# BUILD UP Skills
# – Croatia –

CRO skills – rebooting the National Platform and Roadmap
(CRO skills RELOAD)

National Roadmap for achieving the 2030 goals

February 2024


Co-financed by the European Union



DOI: https://doi.org/10.5592/RP/MR.2024.02
ISBN: 978-953-8168-68-0

**Further information**

You can find more details about the implementation of BUILD UP Skills in Croatia at https://croskills-reload.grad.hr/hr/home-hr/

You can find more details about the BUILD UP Skills initiative at www.build-up.ec.europa.eu

You can find more details about the LIFE program at https://cinea.ec.europa.eu/programmes/life_en

# 1 Content

# 2 Foreword

Energy efficiency has been one of the top issues in the construction sector for more than ten years, more specifically in the field of building construction. The requirements for the thermal properties of buildings are one of the essential conditions imposed on the planning, construction and ultimately the use of buildings, and these requirements are amended, supplemented and tightened every few years. Each new requirement in the regulations is a response to requirements from European directives and agreements.

More than ten years ago, the European Commission launched the Build Up Skills initiative, assigning each Member State the task of conducting a project to develop a national roadmap describing the measures necessary to achieve the plans for energy efficiency in buildings by 2020. The measures are aimed, among other things, at construction workers and improving their skills to ensure that the energy renovation work carried out meets a satisfactory level of quality. The national roadmap was developed in Croatia as part of the CROSKILLS project in 2013.

The implementation of energy renovation in the EU in the last decade did not go exactly as planned, and the European Commission decided to restart the implementation of projects that, among other things, provide for a new roadmap with measures to achieve the plans for energy renovation of buildings by 2030. This year, however, the measures apply to construction workers, installers of renewable energy sources as well as engineers (civil, mechanical and electrical) and architects.

Among the proposed measures with an action plan for their implementation is the need to create modern professional standards and qualification standards so that pupils and students in the existing education system are taught new skills necessary to carry out work on buildings. The measures defining the need for training and certification of workers and engineers, particularly in the field of energy efficiency in buildings and renewable energy sources, were highlighted. The roadmap also include measures to establish (life-long) training for engineers in the field of sustainability, i.e. calculating the life-long impact of buildings (including all built-in products) on the environment. This measure is one of the most challenging for engineers and architects because it actually opens up a completely new field in construction.

Ultimately, the success of these national roadmap depends on their acceptance by the relevant stakeholders, primarily ministries, agencies, funds, local governments, associations and chambers, material manufacturers and companies active in the field of energy efficiency of buildings.

Letters of support can be found at the end of this roadmap and I would like to take this opportunity to thank all those who have recognized the importance of these guidelines and supported them.

On behalf of the consortium of the CRO skills RELOAD project

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Project Coordinator

# 3 Abstract

The European Union has set ambitious goals for sustainable development, as outlined in the European Green Deal and Sustainable Development Goals. The European Commission proposes to increase the European Union's commitment to reducing greenhouse gas emissions. In particular, the goal is to reduce emissions to at least 55% below the level of 1990 by 2030. This plan is aligned with the general goal of the European Union to achieve climate neutrality by 2050. Croatia's experience shows that energy-efficient renovation and construction of buildings represents a significant challenge for the construction sector and related industries. To meet sustainability, energy efficiency, and the utilization of renewable energy sources, the construction sector must augment the number of qualified workers, including construction workers and engineers. Measures are essential to establish conditions conducive to recognizing the value of qualified labor in the market, encompassing regulations and recommendations. As part of the document "*Updated and upgraded National analysis of the status quo: Current state of construction in Croatia*"[1], gave a comprehensive analysis of the construction sector and education in the Republic of Croatia. The analysis encompasses an overview of strategic documents in the buildings and renewable energy sources (RES) sector, the state of education in secondary schools (levels 4 and 5), as well as in higher education (levels 6 and 7) within the construction sector. Additionally, it addresses the current state of the workforce in the labor market, the content of educational programs and curricula in vocational and higher education, and identifies the existing level of knowledge among construction workers about the procedures and technologies of energy-efficient (EE) construction and the use of RES. The possibilities and lifelong learning programs available to workers were also analyzed. The primary objective of the analysis was to determine, in alignment with other available strategic documents related to the construction sector and its role in achieving the goals of energy efficiency (EE) and sustainability, the required number of workers for essential tasks. In addition, the analysis aimed to evaluate existing educational opportunities and recommend optimal solutions, including the redesign of existing programs and the implementation of new ones. The document quantified the needs of quality workforce of the Croatian construction sector in terms of contribution to the national goals of EE and RES. The shortage of skilled labor in the construction sector results in a dramatic increase in the importation of workers, often from countries with different educational systems and technological backgrounds. The education of these workers about energy-efficient technologies poses a significant challenge for achieving the goals by 2030. By analyzing the survey of craftsmen, it was found that between 40% and 60% of them, depending on the type of work, consider that they lack knowledge about energy-efficient technologies and express a desire for additional education. Vocational education faces a lack of student interest in three-year vocational courses, which leads to a disproportion with the needs of the labor market. Vocational occupations have a bad reputation, they are considered unattractive, physically demanding and undervalued. There is a lack of support from ministries and professional chambers for mentors who provide practical teaching, especially in smaller communities. The equipment of vocational schools, especially practicums, is often insufficient for the quality execution of the program. The teachers of professional subjects are insufficiently trained, the connection with work-based learning is limited, and the monitoring of the quality of program execution is insufficient, with a lack of external evaluation. A thorough analysis of currently available courses at universities was conducted, which indicates that only a small number of students enter the labor market with competencies relat-

1 Banjad and others: " Updated and upgraded National Status Quo Analysis: Current State of Construction in Croatia, 2023, ISBN: 978-953-8168-65-9, DOI: 10.5592/BO/978-953-8168-65-9, https://croskills -reload.grad.hr/wp-content/uploads/2023/02/Status-Quo-Analiza-ENG,-finalno.pdf

ed to EE and RES. Analyzes of the workforce in the field of EE and BIM during the last 10 years show low scores of self-assessment of knowledge and understanding of EE and BIM. The analysis showed that in Croatia there is no system for monitoring and controlling the knowledge and skills of workers related to energy renovation. In the document, it is estimated that 24,530 professional workers and 5,800 engineers are needed if the goals of energy efficiency in buildings were to be achieved by 2030. It was analyzed that a minimum of 500 construction workers, 500 RES workers, 435 civil engineers, 290 architects, 145 mechanical engineers and 145 electrical engineers need to be trained annually in order to acquire the necessary skills and knowledge. The document serves as a cornerstone for formulating measures in vocational education and higher education to achieve the ambitious goals outlined in the strategic documents of the Republic of Croatia.

All relevant sectors in the fields of education, energy, and construction were included in the formulation of the National Roadmap to ensure that their future practical application would benefit each sector. The National Qualification platform consists of representatives from various organizations and companies, including government bodies, professional associations, trade unions, chambers, vocational and technical schools, local and regional governments, energy agencies, financial institutions, building managers, tenant associations and individual companies, such as manufacturers and contractors of technical systems, contractors of construction works. The national qualification platform is composed of 105 representatives of educational institutions (7 universities, 3 research organizations, 65 educational centers and 27 high schools), 74 representatives of public institutions (4 national agencies and funds, 5 ministries, 15 representatives of cities and public institutions, 8 financial institution), 36 members of non-governmental organizations (15 professional organizations, 4 non-governmental and 3 for environmental protection), 18 media representatives, 258 representatives from industry, manufacturers and companies and 17 representatives from the real estate sector.

A total of 19 measures for improving vocational education and 13 measures for improving higher education were formulated. All proposed measures are carefully elaborated and classified as general, legal or technical. The action plan further structures the measures according to higher and vocational education. For each individual measure, detailed steps for implementation, responsible holders, required resources (in material, human and financial terms), additional conditions necessary for successful implementation and precisely determined implementation deadlines are listed.

At the end of the National Roadmap, letters of support (document of acceptance) from the relevant bodies and stakeholders are given confirming their commitment to the implementation of the proposed measures.

# 4 Introduction

## Characterization of the construction sector

The construction sector is a key part of the Croatian economy. The analysis of the main sectoral indicators and trends in the construction sector in Croatia was given by the Zagreb Institute of Economics[2]: in the structure of the total economy in the first half of 2023, the construction industry participated with a share of about 5%. Croatian construction industry achieved a gross added value of 21,175 euros per employee in 2022, which is below the average achieved in other EU-27 member states. Wages in construction still lag behind the economy average. In the period from January to July 2023, the average net salary in the construction sector was 17.9% lower than the average net salary in Croatia. The analysis of the value of the works performed by companies with 20 or more employees according to the types of buildings shows that positive trends in the construction sector are mainly the result of changes in the real estate market and the development of transport infrastructure. In the first six months of 2023, the total value of works carried out with own workers amounted to 2.6 billion euros. Of this amount, 36.6% of the works relate to the construction of non-residential buildings, 17% to residential buildings, and the remaining 28.3% to the construction of transport infrastructure.

The Long-term Strategy for National Building Stock Renovation by 2050[3] states that the national fund of existing buildings of the Republic of Croatia in 2020 includes a total usable area of 237,315,397 m², of which 178,592,460 m² are residential buildings and 58,722,937 m² are non-residential buildings. The national fund of buildings of the Republic of Croatia is classified according to purpose into the following categories: multi-apartment buildings, family houses, public purpose buildings and commercial buildings. A multi-apartment building has more than 50% of the gross floor area for housing, with three or more residential units and is managed by a building manager. A family house also has more than 50% of living space, with less than three residential units or a smaller gross construction area of 600 m². Public sector buildings are owned by the public sector, while commercial buildings are mostly private and have more than 50% of the area for business or service purposes.

The value of completed construction works on buildings in Croatia in 2021 amounted to EUR 1,734 million, which is a 12% increase compared to the previous year, while the number of building permits issued for new constructions and reconstructions of residential and non-residential buildings increased by 8% between 2021 and 2022, and the total usable area increased by 20%. The estimate of the necessary investments for the renovation and new construction of buildings until 2030 amounts to 27.28 billion euros.

According to statistical data, the current production capacity of the construction sector in high-rise construction according to statistical data is approximately 3.0 million m² per year, and the maximum was reached in 2007 (5.5 million m²). Considering the decline in the number of inhabitants, it is assumed that such a maximum size of the sector will be difficult to reach and that the ultimate reach will be approximately 5 million m² per year in 2050, assuming linear growth.

According to the Ministry of Physical Planning, Construction and State Assets after January 1, 2019 there were registered 5,032 nZEB buildings with a total usable area of 2,693,904 m², while currently around 8.6 million m² of nZEB buildings are planned or under construction.

2 Economic Institute Zagreb, Goran Buturac : Sectoral analysis – Construction and real estate, 2023. https://www.eizg.hr/userdocsimages//publikacije/serijske-publikacije/sektorske-analize/sa_gradevinarstvo-2023.pdf

3 Ministry of Physical Planning, Construction and State Assets : Long-term Strategy for National Building Stock Renovation by 2050 , 2020. https://mpgi.gov.hr/UserDocsImages/dokumenti/EnergetskaUcinkovitost/DSO_14.12.2020.pdf

According to data from energy certificates, collected from the system on May 25, 2023, a total of 133,930 certificates were issued. The highest percentage in the number of energy certificates belongs to family houses (48.54%), followed by multi-apartment buildings with 39.10%. Sports halls and hospitals have the lowest percentage – 0.27% and 0.29%. According to the distribution of energy classes by energy required for heating, it is evident that as much as 12% of the total number of certificates for family houses belong to class G, which is also true for 11% of certificates for hospitals. On the other hand, the lowest percentage of G class energy certificates, only 1%, refers to office buildings. A+ class energy certificates according to the required energy for heating are most common in apartment buildings, while sports halls have the highest percentage in that category.

### The number of people currently employed in the construction sector

In 2022, a total of 33,638 legal entities were registered in the construction sector in the Republic of Croatia, of which 19,469 were active. In addition, 10,570 trades and crafts were recorded. Within the building construction sector, 44,107 people were employed, while specialized construction activities, which also include compatible professions such as mechanical engineering and electrical engineering, employed 43,687 people. Crafts and free professions in construction employed 23,965 people, while 27,320 people worked in the sector of architectural activities and engineering.

An overview of the workforce according to the European Qualifications Framework (EQF) shows a diverse workforce structure. Namely, 0.15% of employees had EQF8 level, 19.01% of employees were at EQF7 level, 5.64% at EQF6 level, 2.14% at EQF5 level, 42.14% at EQF4 level, 18.65 % at the EQF3 level, 5.44% at the EQF2 level, and 6.83% at the EQF1 level. Additionally, according to data from the Croatian chambers of architects and engineers of construction, electrical and mechanical engineering, as of June 30, 2022, a total of 13,759 persons had authorizations for designing, performing supervision, managing construction sites and works, or auditing. This labor force category is distributed as follows: 3.42% with EQF8 level, 79.91% with EQF7 level, 16.00% with EQF6 level and 0.67% with EQF5 level. In 2022, the number of employees in legal entities in construction sector amounted to 110,937 persons. For the entire construction sector in 2022, the number of employees in the trades and professions is 23,965, while the number of employees in all trades and professions is 199,072. The number of employees in architectural activities and engineering in 2022 is 27,320.

Furthermore, on June 30, 2023, members of all chambers in Croatia held a total of 17,042 different authorizations (licences). Among them, 4,805 authorizations belong to the Chamber of Civil Engineering, 2,714 to the Chamber of Architects, 2,056 to the Chamber of Electrical Engineers and 1,282 to the Chamber of Mechanical Engineers. It is important to note that members holding more than one authorization are not double counted, resulting in a total number of members of all chambers of architects and engineers of 13,759 according to the education levels defined in the European Qualification Framework (EQF).

In 2022, more than 50,000 residence and work permits were issued for this sector, indicating a growing challenge. The changes are reflected in the decreasing reliance on workers from nearby regions, as many have secured jobs in western EU countries. Instead, the sector is seeing an increasing influx of workers from as far afield as India, Nepal, the Philippines and Bangladesh.

### Current energy consumption in the country and in the construction sector

In 2021, direct (final) energy consumption in the Republic of Croatia amounted to a total of 291.54 PJ, that is 80,983 GWh, of which energy consumption in buildings amounted to 38,224 GWh, that is 47.2% (of the total consumption of

buildings, industry, transport, construction and agriculture). In the same year, the total energy produced from renewable energy sources (RES) in buildings amounted to around 13,680 GWh - 13,058 GWh from firewood and biomass, 194.44 GWh from heat pumps, 74.89 GWh from geothermal technology for heating buildings, 198.50 GWh from solar thermal systems and 153.38 GWh from photovoltaic power plants. An overview of energy consumption and energy production from RES is presented in Table 1.

Table 1 Overview of energy consumption and energy production from RES

| Energy consumption in the Republic of Croatia in year 2021 | Year 2021 |
|---|---|
| Direct energy consumption in Croatia | 80,983 GWh |
| Energy consumption in all buildings | 38,224 GWh |
| **Energy production in the Republic of Croatia in year 2021** | **Year 2021** |
| Generated energy from firewood and biomass for buildings | 13,058 GWh |
| Production of primary energy from heat pumps | 194.44 GWh |
| Production of thermal energy from geothermal energy - only heating of buildings | 57.72 GWh |
| Production of thermal energy from geothermal energy - heating of buildings and DHW | 74.89 GWh |
| Production of thermal energy from solar thermal systems | 198.50 GWh |
| Production of photovoltaic power plants in buildings | 153.38 GWh |

## Energy goals for the country until 2030 + expected contribution of the construction sector

According to the *Integrated National Energy and Climate Plan for the Republic of Croatia by 2030*[4], the total goal of energy efficiency or cumulative energy savings is 125.3 PJ or 34,722 GWh. According to the same source, energy renovation of buildings based on all planned energy renovation programs and related measures should contribute to this goal by 2030 with 35.52 PJ or 9,867 GWh of realized savings. In addition, the expected energy production from RES in buildings in 2030 will amount to a total of 16,123 GWh.

One of the strategic national goals is to raise the building renovation rate from the current 0.7% per year to 3% by 2030. The planned rates of energy renovation of the existing fund according to the *Long-term Strategy for National Building Stock Renovation by 2050*[5] are 1.5% in 2023 and in 2024, 2.0% in 2025 and 2026, 2.5% in 2027 and 2028 and 3% in 2029 and 2030.

The total area of renovated residential buildings in 2030 will be 20,171,751 $m^2$ (65%) and area of renovated non-residential buildings 10,667,830 $m^2$ (35%), which together gives a total area of 30,839,581 $m^2$ of renovated buildings, and together with the new buildings that are planned to be built by 2030, this will amount to a total of 46.11 million $m^2$.

Significant contributions of RES energy production technologies in the building sector are planned until 2030. Table 2 includes biomass, thermal energy from the sun, geothermal systems (ie shallow heat pumps), above-ground heat pumps and photovoltaic power plants.

4 Integrated National Energy and Climate Plan for the Republic of Croatia for the period 2021-2030; Ministry of Environmental Protection and Energy, 2019.

5 Ministry of Physical Planning, Construction and State Assets, "Long-term strategy for the restoration of the national building stock until 2050", 2020.

Table 2 Energy goals by 2030

| RES technology | Biomass boilers and furnaces for heating | Solar thermal systeyms for heating | Geothermal systyems (heat pumps) for heating and cooling | Above-ground heat pumps for heating and cooling | Production and integrated photovoltaic power plants | Integrated photovoltaic power plants (only buildings) |
|---|---|---|---|---|---|---|
| Year 2030 | 13,665 GWh | 393 GWh | 437 GWh | 1,122 GWh | 1,013 GWh | 506 GWh |

The production of energy from RES in buildings in 2022 is a total of 14,270 GWh, and the expected production in 2030 will be a total of 16,123 GWh. Compared with the data that in 2021 the total energy consumption in all buildings in Croatia amounted to 38,224 GWh, it is very evident how important the production of energy from RES is for the building sector.

## National policies and existing provisions of vocational education and training

Vocational education is the most represented form of education and is attended by 70% of the secondary school population. The programs are classified by sector (Civil Engineering and Geodesy, Electrical Engineering, Mechanical Engineering, etc.). Vocational education is carried out through several models: classic, unique model of education and dual model. They differ from each other in the number of hours of practical classes and their content, as well as the conditions that the school must meet in order to be approved for work (material, technical and personnel conditions). Regular high school vocational education is the responsibility of state schools, which are financed with the funds of the Ministry of Education and Culture and with the funds of the County, that is, the City of Zagreb, as the founder of the high schools.

In the school year 2018/19, in the field of construction and geodesy there were a total of 4,040 students in 34 institutions and 267 departments. Of these, 815 students were in three-year occupations. In the school year 2021/22, there were a total of 3,749 students in 33 institutions and 278 classes. Of these, 1,056 students were in three-year occupations. Statistics show a decline in the number of students, which is a consequence of negative demography and a decline in students' interest in these professions. The average number of students in a class is 17, which is in line with an average smaller number of students in a class than in most countries in Europe. Four-year mechanical, electrical and construction technician programs are popular among students. They are enrolled by students with good results in elementary school, and very often after passing the state exam, they continue their education at one of the higher schools or colleges. With three-year occupations, the situation is significantly less favorable, and the reasons for this are difficulties in continuing education, unpopularity, the perception that these are difficult jobs with low earnings, etc.

Most programs in vocational education are from 1994 or older. Regardless of the adopted *National Pedagogical Standard*[6] of the secondary school education system, there are great differences in the equipment of schools and school workshops and the conditions of education of students in them. Most secondary vocational schools educate students in several educational sectors, especially in smaller towns. The specificity is a large number of smaller schools with more programs and the approval of classes with a smaller number of students, especially in deficit occupations. In 2017, the Agency for Vocational and Adult Education (hereinafter: the Agency) created a project called "*Modernization of the Vocational Education and Training System*". The project was financed from the European Social Fund, Operational Program Effective Human Resources 2014 - 2020. The goal of the Project is the development of innovative and flexible sectoral and professional curricula based on the needs of the labor market and the strengthening

6 Croatian Parliament, "State Pedagogical Standard of the Secondary Education System (Official Gazette 63/2008, 90/2010)." 2010

of the competencies of educational workers for the introduction and implementation of the curriculum. The project greatly contributes to the development of vocational education and training, which becomes attractive, innovative, relevant, inclusive, connected to the labor market, and enables participants to acquire competencies for personal and professional development as well as continuing education and lifelong learning. The project responds to the priorities and measures of the "*Vocational Education and Training System Development Program 2016-2020*[7]" and the "*Education, Science and Technology Strategy*[8].

