

SKILLS AND QUALITY JOBS IN CONSTRUCTION

IN THE FRAMEWORK OF

THE EUROPEAN GREEN DEAL

AND THE POST-COVID RECOVERY

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EXECUTIVE SUMMARY

Why the Study

Construction industry in Europe faces a number of problems. Trade unions are demanding a paradigm shift, not a return to business as usual. The new investments to renovate and expand the built fabric brings opportunities to create more jobs as well as to discuss existing challenges. The outcome of the study will be used to inform EFBWW and the Just Transition Centre of ITUC to advocate for an overhaul of the business model, which includes an ageing workforce, cheap unskilled labour in long subcontracting chains, with high levels of insecurity and hazardous working conditions. This business model is unlikely to deliver the number of workers and the skill level necessary to meet the climate targets because it is predicated on minimal investment in the labour force and in the quality of the work. The new investments offer an opportunity to restore the attractiveness of the sector for young people and a more diverse workforce, through improving working conditions and the apprenticeship offer.

The objectives of the study are:

- **to identify how many workers need to be upskilled and re-skilled, and how many new workers need to enter and remain in the sector to achieve the Renovation Wave and other relevant EU climate law targets.**
- **to demonstrate how many jobs/workers will be sustained through EU funds, public investment and procurement contracts in the framework of the Resilience and Recovery Facility.**

The EU in action: the Green Deal, Climate Law and the Renovation Wave

Approved in 2020, the EU Green deal is a set of policy initiatives by the European Commission with the overarching aim of making the EU carbon neutral by 2050. To arrive at this target, the EC established a new target: to reduce by 55% the level of Greenhouse Gas Emissions (GHG) by 2030, with respect to GHG Emission levels of 1990. The EGD identified 16 pieces of legislation which need to be updated. It also approved a Sustainable Europe Investment Plan valued at 1 trillion Euros. In addition, the EC approved a Fit for 55 action plan to make sure the 2030 target is achieved. In 2021 the EC Climate objectives were legally adopted in the EU Climate Law.

The role of the construction and in particular the building renovations and maintenance subsector is key. To achieve the 55% GHG reduction target by 2030, the EC approved in 2020 the strategy „A Renovation Wave for Europe – Greening our buildings, creating jobs, improving lives“ [↗](#). The aim is to reduce buildings' GHG Emissions by 60%, their final energy consumption by 14% and energy consumption for heating and cooling by 18%. The renovation wave aims for more. Today the weighted average rate of energy renovation is only 1% per year. The Commissions' target is to at least double this rate by 2030, while increasing the average gains in terms of energy efficiency. A total of 35 million buildings would be renovated and 160,000 jobs would be created in the coming decade. The details of the buildings are unclear. The methodology for estimating the employment creation has not been disclosed and can be considered extremely low.

More than 220 million building units, representing 85% of the EU's building stock, were built before 2001. Yet 85-95% of the buildings that exist today will still be standing in 2050. EC projections are for a 1% annual energy renovation rate for 2021-2022, an increase to 1.2% a year in 2023-2025 before stabilising at least 2% per year in 2026-2029. The rate of renovations that concern the change of heating equipment only will have to reach around 4% in 2026-2030 in both the residential and services sector.

Financing Needs and Instruments in the Renovation Wave

Building renovation is one of the sectors facing the largest investment gap in the EU. To achieve the 55% climate target by 2030, the EC estimates around €275 billion of additional investment in building renovation is needed every year. EU Funding available for the Renovation Wave includes funding from the Recovery and Resilience Facility as well as the Multiannual Financial Framework (MFF) budget. The EU Recovery and Resilience Facility (RRF) is a budget extension to the MFF and is the centrepiece of NextGenerationEU. RRF funding is based on National Recovery and Resilience plans that address policy reform and investment (total of 672.5 bn Euros in loans and grants) needs in the coming years, 2021-2027. These have been approved by the EC and implementation is underway. Energy efficiency accounts for 29% of the total expenditures under the green transition pillar (total cost of EUR 64.4 billion). Some of these relevant investments also include measures aimed at addressing energy poverty. Renovations of public buildings as well as housing are well represented across many plans. Lastly, there are also investments for the construction of new highly energy efficient public and private buildings. All EU countries have established long-term renovation strategies to support the renovation of their national building stock into a highly energy efficient and decarbonised building stock by 2050. Despite having identified skills shortages as a key challenge to address, most long-term strategies

do not include budget allocations for worker upskilling and reskilling. Few countries included clear funding proposals for skills development in the Recovery and Resilience Plans. Among those that do, Croatia plans to finance a framework for green jobs needed for post-earthquake reconstruction, Romania aims to create specialised university courses and certification schemes, and Ireland will create a Green Skills Action Programme focused on the low-carbon economy.

There are few studies that have aimed at quantifying the employment creation of the Renovation Wave. There are also a few studies that have estimated training needs of the construction workforce to address the demand for renovation-related skills, but none of them exclusively for the Renovation Wave. Hence an added value of the current study.

Methodology and data sources assessment

Worker upskilling, reskilling; and recruitment and retention needs

Some of the most important types of training needs relevant to the Renovation Wave are specialised energy efficiency, basic climatic literacy and OSH (occupational safety and health). Three distinct *ad hoc* methodologies were used. Renewable energy and digitalisation are also important, but training needs linked to the Renovation Wave could not be calculated due to lack of available data and methodological issues.

ENERGY EFFICIENCY TRAINING is calculated per occupation based on the information collected in the Construction Blueprint project (2020) and cross-checked with industry studies to cover management occupations out of the scope of the project. The number of workers to be trained include workers already in the labour market and those entering the labour market that will require additional training on EE.

Training related to Energy Efficiency can be classified into two main types: specialised EE training and basic climatic literacy training.

