades with low student numbers (e.g. tinsmith) • Trainers with a comprehensive knowledge of industry, design and construction practices would be needed.
EXTERNAL FACTORS	characteristics of the environment	**OPPORTUNITIES**	**THREATS**
		• digitisation: CREDIT • digital curriculum: not a complete subject, but smaller units • training courses for adults (company training for own employees) • Since companies are also financially interested, more people are taking on students (dual training) • Two professions and one vocational qualification can be obtained with state support in vocational training centres.	• learning from the internet (non-proofread material) • curriculum outdates quickly • the Digital programme did not fully address digital skills development • Examination system: online test (interactive exercise), taken by everyone at the same time in the same profession nationally: adequate infrastructure: institutional level, national level • Teacher turnover, insufficient quality of supply • Dual training: significant administrative overhead for participating companies

6.2 Based on responses from higher education teachers and students

SWOT		USEFUL (+) to achieve the goal	HARMFUL (-) to achieve the goal
INTERNAL FACTORS	characteristics of the organisation	**STRENGTHS** • renewable energy use is becoming more common • university lecturers: are practitioners, so they are subject to compulsory training by the Chamber • a wide range of postgraduate courses • race as learning: the SolarDecathlon • measures to support higher education in existing building energy strategies (e.g. National Smart Specialisation Strategy (s3), 2021-2027) • Erasmus opportunities for students and teachers alike • They are starting to work sooner and sooner alongside their university studies... gaining more work experience.	**WEAKNESSES** • renovation, conservation of historical buildings is not a typical university task • insufficient (proofread) written/digital learning material • e-learning does not mean using ppt • higher education institutions: isolated departments, little communication • university systems are slower to respond to change • Knowledge of BIM ≠ design software • training of trainers is not continuous • no joint work between students from different faculties • student disinterest (94% did not do any work beyond teaching) • the training areas related to building renovation strategies are not coordinated, neither between departments nor within a given department (missing knowledge) • the dual training system within the individual training courses is incomplete and stagnant
EXTERNAL FACTORS	characteristics of the environment	**OPPORTUNITIES** • digitisation: NEPTUN system • linking existing research teams • monitoring of higher education courses by the official bodies set up for this purpose (MAB) • to reduce the number of students in specialisations based on basic education (stop numbers, framework conditions), thus creating scope for quality education • strengthening communication with construction companies	**THREATS** • learning from the internet (non-proofread material) • rapidly aging curriculum, not updated • shortcoming of the higher education strategy, which does not include energy efficiency as part of curricula • e-learning is not widespread • "There is also often a lack of consensus among professionals as to which architectural/structural solution is considered "environmentally sound" and why." • Teachers' knowledge is based on practice only, not backed up by concrete measurements and research • No language exam needed to obtain a diploma, so foreign language skills deteriorate

6.3 Based on responses of construction companies and industry

SWOT		USEFUL (+) to achieve the goal	HARMFUL (-) to achieve the goal
INTERNAL FACTORS	characteristics of the organisation	**STRENGTHS**	**WEAKNESSES**
		• BIM is becoming more widespread (a strength if we write "BIM is present in companies") • **sustainability experts** and **BIM specialists are sometimes present in the company(s)** • Some companies organise regular training for their staff, including innovation. • **more than 80%** (42/52) **of** respondents indicated that they **support their employees in their further training** • added value of vocational training centres acknowledged. • Many companies have a "professional/engineering" mindset. • Teamwork, work organisation, job descriptions, • Importance of hierarchy, responsible management professionals at all levels • Legal, financial, fixed asset, tool use, management and quality compliance of enterprises, • exploiting the potential of dual, practical training • a high percentage (57-61%) of new technology, methods and techniques are subsidised by firms	• renovation, monument protection not typical • new entrants: lack of knowledge of construction costs and materials • materials, **environment and sustainability and energy skills are supported by** well **under half of** respondents • Resources are being chipped away. Little interdisciplinary training (cross-craft skills) • Cooperation between professions and disciplines is lacking, desirable! • compulsory training, lack of qualifications in certain fields • A high percentage of responses (57.7%) show that there is **a lot of theoretical material in** the training • lack supply of QUALITY training • the dependence of designers on traders and manufacturers, • lack of manufacturer-oriented system and device knowledge for commissioning • management and control of complex systems, • inter-job quality-controlled, planned upskilling, LLL not adequate • building automation moderately important and more training should be provided • lack of moral responsibility of dedicated persons (designer, installation manager, technical inspector,..) • **less than half (42%)** said that **training of staff is** included in **company policy** or strategic plans • e-learning/distance learning/blended learning etc. training is moderately supported by market players

		OPPORTUNITIES	THREATS
EXTERNAL FACTORS	characteristics of the environment	• digitisation: ÉTDR • the spread of home office, rather than design offices • We must support reasonable attempts. • Gaining international experience, exchanging training. • manufacturers and contracting authorities should require competence and professional references • the organisation and recognition of various competitions and contests, and greater media coverage • vocational school/university career guidance/job fair • Development of adult/postgraduate training/qualification systems, methods, legislation and institutional framework, • "accredited" trainers/trainers, professional knowledge centres, • the responsible involvement of dedicated professional associations in the operation of training/qualification systems • TEÁOR_FEOR Modernisation-Land model_LLL • Product, system, facility, activity and energy monitoring, • Running LLL Skills Councils in all professions, disciplines and levels of education, in adult and post-graduate systems.	• learning from the internet (non-proofread material) • labour migration: it's OK to leave for a few years, but they should return • labour supply, lack of career guidance from EQF1!, • market entrants with the possibility of running a business, not linked to a master's degree, • lack of financial and moral respect for professionals • More people mention the **lack of appreciation of** skilled work/skilled workers and that the construction industry is **not attractive to those with good skills** • poorly funded, low-prestige vocational and higher education, training that does not keep pace with current knowledge in the profession, • Disinterestedness. Envy. Lack of motivation. • architecture: many artists, declining engineering approach • the quality of the buildings now being created is one generation old, and it is very expensive • low levels of productivity in the construction sector • housing-renovation-black-economy • capital shortfall payment discipline/chain debts • complexity of products, lack of product knowledge, disjointed profession: install/assemble...see-through/operate... • control, automation, building monitoring, 24/7/365 optimization - lack of knowledge, • the lack of a structured post-graduate training/qualification/monitoring system at construction level, • the lack of a coherent system of complex and specialised continuing training, shortcomings in the content, personnel and institutional legal framework, • Disproportionate emphasis on building energy goals at the expense of other aspects