The main reasons for the modernization of the vocational education and training system: (1) obsolescence of the programs: most curricula were created more than 20 years ago, UME programs in the early 2000s, and about 20 professional curricula in the last 5 years; (2) irrational number and structure of programs: existing programs are not systematically developed and there are large overlaps between them; (3) connection with the labor market: apart from the new professional curricula, the curricula are not based on learning outcomes and do not reflect the needs of the labor market and do not allow flexibility in implementation; (4) insufficient representation of learning through work: although there are various forms of learning through work in all vocational programs, this share is not sufficient.

The emphasis of the project is on the rationalization of the number of curricula, which enables students to enter the labor market easier, better horizontal mobility, professional development and continuous education. Special attention is paid to work-based learning in various scopes, in accordance with the *National Curriculum for Vocational Education*. The project provides significant support to schools, as well as strengthening the competencies of teachers and principals for the application of the new approach and model, as well as the flexibility and autonomy of schools.

In December 2021, *the Adult Education Act was introduced* (Official Gazette 144/2021)[9], which enables short and free education for workers and employers. The law enables the financing of formal and informal adult education programs for the acquisition of skills through vouchers from European funds, provided that they are aligned with the occupational and qualification standards in the Register of the Croatian Qualifications Framework (CQF). The Ministry of Labour, Pension System, Family and Social Policy, in cooperation with the Croatian Employment Service, introduced a voucher system that facilitates the distribution of vouchers for the education of unemployed and employed persons, with a special emphasis on the development of green and digital skills. Funds for this initiative were allocated within the framework of *the National Recovery and Resilience Plan 2021 - 2026*[10]. From April 2022, the Croatian Employment Service is launching education for green and digital skills through the public procurement process. In order to support educational institutions and expand the range of educational programs available to voucher users, the Agency for Vocational Education and Training and Adult Education (ASOO) has created and made green skills acquisition programs available through its own official website, and interested educational institutions can download them.

The Ministry of Physical Planning, Construction and State Assets has established a certification program for installers of renewable energy systems and construction workers who perform tasks related to increasing the energy efficiency of buildings

7 Agency for Vocational and Adult Education: Vocational Education and Training System Development Program 2016-2020., https://www.asoo.hr/UserDocsImages/Program%20SOO_HR.pdf

8 Croatian Parliament: Education, Science, and Technology Strategies (OG 124/2014)

9 Croatian Parliament: Adult Education Act, OG 144/2021

10 Government of the Republic of Croatia National Recovery and Resilience Plan 2021-2026, July 2021, page 1119. https://planoporavka.gov.hr/UserDocsImages/dokumenti/Plan%20oporavka%20i%20otpornosti%2C%20srpanj%202021..pdf?vel=13435491

(OG 67/2017, OG 56/15, OG 12/17, OG 12/ 17, OG 12/17[11]). The regulations require the Ministry of Spatial Planning, Construction and State Assets to maintain a database of certified installers of renewable energy systems and construction workers specialized in energy-efficient building components. However, so far only 545 installers are certified for photovoltaic systems, and there are no certified installers for solar thermal systems, small biomass boilers and stoves, and shallow geothermal systems and heat pumps. The register of certified construction workers for the installation of energy efficient systems is not yet available.

### Number of construction workers to be trained in each sub-sector/profession for each skill level in order to achieve the energy targets for 2023.

In order to achieve the energy targets for 2030, a significant number of construction professionals will need to be trained in each sub-sector/profession, and at each level of the European Qualifications Framework (EQF). Within the *Status Quo analysis*[12] (Table 3 ) it was determined that it is necessary to train a minimum of 500 to 1200 VET workers (level 4 and 5 according to the European Qualification Framework) annually to ensure the energy goals until 2030 in the building industry. It was additionally defined that it is necessary to educate 435 construction engineers, 290 architects, 145 mechanical engineers and 145 electrical engineers annually.

Table 3 Estimated number of required skilled workforce per year

| | Type of works | Estimated number of workforce to reach 2030 goals. | Annually required qualifications | European qualification framework |
|---|---|---|---|---|
| VET workers (Professional occupations) | Wall insulation | 9,400 | Minimum 500 Maximum 1200 | Levels 4 and 5. |
| | Roof insulation/replacement | 6,000 | | |
| | Replacement of carpentry | 6,600 | | |
| | Renewable energy sources | 2,530 | 500 | |
| Engineers (Higher Education) | Construction | 1,450 | 435 | Levels 6 and 7. |
| | Architecture | 1,450 | 290 | |
| | Mechanical engineering | 1,450 | 145 | |
| | Electrical engineering | 1,450 | 145 | |

### Qualification needs: required qualification courses per EU qualification level, number of required trainers, training structures and accreditation for training.

Croatia has regulations governing the training of professional workers for energy efficiency (EE) and renewable energy sources (RES) in construction (at levels 4 and 5). These regulations include ordinances that establish a certification program for

11 Ministry of Construction and Spatial Planning, "Regulation on conditions and criteria for determining the quality system of services and works for the certification of installers of renewable energy sources - photovoltaic systems (Official Gazette 56/15)." 2015
Ministry of Construction and Spatial Planning, "Regulation on conditions and criteria for determining the quality system of services and works for the certification of installers of renewable energy sources - solar thermal systems (Official Gazette 33/15, 56/15, 12/17)." in 2017
Ministry of Construction and Spatial Planning, "Regulation on conditions and standards for determining the quality system of services and works for the certification of installers of renewable energy sources - smaller boilers and biomass stoves (Official Gazette 39/15, 56/15, 12/17)." in 2017
Ministry of Construction and Spatial Planning, "Regulation on conditions and standards for determining the quality system of services and works for the certification of installers of renewable energy sources - shallow geothermal systems and heat pumps (Official Gazette 56/15, 12/17)." in 2017
Ministry of Construction and Spatial Planning, " Ordinance on the training and certification scheme for building workers who incorporate building parts that have an impact on energy efficiency in the buildings sector (Official Gazette 67/2017)." in 2017

12 Banjad et al : "BUILD UP Skills - Croatia - Updated and upgraded National Status Quo Analysis : Current state of construction in Croatia", 2023, ISBN: 978-953-8168-65-9, DOI: 10.5592/BO/978-953-8168-65-9, https://croskills-reload.grad.hr/wp-content / uploads/2023/02/Status-Quo-Analiza-ENG,-finalno.pdf

installers of renewable energy systems and construction workers who perform tasks related to increasing the energy efficiency of buildings (Official Gazette 67/2017, Official Gazette 56/15, Official Gazette 12/17, Official Gazette 12/17, Official Gazette 12/17[13]). The Ordinance prescribes the conditions for issuing consent to Training Providers, which also includes the conditions for persons conducting training (trainers). As part of the CROSKILLS II course, 120 trainers were trained, which is considered sufficient for training professionals in the field of energy efficiency. However, all experts (trainers) must undergo training in order to train professional workers in energy efficiency and renewable energy sources. The Ordinance defines the conditions that trainers and training centers must meet, and the future education of workers must take place in accordance with the aforementioned Ordinance. The existing training programs for trainers and workers should be adapted in accordance with the necessary skills specified in chapter 7.3. *Status quo analysis*[14] and harmonize and adapt additional conditions for financing education through vouchers for green jobs. Thus, for example, the education program created as part of the CROSKILLS II project needs to be revised and harmonized with market needs.

For the purposes of training engineers, 15 trainers from construction and architecture are needed, as well as 10 trainers from the field of mechanical engineering and 10 from the field of electrical engineering. In addition, it is necessary to create training programs for engineers that include all the necessary equipment (models, presentations, literature) and to adapt the training for the area of design and the area of supervision and execution. The minimum education for a particular profession for level 6 and 7 would have to last 10 hours. Professional training courses and programs should be conducted by institutions that have the consent of the Ministry of Pysical Planning, Construction and State Assets for a professional training program according to the provisions of the *Ordinance on professional training of persons performing spatial planning and construction tasks* (Official Gazette 55/2020)[15].

### Progress achieved at the national level under the BUILD UP Skills initiative (i.e. in the period 2012-2022)

The CROSKILLS consortium has developed comprehensive training materials and curricula for 6 priority construction trades (masons, facade workers, roofers, carpenters, painters and drywall fitters) for the theoretical part and the practical part of the training (7 manuals for trainers and 6 manuals for workers, 18 presentations depending on the module and occupation, 6 manuals for the practical part, a database of exam questions, a methodology for conducting education for the theoretical and practical part has been elaborated). The consortium has established a system of training and certification of construction workers, which is included in *Ordinance on the training and certification scheme for building workers who incorporate building*

13 Ministry of Construction and Spatial Planning, "Regulation on conditions and criteria for determining the quality system of services and works for the certification of installers of renewable energy sources - photovoltaic systems (Official Gazette 56/15)." 2015
Ministry of Construction and Spatial Planning, "Regulation on conditions and criteria for determining the quality system of services and works for the certification of installers of renewable energy sources - solar thermal systems (Official Gazette 33/15, 56/15, 12/17)." in 2017
Ministry of Construction and Spatial Planning, "Regulation on conditions and standards for determining the quality system of services and works for the certification of installers of renewable energy sources - smaller boilers and biomass stoves (Official Gazette 39/15, 56/15, 12/17)." in 2017
Ministry of Construction and Spatial Planning, "Regulation on conditions and standards for determining the quality system of services and works for the certification of installers of renewable energy sources - shallow geothermal systems and heat pumps (Official Gazette 56/15, 12/17)." in 2017
Ministry of Construction and Spatial Planning, " Ordinance on the training and certification scheme for building workers who incorporate building parts that have an impact on energy efficiency in the buildings sector (Official Gazette 67/2017)." in 2017

14 Banjad et al : "BUILD UP Skills - Croatia - Updated and upgraded National Status Quo Analysis : Current state of construction in Croatia", 2023, ISBN: 978-953-8168-65-9, DOI: 10.5592/BO/978-953-8168-65-9, https://croskills-reload.grad.hr/wp-content/uploads/2023/02/Status-Quo-Analiza-ENG,-finalno.pdf

15 Ministry of Construction and Physical Planning, "Regulations on the professional development of staff performing spatial planning and construction work (Official Gazette 55/2020)." p. 5, 2020.

*parts that have an impact on energy efficiency in the building sector* [16], prepared in cooperation with the Ministry of Construction and Spatial Planning, and officially approved in July 2017. The regulation includes criteria for potential training providers, along with all other criteria and requirements as part of the accreditation and certification scheme. It also encompasses the mutual recognition of certified workers within the BUILD UP Skills initiative from other countries. Eleven training centers (education providers) have been established, and 61 trainers have been qualified for the profession of plasterer, 61 for the profession of bricklayer, 49 for the profession of painter, 34 for the profession of dry construction installer, 37 for the profession of roofers, and 51 for the profession of carpenter. During 53 pilot training sessions for workers, 330 participants (80 bricklayers, 95 plasterers, 56 painters, 22 dry construction installers, 34 roofers, and 43 carpenters) completed both the theoretical and practical parts of the education and successfully passed the exam. Due to the high-quality content and positive feedback from all relevant stakeholders (including trained workers and trainers within the CROSKILLS program), the Agency for Vocational Education and Adult Education approved the trainer and worker manuals as supplementary teaching materials in vocational schools in Croatia.

As part of the document *Analysis of existing educational and study programs in the context of green jobs,*[17] a detailed analysis of the CROSKILLS project results has been conducted, along with its applicability in the *Reform Measure C6.1. R2 Development of a framework for ensuring adequate skills in the context of green jobs required for post-earthquake reconstruction* within the document *National Recovery and Resilience Plan 2021-2026*[18]. It was determined that the training project for construction workers, along with trainer education, the system for certifying construction workers, the quality monitoring system, the system of authorized training centers, and established registers of training centers, trainers, and certified workers, ceased with the conclusion of the CROSKILLS project in 2017. Two factors were identified as the cause for this: the absence of a requirement to certify the workforce for green jobs and the departure from the formal educational framework, ultimately leading to funding issues and the long-term sustainability of the project.

### Identified obstacles to achieving the goals for 2030.

One of the most significant obstacles, which at the same time represents the biggest challenge for the construction sector, is the lack of knowledge among construction workers: a large number of workers are not sufficiently trained or have not received training at all, which is supposed to be the key to achieving the energy goals by 2030. Young people often do not show interest in vocational education. for technical occupations, resulting in overall labour shortage. Scholarship programs have not achieved much success because they depend on the enthusiasm of schools or companies. Furthermore, there is a lack of practical knowledge provided through curricula. In higher education, the focus is often on specific areas of interest and the integration of knowledge from different disciplines is lacking. This results in a lack of interdisciplinary knowledge, especially in the field of energy efficiency. Although there are specialized courses in sustainability, energy efficiency and renewable energy sources, most are optional, resulting in a small number of qualified engineers compared to market needs. Croatia is facing a shortage of domestic labour in the construction sector. To compensate for the shortage, employers rely on foreign labour, but there are problems with the necessary qualifications and language barriers.

16 Ministry of Construction and Physical Planning, " Ordinance on the training and certification scheme for building workers who incorporate building parts that have an impact on energy efficiency in the building sector (Official Gazette 67/2017)." in 2017

17 Ministry of Construction and Physical Planning: Analysis of existing educational and study programs in the context of green jobs, 2022.

18 Government of the Republic of Croatia National Recovery and Resilience Plan 2021-2026, July 2021, page 1119. https://planoporavka.gov.hr/UserDocsImages/dokumenti/Plan%20oporavka%20i%20otpornosti%2C%20srpanj%202021..pdf?vel=13435491

Communication and employment of foreign workers is often difficult, which poses a challenge to productivity and cooperation. Small and medium-sized enterprises face several obstacles in accessing the education of their employees: lack of financial resources for training, lack of time and resources for training, lack of information about available training programs that complicates the identification and access to training, difficult participation of employees from foreign countries due to the language barrier, lack of adaptability of training and lack of capacity to implement educational programs in the workplace. In the lifelong education of adults, several obstacles have been identified: insufficient number of experienced trainers, informal education that is not legally regulated, lack of necessary equipment in educational centers, and longevity of training programs.

# 5 Methodology for creating National Roadmap

The main basis for the development of the National Roadmap was the document *Updated and upgraded National Status Quo Analysis: Current state of construction in Croatia.* In this document, the needs of a high-quality workforce in the Croatian construction sector are defined and quantified, contributing to the national goals of energy efficiency (EE) and renewable energy sources (RES). The document provides a comprehensive analysis of strategic documents at the level of the Republic of Croatia in the construction and renewable energy sectors. It presents the state of education in both secondary schools (levels 4 and 5) and higher education (levels 6 and 7), in the construction sector. The analysis covers the current workforce situation in the labor market and the content of educational programs and curricula in vocational education, higher education, and training. Additionally, it identifies the existing level of knowledge among construction workers regarding procedures and technologies related to energy efficiency (EE) in construction and the use of renewable energy sources.

The result of CRO Skills RELOAD project is the development and acceptance *of National Roadmap for achieving the 2030 goals*, which should enable the market evaluation of workers and engineers and contribute to the achievement of the national goals of EE and RES. The process of creating the National Roadmap is based on the inclusion of all relevant sectors in the field of education, energy and construction, so that the future practical application of the Roadmap will benefit all sectors.

The development of the National Roadmap includes the establishment of a multisectoral working group, known as the National Qualifications Platform (NQP). The platform consists of representatives from various organizations and companies, including government bodies, professional associations, trade unions, chambers, vocational and technical schools, local and regional governments, energy agencies, financial institutions, building managers, tenant associations and individual companies, such as manufacturers and contractors of technical systems and contractors of construction works.

The National Qualification Platform is composed of 105 representatives of educational institutions (7 universities, 3 research organizations, 65 educational centers, 27 high schools), 74 representatives of public institutions (4 national agencies and funds, 5 ministries, 15 representatives of cities and public institutions, 8 financial institution), 36 members of non-governmental organizations (15 professional organizations, 4 non-governmental and 3 for environmental protection), 18 media representatives, 258 representatives from industry, manufacturers and companies and 17 representatives from the real estate sector.

The development of the National Roadmap (Figure 1) was achieved through extensive consultations and discussions with members of the NQP, including a number of key activities (Figure 2):

### 1 National consultation and meetings of the National Qualification Platform

- the first National consultation and the first meeting of the NQP on March 21st 2023 in Zagreb
- the second National consultation and the second meeting of the NQP was held on June 13th 2023 in Zagreb
- the third National consultation and the third meeting of the NQP was held on September 21st 2023, in Zagreb.
- The fourth National consultation and the fourth meeting of the NQP and call for support for the National Roadmap was held on 15th of November 2023 in Zagreb
- the fifth National consultation and the fifth meeting of the NQP was held on February 1st 2024 in Zagreb.

The first meeting of the National Qualification Platform (NQP) brought together more than 70 participants from the fields of education, construction, energy and the public sector. The first National consultation presented the CRO skills RELOAD project and the National Qualification Platform was established with stakeholders from all relevant sectors. The meeting was divided into two parts: the first included the presentation of the progress and goals of the CRO skills RELOAD project and the results of the *Status quo analysis*. After that, the participants engaged in group work to discuss different perspectives of continuous education of construction workers in energy efficiency. The aim of these heterogeneous working groups was to gather high-quality feedback and conclusions on the topics of discussion (the shortage of skilled construction workers and its consequences, including the reasons for the shortage, the impact on business, strategies to solve the problem, improvements in the education system, effective training programs, cooperation with relevant subjects, recruitment challenges, teacher training, government involvement in education and employment of foreign workers amid labor shortages). The second national consultation brought together more than 20 participants, representatives of the construction industry, with a focus on the development of National Roadmap with specific topics such as required qualifications, time and financial resources for education, control systems (as part of renovation/building and education), current regulation and the main obstacle. The third consultation brought together 10 educational institutions and 6 representatives of public institutions with the aim of forming a Roadmap for measures regarding education and lifelong learning, while the fourth informed the public about the development of the National Roadmap and called for the support of relevant institutions in their implementation after the definition process is completed. As part of the fifth National Consultation, NQP stakeholder representatives were informed about each proposed measure, an additional evaluation was proposed and their support was requested.

### 2 Advisory meetings of focus groups

Ten advisory meetings with focus groups were organized, with each of them dedicated to a specific sector. These focus groups included financial institutions, building management and energy trade associations; the construction sector, including companies, tradesmen and professional associations; state administration bodies and public institutions specialized in energy and construction; and the education sector. The meetings were primarily organized during the preparation of the document *Updated and upgraded National Status Quo Analysis: Current state of construction in Croatia*, but they also served to collect information on the necessary measures, and for the dissemination of the future document and its easier acceptance.

### 3 Regional workshops

These advisory meetings were divided into two parts. In the first part, the opinions and experiences of each sector were sought in relation to various aspects, such as

the skills and qualifications needed by construction workers to achieve the goals of 2030 in the construction sector, the priorities of educational content, the possibility of implementing lifelong education in EE for construction workers, financing of lifelong education, certification and market valuation of the educated workforce. In the second part of the meeting, those present proposed priority measures that will be included in the National Roadmap. Building on the insights gathered during these meetings, the project team proposed a more detailed classification of these measures, including legal, technical, general and other measures that indirectly affect the education of workers.