SPECIALISED EE TRAINING is specific to companies and workers dealing directly with the technologies and products related to energy efficiency. The contents of training courses should be adapted to the occupational needs and categories of workers. They have not been quantified in a consistent manner in the national skills needs surveys available. We estimated they are needed for 35% and 45% of the workforce in the building renovations sector, including those already working and those entering the labour market. The figures have been cross-checked with the size of skilled workforce in the general construction sector and training needs represent around half of the skilled workforce.

BASIC CLIMATIC LITERACY, EE AND CIRCULAR ECONOMY TRAININGS are needed for all workers of the building renovations sector to maximise energy savings. From CEOs to non-specialised staff. This was highlighted in the only EU wide survey addressing needs where 52.2% of construction companies stated that energy efficiency skills are important for team leaders. 51.5% consider energy efficiency skills being important or very important for company managers as well. Results were also consistent with the level of experience of workers and among calculation staff, technicians and site managers. Finishers or plasterers for instance require complementary training on new techniques and products. The same for team leaders and site managers. Circular Economy is also important to optimise resources.

FUTURE NEEDS – In the coming years recruitment and retention needs of construction workers will increase due first to the expansion of EE renovation activity. In addition, 1,259,647 building renovation workers will retire between 2023 and 2030. Recruitment and retention needs in the coming years will be triggered by replacement demand in the sector. There is then an opportunity to expand the range of women and youth.

OCCUPATIONAL SAFETY AND HEALTH (OSH) TRAINING: Include company specialists in OSH and labour inspectors. OSH training should be delivered to all, especially those working on sites.

Increased activity in the construction sector will mean that existing inspectorates should cover additional number of workers, worksites and companies. More should be recruited. An approximation can be done assuming two construction site inspections per week, each taking two days.

Direct, indirect and induced employment through Input-Output tables

The methodology used to estimate the impact in terms of direct, indirect and induced employment was the Input-Output Analysis. The FIGARO tables are the most recent input output tables for economic modeling. FIGARO tables show that 1 € invested in the construction sector generates 2.2. € on average in the rest of the EU economy.

The study calculates direct and indirect job impacts of the RRF as well as related training and labour needs. These estimates depend on modeling assumptions. But information is disperse and many times not consistent across EU Members and thus certain assumptions can be contested. Estimates assume there are no labour market frictions. In particular, the labour force is assumed to adapt to the structural change in skill requirements associated with the transition to a low-carbon economy; the faster the change, the more likely it is that there may be frictions that leave some workers temporary unemployed and some demands for new skills unmet, preventing the full potential benefits from being realised. Moreover, the appreciable investment required assumes that there are no barriers in accessing the finance necessary for this transition.

Scenarios

The proposal submitted suggested calculating employment (direct, indirect and induced) effects according to three distinct scenarios.

THE FIRST SCENARIO estimates employment creation under current agreed Recovery and Resilience financing. The total investment in energy efficiency renovations committed by Member States in the context of the Facility were calculated making use of the National Recovery and Resilience Plans (NRRPs) and a study by E3G commissioned by the Renovate Europe Campaign.

More than 38 billion Euros will be spent by EU Member States as direct funding (grants and loans) for energy renovations. This corresponds to approximately 8% of the total RRF funding. This is lower than the estimates of the European Commission. Unfortunately, in most NRRPs funding allocation does not include a corresponding target for number of buildings nor area to be renovated per year. This however is not an impediment to calculate the total number of jobs created under the funding.

SECOND SCENARIO:

2 % ENERGY RENOVATION AND PRE-CRISIS JOB CREATION: The Renovation Wave Strategy estimates that the additional investment needed for renovation to meet the new 55% target, including decarbonising heat in buildings, is 275 billion Euros per year to 2030 – the largest climate investment gap in any sector. This means that the total investment needed until 2030 is over 3.5 trillion Euros, including public and private spending. This large investment corresponds to around 2.3% of the total worth of the European building stock (150 trillion Euros).

According to a BPIE report, the 2% annual renovation rate objective of the Renovation Wave will deliver CO₂ emission reductions of around 46% compared to 1990, or a 42% reduction compared to 2015. This means that the assumed changes in policies and technology deployment under this scenario are far from being aligned with a 55% GHG emissions reduction target.

BPIE advocates for a 3% energy renovation rate but unfortunately the scenario could not be assessed due to lack of costing.

Investments to achieve the renovation wave are not quantified in each country but across the entire EU. The decision to allocate EU funding among different states is political and therefore it is best to calculate employment effects on the entirety of the EU.

Housing investments (including renovations and maintenance) summed up 819 billion Euros. Covering the financing gap of 275 billion Euros represents a 34% increase of investments in Europe. Conversely, the financing gap represents 1.88% of the entire EU GDP while housing investments represent 5.6%.

THIRD SCENARIO:

2 % ENERGY RENOVATION AND CEDEFOP

FORECASTED JOB CREATION: The third scenario makes use of a CEDEFOP study assessing the impacts of the Renovation Wave and relies on the Cambridge Econometrics E3ME macro-econometric model. The assumptions of the study incorporate the efficiency gains and the financial cost of 275 billion Euros as well as changes in the EU emissions trading system aimed at accelerating the renewable energy transition in road transport, and policies encouraging less carbon-intensive technology. The impacts of future price increases of polluting energy sources (through taxation) on road transport and buildings are also incorporated.

Main Findings and Case Studies

Worker training, recruitment and retention needs

To achieve the ambitious objectives of the Renovation Wave, the building construction and renovations sector should recruit and maintain in the sector workers with all kinds of trades and in different hierarchical positions. We can distinguish four types of jobs that will not only be affected, but are essential to the Renovation Wave: (a) Thyroid occupations (R&D positions that typically draw candidates from the STEM profile and are central for designing, developing and implementing technological advancements); (b) Occupations directly related to EE in the building construction and energy renovations sector (mainly the categories of blue collar workers); (c) other occupations in building construction and energy renovations sector (from CEOs to site managers and some skilled occupations as well as related renewable energy, circular economy and digitalisation sectors/occupations); (d) support occupations such as OSH managers and labour inspectors.