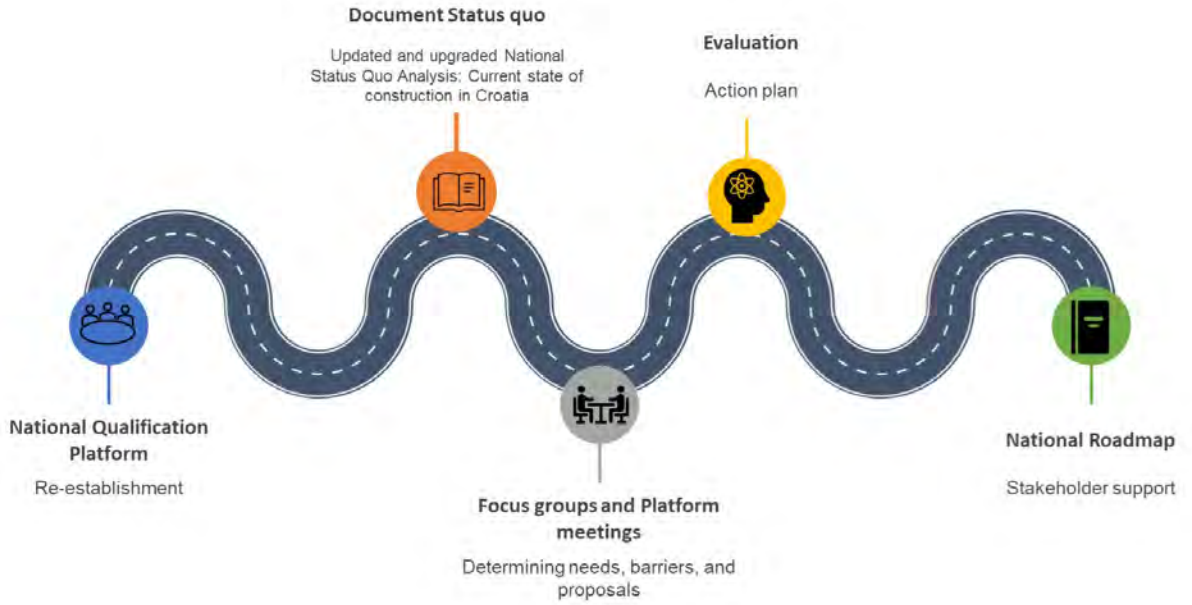


Figure 1. The process of creating National Roadmap


Figure 2 Communication channels used to create the National Roadmap

By analyzing the collected data, the representatives of the consortium collected a total of 55 measures in the first draft version of the National Roadmap. The measures were additionally analyzed, and with a detailed analysis, the number of measures was reduced to 32 (19 measures for vocational education and 13 for higher education). The proposed measures are elaborated and divided into general, legal and technical. The measures in the Action Plan are divided into those related to higher and vocational education. For each individual measure, the activities (steps for implementation), the institution responsible for the measure, the necessary resources (material, human and financial), additional preconditions for implementation and the deadline for implementation are given.

# 6 Measures

## 6.1 Vocational education (levels 3, 4 and 5) and lifelong learning

Table 4 shows a list of all measures for vocational education (levels 3., 4. and 5. according to the Croatian Qualification Framework), and in subsections 6.1.1, 6.1.2 and 6.1.3 individual explanations of each proposed measure are given.

Table 4 List of all measures for vocational education (levels 3., 4. and 5. according to the Croatian Qualification Framework)

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| SM-1 | Training and preparation of teachers for the introduction of new curricula for and modular teaching through the modernization of vocational education |
| SM-2 | Equipping vocational schools and school practicums |
| SM-3 | Education of qualified and unqualified workers in the field of energy efficiency and renewable energy sources |
| SM-4 | Establish a system for recognizing the initial qualifications of foreign workers |
| SM-5 | Expansion of the Regional Centers of Competence to the construction, geodesy and architecture sector |
| SM-6 | To popularize construction professions among women and young people |
| SM-7 | Significantly encourage the inclusion of adults in educational programs for acquiring green skills |
| SM-8 | Continuously monitor the needs of the labour market with enrollment quotas for professional occupations |
| SM-9 | Creation of a unified publicly available informatizationed register of experts in building construction who have acquired professional certificates and authorizations of all kinds in the field of energy efficiency and renewable energy sources |
| SM-10 | Knowledge and skills assessment tool |
| SM-11 | National construction e-workforce platform |
| SM-12 | Gradual increase in the number of certified workers through green public tenders, conditioning employment of certified experts after a sufficient number of educated workers is available in the market, and implementation of criteria for selecting authorized experts in the system of green public procurement |
| SM-13 | Encourage the implementation of student internships with employers |
| SM-14 | Acknowledgment of time spent in education as work experience for students of three-year occupations |
| SM-15 | Establishment of a system of recognition of non-formal education and its application |
| SM-16 | Obligation of continuous education of VET teachers |
| SM-17 | Upgrade of the certification system of experts in the building industry after completed education or recognition of acquired informal education to meet the market needs for new knowledge, skills and technologies |
| SM-18 | Adapt/create the content of the training program for green jobs in construction |
| SM-19 | Trainer training |

### 6.1.1 Technical measures for vocational education

| | |
|---|---|
| SM-1 | Training and preparation of teachers for the introduction of new curricula and modular teaching through the modernization of vocational education |

The existing curricula are outdated. Most vocational education programs date back to 1994 or even earlier. It is necessary to modernize programs in line with new technologies, materials, methods and trends. *National Recovery and Resilience Plan 2021-2027*[19], among other measures, mentions the measure *C3.1 R1 Structural reform of the education system*, where one of the goals is to enhance the quality and relevance of vocational programs and integrate secondary school programs by investing in in

19 Government of the Republic of Croatia National Recovery and Resilience Plan 2021-2026, July 2021, page 1119. https://planoporavka.gov.hr/UserDocsImages/dokumenti/Plan%20oporavka%20i%20otpornosti%2C%20srpanj%202021..pdf?vel=13435491

market-relevant programs. Simultaneously, the aim is to improve the connection between the labor market and vocational education through the modernization of the system and the development of new curriculum documents with an emphasis on green transition and digitization.

In 2017, the Agency for Vocational Education and Adult Education developed a project titled *"Modernization of the Vocational Education and Training System"*. The project was funded by the European Social Fund, Operational Program Efficient Human Resources 2014-2020. The project's objective was to develop innovative and flexible sectoral and professional curricula based on the needs of the labor market, as well as to strengthen the competencies of educational workers for the introduction and implementation of the curriculum.

The project significantly contributes to the development of vocational education and training, making it attractive, innovative, relevant, inclusive, connected to the labor market, and enabling participants to acquire competencies for personal and professional development, continuing education, and lifelong learning. The project aligns with the priorities and measures of the *Program for the Development of the Vocational Education and Training System Development Program 2016-2020*[20] and the *National Curriculum for Vocational Education*[21].

The main reasons for the modernization of the vocational education and training system were identified as follows: (1) outdated programs - e majority of curricula were developed more than 20 years ago, artistic programs in the early 2000s, and around 20 professional curricula in the last five years; (2) an irrational number and structure of programs - existing programs were not systematically developed, leading to significant overlaps among them; (3) alignment with the labour market - apart from new professional curricula, curricula are not based on learning outcomes, do not reflect the needs of the labor market, and do not allow flexibility in implementation; (4) insufficient representation of work-based learning - although various forms of work-based learning exist in all vocational programs, the proportion was deemed inadequate.

The project focuses on rationalizing the number of curricula, facilitating students' entry into the labor market, enhancing horizontal mobility, supporting professional development, and promoting continuous education. Special attention is given to work-based learning in various forms, in line with the *National Curriculum for Vocational Education*.

In the Construction, Geodesy, and Architecture sector, a total of 31 occupational standards at levels 2-5 were developed according to the Croatian Qualifications Framework. These standards were created by the Agency for Vocational Education and Adult Education, Croatian Employers' Association, Croatian Chamber of Economy, and Pučišća Stonemasonry School. Additionally, vocational curriculum was also developed.

Principles of energy-efficient construction are seamlessly integrated into the curriculum of the entire construction subsector, with a special emphasis on programs such as Architectural Technician, Construction Worker for Sustainable Construction, and Expert in Ecological and Sustainable Construction. This integration is achieved through modules like Building Physics, Energy-Efficient Construction, Sustainable Development in Construction, Materials and Products in Green Construction, Green Construction, Green Construction and Energy Efficiency, Quality Control in Green Construction, Principles and Aspects of Green Construction, Ecologically Sustainable Materials and Resources, Ecologically Sustainable Buildings, and Energy Renovation of Existing Buildings.

20 Ministry of Science and Education: Vocational Education and Training System Development Program 2016-2020.

21 Ministry of Science and Education: National Curriculum for Vocational Education, OG 62/2018

In the sector of Mechanical Engineering, Shipbuilding, and Metallurgy, content related to renewable energy sources and energy efficiency is integrated throughout the curricula in the Mechanical Engineering subsector. This integration is observed in occupation standards such as Renewable Energy Service Technician, Gas Installer, Household Installation Installer, Heating and Air Conditioning Installer, Basics of Renewable Energy, Electrotechnics in the Assembly of Renewable Energy, Solar Thermal Systems, Biomass Systems, Application of Solar Systems, Application of Biomass Systems, Heat Pumps, Application of Heat Pumps, Ecology, Sustainable Development, Production of Electricity from Sun and Wind, Energy of Water and Hydrogen, Biofuels and Biogas, and Alternative Energy Sources.

In the sector of Electrical Engineering and Computer Science, content related to energy efficiency and renewable energy sources is woven into the curricula of the Electrical Engineering subsector through occupation standards such as Electrical Assembler, Electrotechnician, and Electrician. Learning outcomes encompass Renewable Energy in Application, Application of Renewable Energy, Smart Installations, Public Lighting, Processing and Joining Materials in Electrotechnics, and Smart Installation Systems in Use. All occupation standards and qualification standards have been prepared and entered into the *Croatian Qualifications Framework Registry* [22]. Vocational curricula have been developed and are in the final stages of review and editing by the Agency for Vocational Education and Adult Education. They are expected to be submitted to the Ministry of Science and Education for approval by the end of 2024, with implementation anticipated in the academic year 2025./2026. The goal is to gradually leave out old education models and curricula, introducing unified and modernized programs in all high schools through modular teaching and work-based learning.

During the development of curriculum documents, occupation standards and qualification standards were utilized, crafted in accordance with the guidelines and directives of the Croatian Qualifications Framework. This approach aims to ensure the quality of vocational education in a manner that allows all students, regardless of the vocational institution they attend, to acquire relevant and mutually comparable competencies necessary for professional and personal development. These competencies encompass employability and entrepreneurship, active and responsible citizenship, and lifelong learning.

The introduction of these innovations, or modernization, requires trained and skilled teachers with a different approach to teaching. The Agency for Vocational Education and Adult Education conducts training in methodology and implementation methods to enable teachers to adapt to these changes. There is a need for ongoing training in the areas of energy efficiency and renewable energy, new technologies and materials, sustainability, green construction, and adaptation to climate change.

| SM - 2 | Equipping vocational schools and school practicums |
|---|---|

Employers mention that students lack sufficient practical knowledge and are not familiar enough with new technologies upon completing high school. This is a result of outdated curricula and teaching methods, as well as insufficient dedication from mentors to guide students during practical training in the work process. Students in three-year vocational professions have between 600 to 900 hours of practical training per year. The majority of these hours are completed at employers' workplaces, where they have assigned mentors. In school practicums, a portion of practical training is conducted under the supervision of professional teachers. This lack of practical knowledge could be compensated by implementing high-quality practical training in controlled conditions under the

22 http://www.kvalifikacije.hr/hr/registar-hko

supervision of professional teachers in school practicums. Additionally, despite the prescribed *Pedagogical standard*[23], the equipment of high schools and practicums is not consistent across all schools and varies significantly from one school to another. Some schools have acquired additional equipment through projects or other sources of funding. By equipping school practicums uniformly, equal conditions for conducting practical education and learning new technologies on modern devices would be ensured.

| SM-3 | Education of qualified and unqualified workers in the field of energy efficiency and renewable energy sources |
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An analysis of the current situation in the construction sector[24] revealed little interest among existing qualified workers and their employers in additional education in the field of energy-efficient construction and renewable energy sources. The reason is twofold: the lack of time and motivation from the side of the workers, and the cost of education and the lack of qualified workers from the side of the employers. The measure could be implemented in a way that schools (education centres), in partnership with manufacturers of equipment and materials, conduct training for qualified and unqualified workers in the field of green construction, sustainability, energy efficiency, renewable energy sources in a time adapted to the student. A worker who undergoes training would receive a license, and his company would receive points that could give an advantage on tendering. The CROSKILLS[25] project was a good start to such training, well received by all participants, but in the meantime, the volume of work grew so much that employers no longer had time to send workers to training, there was a large shortage of manpower, and through public procurement procedures companies with educated workers did not have an advantage.

To meet the rapidly growing need for labor, the import of foreign workers, mostly unskilled, increased. Foreign employees who come from the countries of the region (Bosnia and Herzegovina, Kosovo, Macedonia, Serbia) or from distant Asian countries (Nepal, India, Philippines) often do not have enough professional knowledge and experience. 23.1% of the respondents among the contractors pointed out the inexperienced workforce as a significant obstacle when cooperating with foreign employees[26]. A special problem related to training is the language barrier. If the training programs are in a different language than the one the employees know, it prevents them from attending and participating in the training. This barrier is becoming more and more important because more and more foreign employees from other speaking areas are coming to work in Croatia and cannot be expected to learn the language. As a rule, employers communicate with these employees in English. Education programs should also be written in English, and part of the trainers and lecturers must know English at a level at which it is possible to transfer knowledge to the listeners.

The existing education system has already been established and is described in detail in the regulations for the certification of RES system installers and construction workers who perform tasks related to improving the energy efficiency of buildings

23 Croatian Parliament: State Pedagogical Standard of the Secondary Education System, NN 63/2008

24 Banjad et al : "BUILD UP Skills - Croatia - Updated and upgraded National Status Quo Analysis : Current state of construction in Croatia", 2023, ISBN: 978-953-8168-65-9, DOI: 10.5592/BO/978-953-8168-65-9, https://croskills-reload.grad.hr/wp-content / uploads/2023/02/Status-Quo-Analiza-ENG,-finalno.pdf

25 Ministry of Construction and Spatial Planning: Analysis of existing educational and study programs in the context of green jobs, 2022.

26 Banjad et al : "BUILD UP Skills - Croatia - Updated and upgraded National Status Quo Analysis : Current state of construction in Croatia", 2023, ISBN: 978-953-8168-65-9, DOI: 10.5592/BO/978-953-8168-65-9, https://croskills-reload.grad.hr/wp-content / uploads/2023/02/Status-Quo-Analiza-ENG,-finalno.pdf

(OG 67/2017, OG 56/15, OG 12/17, OG 12/17, OG 12/17 [27]). It is necessary to redefine the key skills that are of exceptional importance in the education of workers in the field of energy efficiency, renewable energy sources, the application of new technologies and materials, green construction and sustainability and circularity in construction, and further expand so that education can be covered by the voucher system in the future. A voucher system, along with quality programs, can attract the interest of participants and employers and ultimately alleviate the lack of skilled workers.

| SM - 4 | Establish a system for recognizing the initial qualifications of foreign workers |
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One of the immense problems of the construction sector is the lack of manpower. At the administrative level, the import of foreign workforce was facilitated to meet the rapidly growing need for labor, but increasing quotas and speeding up the process did not solve the problem of unskilled workers. Data obtained from employment agencies show that foreign workers submit only the necessary certificates, and the pre-selection process in terms of knowledge/skills and qualifications is most often not carried out. Very often, certificates do not correspond to real knowledge.

It is necessary to check the initial qualifications, knowledge and skills of foreign workers. This way, employers would have a clearer picture of the knowledge and skills of workers before coming to Croatia, their way of working and familiarity with materials. The existing legal framework related to the employment of foreigners does not correspond to the current needs of the construction sector for foreign labor. It is necessary to shorten lengthy administrative procedures and establish better coordination between institutions to facilitate the employment of foreign employees and their training.

| SM - 5 | Expansion of the Regional Centers of Competence to the construction sector, geodesy and architecture |
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In Croatia, there are 25 Regional Centers of Competence being established in the sectors of mechanical engineering, electrical engineering, tourism, and agriculture. The Ministry of Science and Education has appointed selected high schools as competence centers. Their goal is to promote vocational education, provide professional development for teachers, establish collaboration with economic entities, develop new innovative programs, modernize existing ones, and equip facilities with the latest equipment and technologies. They are financed by the European Social Fund. In the future, they are expected to become self-sustainable or to be under the jurisdiction of the founders (counties and cities). In the next cycle, there should be an expansion into the construction, geodesy, and architecture sector, as outlined in the *National Plan for the Development of the Vocational Education and Training System 2021-2027*[28]. This would create spaces for the education of students, workers, and teachers - a collaborative environment for schools, colleges, universities, construction material manufacturers, construction companies, and other interested parties.

27 Ministry of Construction and Spatial Planning, "Regulation on conditions and criteria for determining the quality system of services and works for the certification of installers of renewable energy sources - photovoltaic systems (Official Gazette 56/15)." 2015
Ministry of Construction and Spatial Planning, "Regulation on conditions and criteria for determining the quality system of services and works for the certification of installers of renewable energy sources - solar thermal systems (Official Gazette 33/15, 56/15, 12/17)." in 2017
Ministry of Construction and Spatial Planning, "Regulation on conditions and standards for determining the quality system of services and works for the certification of installers of renewable energy sources - smaller boilers and biomass stoves (Official Gazette 39/15, 56/15, 12/17)." in 2017
Ministry of Construction and Spatial Planning, "Regulation on conditions and standards for determining the quality system of services and works for the certification of installers of renewable energy sources - shallow geothermal systems and heat pumps (Official Gazette 56/15, 12/17)." in 2017
Ministry of Construction and Spatial Planning, " Ordinance on the training and certification scheme for building workers who incorporate building parts that have an impact on energy efficiency in the buildings sector (Official Gazette 67/2017)." in 2017

28 Ministry of Science and Education: National Education System Development Plan for the period up to 2027, 2023.

Regional Centers of Competence or Excellence would offer interested parties the opportunity to work with the latest equipment and modern materials in line with new technologies. Each region in Croatia should have one Regional Center of Competence for the easier, faster, and more cost-effective organization of education and practical training.

| SM-6 | To popularize construction professions among women and young people |
|---|---|

For a long time, there has been insufficient student interest in three-year professional occupations due to the unattractiveness of construction jobs among young population. One of the biggest challenges is to interest young people when deciding on a secondary education, because they avoid occupations such as bricklayers, facade workers, carpenters, etc. Young people shy away from construction jobs due to the prevailing opinion that these are ordinary physical jobs that anyone can do and that are not valued. The result is that these programs in secondary vocational schools often do not meet the enrolment quotas [29]. In some construction schools, some offered programs have zero interested enrolled students (example: insulator, rebar maker, carpenter, bricklayer), which causes a mismatch with the needs of the labor market. This problem is somewhat less pronounced in mechanical and electrical engineering professions. To increase the popularity of such programs in secondary education, a scholarship system was established by Cities, Counties, Chambers of Crafts, the Ministry of Economy and employers. Scholarships are certainly a good measure and help in the promotion of deficit professions. In addition, some counties implement high-quality enrolment campaigns (e.g. Karlovac County covers the entire cost of education and a stipend of EUR 130 for each enrolled mason and carpenter in the County) and encourage enrolment in deficit occupations with enrolment quotas. All incentive measures should have a large and comprehensive support of public bodies. Such measures would be enforceable in all counties and cover all interested students. The Agency for Vocational Education and Adult Education leads a very extensive promotion of vocational occupations through the *Worldskills Croatia* student competition in knowledge and skills. The campaign covers all professions, gives importance to women and girls in traditionally men's professions, shows the most beautiful sides of professions through attractive videos and enables the best students to continue competing in international competitions. Still, there is a need to promote the profession through all media with the support of construction companies and well-known influencers. To promote the construction profession and vocational education, it is necessary to think and act outside the box. Therefore, the idea of creating a television show (along the lines of culinary competitions) would increase the popularity of the entire construction industry and education. A comprehensive and broad promotional campaign is needed to change the awareness about the jobs of construction workers.

| SM-7 | Significantly encourage the inclusion of adults in educational programs for acquiring green skills |
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Through the *National Development Strategy of the Republic of Croatia until 2030*[30], five thematic areas have been defined that include priority areas of education policy, among which are vocational education and training and adult education. According to the data of the Croatian Employment Service, Croatia has one of the lowest participation rates in adult education programs in the EU, especially among the low-skilled, elderly, rural and long-term unemployed population. According to the data of the Agency for Vocational and Adult Education, the three main obstacles to the participation of adults in lifelong education are the high cost of the program, other personal priorities and professional obligations.

29 e-rudnik of the Ministry of Science and Education: https://mzo.gov.hr/ser-skolski-e-rudnik-3419/3419

30 Croatian Parliament, National Development Strategy of the Republic of Croatia until 2030, OG 13/2021

The two main goals of adult education arising from *the Education, Science and Technology Strategy*[31] are the acquisition of transversal competencies and the acquisition of knowledge and skills that enable employability and mobility on the labor market. Adult education will be one of the key elements contributing to the ultimate goal of increasing knowledge and skills in the context of green jobs related to the post-earthquake reconstruction process. The development of formal programs of training, improvement and retraining results from continuous monitoring of the needs of the labor market, especially in the case of informal programs. Adult education covers levels 2 to 5 of the Croatian Qualification Framework, and includes people aged 14 and over. The Croatian qualification framework and the new methodology for creating programs for the acquisition of micro-qualifications and partial qualifications further strengthened the connection between the labor market and education and enabled a more flexible response to the needs of the labor market. *An updated and supplemented national analysis of the current state of construction in the Republic of Croatia*[32] it was observed that data from the Croatian Employment Service show a drastic drop in the number of participants in the adult education program Construction and Technology in the period 2018-2022. Most likely, this is a consequence of the coronavirus pandemic and the introduction of the voucher system from 2022.

From April 2022, in addition to standard education through the public procurement procedure, the Croatian Employment Service will start providing education through vouchers for green and digital skills. Vouchers can be obtained by all employed or unemployed people. The minimum number of hours of education is 50. This has led to the expansion of the offer of programs for voucher users, especially regarding the acquisition of green skills.

Interesting examples of micro-qualifications (in the register of CQF[33]) are: manufacturer and fitter of aluminum and PVC carpentry, fitter of home installations, service fitter of renewable energy sources, specialist in mechanical installations in construction, fitter of heating and air conditioning. In the electrical engineering sector, interesting examples of qualification standards (micro-qualification) in the analysis are: electrical fitter, electrician, installer of photovoltaic systems, specialist in sustainable energy systems, specialist in advanced building management.

The upgrading of micro-qualifications for green skills, especially the greater inclusion of schools that offer of micro-qualifications in the field of green and sustainable construction, would lead to an increase in the interest of unemployed people in this area. It is necessary to raise awareness of the importance of lifelong education, especially in the direction of energy-efficient technologies, green construction, sustainability and circularity. The mentioned measure would be implemented through media campaigns aimed at employers and other and target groups, for example the unemployed. The Agency for Vocational and Adult Education conducts media campaigns, but this is not enough. Voucher system proved to be a very good measure that should be more widely extended to the construction sector (more vouchers were distributed in the field of mechanical engineering and electrical engineering), especially among unemployed people.

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| SM-8 | Continuously monitor the needs of the labor market with enrolment quotas for professional occupations |

31 Ministry of Science, Education and Sports: Education, Science and Technology Strategies, 2014 https://vlada.gov.hr/UserDocsImages//2016/Glavno%20tajni%C5%A1tvo/Materijali%20za%20istaknuto/2014/Srategija%20obrazovanja %20sciences%20and%20technology//Cjelovit%20sadr%C5%BEaj%20Education%20Strategies,%20science%20and%20technology.pdf

32 Banjad et al : "BUILD UP Skills - Croatia - Updated and upgraded National Status Quo Analysis : Current state of construction in Croatia", 2023, ISBN: 978-953-8168-65-9, DOI: 10.5592/BO/978-953-8168-65-9, https://croskills-reload.grad.hr/wp-content / uploads/2023/02/Status-Quo-Analiza-ENG,-finalno.pdf

33 http://www.kvalifikacije.hr/hr/registar-hko

The legal acts that regulate the implementation of vocational education, namely the *Vocational Education Act*[34] and the *Trades Act*[35] (for programs to acquire qualifications for related trades, the so-called "craft" professions), prescribe the planning of student enrolment in the first grades, among other things, based on needs of the economy. The *Law on Vocational Education* (Official Gazette 30/09) states: "*The number of students enrolled in the first grade by a vocational education institution is planned in accordance with the number of students completing primary education, the institution's personnel and spatial capabilities, the needs of the economy, and available places for practical education.*" In amendments to the *Law on Vocational Education* (Official Gazette 69/22), the following is added: "*In Article 20, paragraph 2, the words 'practical part of education' are replaced with the words 'work-based learning and recommendations of the Croatian Employment Service for educational enrolment policy and scholarship policy.'*"

The analysis and forecast of labor market needs for specific professions are conducted based on statistical data and relative indicators of employment of unemployed individuals according to the educational program they have completed, data on the shortage of workers in specific professions obtained through employer surveys, and qualitative impressions of advisors gained from employment mediation experience.

Based on the relative position of specific professions in the previous period, a future forecast is developed. Additionally, strategies and plans for economic development or development of specific sectors at the national, regional, and local levels are taken into account as well. Recommendations regarding the increase or decrease in the number of enrolled students in specific educational programs are then made based on the forecasted position of specific professions in the labor market.

The problem is that although the recommendations are clear and direct, unfortunately, they have a qualitative character. There is a recommendation for an increase or decrease in the number of enrolled and sponsored students in specific educational programs, but it is not quantitatively determined.

On the other hand, since recommendations are made and sent every year, the repeated appearance of specific educational programs should be given increasing importance and considered more seriously when making decisions. Changes in educational enrolment policy and scholarship policy based on the recommendations of the Croatian Employment Service would contribute to aligning education with the needs of the labor market, reducing structural mismatch between labor supply and demand, which is one of the main long-term problems of the Croatian labor market.

Furthermore, in the segment of vocational education covering education programs not related to the system of associated crafts, there is no mechanism for monitoring the needs of the economy and the number of available places for practical education, or work-based learning in the economy.

To ensure monitoring of labor market needs in the process of planning student enrolments, existing positive practices should be applied. In the other segment of vocational education that does not relate to education programs for so-called associated crafts, an institution should be designated to verify the conditions that economic entities must meet to receive students for practical training, as prescribed by the *Act on Trades*[36] and the *Ordinance on the Method and Conduct of Teaching in Vocational Schools*[37]. This institution would also keep records of available places for practical education (similar to the role played by the Croatian Chamber of Crafts for education programs related to associated trades).

34 Law on Vocational Education, Official Gazette 30/09, 24/10, 22/13, 25/18, 69/22

35 Trades Act, Officical Gazette 143/13, 127/19, 41/20

36 Trades Act, Officical Gazette 143/13, 127/19, 41/20

37 Ministry of Science, Education and Sports: Rulebook on the method and conduct of teaching in vocational schools, OG 140/2009, OG 130/2020

| SM-9 | Creation of a unified publicly available informatized register of experts in building construction who have acquired professional certificates and authorizations of all kinds in the field of energy efficiency and renewable energy sources |
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The Ministry of Physical Planning, Construction and State Assets maintains the register of authorized persons who carry out spatial planning and construction work[38], while professional chambers regularly maintain a directory of authorized engineers, work managers and records of technicians of a particular profession in the building sector. The establishment and maintenance of registers of experts who install parts of buildings that affect energy efficiency in buildings and installers of renewable energy sources is determined by the *Ordinance on the Education and Certification System for Construction Workers involved in the installation of building components affecting the energy efficiency of buildings*[39] and by four ordinances on requirements and criteria for the establishment of a quality system for the certification of installers of renewable energy sources - photovoltaic systems[40], solar thermal systems[41], small boilers and biomass heating systems[42], and shallow geothermal systems and heat pumps[43]; these ordinances also define the registers of holders of training programs for certification. The same ministry is responsible for keeping the aforementioned registers of construction workers and installers, but currently only the register of installers of photovoltaic systems is in operation. The remaining registers should be fully organized as soon as possible, but before this the implementation of the training of certain types of experts should be conducted – that is, the measure SM-17 should start with implementation. In addition to these registers, there is also a register of craft masters' diplomas maintained by the Croatian Chamber of Trades and Crafts based on the subject matter ordinance[44], being the craft masters' professions[45] such as electrician, facade fitter, heating and air conditioning installer, roofer, etc. important for building construction. The same chamber also keeps records of persons who have passed professional qualification exams, where important professions[46] for building construction are insulators, ceramists, etc. In addition to all of the above, there is also a database of the Crafts and Trades Register[47], which is managed by the Ministry of Economy and Sustainable Development – Croatian Chamber of Trades and Crafts in accordance with the subject matter ordinance[48], and there is also the Register of

38 Ministry of Construction and Spatial Planning: Regulations on professional development of persons who perform Physical Planningand construction tasks (Official Gazette 55/2020)", 2020., https://narodne-novine.nn.hr/clanci/sluzbeni/2020_05_55_1100.html

39 Ministry of Construction and Spatial Planning, " Ordinance on the training and certification scheme for building workers who incorporate building parts that have an impact on energy efficiency in the buildings sector (Official Gazette 67/2017)., 2017., https://narodne-novine.nn.hr/clanci/sluzbeni/2017_07_67_1578.html

40 Ministry of Construction and Spatial Planning „Ordinance on requirements and criteria for establishing a quality system for services and works for certification of installers of renewable energy sources - photovoltaic systems (OG 56/2015)", 2015., https://narodne-novine.nn.hr/clanci/sluzbeni/2015_05_56_1105.html

41 Ministry of Construction and Spatial Planning" Ordinance on requirements and criteria for establishing a quality system for services and works for certification of installers of renewable energy sources - solar thermal systems (OG 33/2015, 56/2015, 12/2017)", 2017., https://narodne-novine.nn.hr/clanci/sluzbeni/2015_03_33_686.html, https://narodne-novine.nn.hr/clanci/sluzbeni/2015_05_56_1107.html, https://narodne-novine.nn.hr/clanci/sluzbeni/2017_02_12_304.html

42 "Ordinance on requirements and criteria for establishing a quality system for services and works for certification of installers of renewable energy sources - smaller boilers and biomass stoves (Official Gazette 39/2015, 56/2015, 12/2017)", 2017., https://narodne-novine.nn.hr/clanci/sluzbeni/2015_04_39_813.html, https://narodne-novine.nn.hr/clanci/sluzbeni/2015_05_56_1108.html, https://narodne-novine.nn.hr/clanci/sluzbeni/2017_02_12_303.html

43 "Ordinance on requirements and criteria for establishing a quality system for services and works for certification of installers of renewable energy sources - shallow geothermal systems and heat pumps (Official Gazette 56/2015, 12/2017)", 2017., https://narodne-novine.nn.hr/clanci/sluzbeni/2015_05_56_1106.html, https://narodne-novine.nn.hr/clanci/sluzbeni/2017_02_12_305.html

44 "Regulations on the procedure and method of taking the master's exam and the exam on professional qualification (Official Gazette 88/2002)", 2022., https://narodne-novine.nn.hr/clanci/sluzbeni/2002_07_88_1466.html

45 Croatian Chamber of Crafts - master's exam and titles: https://www.hok.hr/obrazovanje/majstorski-ispit

46 Croatian Chamber of Crafts - simpler occupations: https://www.hok.hr/obrazovanje/ispit-o-strucnoj-osposobljenosti

47 Trade Register, Ministry of Economy and Sustainable Development, https://pretrazivac-obrta.gov.hr

48 "Regulations on the form and manner of keeping the trade register (Official Gazette 58/2009)", 2009., https://narodne-novine.nn.hr/clanci/sluzbeni/2009_05_58_1364.html

craft companies in construction sector and related activities[49], which is managed by the Zagreb Chamber of Trades and Crafts on its own initiative. Some professional associations keep their own records of experts in building construction.

In order to achieve the 2030 goals, it is necessary to enable efficient and informatized access to the data of all trained and certified experts of all types in the field of energy efficiency and renewable energy sources, and this is only possible by unifying or linking the above-mentioned registers and records into one unified, publicly available register of experts in the building sector. This measure does not prejudge the form of the final solution of such a register, which can be a completely new register only for the purpose of building construction or an IT-interconnected set of existing registers in the building sector. An important component of the final solution will be the methodological and IT upgrade of the existing registers with a unifying "hub" or the unified register itself, which in that case will be the central place through which all stakeholders in the field of building construction could enter information about certified experts. The unified solution (which can also be a hybrid one) should enable access and insight into data for both public and private clients, as well as contractors in search of certified workforce, and it could also contain records of continuous training of certified experts. Recommendations for unifying the existing registers are as follows:

- Fill the existing registers with missing data as soon as possible in order to create a basic database of all required certificates.
- Conduct an analysis of the current situation of existing registers and establish a unified solution, together with data entry and data exchange methods.
- In the process of unifying the registers, include manufacturers of equipment and materials that issue their own certificates, as well as all professional chambers and associations that keep their own records, so this measure will cover all stakeholders and all experts.
- The unified register of experts should be available in the form of a database to the future National construction e-workforce platform through the constant exchange of data (see measure SM-11).

The end users of this register would be all interested stakeholders and users from the building sector, as the register should be publicly available.

| SM-10 | Knowledge and skills assessment tool |
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Since there is no solution for self-assessment of knowledge and skills in the building sector in Croatia, it would be useful to develop an IT online tool for assessing knowledge and skills (hereinafter: the Tool). The primary users of the Tool would be workers in the building sector of all professions and all levels of education (including university level), but also other workers who want to retrain, for example, to move from a sector closely related to fossil fuels to a green sector.

The tool could contain numerous interactive modules with which the users – by answering questions, solving given problems and performing a self-assessment – will receive feedback or evaluation of their knowledge and skills, and in this way will be able to compare their current expertise in relation to specific requirements in the field of energy efficiency and renewable energy sources. In addition, the Tool would be able to propose the type of training, the certification needed and provide information about the holders of the professional qualification training and certification program, all this based on the performed evaluation and the expressed interest of users. In this sense, the Tool could be integrated into the process of recognition of prior learning, that is, into the future system of recognition of non-formal education. One of the IT online solutions on which the development of the Tool could be based

49 Register of craftsmen in construction and related activities, Chamber of Crafts of Zagreb County, https://okz.hr/registar-obrtnika-gra%C4%91evinskih-srodnih-djelatnosti

has already been developed during the implementation of the REACT project[50] in Croatia.

In order for this concept to work, information on all existing certificates and learning outcomes for a particular certificate should be available to the Tool in the form of a database, ie through constant data exchange (see relevant measures SM-9 and SM-17). The Tool would have to be developed in cooperation with stakeholders who have the possibility to officially confirm the outcome of the training and who perform trainings and educations and who would significantly contribute to the content of the Tool with their knowledge. These stakeholders are, for example, secondary vocational schools, colleges, open public universities, professional associations of experts that organize and/or conduct education (e.g. professional chambers), etc. Manufacturers of materials and solutions could also be involved in the development of the Tool due in order to incorporate the latest information on new technologies in the modules' contents.

In addition to the Croatian language, the Tool should also be available in English, so that foreign workers who want to work or are already working in Croatia could also use it. Information from various employment agencies indicate that foreign workers looking for a job in Croatia submit only the most necessary certificates and that there is practically no pre-selection procedure before employment, that is, no knowledge and skills verification procedure is carried out. That is why the Tool could be used as the first step of the pre-selection process, that is, as an entrance test for foreign workers.

The end users of this tool would be: higher education institutions that are a source of future "white-collar" specialists in the construction sector, secondary vocational schools that are a source of future "blue-collar" specialists in the construction sector, institutions and centers for lifelong and adult education, associations of workers of all professions in building sector ("blue-collar" professional associations), professional associations in building sector and professional chambers ("white-collar" professional associations), public authorities – national agencies, public services (e.g. Agency for Vocational Education and Training and Adult Education), contractors in the building sector (companies, SMEs and craft companies), "blue-collar" experts, "white-collar" experts – engineers and specialists, "white-collar" experts – design engineers, manufacturers of materials, equipment and solutions, other workers from the field of construction.

| SM-11 | National construction e-workforce platform |
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The building sector in the Republic of Croatia falls under the domain of various stakeholders from public authorities, from ministries and government bodies to agencies, bureaus and institutions. In order to unify the field of building sector in one place and connect as many stakeholders as possible, this measure proposes the establishment of a single access point – the *National construction e-workforce platform* (hereinafter: the Platform). The Platform should be a central point through which all interested parties (public authorities, clients, contractors, natural persons) could gain access to:

- all stakeholders and information in the field of certification, issuing of licences and certificates of professional qualification (see measure SM-17),
- unified register of experts in building sector (see measure SM-9),
- knowledge and skills assessment tool (see measure SM-10),
- information on the workforce in the building sector.

In addition, the Platform could contain, in one place, a structured overview and links from the field of construction and building sector to all relevant stakeholders,

50 Project REACT, https://rea-sjever.hr/projekti/react/

regulations and information from the field of regulation, trainings, lifelong and adult education and news in the construction industry, as well as to various associations, taking into account as much as possible what is detected in the prepared *Updated and upgraded National Status Quo Analysis: Current state of construction in Croatia*[51].

Some of the main functionalities of the Platform could be enabling insight into the status of registered (qualified and unqualified) persons at the Croatian Employment Service who are available for the work in the building sector and enabling the insight into the professional qualification of unemployed and employed experts in the field of energy efficiency and renewable energy sources. These functionalities would enable all interested parties to plan policies more efficiently, order and execute construction works for the public and private sector, and official insight into the verification of the capacity and expertise of companies, craft companies and the workforce.

Since there is a need to introduce a mandatory criterion of qualitative selection into public procurement procedures for co-financed projects, according to which those public bidders that can prove they have a certified labour force will have an advantage when bidding for works, the Platform could represent the official channel for the verification of bidders in the procedures of bids evaluation, by accessing the unified register of experts. One of such proposals was that contracts with public beneficiaries of grants could contain a provision according to which the beneficiary of grant (a public contractor of works) should use a qualitative selection criterion type, such as "professional qualification in the field", in the procurement documentation, applicable not only to engineers ("white collars") but also on other experts of the bidder ("blue collars") and that this criterion would amount to a minimum of 10% of all points.

Taking into account all of the above, the Platform would significantly contribute to the credibility of the building sector and industry, increase the need and motivation of employers to invest more resources in the education and certification of their employees, and all together would increase the quality of future works in the building sector.

The end users of the Platform would be: public authorities - ministries, national agencies, public services (e.g. Agency for Vocational Education and Training and Adult Education, Croatian Employment Service), public procurers (local and regional governments, public institutions), contractors in the building sector (companies, SMEs and crafts companies), higher education institutions that are a source of future "white-collar" specialists in the building sector, secondary vocational schools that are a source of future "blue-collar" specialists in the building sector, institutions and centers for lifelong and adult education, professional building associations and chambers ("white-collar" professional associations), "blue-collar" experts, "white-collar" experts – engineers and specialists, "white-collar" experts – design engineers, manufacturers of materials, equipment and solutions, private and public investors, energy service providers, energy agencies.

### 6.1.2 Legal measures for vocational education

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| SM-12 | Implement criteria for selecting authorized experts and workers in the green public procurement system at the moment when a sufficient number of educated workers and experts appear on the market |

Considering the stated goals for 2030 related to energy efficiency, the question of the efficiency of spending public funds through public procurement in construction and, consequently, the effect of spending of mentioned funds has on the contribution to energy efficiency goals logically arises. In this sense, there is a need to set certain goals or obligations in public procurement, as a contribution to energy effi-

51 Project CRO skills RELOAD, „Status Quo Analysis", 2023., https://croskills-reload.grad.hr

ciency goals. In this regard, it is possible to demand technically measurable results during public procurement for the renovation of publicly owned buildings, but also when allocating funds for energy renovation of privately owned buildings and family houses. For example, one possible way of implementing green public procurement would be the introduction of expert/technical verification of the performed works in terms of achieving energy efficiency goals, for example by "blower-door" test or thermography. It would be possible to pay part of the public funds through public procurement to the contractor only after the performed works have passed independent testing, that is, if inadmissible deviations are determined, after the deficiencies due to which the targeted results were not achieved have been removed. In this way, contractors participating in (green) public procurement would be encouraged to systematically educate their workers.

In the existing public procurement system, it is usual for the selection criteria to refer to engineers and designers, but the selection criteria for professional workers (e.g. authorized installers) are not used in public procurement procedures.

**Without workforce certification requirements, additional education does not provide marketable advantages.** As a result, business owners and artisans refrain from sending their workers for training, resulting in reduced interest in such educational opportunities. The public sector should use certified labor in the renovation of existing public buildings. The fundamental challenge in the public sector is highlighting the advantages of hiring certified workers and ensuring quality construction when public tenders are announced. Most public procurement decisions are primarily based on purchase price, often ignoring overall life cycle costs and the quality of the products used. Public authorities have the potential to stimulate changes in the market, directing it towards the production of sustainable products and services, reducing the negative impact on the environment by limiting the consumption of resources in production processes, and aligning with socially responsible practices.