Training, recruitment and retention needs in the second scenario

To find out the total number of workers that will be needed in 2030, we need to estimate the number of new workers needed by the industry for that date. If demand in the EU were to grow to meet the 2030 targets, we can say that all new workers would engage in conducting work related to energy efficiency renovations in construction, except for a small group dedicated to the finishing touches of the undertaken works.

Employment in Energy Efficient construction and renovations was around 8,536,000 workers as of 2021. To estimate the number of workers needed in 2030 we compare the current employment levels with those with similar investment levels. It will be necessary at least 1,549,000 more workers to meet the European targets for 2030.

Approximately 1,259,647 workers will retire between 2023 and 2030 and will need to be replaced with new recruitments. The figure does not include recruitment needs derived from workforce leaving jobs in the sector and into others. Therefore, additional recruitment needs between 2022 and 2030 will be at least 2,808,647 workers.

Specialised Energy Efficiency training: between 35% and 45% of the buildings construction and renovation workforce will need specialised EE training: between 3,529,759 and 4,538,262 workers. They cover both the new workers and those already engaged in such activities.

Basic climatic literacy, Energy Efficiency and Circular Economy trainings – to recap, 10,085,026 workers (100%) of the building renovations sector would need such training on basic climatic literacy and applied aspects of EE.

Training, recruitment and retention needs in the third scenario

The CEDEFOP study estimates an additional 486,600 jobs in construction by 2030 compared to a baseline scenario without the Green Deal. These include Highly skilled non-manual occupations (122,500), skilled non-manual occupations (28,600), skilled manual occupations (305,200) and elementary occupations (30,400). Additional recruitment needs between 2022 and 2030 will be 1,746,247 workers. The figure does not include recruitment needs derived from workforce leaving jobs in the sector and into others.

SPECIALISED ENERGY EFFICIENCY TRAININGS – In the third scenario, between 3,157,871 and 4,060,230 workers will need specialised EE training.

BASIC CLIMATIC LITERACY, ENERGY EFFICIENCY AND CIRCULAR ECONOMY TRAININGS – 9,022,488 workers (100%) of the building renovations sector would need such training on basic climatic literacy and applied aspects of EE. From CEOs to team leaders,

design and calculation professionals, site managers as well as specialised and non-specialised staff.

Combining the results from the second and third scenarios, between 3,157,871 and 4,538,262 workers will require specialised Energy Efficiency training.

Labour demand for OSH Managers and Labour Inspectors

To highlight the importance of investing in a prevention culture for workers we estimated broad recruitment and retention needs for OSH managers and labour inspectors. Calculating the additional demand is complex, as it depends on the recruited capacity, national legislation and the increased business. In some European countries OSH managers are required by law in companies with over 10 employees. Assuming an OSH manager is hired for every additional 90 construction workers, considering all the building construction and renovations sector, total OSH managers would be 112,056 and 100,250 respectively in scenarios 2 and 3.

Additional recruitment and retention requirements for labour inspectors under the Renovation Wave depend on the number of existing labour inspectors, tasks performed and overall targets for the sector. Assuming 30 million buildings will require EE renovations and between 0.5% and 10% of all buildings will be inspected at least once, between 268 and 5,357 labour inspectors will be required to ensure labour rights and working conditions are effectively respected in construction worksites. These will be mobilised from the existing labour inspection teams and from recruitment processes.

Job creation in energy and resource-efficient renovations sector in different scenarios

Scenario 1. Job creation under the National Recovery and Resilience Plans, 2021-2026

The most recent bibliography and statistical findings available have been considered to calculate job creation projections. All formulas and key numbers are outlined in the annexes and in the scenario building sections above mentioned. Energy Efficient renovations of the European Building stock linked to National Recovery and Resilience Plans will have a positive effect on direct job creation in the EU, generating around 2.4 million jobs. The countries with most direct job creation correspond logically to those with highest investment. It is worth noting that countries include important EE Renovation packages aside from the funds allocated by the EU. These are however not part of the study.

Scenarios 2 and 3 The Renovation Wave and CEDEFOP Study

The job creation potential of EE in the EU is huge. An increase of 275 billion Euros investment between 2022 and 2030 would have the potential to generate around 44.5 million direct jobs in the same period. This is more than 3 times the current employment in the sector (13.4 million). Equally important is the indirect job creation potential generated by increased demand in all other sectors generated by the construction sector, 106.8 million jobs. Finally, around 61 million induced jobs would be created between 2022 and 2030.

Main Findings

The impacts of the Renovation Wave on construction employment have not been studied in depth. Available information is scarce. Nevertheless, it was possible to bring together and analyse the data here presented. The policy recommendations are within the limits of such data. Construction sector training needs were last estimated in 2012, and only for blue collar workers. By the end of 2023, countries participating in the Building Up Skills programme will conduct *Status Quo* analysis' quantifying Energy Efficiency, Circularity and training needs for white as well as blue collar workers.

There are three interrelated elements key to the successful delivery of the Renovation Wave, the Fit for 55 and the EU Green Deal targets: access to financing, technical assistance addressing demand for renovations, and most importantly, workers' skills. Financing of workers' upskilling and reskilling has however not been addressed in a consistent way in the Facility Plans and in most specific countries. Long term renovation strategies of Member States mention a number of programmes that can address the skills challenge. However, it seems that these remain largely targeted to specific training areas and are not mainstreamed along the entire construction sector value chain. To bring out system innovations – concerted action among knowledge institutions, education and training, trade unions, government, contracting authorities and contractors is needed.