Since part of building renovation, including seismic and energy renovation, is financed with public funds, it is necessary to introduce a scoring system in the public procurement process with additional points for contractors who employ qualified labor or support (finance) the education of their employees. This would encourage the employment of qualified workers and accelerate the professional training of the construction workforce.

A wider scope of workforce certification could be accessed through previously defined internal certification processes at the level of companies or trades. Also, it is necessary to establish a system of checking the basic knowledge of workers from third countries for whom a work permit is issued to work in construction.

As one of the measures, the use of certified workforce in public procurement was proposed. "Energy-efficient" public procurement will enable the faster entry of certified construction workers into renovation work, and it is expected that the employment of certified construction workers will take place on a wider level over time.

This legal measure was proposed in the initial CROSKILLS project and was additionally emphasized in the document "*Analysis of existing educational and study programs in the context of green jobs*"[52] of the Ministry of Physical Planning, Construction and State Assets. **Given that a significant part of the funds for reconstruction comes from EU funds, it is suggested that this measure becomes incorporated at the EU level.**

| SM-13 | Encourage the implementation of student internships with employers |
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In three-year vocational programs, students have between 500 and 900 hours of practical training per year. Only a smaller portion of these hours can take place in

52 Ministry of Construction and Physical Planning: Analysis of existing educational and study programs in the context of green jobs, 2022.

the school workshop, primarily in lower grades. Practical training is regulated by an apprenticeship contract or a practical training implementation contract signed by the employer, parent, and school. The contract outlines the rights and obligations of all signatories. Employers who take students for practical training have significant responsibilities and face the challenge of supervising a child, sometimes under the age of 15, as first-year students embark on practical training. It often happens that employers decline to take students for practical training due to the significant commitment and the inability to dedicate sufficient quality time to them amid their workload. Contracts are typically established with employers who have a tradition of good collaboration with the school and depend on the school's efforts to maintain those positive relationships. The government should encourage employers to take apprentices for practical training through legislative measures. Such measures would place students in a better position to find a suitable employer for practical training. Employers would be more motivated to take on apprentices and provide them with better attention. Although each student has an assigned mentor, this is often impractical due to a shortage of personnel and workload constraints. A practical training supervisor appointed by the school would have more effective mechanisms for overseeing the implementation of practical training in the work process. In some cities, especially smaller ones, the lack of licensed employers makes it impossible for students to enrol in vocational programs for in-demand occupations, even if the school meets the training requirements for those occupations.

| SM-14 | Acknowledgment of time spent in education as work experience for students of three-year occupations |
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In the Republic of Croatia, students who enrol in three-year occupations and complete up to 900 hours of practical training or professional internships annually do not have these hours recognized in their work experience. Each year, schools send forms to the Ministry of Science and Education containing a list of students, personal identification numbers (OIB), and the number of hours (converted into workdays) of practical training with employers. The Ministry is obliged to pay contributions for pension and health insurance based on these reports. Recognizing practical training in work experience, or at least practical training with employers, would further encourage students to enrol in these occupations with labor shortages.

The Bavarian education model in skilled trades, as well as some other European countries, acknowledges experience from the first year of education. This underscores the importance of practical experience, fostering student motivation. Considering the physically demanding jobs in the construction sector, the possibility of early retirement has a significant impact on workers. These are often the years when construction workers frequently miss work due to health reasons. Introducing such a model in Croatia would additionally stimulate students' interest in choosing construction-related occupations.

| SM-15 | Establishment of a system of recognition of non-formal education and its application |
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In 2018, the National Council for the Development of Human Resources adopted *Recommendations for the strategic development of recognition and evaluation of prior learning*[53]. Recommendations have been included in the new *Adult Education Act*[54] and soon a Rulebook will be adopted that will describe the way of external evaluation of sets of learning outcomes and enable the recognition of informally and informally acquired knowledge and skills.

53 National Council for the Development of Human Potential: Recommendations for the strategic development of recognition and evaluation of prior learning, 2018, Zagreb

54 Adult Education Act, Croatian Parliament, NN 144/2021

*The Act on Adult Education* aims to make the adult education system functional by enabling flexibility, but also to ensure the quality of programs for the labor market, which will enable greater participation in lifelong education programs. In this way, significant strategic goals defined in *the Strategy of Education, Science and Technology*[55] will be achieved, which aim to establish a quality assurance system in adult education and process development, and will achieve a system for recognizing informally acquired knowledge and skills, as well as *the Recommendation of the EU Council for the evaluation of informal and informal learning* (2012)[56], which focuses on the development of an evaluation system for such forms of learning and their connection with national qualification frameworks.

| SM-16 | Obligation of continuous education of professional teachers |
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According to the *Regulation on the Advancement of Teachers, Educators, Professional Associates, and Principals in Secondary Schools*[57] and the *Adult Education Act*[58], teachers have the obligation of continuous professional development. This is particularly important for teachers of vocational subjects and instructors in school practicums who need to keep up with new knowledge about materials and technologies. Professional development is left to the will of the teacher and the financial capabilities of the school, with no sanctions for teachers who do not undergo professional development or for schools that do not encourage teachers to enrol the trainings. The Agency for Vocational Education and Adult Education organizes training programs such as "*Teachers in Enterprises - Practice for Teachers*" for vocational teachers during school holidays, as well as regular training sessions for professional teams. The measure of the obligation for continuous professional development should compel teachers to undergo training through scoring and licensing, not just for career advancement. Additionally, 74% of respondents working in adult education believe that trainers are not qualified or need additional training. When asked about the number of schools with qualified trainers for adult education in the construction sector, it was mentioned that there are a total of 30 qualified trainers (23 secondary vocational schools provide adult education)[59]. This highlights the need for additional education for teachers and future trainers in the field of energy efficiency, sustainability, deep renovation, digitalization, and the use of renewable energy systems.

| SM-17 | Upgrade of the certification system of experts in the building industry after completed education or recognition of acquired informal education to meet the market needs for new knowledge, skills and technologies |
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The system of training and certification of experts in building sector in the Croatian legal system is mainly defined through five related ordinances: *Ordinance on the Education and Certification System for Construction Workers involved in the installation of building components affecting the energy efficiency of buildings*[60] and by four

55 Ministry of Science, Education and Sports: Education, Science and Technology Strategies, 2014 https://vlada.gov.hr/UserDocsImages//2016/Glavno%20tajni%C5%A1tvo/Materijali%20za%20istaknuto/2014/Srategija%20obrazovanja %20sciences%20and%20technology//Cjelovit%20sadr%C5%BEaj%20Education%20Strategies,%20science%20and%20technology.pdf

56 Recommendation of the Council on the Validation of Non-Formal and Informal Learning of 20 December 2012 (2012/C 398/01, https://www.cedefop.europa.eu/files/Council_Recommendation_on_the_validation_20_December_2012.pdf

57 Ministry of Science and Education: Rulebook on the promotion of teachers, teachers, professional associates and principals in secondary schools, Official Gazette 68/19, 60/20, 32/21

58 Law on Vocational Education, Official Gazette 30/09, 24/10, 22/13, 25/18, 69/22

59 Banjad et al : "BUILD UP Skills - Croatia - Updated and upgraded National Status Quo Analysis : Current state of construction in Croatia", 2023, ISBN: 978-953-8168-65-9, DOI: 10.5592/BO/978-953-8168-65-9, https://croskills-reload.grad.hr/wp-content / uploads/2023/02/Status-Quo-Analiza-ENG,-finalno.pdf

60 Ministry of Construction and Spatial Planning: Ordinance on the training and certification scheme for building workers who incorporate building parts that have an impact on energy efficiency in the buildings sector (Official Gazette 67/2017)", 2017., https://narodne-novine.nn.hr/clanci/sluzbeni/2017_07_67_1578.html

ordinances on requirements and criteria for the establishment of a quality system for the certification of installers of renewable energy sources - photovoltaic systems[61], solar thermal systems[62], small boilers and biomass heating systems[63], and shallow geothermal systems and heat pumps[64]. These ordinances prescribe the requirements and criteria for certification, the validity period of certificates and the duty of regular professional development at the official holders of the training program. Compared to the system of lifelong training and issuing of licences for architects and design engineers, which fully functions in practice on the basis of the ordinance on professional training[65] and professional qualification exam[66] of persons who perform construction and spatial planning activities and with the help of professional chambers, the certification of other experts in the building sector (such as RES installers) only partially functions in practice. The existing system of training and certification of these experts in the building sector would have to be fully implemented as soon as possible in order to achieve the 2030 goals, because there are already established legal foundations for this through the aforementioned ordinances.

Achieving the 2030 goals is determined at the level of the European Union by the "*Fit for 55*[67]" package, i.e. the *European Green Deal*[68], which foresees a reduction of the European Union's greenhouse gas emissions by 55% by 2030 through the "*European Climate Act*"[69]. That is why the existing certification system, apart from the necessity to be fully activated in practice, needs to be additionally upgraded with new components in accordance with the guidelines of the "*Fit for 55*" package, which are more recent than the last published ordinance for the certification of installers from 2017. This upgrade will be an extension of the aforementioned established certification framework managed by the Ministry of Physical Planning, Construction and State Assets. Additional reasons for upgrading this system are the fact that the existing legal framework related to the work of foreigners and their professional integration does not meet the current needs of the construction sector and that the system for recognizing informal education, acquired through practical work, has not yet been established. Another reason lies in the increasingly frequent need to introduce a mandatory criterion of qualitative selection for the construction and renovation of public sector buildings, according to which those public bidders that can prove they have a certified labour force will have an advantage when bidding for works, which will be especially true for co-financed projects.

The certification system upgrade will enable construction workers to gain recognition of their knowledge, skills and (micro)qualifications through the officially estab-

61 Ministry of Construction and Spatial Planning : Ordinance on requirements and criteria for establishing a quality system for services and works for certification of installers of renewable energy sources - photovoltaic systems (OG 56/2015)", 2015., https://narodne-novine.nn.hr/clanci/sluzbeni/2015_05_56_1105.html

62 " Ministry of Construction and Spatial Planning: Ordinance on requirements and criteria for establishing a quality system for services and works for certification of installers of renewable energy sources - solar thermal systems (OG 33/2015, 56/2015, 12/2017)", 2017., https://narodne-novine.nn.hr/clanci/sluzbeni/2015_03_33_686.html, https://narodne-novine.nn.hr/clanci/sluzbeni/2015_05_56_1107.html, https://narodne-novine.nn.hr/clanci/sluzbeni/2017_02_12_304.html

63 " Ministry of Construction and Spatial Planning Ordinance on requirements and criteria for establishing a quality system for services and works for certification of installers of renewable energy sources - smaller boilers and biomass stoves (Official Gazette 39/2015, 56/2015, 12/2017)", 2017., https://narodne-novine.nn.hr/clanci/sluzbeni/2015_04_39_813.html, https://narodne-novine.nn.hr/clanci/sluzbeni/2015_05_56_1108.html, https://narodne-novine.nn.hr/clanci/sluzbeni/2017_02_12_303.html

64 Ministry of Construction and Spatial Planning " Ordinance on requirements and criteria for establishing a quality system for services and works for certification of installers of renewable energy sources - shallow geothermal systems and heat pumps (Official Gazette 56/2015, 12/2017)", 2017., https://narodne-novine.nn.hr/clanci/sluzbeni/2015_05_56_1106.html, https://narodne-novine.nn.hr/clanci/sluzbeni/2017_02_12_305.html

65 " Regulations on professional development of persons who perform Physical Planningand construction tasks (Official Gazette 55/2020)", 2020, https://narodne-novine.nn.hr/clanci/sluzbeni/2020_05_55_1100.html

66 „Regulations on the professional examination of persons performing construction and Physical Planningwork (Official Gazette 129/2015)", 2015., https://narodne-novine.nn.hr/clanci/sluzbeni/2015_11_129_2445.html

67 https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/

68 https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

69 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021R1119

lished training and certification system and will also support the need for new (micro) qualifications. In addition, it will enable the reduction of the existing skills gap by enabling all those interested to acquire upskilling or reskilling (e.g. moving from a sector closely related to fossil fuels to a green sector). Recommendations for fully activating the existing certification system and upgrading it are as follows:

• As soon as possible conduct all the planned trainings and certifications of experts who are involved in the installation of building components affecting the energy efficiency of buildings and installers of solar thermal systems, small boilers and biomass heating systems and shallow geothermal systems and heat pumps, in order to significantly increase the number of certified experts.

• Establish records and monitoring of the implementation of continuous training of certified experts and encourage regular professional development, following the successful example of chambers of engineers. This approach will work under the condition that a register of individual experts is established in practice (see measure SM-9).

• Fully integrate the latest ZEB principles (zero emission buildings) and requirements for work on building construction and renovation into the training and certification system, so that the acquired (micro)qualifications could be defined as "ZEB ready".

• Conduct an analysis of existing certification procedures and analyse the possibility for certification of future experts who would have a wider specialization than the current one and obtain a certificate whose title, for example "*certified expert in building sector*", would highlight the importance of acquired knowledge, skills and (micro)qualifications and thus increase reputation, attractiveness and interest in professional occupations in the building sector. Such a certificate could combine several qualifications, for example the qualifications of bricklayers, facade workers and dry construction installers, in one certificate. This is a general idea that should be harmonized with the results of the modernization of professional curricula (currently in the field of construction).

• In addition to existing certificates (e.g. for facade workers, roofers, etc. or for installers of photovoltaic systems, solar thermal systems, etc.), it is proposed to introduce additional certificates adapted to the new needs of the labour market. Some possible examples of new possible certification procedures are certification for the expert for smart readiness and BEMS, the expert for energy communities', the expert for district level energy renovation and the energy efficiency in buildings technician[70].

• Manufacturers of equipment and materials that conduct their own training for their products or conduct training that is an integral part of professional development programs of professional chambers, should be included in the upgrade of the certification system. In this way, the latest techniques and technologies would always be incorporated into the certification system and trainings in accordance with market requirements; the relevance and attractiveness of certain certificates will increase, which will affect the increase in the number of workers that employers send for training and certification. The need for standardization or unification of various existing highly specialized certificates should also be determined in order to achieve the greatest possible synergy and compliance and thereby increase the understanding of the purpose of individual certificates. The selection of manufacturers should be carried out in accordance with independent and transparent criteria.

• Upgraded and new certification programs can be based on already developed training materials for individual professional fields, whereby materials developed as part of similar projects implemented in Croatia can also be used (e.g. the REACT project[71]). These materials will need to be additionally developed for those professional areas, knowledges, skills and (micro)qualifications for which the existing materials are insufficient or do not exist (which is the subject of other recommendations in this document).

70 https://www.seerc.org/new/component/entities/?view=project&layout=details&id=79

71 https://rea-sjever.hr/projekti/react/

- The list of all existing certificates and learning outcomes for a particular certificate should be in the form of a database available to the future Knowledge and skills assessment tool through continuous data exchange (see measure SM-10).
- As many certification providers as possible should be included in the updated certification system, that is, every interested institution or organization that meets all the conditions prescribed by law and regulations (certification providers) could participate in the upgraded certification program. All certification providers should be connected to individual registers of certified experts, but also to the future unified register of certified experts (see measure SM-9), which in turn should be available to the future National construction e-workforce platform through constant data exchange (see subject matter measure SM-11).
- All certification providers should implement the same certification procedure for each specific certificate, that is, the knowledge verification procedure must be standardized.
- Establish a body that will periodically, on an annual basis, monitor the development and implementation of good practices in the area of adoption and implementation of knowledge and skills of professional workers in the building sector. The task of this body will also be to monitor trends in the implementation of energy-efficient systems in buildings at the national level in order to detect key gaps in the knowledge of workers and prepare appropriate guidelines for all stakeholders to introduce changes in the existing training and certification systems.

The end users of the upgraded certification system would be: institutions and centers for lifelong and adult education, associations of workers of all professions in the building sector ("blue-collar" professional associations), professional associations in the building sector and chambers ("white-collar" professional associations), higher education institutions that are a source of future "white-collar" specialists in the building sector, secondary vocational schools that are a source of future "blue-collar" specialists in the building sector, public authorities – national agencies, public services (e.g. Agency for Vocational Education and Training and Adult Education), contractors in the building sector (companies, SMEs and craft companies), "blue-collar" experts, "white-collar" experts – engineers and specialists, "white-collar" experts – design engineers, manufacturers of materials, equipment and solutions.

### 6.1.3 General measures for vocational education

| SM-18 | Adapt/create the content of the training program for green jobs in construction |
|---|---|

The existing training programs for trainers and workers need to be adapted to the necessary skills listed in the *Status Quo analysis* and to be harmonized and adapted to the additional conditions of financing education through vouchers for green jobs. The minimum number of hours of education must be 50 hours, which is a requirement for programs financed through vouchers. Such a measure would encourage the education of adults in the construction sector, encourage employers to refer workers to education, and workers to acquire new knowledge about green construction. Education should also be adapted to workers from other countries who speak the Croatian language less well, with as many practical examples and professional expressions in English as possible. Brochures with pictures and simple bilingual descriptions should be created for each program or more.

| SM-19 | Trainer training |
|---|---|

There is a lack of adequate professional development in line with trends and new technologies for teachers of vocational subjects, as well as their connection with workplace learning. Moreover, there is a shortage of a sufficient number of qualified

trainers who could conduct training programs. This shortage of experienced and skilled trainers further hinders the effective development of skills in the construction sector.

The *Regulation on the System of Education and Certification of Construction Workers Working on the Installation of Building Elements Affecting the Energy Efficiency of Buildings*[72] defines the conditions that trainers and training centers must meet. Accordingly, all existing and future trainers must undergo training to become experts in energy efficiency and renewable energy sources.

The measure "Trainer Training" recommends systematic training and improvement of knowledge and skills for teachers and future trainers who can then transfer the acquired knowledge and skills to workers. Teachers can enhance their knowledge of new skills and materials through collaboration with experts from the construction industry. High school teachers possess educational knowledge crucial for transferring knowledge from teachers to students (workers), while technical knowledge and green skills needed for building and renovating structures are characteristic of technical experts. As part of trainer training, it is important to adapt existing trainer and worker training programs to the necessary skills outlined in the *Status Quo analysis*[73] align them with funding conditions for vouchers for green jobs education.

72 Ministry of Construction and Spatial Planning, " Ordinance on the training and certification scheme for building workers who incorporate building parts that have an impact on energy efficiency in the buildings sector (Official Gazette 67/2017)." in 2017

73 Banjad et al : "BUILD UP Skills - Croatia - Updated and upgraded National Status Quo Analysis : Current state of construction in Croatia", 2023, ISBN: 978-953-8168-65-9, DOI: 10.5592/BO/978-953-8168-65-9, https://croskills-reload.grad.hr/wp-content / uploads/2023/02/Status-Quo-Analiza-ENG,-finalno.pdf

## 6.2 Higher education (levels 6. and 7. according to CQF)

Table 5 shows a list of all measures for higher education (levels 6. and 7. according to the Croatian Qualification Framework), and subsections 6.2.1, 6.2.2 and 6.2.3 provide individual explanations of each proposed measure.

Table 5 Measures for higher education (levels 6. and 7. according to the Croatian Qualification Framework)

| | |
|---|---|
| HM-1 | Creation of occupational standards and qualification standards for higher education in the field of construction, architecture, mechanical engineering and other relevant fields |
| HM-2 | Update of regular curriculum programs to keep in pace with new technologies, knowledge and skills in order to strengthen the capacity of future workforce in the field of sustainability, energy efficiency, renewable energy source and climate change |
| HM-3 | Establishment of new courses in the field of civil engineering, mechanical engineering, electrical engineering and architecture that will integrate knowledge about energy efficiency, fire safety, digitalization, sustainable development and quantification, green construction, renewable energy sources, building management systems and ZEBs |
| HM-4 | The development and preparation of an undergraduate and/or graduate study program oriented towards sustainability, green construction, post-earthquake reconstruction, cultural heritage restoration with elements of climate change adaptation, increased energy efficiency and energy independence, circular economy practices, decarbonization, integration of nature-based solutions (NBS), as well as building safety and resilience |
| HM-5 | Organization of interdisciplinary conferences, summer schools, events and competitions on the topic of green knowledge and skills to facilitate knowledge exchange and promote the development of future collaborations |
| HM-6 | Establishment of a monitoring system for the number of students who successfully complete specific courses related to green jobs through the ISVU system (Information System of Higher Education Institutions) |
| HM-7 | Development of an online catalogue of green skills for higher education |
| HM-8 | Establishment of professional training programs specialized in energy efficiency, sustainable urban development and planning, sustainability, green construction, fire, cultural heritage restoration with elements of climate change adaptation, energy independence, circular economy practices, decarbonization, integration of natural solutions |
| HM-9 | Establishment of a laboratory for simulating scenarios and testing innovative solutions in the field of energy efficiency in buildings |
| HM-10 | Introducing a legal obligation for the training of engineers in the field of energy efficiency, fire safety, sustainability, green construction, restoration of cultural heritage with elements of climate change adaptation, energy independence, circular economy practices, decarbonization, and integration of natural solutions in buildings |
| HM-11 | Introducing a legal obligation for the training of employees in construction offices within local and regional self-governments units in the field of energy efficiency, fire safety, sustainability, green construction, restoration of cultural heritage with elements of climate change adaptation, energy independence, circular economy practices, decarbonization, and integration of natural solutions in buildings |
| HM-12 | Monitoring the training of engineers on the topic of energy efficiency in buildings |
| HM-13 | Education of employees in construction offices within local and regional self-government units |

### 6.2.1 Technical measures for higher education

| | |
|---|---|
| HM-1 | Creation of occupational standards and qualification standards for higher education in the field of construction, architecture, mechanical engineering and other relevant fields |

Upon reviewing the existing programs in higher education within the fields of construction, architecture, electrical engineering, and mechanical engineering, as outlined in the *Status Quo document* [74], it is evident that some programs lack clearly defined learning outcomes. This means that the procedure defined by the *Croatian Qualification Framework Act* (Official Gazette 22/13, 41/16, 64/18, 47/20,

74 Banjad et al : "BUILD UP Skills - Croatia - Updated and upgraded National Status Quo Analysis : Current state of construction in Croatia", 2023, ISBN: 978-953-8168-65-9, DOI: 10.5592/BO/978-953-8168-65-9, https://croskills-reload.grad.hr/wp-content / uploads/2023/02/Status-Quo-Analiza-ENG,-finalno.pdf

20/21)[75] and the *Ordinance on the Croatian Qualification Framework Register* (Official Gazette 96/21)[76] is not fully or at all conducted. Programs without defined learning outcomes may be less focused and targeted, making it difficult to assess their effectiveness and may result in less alignment with labor market and industry needs. Therefore, it can lead to a lack of control over the educational process.

The Croatian Qualifications Framework (CQF) is a reform instrument that regulates the entire system of qualifications at all educational levels in the Republic of Croatia. CQF is based on occupational standards aligned with the needs of the labor market and defined through qualification standards based on learning outcomes. In order to create qualification standards with sets of learning outcomes or develop educational programs, it is necessary to define the key tasks and competencies required for a specific profession. CQF is an instrument for achieving the strategic goals of quality education relevant to the needs of the labor market, individuals and society as a whole. **This is a fundamental measure that will enable the adaptation and expansion of university curricula in order to ensure the acquisition of relevant skills (green and practical skills), which are recognized as insufficiently represented in the educational programs of higher education institutions.**

The measure is based on the *National Action Plan for Development of Green Skill Jobs Related to Energy and Post-Earthquake Reconstruction* [77].

| | |
|---|---|
| HM-2 | Update of regular curriculum programs to keep in pace with new technologies, knowledge and skills in order to strengthen the capacity of future workforce in the field of sustainability, energy efficiency, renewable energy source and climate change |

It was established that the regular curricula at higher education institutions are not regularly updated, which leads to a decline in the quality of preparation of specialists for the labor market, which is characterized by frequent and rapid changes. Regular curriculum updates are essential to ensure that educational programs remain in line with the latest developments in relevant areas, such as sustainability, energy efficiency, renewable energy sources and climate change. This makes education relevant to the dynamic labor market. The workforce is continuously adapting to incorporate new technologies and practices. By regularly updating study programs, students can acquire the latest knowledge and skills, thus becoming better prepared to face the ever-changing needs of employers and society. Given the increasing importance of sustainability and climate change, it is important that professionals are familiar with the latest research, policies and practices. Regular updates of study programs help to include these key aspects. The focus on sustainability, energy efficiency and renewable energy sources plays a key role in reducing negative environmental impacts and realizing economic benefits. As challenges related to sustainability, energy and climate change are constantly evolving, education needs to equip students with the necessary skills and knowledge to effectively address these challenges.

This measure implies the adaptation of the content and structure of higher education study programs to meet the changing conditions and requirements of the labor market, especially in the area of green skills (energy efficiency, digitization, sustainable development, use of digital tools for quantifying sustainability on the buildings and products level, renewable energy sources, building management systems, waste management, ZEB construction and renovation, modular construction, restoration of cultural heritage in the light of sustainability, life cycle, circularity). This measure applies to existing undergraduate and graduate study programs, which are obliged to

75 Law on the Croatian Qualifications Framework, OG 22/13, 41/16, 64/18, 47/20, 20/21

76 Ministry of Science and Education: Rulebook on the Register of the Croatian Qualification Framework, OG 96/2021

77 Ministry of Spatial Planning, Construction and State Assets: National action plan for skills development in the context of green jobs related to energy restoration and post-earthquake reconstruction, 2022. https://mpgi.gov.hr/UserDocsImages/dokumenti/NPOO/NAP_2022_NPOO.pdf , page 94

adapt their curricula to current challenges in the field of green and sustainable construction, architecture, renewable energy sources, digitization and similar areas. This involves analyzing current trends, technological innovations, and practices relevant to sustainability, renewable energy sources, environmental protection, and similar areas. It also involves adapting programs, courses, and teaching methods to ensure that students acquire relevant knowledge and green skills. The goal is to ensure that educational programs offer the knowledge and skills needed to work in the construction sector that is in line with sustainability, circularity and energy efficiency, environmental areas and green industries. The measure includes the integration of practical experience, field work or project based learning focused on the challenges currently faced by the construction sector in terms of sustainability, circularity and green transition. An example of successful integration of project-based learning is the course *Green Building* (further strengthened through the European project *GREENCO: Education for GREEN transformation of COnstruction sector*[78]) and the course *Building Physics* at the Faculty of Civil Engineering, University of Zagreb. Through this measure, higher education institutions ensure that the education they provide responds to the rapid changes and needs of the sector, providing students with relevant skills for the future in the field of sustainability.

By analyzing the higher education system and study programs, there are currently 50 identified courses in the field of construction and architecture, 42 in the field of mechanical engineering, and 18 in the field of electrical engineering, covering topics related to energy efficiency, sustainable construction, use of renewable energy sources, digitalization, BIM, energy-efficient lighting and similar items of interest that are associated with green skills. Regular curriculum program updates must be in accordance with the procedure prescribed by the *Croatian Qualifications Framework Act* (OG 22/13, 41/16, 64/18, 47/20, 20/21)[79]. In view of the above, it would probably be necessary to introduce mandatory courses or expand the mandatory course offerings at the undergraduate level, focusing on green skills (measure HM-3).

This measure is based on HM-1, which means it is necessary to define the qualifications and occupation standards.

The measure is based on the national document *National Action Plan for Development of Green Skill Jobs Related to Energy and Post-Earthquake Reconstruction* [80].

| | |
|---|---|
| HM-3 | Establishment of new courses in the field of civil engineering, mechanical engineering, electrical engineering and architecture that will integrate knowledge about energy efficiency, fire safety, digitalization, sustainable development and quantification, green construction, renewable energy sources, building management systems and ZEBs |

Through a detailed analysis of study programs in higher education institutions of construction, architecture, mechanical engineering and electrical engineering, as well as curricula that include topics such as energy efficiency, sustainable construction, use of renewable energy sources, digitalization, BIM, energy-efficient lighting and related subjects, it was observed that the majority of these courses are primarily designed for graduate programs and are not mandatory.

A thorough analysis of currently available courses was carried out, whereby the contents of individual courses and their defined learning outcomes were reviewed and categorized based on the specific skills that the existing higher education system deals with. In the field of civil engineering and architecture, it has become apparent

78 Erasmus - Alliances for Education and Enterprises, projekt GREENCO: Education for GREEN transformation of Construction sector, https://www.greenco.grad.hr/project

79 Croatian Qualifications Framework Act, OG 22/13, 41/16, 64/18, 47/20, 20/21

80 Ministry of Spatial Planning, Construction and State Assets: National action plan for skills development in the context of green jobs related to energy restoration and post-earthquake reconstruction, 2022. https://mpgi.gov.hr/UserDocsImages/dokumenti/NPOO/NAP_2022_NPOO.pdf , page 94

that there is a lack of courses focusing on the renovation of buildings towards near-zero energy buildings (nZEB) and zero energy buildings (ZEB), with a specific focus on cultural and heritage. Moreover, there is a lack of courses dealing with the use of building information modeling (BIM) in the renovation and implementation of energy efficiency measures and renewable energy sources in new and existing buildings. Also, there is a lack of courses dealing with environmental impact assessment of buildings and/or products, quantification of sustainability, circular economy, circular resource efficiency as part of project design and construction/renovation.

In the field of mechanical engineering, there is a lack of courses that cover renewable energy sources in renovation, especially in buildings that are part of cultural heritage. In addition, the use of BIM, sustainability quantification, renewable energy management systems and building management systems are not sufficiently covered.

Within the domain of electrical engineering, there is a lack of courses related to implementing BIM and increasing building intelligence for improved energy efficiency, both in older and newer buildings. The topics of sustainability, application of sensors, building control and building management systems are not sufficiently covered.

It is desirable that new courses focus on project-based and problem-based teaching and learning.

In Table 6, the necessary skills are identified for each individual sector.

Table 6 Green skills required for level 6 and 7 according to CQF

| Civil engineering and architecture | Mechanical engineering | Electrical engineering |
|---|---|---|
| Implementation of energy efficiency and renewable energy measures in buildings | | |
| Digitalization (BIM) | | |
| Safety | | |
| Sustainability quantification (via the assessment of Global Warming Potential), circular construction and resource efficiency, and leveraging the Level(s) framework | | |
| Bridging the gap towards Zero Emission Buildings (ZEBs) | | |
| Building deep renovation (including heritage buildings) | Implementation of RES in deep renovation and heritage buildings | Upgrading the smartness of buildings for greater energy performance (in old and new buildings) |
| Building management system | RES management system and control | Sensors, building controls and building management system |

This measure includes the establishment of new courses in the field of civil engineering, mechanical engineering, electrical engineering and architecture at the undergraduate level. Offering these courses at undergraduate level ensures that a wider range of students have access to this important knowledge and can begin their careers with a strong foundation in sustainable and efficient construction practices. Examples of new collections established (2022/2023) are *Green Building*, *Energy Renovation of Buildings* and *Building Information Modeling* at the Faculty of Civil Engineering, University of Zagreb, *Heating and Air Conditioning* at the Technical University of Zagreb, *Low Carbon and Smart Buildings* at the Faculty of Mechanical Engineering and Shipbuilding, University of Zagreb, *Energy efficient management of buildings* and *Energy efficiency and consumption management* at the Faculty of Electrical Engineering and Computing, University of Zagreb.

The development of the program for the given courses must be in accordance with the procedure prescribed by the *Croatian Qualification Framework Act* (Official Gazette 22/13, 41/16, 64/18, 47/20, 20/21)[81].

81 Croatian Qualifications Framework Act, OG 22/13, 41/16, 64/18, 47/20, 20/21

| | |
|---|---|
| HM-4 | The development and preparation of an undergraduate and/or graduate study program oriented towards sustainability, green construction, post-earthquake reconstruction, cultural heritage restoration with elements of climate change adaptation, increased energy efficiency and energy independence, circular economy practices, decarbonization, integration of nature-based solutions (NBS), as well as building safety and resilience |

Higher education curricula are often specialized in a particular area of interest and rarely include the acquisition of knowledge and skills from other disciplines. This ultimately leads to a lack of interdisciplinary knowledge, especially in the context of energy efficiency work, green construction, use of renewable energy sources (RES), digitization, BIM, energy-efficient lighting, and similar topics of interest. Additionally, during the initial activities related to post-earthquake reconstruction in March 2020, there was a noticeable need for a larger number of individuals with the necessary expertise to effectively and qualitatively carry out comprehensive reconstruction activities, including energy efficiency, seismic reconstruction, and cultural heritage restoration. The shortage of adequately educated workforce has a negative impact on the possibilities for more efficient post-earthquake reconstruction and decarbonation of building sector.

Although there are a significant number of specialized programs and courses in the field of energy efficiency, renewable energy sources and digitization in higher education for civil engineering, architecture, mechanical engineering and electrical engineering, most subjects are optional and depend on students' interest in a particular topic, leading to a very small number of qualified engineers for individual specialized areas compared to market needs. Too few students enter the labor market with knowledge and skills related to energy efficiency and renewable energy sources, and previous analyzes of the workforce working in the fields of energy efficiency and BIM for ten years showed low self-assessment score of knowledge and understanding of these areas.

The measure will involve the establishment and preparation of a new undergraduate and/or graduate study program that will integrate knowledge of post-earthquake reconstruction, cultural heritage restoration with elements of climate change adaptation, increased energy efficiency and energy independence, circular economy practices, decarbonization, sustainability, green construction, integration of nature-based solutions (NBS), as well as building safety and resilience all within the context of building maintenance and comprehensive reconstruction.

It is desirable that the interdisciplinary study program is the result of the cooperation of different scientific disciplines with a focus on project-based and problem-based teaching and learning.

New undergraduate and/or graduate study program must be in accordance with the procedure prescribed by the *Croatian Qualifications Framework Act* (OG 22/13, 41/16, 64/18, 47/20, 20/21)[82].

A similar measure is proposed in the document *National Action Plan for Development of Green Skill Jobs Related to Energy and Post-Earthquake Reconstruction*[83] and the document *National Recovery and Resilience Plan 2021-2026*[84].

| | |
|---|---|
| HM-5 | Organization of interdisciplinary conferences, summer schools, events and competitions on the topic of green knowledge and skills to facilitate knowledge exchange and promote the development of future collaborations |

82 Croatian Qualifications Framework Act, OG 22/13, 41/16, 64/18, 47/20, 20/21

83 Ministry of Physical Planning, Construction and State Assets: National action plan for skills development in the context of green jobs related to energy restoration and post-earthquake reconstruction, 2022. https://mpgi.gov.hr/UserDocsImages/dokumenti/NPOO/NAP_2022_NPOO.pdf

84 Government of the Republic of Croatia National Recovery and Resilience Plan 2021-2026, July 2021, page 1119. https://planoporavka.gov.hr/UserDocsImages/dokumenti/Plan%20oporavka%20i%20otpornosti%2C%20srpanj%202021..pdf?vel=13435491

Interdisciplinary collaboration among different fields (architecture, civil engineering, mechanical engineering, environmental engineering, electrical engineering) and cooperation with entrepreneurs, authorities and others facilitate the transfer and acceptance of new knowledge and skills relevant to a broader understanding of the practical application of acquired education. Specially collaboration with entrepreneurs can enabled accessible acquisition of practical knowledge and work experience for students. The organization of interdisciplinary conferences, summer schools, events and competitions on the topic of green knowledge and skills can serve as a bridge for cooperation between business and universities: creation of professional networks and partnerships for future projects or research, exchange of information and contribution to mutual learning, better understanding of each other's needs which facilitates the adaptation of education programs and research priorities to the real needs of industry.

Connecting with the economy and small and medium-sized enterprises for the practical application of acquired knowledge can be achieved by organizing various multidisciplinary events, such as summer schools, workshops and similar activities. This approach promotes a dynamic exchange of expertise, fostering a collaborative environment where theoretical knowledge is translated into practical solutions.

For the organization of summer schools, workshops, and similar events, the application of service learning is proposed as a multidisciplinary approach to problem-solving at the community level. This approach brings together students, engineers, industry professionals, and local stakeholders, including authorities and community representatives, to work collaboratively on addressing community challenges (resilient, sustainable, decarbonize building sector and community). A similar approach was successfully applied as part of the bilateral initiative " *Ecosystem-based strategies for remediation of brownfield sites in coastal area* (2023-2024)"[85] financed by the EEA Bilateral Fund and the Norwegian Financial Mechanism for the period 2014-2021.

A similar measure was proposed in the document *National Action Plan for Development of Green Skill Jobs Related to Energy and Post-Earthquake Reconstruction*[86].

| | |
|---|---|
| HM-6 | Establishment of a monitoring system for the number of students who successfully complete specific courses related to green jobs through the ISVU system (Information System of Higher Education Institutions) |

During the analysis of data given in *Status Quo document*[87], in the higher education sector, specifically the data related to the number of students studying at faculties of civil engineering, architecture, mechanical engineering, electrical engineering, and enrolling in courses related to energy efficiency, sustainability, circularity, green construction, renewable energy sources, digitization, energy-efficient lighting, etc., it is evident that there is no unified tracking of the workforce that graduates from these educational institutions and possesses these specific skills. The analysis presented in the *Status Quo document* was conducted through surveys and individual data collection. The analysis of the transition of the workforce from the education system to the labor market over a four-year period, based on data from the National Bureau of Statistics, does not provide us with an insight into how many of the total number of students possess the relevant skills needed to achieve ambitious goals in the construction sector by 2030 regarding energy efficiency and RES.

In order to implement the proposed measure of tracking students who have completed courses related to green jobs through the existing ISVU system, it is necessary

85 https://cbr.grad.hr/hr/

86 Ministry of Physical Planning, Construction and State Assets: National Action Plan for Development of Green Skill Jobs Related to Energy and Post-Earthquake Reconstruction 2022. https://mpgi.gov.hr/UserDocsImages/dokumenti/NPOO/NAP_2022_NPOO.pdf

87 Banjad et al : "BUILD UP Skills - Croatia - Updated and upgraded National Status Quo Analysis : Current state of construction in Croatia", 2023, ISBN: 978-953-8168-65-9, DOI: 10.5592/BO/978-953-8168-65-9, https://croskills-reload.grad.hr/wp-content / uploads/2023/02/Status-Quo-Analiza-ENG,-finalno.pdf

that these courses have established occupation standards, qualification standards, and learning outcomes in accordance with the procedure outlined in the *Croatian Qualifications Framework Act* (Official Gazette 22/13, 41/16, 64/18, 47/20, 20/21)[88].

| HM-7 | Development of an online catalog of green skills for higher education |
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The Ministry of Labour, Pension System, Family and Social Policy started implementing a voucher system in 2022. The goal of this system is to encourage higher participation of both unemployed and employed individuals in lifelong learning, with a focus on acquiring skills related to green and digital fields. To identify which educational programs are eligible for voucher allocation and which skills should be funded to address labor market needs, an initial skill mapping process was conducted, according to an agreed methodology, https://vjestine.hzz.hr/projekt.

The Croatian Employment Service, through the development of employment measures and the promotion of green and digital skills, has created a *Skills and Program Catalog* [89]. This catalog provides job seekers and employers with insights into the skills in demand in the labor market. Within the catalog, users can explore potential training and development programs for both the unemployed and employed individuals. To support the comprehensive process of post-earthquake reconstruction and energy-efficient renovation with nature-based solutions, circular management of space and buildings, as well as the development of green infrastructure, and the execution of specialized restoration processes on culturally protected structures, it is essential to establish a comprehensive database containing relevant. The final outcome of this process was the development of a catalog of skills necessary for the digital and green transformation of the economy. The catalog of green and digital skills enables the Ministry of Labour, Pension System, Family and Social Policy of the Republic of Croatia to detect the skills required to work in existing sectors and subsectors of the Croatian Qualifications Framework, especially in the context of green and digital transitions, which are crucial for enhancing employability, maintaining existing employment opportunities, and preventing an increase in the number of unemployed individuals.

| HM-8 | Establishment of professional training programs specialized in energy efficiency, sustainable urban development and planning, sustainability, green construction, fire, cultural heritage restoration with elements of climate change adaptation, energy independence, circular economy practices, decarbonization, integration of natural solutions |
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It is necessary to create training programs for engineers that include all the necessary equipment (models, presentations, literature) and to adapt the training for the area of design and the area of supervision and execution. The minimum education for a particular profession for level 6 and 7 would have to last 50 hours. Professional training courses and programs should be conducted by institutions that have the approval of the Ministry of Spatial Planning, Construction and State Assets for a professional training program according to the provisions of the *Ordinance on professional training of persons performing physical planning and construction activities* (Official Gazette 55/2020),[90] such as professional organizations, universities, polytechnics and other legal entities.