Lifelong learning and training to develop professional skills for several occupations within the sector is essential. The industry should also be enabled to absorb specialised professionals with compatible skill sets (including those with experience in relevant declining industries), by offering targeted training.

Addressing energy efficiency of buildings, and in particular the Renovation Wave constitutes an important opportunity to address decent work deficits. Environmental protection has a human rights ethos. So has decent work. It is contradictory not to respect the rights of the very workers involved in the renovation programmes.

Effects of RW on OSH

The Renovation Wave will also affect the supply chain, generating demand for renewable energy solutions and the replacement of fossil fuels. Examples include the wind turbine sector, the solar energy industry and the later recycling of its parts, the manufacture of energy-efficient lights. There are risks as a result of substitution of materials.

Risks as a result of substitution for more environmentally friendly substances include, for example: the substitution of solvent-based for water-based paints has included the addition of biocides, and the substitution of hydro-chlorofluorocarbons for chlorofluorocarbons has increased the risk of exposure to carcinogens, as well as to fire hazards. The increased volume of construction works will also create demand for more inspectors.

Case study: Germany

The German case first presents how low energy and climate literacy have been embedded into vocational education and training in construction in the country. Germany's training approach is called "occupational", resting on a statutory framework, social partnership, recognised qualifications, comprehensive, broad, and recognised VET programmes, multi-dimensional competence, occupational capacity and knowledge, general and civic education, permeability, and educational standards related to curriculum content.

The German case also includes specific illustrations of just transition to clean energy in two German regions. The cases of phasing-out coal mining has direct implications for the workers along the construction value-chain, as they are related to construction materials. This is an important reason for unions from other countries to learn about the German experience.

Case study: Spain

The case of Spain starts with an overview of good practices in the overall VET system, followed by a specific analysis of the Labour Foundation of the Construction Sector. VET in Spain is organised by the state in close collaboration with social partners, such as employers' organisations and trade unions. Vocational training has a higher workshop and work-based learning element, with classroom learning making up 43%, and completers are awarded certificates endorsing their professional skills, rather than diplomas. Vocational Certificates can be gained in all the professional families indicated below.

Initial Vocational Education and Training (IVET) is nationally organised and college-based, with substantial work-based learning (up to 65%) elements within it. It is organised into Basic Vocational Education, Mid-Grade Vocational Education and High-Grade Vocational Education. Basic VET programmes are offered from age 15 and target students at risk of leaving education. After this 2-year training, they can continue onto mid-grade VET or take general school leaving examinations. Mid-grade programmes start at 16 years old and allow access to higher level VET. There are 26 strands ('professional families') in the VET system. The Ministry of Education and Vocational Training oversees the design and approval of the minimum training contents for each diploma of vocational education. VET at all three grades involves work-based learning (20%), together with practice in a workshop (32%) and theoretical learning in the classroom (48%). There are also recent initiatives to introduce a dual system. Continuous training (CVET) is provided by public and private organisations. All companies can have access to the CVET system, including micro companies, though not all appear to take advantage as in 2017 there were about 4 million participants out of a working population of 18 million.

The Spanish case concludes with an analysis of the Labour Foundation of the Construction Sector. It has national implementation, sectoral nature, and is a non-profit parity entity, focusing on continuous and lifelong learning. Moreover,

the social dialogue aspect of the FLC has contributed greatly to its success because the levies made VET free for the workers themselves. Furthermore, the social dialogue has unified the construction sector in promoting professionalism, training, health and safety, and employment opportunities.

Policy recommendations

EU and national policy

Establishing ambitious EU-level strategies and legislation packages transposed to national legislation is an important aspect of delivering the EU Renovation Wave. EFBWW can advocate for the reduction of clauses diluting the ambitious goals set by the directives, focusing on the governments that are most opposed to an ambitious agenda. Practical options include:

- (a) advocate for a more ambitious Energy Performance of Buildings directive and the Energy Efficiency directive, regarding renovation targets of public and private buildings, health and safety protection, and social issues such as energy poverty and roof leakages;
- (b) advocate and build partnerships with other civil society organizations to promote greater buy-in of national governments.

GOVERNANCE AND SOCIAL DIALOGUE:

Given the fact that changes in construction have been happening fast and are due to continue, a constant mechanism of social dialogue should remain in place. The goal is to co-govern the green transition by implementing transversal action plans. Unions should have clear policies, action plans and trainings that focus on:

- (a) appointing a supporting TU green representatives at company and national levels;
- (b) set up Sustainability Committees. Forums can be integrated into different structures with clearly established membership criteria and operational procedures;
- (c) negotiate an environmental agreement or policy;

(d) build alliances that strengthen the needs of workers to the climate and wider social agenda. Alliances should take place across regional, national and local levels and areas of intervention; (e) deliver adapted strategies for smaller companies where worker representation is lacking, based on good practices (f) promote local social dialogue to address specific local issues which cannot be grasped at the national level.

NEW JOBS: between 486,600 and 1,549,000 additional workers will be needed in the buildings construction and energy renovations sector between 2023 and 2030. Around 1,259,647 additional job posts will need to replace the ageing of the workforce in the same period. The Renovation Wave will also require between 100,250 and 112,056 OSH managers and between 268 and 5,357 labour inspectors. Investments in energy renovations under the Recovery and Resilience plans already have important employment effects in the construction sector and supply chains. An important recommendation is that policies should take into consideration that real figures are higher than existing estimations. This has different implications, for example: (a) unions should plan their awareness raising and advocacy campaigns taking into consideration the actual number of entrants in the industry; (b) training needs should take into consideration not only upskilling and reskilling, but also the entrants; (c) make sure that the 2023 *Status Quo* analysis to be conducted by the Building Up Skills programme be as accurate as possible in quantifying energy efficiency, circularity and training needs; (d) there are established institutions, which can cross-reference and support the above (e.g. ITEC, labour-oriented university departments, etc.); (e) campaign to the creation of local, inclusive, and decent work (no outsourcing).

CALCULATIONS ON TRAINING NEEDS: Policies related to the Renovation Wave do not include estimates nor plans to address the skills gap. Skills needs assessments are seldomly updated and there are no consistent EU wide methodologies to calculate them. Making use of conservative assumptions and the (scarce)

information available, between 3,157,871 and 4,538,262 workers will require specialised energy efficiency training to achieve the Renovation Wave. Additionally, all the buildings construction and energy renovations workforce (10,085,026 workers) will require basic climatic literacy and energy efficiency training. Consistent information at the EU level is required to formulate EU-wide policy recommendations. In the first quarter of 2023, further information will be made available from the Construction Blueprint Observatory and CEDEFOP Skills Forecast survey. Specific points (a) assessments do not quantify training needs for the different work profiles. Existing surveys provide *ad hoc* methodologies to quantify skills needs; (b) all workers in the buildings construction and energy renovations sector require basic climatic literacy and energy efficiency training. This also includes higher dependency and coordination between occupations and hierarchical levels in businesses.

FINANCING UPSKILLING: National programmes remain targeted to specific training areas. Despite their importance, upskilling and reskilling financing have not been addressed in a consistent manner in the Recovery and Resilience Facility Plans. Trade Unions should advocate for policies which finance upskilling and reskilling along the entire construction sector value chain.

TRAINING: Considering that approximately 2,200,000 workers will retire between 2022 and 2030, job advertisements in the coming years should focus more on replacement demand, not only new demand. Attracting youth is therefore important to deliver the Renovation Wave. Approaches to VET for LEC vary considerably, though countries face similar challenges. Deep integration of energy literacy into existing occupational profiles, curricula or syllabi at all levels is preferable to just adding LEC-related topics onto IVET programmes. CVET for LEC presents a challenge, particularly in the short term, as courses and a range of delivery methods are needed, catering to different existing training and qualifications levels. There are factors which hinder VET for LEC

development and to achieve an integrated construction process need addressing. Recommendations for action include: (a) update the list of specific professions for VET, related to energy efficiency improvement and the use of renewable sources. This may involve increasing, merging and/or updating the list; (b) mainstream in educational requirements by professions of new knowledge, skills and competences (KSC), related to the energy efficiency renovations. E.g. waste management in construction sites, the use of innovative materials and technologies for thermo-modernisation of buildings; (c) involve trade unions and companies in training plans and programmes for schools and vocational training centres; (d) start from basic education.

CHANGES IN THE INDUSTRY: The construction industry is changing rapidly to address environmental and other challenges (such as demographic growth) and at the same time to incorporate the evolving digital technologies. Changes in the industry will naturally create new demands for VET. Trade Unions should keep abreast of the ever-changing industry and at the same time dialogue with VET institutions to make sure that they are aligned.

GOOD PRACTICES / CASE STUDIES: There are many other good practices, in addition to the ones presented in the “Case Studies” section. There are many programmes to upskill and train workers (noted throughout the Report and annexes). There is scant information about how many green jobs will be created and whether they are new jobs or replace non-green jobs. Trade Unions should: (a) consult the good practices, which can serve as inspiration (with the necessary adaptations); (b) bear in mind that to obtain existing and detailed data about case studies would entail finding institutions which have such appropriate information, or they should advocate to set up new one(s). Other useful documents are included in Annex 1; (c) if the Unions in a given country do not have the necessary information, they can either set up a way to obtain it via a partnership and/or to refer to additional sources.

BUSINESS CASE: There is definitely a business case for energy efficiency in construction. Trade Unions and other organizations interested in sustainable construction and its positive impact on labour can use this for advocacy purposes. The motivations for the business case include existing incentives for sustainable construction, taxes for non-sustainable construction, market choices and corporate image. Trade Unions could: (a) consider disseminating the business case to possible uninformed entrepreneurs, (b) bear in mind that there is a specific business case for occupational safety and health, applicable to this context.

A HOLISTIC APPROACH: putting everything together low energy construction means a transformation of VET systems to encompass deeper knowledge of energy efficiency, higher technical and precision skills and, above all, a holistic approach so that the building envelope is conceived as a single thermal unit and the social interaction of different occupations is understood. Climate literacy is tied to social equity and climate justice, comprising affirmation of the social contribution and responsibility construction workers, their unions, and the industry have to reduce emissions and the influence they have in determining policy direction.

POLICY AND PRACTICAL BACKGROUND TO THE STUDY

Purpose of the study

An ageing workforce, skills shortages, precarious work, and a lack of gender diversity are among the largest main challenges in a sector that has also been severely hit by the COVID pandemic. Trade unions are demanding a paradigm shift. Not a return to business as usual. In particular, the European Federation of Building and Woodworkers (EFBWW) is calling for sustainable investment to create new jobs in the context of the Green Deal, a relaunch of the building and related industries based on social progress and direct employment, a plan for new European infrastructure and to update and maintain existing infrastructure, speeding up the Renovation Wave with specific attention to affordable housing, and initiatives to combat energy poverty. The EU estimates that 160,000 new jobs will be created in Europe. But the EFBWW believes this grossly underestimates the actual need.

The outcome of the study will be used to empower EFBWW members with information that supports their advocacy for an overhaul of the business model, which at present includes cheap unskilled labour in long subcontracting chains, with high levels of insecurity and hazardous working conditions. This business model is unlikely to deliver the number of workers and the skill level necessary to meet the climate targets, because it is predicated on minimal investment in the labour force and in

the low quality of the work. The new investments offer an opportunity to restore the attractiveness of the sector for young people and a more diverse workforce, through improving working conditions and the apprenticeship offer.