For the approval of the training program, the Ministry of Spatial Planning, Construction and State Assets must determine the number of hours from the proposed program related to topics such as energy efficiency, sustainability, green construction, fires, the restoration of cultural heritage with elements of climate change adaptation,

88 Law on the Croatian Qualifications Framework, OG 22/13, 41/16, 64/18, 47/20, 20/21

89 https://vauceri.hzz.hr/katalog-vjestina/

90 Ministry of Construction and Physical Planning: Ordinance on professional development of persons performing physical planning and construction work, Official Gazette 55/2020

energy independence, circular economy practices, decarbonization, and the integration of natural solutions in the field of construction.

The development of the program must be in accordance with the procedure prescribed by the the *Croatian Qualification Framework Act* (Official Gazette 22/13, 41/16, 64/18, 47/20, 20/21) [91]. Instructions for creating, harmonizing and approving educational programs of higher education institutions at the level of higher education for the purposes of financing via vouchers have been prepared [92].

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| HM-9 | Establishment of a laboratory for simulating scenarios and testing innovative solutions in the field of energy efficiency in buildings |

The establishment of the laboratory will ensure the development of new techniques and technologies in building, focused on innovative solutions, with a special emphasis on safety and environmental sustainability. Conditions will be created for conducting advanced research in collaboration with the economy, especially with small and medium-sized enterprises based on excellence, knowledge, and innovation. Such a laboratory will be able to provide industry services that have so far been provided by foreign laboratories and actively participate with the industry in establishing competitiveness clusters in the field of energy efficiency and sustainability in construction. In addition to acquiring practical knowledge for future market competitiveness and innovation development, it is crucial to encourage the adoption and application of new knowledge and skills related to emerging technologies and tools in construction (renewable energy sources, automation, digitization, new materials, etc.).

A similar measure was proposed in the documents *National Action Plan for the Development of Green Skills in Jobs Related to Energy and Post-Earthquake Reconstruction*[93] and *National Recovery and Resilience Plan 2021-2026* [94].

### 6.2.2 Legal measure for higher education

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| HM-10 | Introducing a legal obligation for the training of engineers in the field of energy efficiency, fire safety, sustainability, green construction, restoration of cultural heritage with elements of climate change adaptation, energy independence, circular economy practices, decarbonization, and integration of natural solutions in buildings |

Obligatory participants in professional development who are involved in activities related to energy efficiency in construction must mandatory advance their expertise in monitoring technical regulations and professional knowledge related to energy efficiency, sustainability, green construction, restoration of cultural heritage with elements of adaptation to climate change, energy independence, circular economy practices, decarbonization, and the integration of natural solutions in construction.

The conditions and methods for conducting professional development are currently defined by the *Regulation on the Professional Development of individuals engaged in spatial planning and construction activities*, OG 55/2020[95].

91 Croatian Qualifications Framework Act, OG 22/13, 41/16, 64/18, 47/20, 20/21

92 Ministry of Science and Education: Instructions for creating, harmonizing and approving educational programs of higher education institutions at the level of higher education for the purposes of financing through vouchers with funds from the National Recovery and Resilience Plan 2021 - 2026, 2022 https://www.azvo.hr/ images/stories/HKO/Uputa_za_zradu_uskla%C4%91invanje_i_obravanje_obrazovnih_programa_visokih_u%C4%8Dila%C5%A1ta_na_zini_skog_obrazovanja_za_nepobe_financiranja_via_vau%C4%8Dera.pdf

93 Ministry of Physical Planning, Construction and State Property: National Action Plan for Development of Green Skill Jobs Related to Energy and Post-Earthquake Reconstruction, 2022. https://mpgi.gov.hr/UserDocsImages/dokumenti/NPOO/NAP_2022_NPOO.pdf

94 Government of the Republic of Croatia National Recovery and Resilience Plan 2021-2026, July 2021, p. 890, measure C3.2. R1-12 https://planoporavka.gov.hr/UserDocsImages/dokumenti/Plan%20oporavka%20i%20otpornosti%2C%20srpanj%202021..pdf?vel=13435491

95 Ministry of Construction and Physical Planning: Ordinance on professional development of persons performing physical planning and construction work, Official Gazette 55/2020.

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| HM-11 | Introducing a legal obligation for the training of employees in construction offices within local and regional self-governments units in the field of energy efficiency, fire safety, sustainability, green construction, restoration of cultural heritage with elements of climate change adaptation, energy independence, circular economy practices, decarbonization, and integration of natural solutions in buildings |

*The Law on civil servants and employees in local and regional self-government units* (OG 86/08, 61/11, 04/18, 112/19) [96] regulates the possibility of continuous improvement and training of officials, especially through the provisions of Articles 81, 82 and 83. According to Article 81 of *the Law on civil servants and employees in local and regional self-government units,* the Government of the Republic of Croatia adopts a strategy and plan for the continuous training and development of officials. Within the framework of the Law, it is necessary to define mandatory training and development for employees working in the construction sector. In this specific case, these employees need to undergo training in the areas of energy efficiency, sustainability, green construction, fire prevention, restoration of cultural heritage with an emphasis on adaptation to climate change, achieving energy independence, applying circular economy practices, decarbonization, and the integration of natural solutions in construction. Well-trained employees can provide better support to citizens and investors during the construction process, reducing the possibility of errors and issues. Understanding regulations, standards, and procedures allows them to adequately review and control documentation, ensuring the safety and compliance of construction projects with relevant regulations.

### 6.2.3 General measure for higher education

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| HM-12 | Monitoring the training of engineers on the topic of energy efficiency in buildings |

This measure includes monitoring and recording the number of seminars and their duration, which are thematically related to energy efficiency, fire safety, sustainability, green construction, restoration of cultural heritage with elements of adaptation to climate change, energy independence, circular economy practices, decarbonization, and the integration of natural solutions in the field of construction. The number of engineers who have attended seminars related to these topics will also be monitored.

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| HM-13 | Education of employees in construction offices within local and regional self-government units |

The education of employees in construction offices within local and regional self-government units is essential for their expertise and efficiency in performing their duties, as well as for ensuring the safety, correctness, and quality of construction projects in the local community. Well-trained employees can provide better support to citizens and investors during the construction process, helping to prevent errors or issues during construction. Additionally, understanding regulations, standards, and procedures enables them to adequately review and control documentation, ensuring the safety and compliance of construction projects with regulations. Education on new technologies, materials, and environmental standards allows them to stay informed about the latest trends and practices in construction, contributing to the improvement of construction quality in local communities.

96 Croatian Parliament: Law on civil servants and employees in local and regional (regional) self-government units (Official Gazette 86/08, 61/11, 04/18, 112/19)

# 7 Monitoring of the implementation of measures for higher education and vocational education

The document *"Updated and upgraded National analysis of the status quo: Current state of the construction industry in Croatia*" established that in the Republic of Croatia there is no system for monitoring and controlling the knowledge and skills of workers (levels 3, 4 and 5 according to CQF) and engineers (level 6. and 7. according to CQF) related to energy efficiency, renewable energy sources, sustainability and circularity in the construction sector. Early warning systems for the risks of insufficient skills are also not in use, especially for the needs of the CRO skills RELOAD project. Project partners have emphasized the importance of monitoring competencies and verifying the acquired knowledge of workers in the field of energy efficiency, fire safety, sustainability, green construction, restoration of cultural heritage with elements of adaptation to climate change, energy independence, circular economy practices, decarbonization, and the integration of natural solutions in construction. Therefore, the formation of a working group consisting of representatives from project partners and the real sector is necessary. The task of the working group is to monitor the implementation of measures at the national level during the two-year period.

# 8 Action plan



In this chapter, the action plan for the implementation of the given measures is presented with the activities or steps necessary for the implementation of the given measure, the responsible institution for the measures, the time period of implementation, the required resources and any additional prerequisites necessary for the implementation of the given measure.

## 8.1 Action plan for vocational education (levels 3, 4 and 5 according to the Croatian Qualification Framework)

| MEASURE MARK | MEASURE | ACTIVITIES (steps for implementing the measure) | Contributor | RESOURCES REQUIRED (material, human, financial) | ADDITIONAL PREREQUISITES FOR IMPLEMENTATION (Eventual) | DEADLINE / PERIOD OF IMPLEMENTATION |
|---|---|---|---|---|---|---|
| SM-1 | Training and preparation of teachers for the introduction of new curricula and modular teaching through the modernization of vocational education | A1. The formation of school teams with a clear division of responsibilities that will approach the implementation and creation of the sectoral curriculums<br>A2: Educational meetings with AS00<br>A3: Form sectoral teams and individuals who are in charge of creating a modular timetable and teacher assignments<br>A4: Form teams for the organization of project teaching, interactive learning and work-based learning<br>A5: Create the institution's curriculum | Schools and formed teams, Agency for Vocational Education and Adult Education Ministry of Science and Education, Association of Construction Schools of the Republic of Croatia | Financial resources for the organization of travel, Team meetings and printing of manuals necessary for harmonizing modular teaching | The activities are determined within project *Modernization of the Vocational Education and Training System* | 2021-2027 |
| SM-2 | Equipping vocational schools and school practicums | A1: Form teams that define the needs for materials and other didactic tools for the implementation of modular and project teaching according to the modules and the institution's Curriculum<br>A2: Creating a procurement plan<br>A3: Equipment of teaching spaces according to new pedagogical standards and needs<br>A4: Initiate cooperation with the local community, the Employers' Association, the Croatian Chamber of Commerce, the School Founder and all others who can help in equipping | The school and its teams Founder (city or county) Agency for Vocational Education and Adult Education Chamber of Commerce, Croatian employers association | Financial resources for the organization of travel, team meetings and lobbying for equipping the practicum for the introduction of modular teaching | | 2024-2027 |
| SM-3 | Education of qualified and unqualified workers in the field of energy efficiency and renewable energy sources | A1: Meeting with relevant manufacturers and contractors to define required skills<br>A2: Meeting of relevant stakeholders (from business, schools and representatives of the Agency for Vocational and Adult Education)<br>A3: Define learning outcomes according to different qualifications and occupations<br>A4: Creating a curriculum for training and education of existing qualified and unqualified workers<br>A5: Issuance of work licenses | Adult education institutions Regional centers of competence for the construction and architecture sector | Financial means for printing the manual | | 2024-2027 |
| SM-4 | Establish a system for recognizing the initial qualifications of foreign workers | A1: Establishment of a body that would implement the procedure and recognize foreign qualifications<br>A2: Testing of participants for retraining according to the established standard and catalogue of knowledge and skills outcomes<br>A3: Verification of knowledge of the minimum learning outcomes for the recognition of foreign qualifications<br>A4: Issuing a licensed certificate of recognition<br>A5: Securing the time value of the issued license | Ministry of Construction and Spatial Planning | Financial means | | 2024-2027 |

| MEASURE MARK | MEASURE | ACTIVITIES (steps for implementing the measure) | Contributor | RESOURCES REQUIRED (material, human, financial) | ADDITIONAL PREREQUISITES FOR IMPLEMENTATION (Eventual) | DEADLINE / PERIOD OF IMPLEMENTATION |
|---|---|---|---|---|---|---|
| SM-5 | Expansion of Regional Centers for Competence to the construction and architecture sector (RCK) | A1: Formation of the project team and the creation of strategic documents for RCK - construction and architecture<br>A2: Cooperation with professional bodies and institutions in counties<br>A3: Creation of strategic documents for the work and development of RCK<br>A4: Development of a competency model for RCK management<br>A5: Promotion of RCK through a media campaign | Agency for Vocational Education and Adult Education<br>Ministry of Science and Education,<br>Association of Construction Schools of the Republic of Croatia;<br>Founder, (city or county)<br>Chamber of Commerce,<br>Association of employers | They are financed by the European Social Fund. In the future, they should be self-sustained or under the jurisdiction of the Founders (counties and cities). | | 2024-2027 |
| SM-6 | To popularize construction professions among women and young people | A1: Create a propaganda and marketing plan for the popularization of trade deficit occupations<br>A2: Provide financial incentives or incentives to employers for accepting students for internships<br>A3: Provide scholarships for students in deficit occupations<br>A4: Advertising campaign, video and advertisements on TV and social networks, popularization of entrepreneurship | Agency for Vocational Education and Adult Education,<br>Ministry of Science and Education<br>Association of Construction Schools of the Republic of Croatia<br>Founder (city or county)<br>Chamber of Commerce,<br>Association of employers | Finances for the implementation of the mentioned activities and human resources | | 2024-2030 |
| SM-7 | Significantly encourage the inclusion of adults in educational programs for acquiring green skills through vouchers | A1: Media campaign to popularize adult education<br>A2: Creating a curriculum for acquiring green skills<br>A3: Popularization of construction professions with an emphasis on green skills | Agency for Vocational Education and Adult Education<br>Ministry of Science and Education,<br>Association of Construction Schools of the Republic of Croatia | | | until 2030 |
| SM-8 | Continuously monitor the needs of the labor market with enrollment quotas | A1: Create an analysis and forecast of labor market needs<br>A2: Changes in educational enrollment policy and scholarship policy based on the recommendations of the Croatian Employment Service<br>A3: Make the recommendations of the Croatian Employment Service binding and quantitatively determine the need to increase or decrease the number of enrolled students | Croatian Employment Service | Existing resources | | in 2026 |

| MEASURE MARK | MEASURE | ACTIVITIES (steps for implementing the measure) | Contributor | RESOURCES REQUIRED (material, human, financial) | ADDITIONAL PREREQUISITES FOR IMPLEMENTATION (Eventual) | DEADLINE / PERIOD OF IMPLEMENTATION |
|---|---|---|---|---|---|---|
| SM-9 | Creation of a unified publicly available electronic register of experts in building construction who have acquired professional certificates and authorizations of all kinds in the field of energy efficiency and renewable energy sources | A1: Activating and fill all remaining legally defined registers that are not yet in operation.<br>A2: Establishment of a working group for the analysis of all existing registers of certificates, diplomas, licences and proofs on professional qualification.<br>A3: Development of conceptual and technical proposals for the unification of existing (and future) registers in the building sector and development of proposals for the methodology of filling out registers and exchanging data with existing registers.<br>A4: Prepare and conduct the procurement procedure for a business analyst and the procurement procedure for the creation of an IT solution for the unified register of experts. | Ministry of Physical Planning, Construction and State Assets<br>Chambers of experts and other public institutions that issue certificates<br>Ministry of Economy and Sustainable Development / Croatian Chamber of Trades and Crafts / Regional and Local Chambers of Crafts<br>Professional associations in the building sector | Human resources<br>Financial resources for the service of business analysis of existing needs and the preparation of conceptual and technical specifications of IT solution<br>Financial resources for developing an IT solution for the unified register | | 2024-2026 |
| SM-10 | Knowledge and skills assessment tool | A1: Establishment of a working group for the analysis of existing solutions in the field of interactive evaluation of knowledge and skills.<br>A2: Development of methodological and content proposals for the phased and modular development of the Tool.<br>A3: Prepare and conduct the procurement procedure for a business analyst and the procurement procedure for developing an IT solution for the first version of the Tool and connecting it to the certificate databases and the unified register of certified experts. | Ministry of Physical Planning, Construction and State Assets<br>Agency for Vocational Education and Training and Adult Education<br>Agency for Science and Higher Education<br>Association of Construction Engineering Schools<br>Universities that implement programs connected with the building sector<br>Holders of training programs for all EQF levels<br>Manufacturers of materials, equipment and solutions | Human resources<br>Financial resources for the work of the working group<br>Financial resources for the service of business analysis of existing needs and the preparation of conceptual and technical specifications of IT solutions<br>Financial resources for the development of the IT solution of the Tool | | 2024-2028 |

| MEASURE MARK | MEASURE | ACTIVITIES (steps for implementing the measure) | Contributor | RESOURCES REQUIRED (material, human, financial) | ADDITIONAL PREREQUISITES FOR IMPLEMENTATION (Eventual) | DEADLINE / PERIOD OF IMPLEMENTATION |
|---|---|---|---|---|---|---|
| SM-11 | National construction e-workforce platform | A1: Establishment of a working group for the establishment of continuous cooperation between all necessary stakeholders and the analysis of the possibility of establishing the Platform and the creation of proposals for the phased and modular establishment of the Platform.<br>A2: Creation of a proposal for a structured and unified review of the entire building sector on the Platform (stakeholders, legal framework, ordinances, information from the field of regulations, training, lifelong adult training, etc.).<br>A3: Development of conceptual and technical proposals for including the newly developed databases of certificates, learning outcomes, unified register of experts and Knowledge and skills assessment tool in the content of the Platform.<br>A4: Drafting a proposal for data exchange with the Croatian Employment Service.<br>A5: Prepare and conduct the procurement procedure for a business analyst and the procurement procedure for the development of an IT solution for the first version of the Platform. | Ministry of Physical Planning, Construction and State Assets<br>Ministry of Economy and Sustainable Development<br>Ministry of Labour and Social Affairs<br>Croatian Employment Service<br>Managing body of the database of certificates and learning outcomes<br>Managing body of the unified register of experts | Human resources<br>Financial resources for the work of the working group<br>Financial resources for the service of business analysis of existing needs and the preparation of conceptual and technical specifications of IT solutions<br>Financial resources for the development of the IT solution of the Platform | | 2024-2028 |
| SM-12 | Implement criteria for selecting authorized experts and workers in the green public procurement system at the moment when a sufficient number of educated workers and experts appear on the market | A1: Meeting with the competent persons for the adoption, i.e., amendments to the Law on Public Procurement and a meeting with the implementing bodies that, through ZOJN, implement projects for the allocation of funds for investment in energy efficiency<br>A2: Defining rules and procedures for conducting green public procurement<br>A3: Meeting with contractors and manufacturers to define the methodology for self-assessment of construction workers' knowledge as a first step towards worker certification<br>A4: In the process of public procurement, the introduction of the use of licensed workers and ex post control of the performed works.<br>A5: Creation of first/pilot tenders by FZOE that include elements of green public procurement | Ministry of Economy and Sustainable Development<br>Ministry of Construction and Spatial Planning;<br>The Environmental Protection and Energy Efficiency Fund | Chief Advisor for Green Public Procurement (contact person);<br>Existing human resources;<br>The financial cost of licensing is borne by the companies | | 2024-2027 |

| MEASURE MARK | MEASURE | ACTIVITIES (steps for implementing the measure) | Contributor | RESOURCES REQUIRED (material, human, financial) | ADDITIONAL PREREQUISITES FOR IMPLEMENTATION (Eventual) | DEADLINE / PERIOD OF IMPLEMENTATION |
|---|---|---|---|---|---|---|
| SM-13 | Encourage the implementation of student internships with employers | A1: Passing legal measures to encourage employers to take on students for internships through financial incentives or tax breaks<br>A2: Licensing of employers<br>A3: Motivating employers to accept students for internships<br>A4: Motivating mentors during practice to work with students | Parliamentary Committee for Education Founder (city or county), Chamber of Commerce, Association of employers Agency for Vocational Education and Adult Education, Ministry of Science and Education, Association of Construction Schools of the Republic of Croatia | Finances for the implementation of the mentioned activities | | 2024-2027 |
| SM-14 | Acknowledgment of the time spent on practical classes as work experience for students of three-year occupations | A1: Enactment of a legal measure by which three years of regular schooling in trades are included in the retirement age.<br>A2: Exclude retraining in order not to bypass regular school | Parliamentary Committee for Education Chamber of Commerce, Association of employers Agency for Vocational Education and Adult Education, Ministry of Science and Education, Association of Construction Schools of the Republic of Croatia | | | 2024-2027 |
| SM-15 | Establishment of a system of recognition of non-formal education | A1. Creation of regulations for the recognition of previously acquired knowledge<br>A2: Creating plans for informal education<br>A3: Testing acquired knowledge and skills<br>A4: Issuing certificates on acquired knowledge and skills | Agency for Vocational Education and Adult Education, Ministry of Science and Education, Association of Construction Schools of the Republic of Croatia | Finances for the implementation of the mentioned activities and human resources | | 2024-2027 |
| SM-16 | Obligation of continuous education of professional teachers | A1: Adoption of the Law on Education, which will prescribe the obligation of continuous education of vocational teachers and licensing every 5 years<br>A2: Organization of seminars and training for improvement<br>A3: Issuing certificates of education necessary for quality teaching and advancement in the profession | Agency for Vocational Education and Adult Education, Ministry of Science and Education, Association of Construction Schools of the Republic of Croatia | Material, financial and human resources | | 2024-2027 |

| MEASURE MARK | MEASURE | ACTIVITIES (steps for implementing the measure) | Contributor | RESOURCES REQUIRED (material, human, financial) | ADDITIONAL PREREQUISITES FOR IMPLEMENTATION (Eventual) | DEADLINE / PERIOD OF IMPLEMENTATION |
|---|---|---|---|---|---|---|
| SM-17 | Upgrade of the certification system of experts in the building industry after completed education or recognition of acquired informal education to meet the market needs for new knowledge, skills and technologies | A1: Implementation of all remaining legally defined trainings and certification procedures.<br>A2: Establishing a working group for the analysis of the existing certification system, making proposals for additional certification procedures to meet the new needs of the construction labour market.<br>A3: Creation of detailed records of all existing certificates, diplomas, licences and proofs on professional qualification that are awarded in the field of energy efficiency and renewable energy sources and all related learning outcomes; it also includes the preparation and implementation of the procurement procedure for the creation of a simple database of certificates, diplomas, licences and solutions which will be able to connect to the register of experts.<br>A4: Establishing records and procedures for monitoring the continuous training of certified experts.<br>A5: Establishment of a professional body to monitor the effects of certification and the need to improve the existing training and certification system in accordance with market requirements. | Ministry of Physical Planning, Construction and State Assets<br>Agency for Vocational Education and Training and Adult Education<br>Agency for Science and Higher Education<br>Association of Construction Engineering Schools<br>Universities that implement programs connected with the building sector<br>Holders of training programs for all certification levels | Human resources<br>Financial resources for the organization and implementation of the remaining trainings and certifications<br>Financial resources for the development of a database of certificates, learning outcomes and the establishment of records for continuous training | | 2024-2026 |
| SM-18 | Adapt/ create the content of the training program for green jobs in construction | A1: Creation of micro-qualifications in green jobs in construction<br>A2: Creation of a program for training trainers for workers in the specified areas<br>A3: Provide financial resources for the execution of the program in a minimum of 50 hours of education | Croatian Chamber of Trades and Crafts<br>Agency for Vocational Education and Adult Education,<br>Ministry of Science and Education,<br>Association of Construction Schools of the Republic of Croatia | Material, financial and human resources | | 2024-2027 |
| SM-19 | Trainer training | A1: Define learning outcomes according to different qualifications and occupations<br>A2: To form teams that will create teaching programs for Coach education<br>A3: Conduct trainer training (for teachers of professional subjects in the field of construction and energy efficiency, sustainability, in-depth renovation, digitization and use of renewable energy systems.)<br>A4. Designate the RCK as the place for the program | Ministry of Construction through a national project | Material, financial and human resources | | 2024-2026 |