The objectives of the study are:

- to identify how many workers need to be upskilled and re-skilled¹, and how many new workers need to enter and remain in the sector to achieve the Renovation Wave and other relevant EU climate law targets;
- to demonstrate how many jobs/workers will be sustained through EU funds, public investment and procurement contracts in the framework of the Resilience and Recovery Facility.

Policy analysis – The EU Green Deal, Climate Law and targets of the Renovation Wave

Approved in 2020, the EU Green Deal (EGD) is a set of policy initiatives by the European Commission (EC) with the overarching aim of making the EU carbon neutral by 2050. To arrive at this target, the EC established a new target: to reduce by 55% the level of Greenhouse Gas Emissions (GHG) by 2030, with respect to GHG Emission levels of 1990.² The EGD identified 16 pieces of

1 For the purpose of this report, the term 'reskilling' is used when the skills of a given worker are not useful for a given new type of work. Therefore, the worker needs a different set of skills. Here it does not refer to situations in which companies use the term 'reskilling' as an excuse to lay-off workers that may not have a given set of skills.

2 Previous climate targets aimed for a decline of GHG Emissions of 40%, but the new EC aimed for a faster and deeper climate transition.

legislation (e.g. the Energy Performance of Buildings Directive and the Energy Efficiency Directive) which need to be updated. It also approved a Sustainable Europe Investment Plan accompanying the EGD valued at 1 trillion Euros. In addition, the EC approved a Fit for 55 Action Plan to make sure the 2030 target is achieved. In 2021, the EC Climate objectives were legally adopted in the EU Climate Law.³

The EU Renovation Wave

The role of the construction and in particular the building renovations and maintenance sectors are key. Buildings in the EU are responsible for around 40% of the final energy use and 36% of total GHG Emissions. To achieve the 55% GHG reduction target by 2030, the EC approved in 2020 the strategy “A Renovation Wave for Europe – Greening our buildings, creating jobs, improving lives” ↗ to boost renovation in the EU. According to the Renovation Wave Strategy (RWS) and action plans⁴, The EU should reduce buildings’ GHG Emissions by 60%⁵, their final energy consumption by 14% and energy consumption for heating and cooling by 18%. The renovation wave aims for more and deeper renovation. Today the weighted average rate of energy renovation is only 1% per year. The Commissions’ target is to at least double this rate by 2030, while increasing the average gains in terms of energy efficiency. A total of 35 million buildings would be renovated and 160,000 jobs would be created in the coming decade due to the Renovation wave. It is unclear the depth (light, medium, deep) and the types of buildings (residential or non-residential) that are included in the 35 million figure, as this has not been disclosed. The methodology for estimating the employment creation has not been disclosed and can be considered extremely low.⁶

The Renovation Wave Challenge

- More than 220 million building units, representing 85% of the EU’s building stock, were built before 2001. Yet 85-95% of the buildings that exist today will still be standing in 2050.
- Most of those existing buildings are not energy-efficient and only 3% are class A. Many rely on fossil fuels for heating and cooling, and use old technologies and wasteful appliances. Energy poverty remains a major challenge for 35 million Europeans.
- The Energy Building Performance of Buildings Directive already establishes requirements for Energy Performance Certificates (EPCs) in case of construction, change of occupancy and for buildings occupied by public authorities and frequently visited by the public of over 250 m². However, the coverage of EPC is still limited, with several Member States having less than 10% of the building stock with EPCs. Their quality and fair pricing remain an issue, eroding the trust in this tool.
- Only 11% of the EU existing building stock undergoes some level of renovation each year. However, very rarely, renovation works address energy performance of buildings. The weighted annual energy renovation rate is low at some 1%. Across the EU, deep renovations that reduce energy consumption by at least 60% are carried out only in 0.2% of the building stock per year and in some regions, energy renovation rates are virtually absent. At this pace, cutting carbon emissions from the building sector to net-zero would require more than 100 years.
- As well as reducing emissions, these renovations will enhance quality of life for people living in and using the buildings, and should create many additional green jobs in the construction sector.

3 EU Climate Law, July 2021. More in: https://climate.ec.europa.eu/eu-action/european-green-deal/european-climate-law_en#:~:text=The%20Climate%20Law%20includes%3A,of%20emission%20reductions%20and%20removals

4 The Renovation Wave identifies 3 focus areas: tackling energy poverty and worst-performing buildings, public buildings and social infrastructure, and decarbonising heating and cooling. More on the RW here. For a detailed analysis the Staff Working Document is most recommended.

5 Climate Target Plan 2030 (“Stepping up Europe’s 2030 climate ambition Communication” COM (2020) 562 final

6 The EC uses E3ME Cambridge Macroeconomic model. <https://www.e3me.com/>

- **THE RENOVATION WAVE TARGET** – The EU building stock includes more than 220 million building units. To account for the fact that renovation projects have certain lead times, EC projections are for a 1% annual energy renovation rate for 2021-2022, an increase to 1.2% a year in 2023-2025 before stabilising at least 2% per year in 2026-2029.⁷ The rate of renovations that concern the change of heating equipment only will have to reach around 4% in 2026-2030 in both the residential and services sector.

Financing Needs and Instruments in the Renovation Wave

Building renovation is one of the sectors facing the largest investment gap in the EU. To achieve the 55% climate target by 2030, the EC estimates around €275 billion of additional investment in building renovation is needed every year. EU Funding available for the Renovation Wave includes funding from the Recovery and Resilience Facility as well as the Multiannual Financial Framework (MFF) budget.

The EU Recovery and Resilience Facility (RRF) is a budget extension to the MFF and is the centrepiece of NextGenerationEU. RRF funding is based on National Recovery and Resilience plans that address policy reform and investment (total of 672.5 bn Euros in loans and grants) needs in the coming years, 2021-2027. These have been approved by the EC and implementation is underway. Energy efficiency accounts for 29% of the total expenditures under the green transition pillar (total cost of EUR 64.4 billion). The majority of investments in this area concern the energy efficiency of residential buildings, typically targeting a reduction in primary energy demand of 30% or more. Some of these relevant investments also include measures aimed at addressing energy poverty, by targeting vulnerable groups for whom the significant upfront costs make it almost impossible to invest in the energy efficiency of their homes. Renovations of public buildings are well represented across the majority of plans, such as in schools, sport halls and historical buildings. Lastly, there are also investments for the construction of new highly energy efficient public and private buildings. Selected examples from Spain and Belgium are included in Box 1. Beyond buildings, energy efficiency investments in other sectors will help the decarbonisation of production processes in SMEs, larger enterprises and district heating systems, e.g., by promoting the integration of cleaner and more energy efficient technologies for manufacturing processes and centralised heat production.

BOX 1.

SELECTED EXAMPLES OF ENERGY EFFICIENT RENOVATION PROGRAMMES INCLUDED IN NATIONAL RECOVERY AND RESILIENCE PLANS

SPAIN will support more than half a million energy renovation actions in residential buildings by 2026. These renovations will achieve on average a primary energy demand reduction of at least 30%. The investments are complemented by a coherent package of reforms, including tax incentives and renovation offices (“one-stop-shops”) to facilitate renovations.

THE RRF OF BELGIUM will stimulate energy efficient renovations of buildings with a total support of over EUR 1 billion. The wave of renovation will concern more than 200,000 private and social housing units and will cover more than one million m² of public buildings. Belgium faces important renovation needs to meet climate objectives.

⁷ Energy renovations are based on total floor area and not in terms of buildings.

Few countries included clear funding proposals for skills development in the Recovery and Resilience Plans. Among those that do, Croatia plans to finance a framework for green jobs needed for post-earthquake reconstruction, Romania aims to create specialised university courses and certification schemes, and Ireland will create a Green Skills Action Programme focused on the low-carbon economy.

All EU countries have established long-term renovation strategies to support the renovation of their national building stock into a highly energy efficient and decarbonised building stock by 2050.⁸ In spite of having identified skills shortages as a key challenge to address, most long-term strategies do not include budget allocations for worker upskilling and reskilling.⁹

Energy efficient renovations of private and social housing will also help address energy poverty. RRP include several reform programmes to encourage building renovation in all sectors: private and public buildings, residential, office and factory buildings. The reforms aim at making financial support available for renovation more efficient (e.g., one stop shop) and more environmentally friendly. In particular, they include conditions for replacing outdated heating and cooling systems and encourage their replacement by renewable energy or district heating.

As mentioned above, there are other EU Financing instruments that will help to deliver the Renovation Wave. These are presented in Figure 1.

FIGURE 1.
EU FINANCING INSTRUMENTS TO DELIVER THE RENOVATION WAVE

FOR DIRECT INVESTMENTS	<ul style="list-style-type: none"> • Recovery and Resilience Facility • Cohesion Policy Funds (ERDF, ESF, EU-REACT)
FOR RESEARCH AND INNOVATION	<ul style="list-style-type: none"> • Horizon Europe • Built4People • EGD Calls • Smart Cities
TO LEVERAGE PRIVATE INVESTMENTS	<ul style="list-style-type: none"> • InvestEU • Private Financing 4 Energy Efficiency • European Energy Efficiency Fund
TO ADDRESS MARKET BARRIERS	<ul style="list-style-type: none"> • LIFE – Clean Energy Transition • EU City Facility • PDA Facility • LIFE – Circular Economy & Quality of Life
FOR TECHNICAL ASSISTANCE AND ADVISORY	<ul style="list-style-type: none"> • ELENA Facility • Technical Support Instrument • Technical Support Cohesion Policy

Source: Author’s elaboration utilizing several EC sources. A more detailed overview of the funding instruments is available in Annex 2.

8 The requirement for EU countries to adopt a long-term renovation strategy is set out in the Energy Performance of Buildings Directive (2010/31/EU), which was revised in 2018 (2018/844/EU). These strategies form part of EU countries’ integrated national energy and climate plans (NECPs). Long-term strategies can be accessed here. Good cross-country analysis of the LTRS is available here.

9 Romania for instance has budget allocations for upskilling and reskilling, and has already implemented new qualification schemes. A comprehensive review of long-term renovation strategies is the European Commission Staff Working Document 365/2 from 2021.

Findings from other studies

There are a few other studies that have aimed at quantifying the employment creation of the Renovation Wave. There are also some that have estimated the training needs of the construction workforce to address the demand for renovation-related skills, but none of them exclusively for the Renovation Wave. A summary is found in Table 1 below with related findings for both employment effects and training needs.

TABLE 1.
MAIN FINDINGS FROM OTHER STUDIES

FINDINGS	SOURCES
The Renovation Wave will create 160,000 jobs in the construction sector.	EU RENOVATION WAVE STRATEGY https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1603122220757&uri=CELEX:52020DC0662
Provisions in the European Green Deal, including the Renovation Wave, will create an additional 486,600 jobs in construction by 2030 compared to a baseline scenario without the Green Deal (+3.6%). These include: Highly skilled non-manual occupations (122,500), skilled non-manual occupations (28,600), skilled manual occupations (305,200) and elementary occupations (30,400).	CEDEFOP (2021): The green employment and skills transformation: insights from an European Green Deal skills forecast scenario. Luxembourg: Publications Office. http://data.europa.eu/doi/10.2801/112540
The number of workers who will need Energy Efficiency training by 2020 is between 4,000,000 and 4,400,000	COWI (2016): Evaluation of the BUILD UP Skills initiative under the Intelligent Energy Europe Programme
3 to 4 million construction workers in Europe will need to develop their EE related skills in the building sector. ¹⁰	ECSO (2020): Improving the human capital basis. Analytical report. https://single-market-economy.ec.europa.eu/sectors/construction/observatory/analytical-reports_en

Note: Annex 3 includes information on findings of other reports.