## 8.2 Action plan for higher education (levels 6 and 7 according to the Croatian Qualification Framework)

| MEASURE MARK | MEASURE | ACTIVITIES (steps for implementing the measure) | CONTRIBUTOR | RESOURCES REQUIRED (material, human, financial) | ADDITIONAL PREREQUISITES FOR IMPLEMENTATION (Eventual) | DEADLINE / PERIOD OF IMPLEMENTATION |
|---|---|---|---|---|---|---|
| HM-1 | Creation of occupational standards and qualification standards for higher education in the field of construction, architecture, mechanical engineering and other relevant fields | A1: Research and analysis of the current needs of the labor market in the field of construction, architecture, mechanical engineering and other relevant sectors.<br>A2: Defining occupational standards<br>A3: Defining qualification standards<br>A4: Integration of developed occupational standards and qualification standards into higher education programs | Agency for Science and Higher Education<br>Universities and faculties | Financial resources for the implementation of the mentioned activities<br>Human resources | | 2024-2026 |
| HM-2 | Update of regular curriculum programs to keep in pace with new technologies, knowledge and skills in order to strengthen the capacity of future workforce in the field of sustainability, energy efficiency, renewable energy source and climate change | A1: Evaluation of existing programs: analysis of current study programs of higher education institutions in the field of sustainability, energy efficiency, renewable energy sources and climate change in order to identify gaps and needs for updating<br>A2: Liaising with the industrial sector to identify new technologies, practices and required skills in these areas<br>A3: Updating study programs to include new technologies, techniques and knowledge | Agency for Science and Higher Education<br>Universities and faculties | Financial resources for the implementation of the mentioned activities<br>Human resources | This measure is based on measure HM-1. It is necessary to define the qualifications and occupation standard. | 2026-2030 |
| HM-3 | Establishment of new courses in the field of civil engineering, mechanical engineering, electrical engineering and architecture that will integrate knowledge about energy efficiency, fire, digitalization, security, sustainable development and quantification, green construction, renewable energy sources, building management systems and ZEBs | A1: Identification of labor market and industry needs to determine what skills and knowledge are lacking<br>A2: Defining the basic elements of new courses - content, goals, learning outcomes, topics, and teaching methods (focus on project-based and problem-based learning and cooperation with industry)<br>A3: Creation of materials (presentations, books, tools, online materials, assignments, evaluation methods, videos, exhibits, etc.)<br>A4: Implementation of a pilot project of student education | Faculties | Financial resources for the implementation of the mentioned activities<br>Human resources | | 2024-2030 |

| MEASURE MARK | MEASURE | ACTIVITIES (steps for implementing the measure) | CONTRIBUTOR | RESOURCES REQUIRED (material, human, financial) | ADDITIONAL PREREQUISITES FOR IMPLEMENTATION (Eventual) | DEADLINE / PERIOD OF IMPLEMENTATION |
|---|---|---|---|---|---|---|
| HM-4 | The development and preparation of an undergraduate and/or graduate study program oriented towards sustainability, green construction, post-earthquake reconstruction, cultural heritage restoration with elements of climate change adaptation, increased energy efficiency and energy independence, circular economy practices, decarbonization, integration of nature-based solutions (NBS), as well as building safety and resilience | A1: Ensuring study compliance with CQF<br>A2: Creation of new curricula, which includes defining subjects, goals, learning outcomes, subject content and teaching methods (focus on project-based and problem-based learning and cooperation with industry)<br>A3: Creation of materials (presentations, books, tools, online materials, assignments, evaluation methods, videos, exhibits, etc.)<br>A4: Collaboration with industry: involvement of experts from industry and relevant sectors to ensure the relevance of study programs and enable practical work, real experiences and making connections with real work environments<br>A5: Conducting an information campaign about the new undergraduate and/or graduate studies | Ministry of Spatial Planning, Construction and State Assets, Ministry of Science and Education, Ministry of Labour, Pension System, Family and Social Policy in cooperation with educational institutions | Financial resources for the implementation of the mentioned activities Human resources | This measure is based on measure HM-1, that is, it is necessary to define the qualifications and occupation standards. | until 2030 |
| HM-5 | Organization of interdisciplinary conferences, summer schools, events and competitions on the topic of green knowledge and skills to facilitate knowledge exchange and promote the development of future collaborations | A1: Defining topics, goals and event format<br>A2: Involvement of experts from industry, abroad, researchers and other stakeholders<br>A3: Organization of events with an emphasis on creating an environment that encourages collaboration among participants to develop new projects, initiatives or research in the field of green skills.<br>A4: Event management<br>A5: Evaluation of the success of the event | institutions that have the approval of the Ministry of Spatial Planning, Construction and State Assets for the professional training program | Financial resources for the implementation of the mentioned activities Human resources | | 2024-2030 |
| HM-6 | Establishment of a monitoring system for the number of students who successfully complete specific courses related to green jobs through the ISVU system (Information System of Higher Education Institutions) | A1: Identifying courses that are related to green jobs and creating a clear list of these courses<br>A2: Developing a mechanism within the ISVU system that enables the recording and monitoring of students who have successfully completed these selected courses.<br>A3: Continuing to adapt the enrollment policy. | Ministry of Science and Education | Financial resources for the implementation of the mentioned activities Human resources | | until 2030 |

| MEASURE MARK | MEASURE | ACTIVITIES (steps for implementing the measure) | CONTRIBUTOR | RESOURCES REQUIRED (material, human, financial) | ADDITIONAL PREREQUISITES FOR IMPLEMENTATION (Eventual) | DEADLINE / PERIOD OF IMPLEMENTATION |
|---|---|---|---|---|---|---|
| HM-7 | Development of an online catalogue of green skills for higher education | A1: Identification of labor market and industry needs to determine what skills and knowledge are lacking<br>A2: Defining green skills in higher education<br>A3: Upgrade of the existing online catalogue of green skills in higher education<br>A4: Promotion of the online catalogue of green skills | Agency for Science and Higher Education institutions that have the approval of the Ministry of Spatial Planning, Construction and State Assets for the professional training program | Financial resources for the implementation of the mentioned activities Human resources | This measure is based on measure HM-1, that is, it is necessary to define the standard of qualifications and the standard of occupation | until 2026 |
| HM-8 | Establishment of professional training programs specialized in energy efficiency, sustainable urban development and planning, sustainability, green construction, fire, cultural heritage restoration with elements of climate change adaptation, energy independence, circular economy practices, decarbonization, integration of natural solutions | A1: Identification of labor market and industry needs to determine what skills and knowledge are lacking<br>A2: Defining the training program - content, goals, topics, and teaching methods (focus on project-based and problem-based learning and cooperation with industry)<br>A3: Creation of materials (presentations, books, tools, online materials, assignments, evaluation methods, videos, exhibits, etc.)<br>A4: Information campaign: Informing engineers about training and available programs<br>A5: Implementation of the pilot project of the training program | institutions that have the approval of the Ministry of Spatial Planning, Construction and State Assets for the professional training program | Financial resources for the implementation of the mentioned activities Human resources | | until 2026 |

| MEASURE MARK | MEASURE | ACTIVITIES (steps for implementing the measure) | CONTRIBUTOR | RESOURCES REQUIRED (material, human, financial) | ADDITIONAL PREREQUISITES FOR IMPLEMENTATION (Eventual) | DEADLINE / PERIOD OF IMPLEMENTATION |
|---|---|---|---|---|---|---|
| HM-9 | Establishment of a laboratory for simulating scenarios and testing innovative solutions in the field of energy efficiency in buildings | A1: Identification of key technologies and areas to focus on, development of simulation scenarios that will allow testing innovative solutions in real conditions<br>A2: Construction of infrastructure, procurement of equipment, software and technology for simulation and testing<br>A3: Establishment of a laboratory that includes staff training (to ensure proper use of equipment and technologies), establishment of administrative and laboratory staff, verification and testing of technology, equipment and methods<br>A4: Promotion of the laboratory and involvement of business representatives, researchers and other stakeholders | Ministry of Science and Education, Higher Education Institutions and Research Institutions | Financial resources for the implementation of the mentioned activities Human resources | based on the list of projects financed through OPKK 2014-2020. call "*Preparation of IRI infrastructure projects*" | in 2026 |
| HM-10 | Introducing a legal obligation for the training of engineers in the field of energy efficiency, fire safety, sustainability, green construction, restoration of cultural heritage with elements of climate change adaptation, energy independence, circular economy practices, decarbonization, and integration of natural solutions in buildings | A1: Defining mandatory subject areas<br>A2: Drafting and adoption of legislation that will prescribe the obligation to train engineers in the specified areas. | Ministry of Spatial Planning, Construction and State Assets | Financial resources for the implementation of the mentioned activities Existing human resources | | until 2027 |

| MEASURE MARK | MEASURE | ACTIVITIES (steps for implementing the measure) | CONTRIBUTOR | RESOURCES REQUIRED (material, human, financial) | ADDITIONAL PREREQUISITES FOR IMPLEMENTATION (Eventual) | DEADLINE / PERIOD OF IMPLEMENTATION |
|---|---|---|---|---|---|---|
| HM-11 | Introducing a legal obligation for the training of employees in construction offices within local and regional self-governments units in the field of energy efficiency, fire safety, sustainability, green construction, restoration of cultural heritage with elements of climate change adaptation, energy independence, circular economy practices, decarbonization, and integration of natural solutions in buildings | A1: Development of a training and development plan for officials, with the identification of key focus areas and training objectives<br>A2: Creation of specific education programs adapted to the needs of employees in construction offices with a focus on practical application and solutions and cooperation with industry, ministries, contractors, designers and educational institutions<br>A3: Organization of workshops at the local level, where employees would learn about the latest knowledge, techniques and technologies in the field of construction.<br>A4: Introducing a system for monitoring progress and evaluating the effectiveness of educational programs in order to continuously adapt and improve them | Ministry of Spatial Planning, Construction and State Assets | Financial resources for the implementation of the mentioned activities Existing human resources | | until 2026 |
| HM-12 | Monitoring the training of engineers on the topic of energy efficiency in buildings | A1: Identification of specific topics, skills and knowledge that are relevant<br>A2: Establishment of a system that monitors the participation of engineers in training programs<br>A3: Monitoring and documentation of engineer training activities | Chambers | Financial resources for the implementation of the mentioned activities Human resources | This measure is based on measure HM-10 | until 2028 |
| HM-13 | Education of employees in construction offices within local and regional self-government units (JLRS) | A1: Identification of specific topics, skills and knowledge that are relevant<br>A2: Organization of courses and conducting trainings<br>A3: Facilitating practical exercises or situations that employees may encounter in their daily work, in order to gain practical experience and apply the knowledge learned.<br>A4: Periodic evaluation of the knowledge and skills of employees in order to identify the needs for additional training and adjust the training according to these needs. | JLRS (Counties and cities) | Financial resources for the implementation of the mentioned activities Human resources | | until 2030 |

# 9 Conclusions

BUILD UP Skills is a strategic initiative launched by the European Commission in 2011 as part of the *Intelligent Energy Europe program*, while in the last third version it takes place as part of the LIFE *Transition program Clean Energy*. It is currently managed by the EU Climate, Infrastructure and Environment Executive Agency (CINEA).

The main, general aim of the initiative is to increase the number of trained and qualified construction professionals across Europe to provide renovation of buildings that offer high energy efficiency as well as new buildings with almost zero energy consumption. In order to achieve this, it is necessary to increase the number of qualified construction professionals at all levels of the building design, operation and maintenance value chain. There is a need to increase efforts in training and retraining specialists for key skills required for, for example, high-quality construction of zero-emission buildings, increasing ambitious renovation interventions, introducing efficient heating and cooling based on renewable energy sources, especially heat pumps, phasing out boilers on fossil fuels as indicated in the framework of *the REPowerEU plan* to phase out the EU's dependence on fossil fuel imports, while achieving a holistic vision of decarbonizing the building stock. This requires the upgrading of existing training and qualification programs or the development of new ones.

The main activities of the third version of the program were to revitalize the National Platform created in the first phase of the BUILD UP Skills initiative (2011-2012), bringing together all key national stakeholders. The relaunched National Platforms serve to update the Status Quo Analysis and National Roadmap to reflect the new realities of the construction sector.

As part of the CRO skills RELOAD project, the re-launched National Platform brought together all relevant recognized stakeholders in the construction and education sector (representatives of craftsmen, industry members, employers' associations, educational and professional institutions, relevant public bodies and civil society and the media).

Based on a complete analysis of the national situation (*Analysis of the current state of construction in the Republic of Croatia and the skills of construction workers in the field of energy efficiency and renewable energy sources, July 2023*), roadmap was made for the continuous training of construction workers and engineers in the field of energy efficiency. The roadmap takes into account the expected contribution of the construction sector to the national goals for 2030 and the requirements for zero emission buildings (ZEB) through the strategic planning of the system of education and training of construction workers in the field of energy efficiency and renewable energy sources and through the assessment of the market for such labour, which can improve the long-term energy properties of buildings in the Republic of Croatia.

The roadmap is oriented towards three levels of education of the existing and future workforce for professions in construction - vocational education, higher education and lifelong education in the form of training and retraining programs for existing and unemployed workers for the necessary professions.

The roadmap includes:

- overview of trends and prediction of future needs for qualified labour with the aim of meeting defined goals at the level of the European Union by the 2030,
- identification of qualification needs and deficiencies in the construction sector, i.e. quantification of the number of workers who need to be trained at each of the required qualification levels (professional workers, engineers)

- identification of priority measures according to the needs of different sectors (new qualification schemes and/or updating of existing schemes) related to different professions in order to achieve the set goals,
- defining an action plan for the identified measures until 2030, steps for implementing the measure, additional resources, responsible institution for the implementation, sources of implementation, necessary accompanying measures,
- monitoring the progress of proposed activities.

Defined in this way, the Roadmap provides a concrete plan and necessary steps to overcome identified deficiencies at all levels of professional qualifications in order to achieve the 2030 goals in the construction sector. As a result, the National Roadmap have been accepted by the relevant bodies and stakeholders with the obligation of implementation and implementation.

# 10 Letters of endorsement

One of the more important expected results of the CRO skills RELOAD project is the approval (letter of support) of the *National Roadmap for achieving the 2030 goals*, by the ministries and other institutions. This approval should also facilitate the market evaluation of workers and engineers in construction, contributing to the attainment of national energy efficiency and renewable energy source goals.

Table 7 lists the ministries, agencies, associations, schools, and relevant institutions that have provided letters of endorsement for the *National Roadmap for achieving the 2030 goals*. The letters of support for the National Roadmap are provided below.

Table 7 The list of institutions that have provided Endorsement letter

| | Name of institution/organisation |
|---|---|
| 1 | Ministry of Physical Planning, Construction and State Assets Republic of Croatia |
| 2 | Ministry of Science and Education Republic of Croatia |
| 3 | Croatian Employment Service |
| 4 | Agency for Vocational Education and Training and Adult Education |
| 5 | Environmental Protection and Energy Efficiency Fund |
| 6 | Croatian Chamber of Economy |
| 7 | Croatian Chamber of Civil Engineers |
| 8 | Karlovac County |
| 9 | City of Koprivnica |
| 10 | Industry and Trade Vocational School Karlovac |
| 11 | Secondary school Bedekovčina |
| 12 | Vocational school Sisak |
| 13 | High school of construction, natural science, and mining Varaždin |
| 14 | Public Open University Koprivnica |
| 15 | North-West Croatia Regional Energy and Climate Agency REGEA |
| 16 | Međimurje Energy Agency Ltd MENEA |
| 17 | Energy institute HRVOJE POŽAR |
| 18 | HUP Croatian employers' association |
| 19 | Croatian Association of Dry Construction Contractors |
| 20 | HUPFAS Croatian Association of Thermal Façade System Producers |
| 21 | MAPEI CROATIA Ltd |
| 22 | VELUX Croatia Ltd |
| 23 | PLASTFORM Ltd |
| 24 | BAUMIT Ltd |
| 25 | ROCKWOOL Adriatic Ltd |
| 26 | BIM Concept d.o.o. |
| 27 | Architectural studio Helman and Jukić |
| 28 | Keindl BAU Ltd |
| 29 | Klimaproing Ltd |
| 30 | GREENiKA |
| 31 | Croatian post bank - real estate Ltd |
| 32 | University of Zagreb Faculty of Civil Engineering |
| 33 | Croatia Green Building Council |
| 34 | Regional Energy Agency North |
| 35 | Association of Construction Schools of the Republic of Croatia |
| 36 | Croatian Chamber of Trades and Crafts |

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Matija Duić and Marko Turković

REGIONAL ENERGY AGENCY NORTH:
Denis Premec, Marija Somogji Lončarić and Tomislav Hlevnjak

GREEN BUILDING COUNCIL CROATIA:
Franciska Erdelj and Aleksandar Jelovac

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Snježana Erdeljac and Andreja Jurman

# 12 Dictionary

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|---|---|
| ASOO | Agency for Vocational Education and Adult Education |
| BIM | Information modeling of buildings (Building Information modeling) |
| EE | energy efficiency |
| EQF | European Qualification Framework |
| EU | European Union |
| CQF | Croatian qualification framework |
| ISVU | Information System of Higher Education Institutions |
| NQP | National qualification platform |
| nZEB | nearly zero energy buildings |
| RES | renewable energy sources |
| JLRS | local and regional self-governments unit |
| RH | Republic of Croatia |
| VET | Vocational education and training |
| ZEB | zero energy buildings |
| FZOE | Environmental Protection and Energy Efficiency Fund |
| ZOJN | Public Procurement Law |



Co-financed by the European Union