¹⁰ Quantification of training needs are derived from Status Quo Reports. These are available here: <https://www.buildup.eu/en/skills/bus-projects>

METHODOLOGY AND DATA SOURCES ASSESSMENT

The methodological and data sources assessment is distinct between the two different objectives and the case studies.

Worker upskilling, reskilling; and recruitment and retention needs

Some of the most important types of training needs relevant to the Renovation Wave are: specialised energy efficiency, basic climatic literacy and OSH (occupational safety and health). Three distinct *ad hoc* methodologies were used. Renewable energy, circular economy and digitalisation are also important, but training needs linked to the Renovation Wave could not be calculated due to lack of available data and methodological issues.

ENERGY EFFICIENCY TRAININGS are calculated per occupation based on the information collected in the Construction Blueprint project (2020)¹¹ and cross-checked with industry studies to cover management occupations out of the scope of the project. A new 2030 Construction Blueprint project is underway, but results have not been updated as of February 2023. The number of workers to be trained include workers

already in the labour market and those entering the labour market that will require additional trainings on EE:

Total EE Training Needs (TEETN) of workers =
TEETN of workers already in the labour market
+ TEETN Workers entering the labour market

Trainings related to Energy Efficiency can be classified into two main types: specialised EE trainings and basic climatic literacy trainings.

SPECIALISED ENERGY EFFICIENCY TRAININGS

are specific to companies and workers dealing directly with the technologies and products related to energy efficiency. These include insulation, airtightness, ventilation, heat and cool pumps, photovoltaics, smart home automation, geothermal energy, smart meters, aerothermal energy, biomass, and wind energy. The contents of training courses should be adapted to the occupational needs and categories of workers. Unfortunately these have not been quantified in a consistent manner in the national skills needs surveys available at a national level and are by no means estimated in a consistent manner.¹² We assume they are needed for 35% and 45%¹³ of the workforce in the building renovations sector, including those already working and those entering the labour market requiring additional training. The figures

11 Construction Blueprint project (2020): Sectoral strategic approach to cooperate on skills in the construction industry report, available [here](#). Note: Training needs depend on the training demand for specific skillsets that depend on changing needs and increased demand for EE renovations. They also depend on skills supply factor, such as the number of workers that are already trained. It may not be possible to weight all different factors.

12 Note: National skills needs for energy efficiency will be repeated in 2023. Methodologies should be mainstreamed to be able to draw comparisons between different countries and arrive at EU-wide recommendations.

13 The assumption used in the Spanish survey (25-35%) is rather conservative and not representative of the EU as a whole. We believe 35-45% to be more realistic, as it broadly includes specialised trades. The Dutch training needs report assumes as much as 60% of workers needing additional training.
BUS Spain Roadmap report: https://www.buildup.eu/sites/default/files/bus_projects/build_up_skills_spain_roadmap_final_en_1.pdf
BUS Netherlands Status Quo Report: https://www.buildup.eu/sites/default/files/bus_projects/analysys_of_status_quo.pdf

have been cross checked with the size of skilled workforce in the general construction sector and training needs represent around half of the skilled workforce (Annex 4).¹⁴

BASIC CLIMATIC LITERACY, ENERGY EFFICIENCY AND CIRCULAR ECONOMY

TRAININGS are needed for all (100%) workers of the building renovations sector. CEOs, team leaders, design and calculation professionals, site managers as well as specialised and non-specialised staff require basic trainings on climate literacy, EE and CE to be able to maximise energy savings. This was highlighted in the only EU wide survey addressing EU needs where 52.2% of construction companies stated that energy efficiency skills are between important and very important to master for team leaders. 51.5% consider energy efficiency skills being between important and very important for company managers as well. Results were also consistent with the level of experience of workers and among staff, technicians and site managers.¹⁵ Finishers or plasterers for instance require complementary general notions on how to avoid damaging works from insulation and air tightness. Similarly, team leaders and site managers need to be able to assess technological requirements, check for efficiency gains and stay on top of the most recent products and technologies available in the market.

FUTURE EMPLOYMENT NEEDS – In the coming years recruitment and retention needs of construction workers will increase due to (a) the expansion of EE renovation activity, as well as (b) the need to replace retiring workforce.

EMPLOYMENT NEEDS FROM THE RENOVATION

WAVE – The expansion of energy renovation activities creates new demand for workers. Additional employment needs are calculated in scenario 2 approximating housing expenditures, while scenario 3 makes use of forecasted CEDEFOP net employment creation.

EMPLOYMENT NEEDS FROM LABOUR

REPLACEMENT – According to the CEDEFOP Skills Intelligence database, 277,726 workers (2.1% of the construction workforce) will retire each year. Assuming age distribution is the same across workers of the building construction and renovations sector, 179,950 workers would retire in the subsector. 1,259,647 building renovation workers will retire between 2023 and 2030. Recruitment and retention needs in the coming years will be triggered by replacement demand in the sector. Attracting women and youth is therefore important for the construction sector to deliver the Renovation Wave.

OCCUPATIONAL SAFETY AND HEALTH

TRAINING – These refer to company specialists in occupational health and safety, and labour inspectors.¹⁶ Construction companies have specialists based both on construction companies and construction sites. OSH training should be delivered to all labour market entrants, especially those working on construction sites. Both elementary occupation workers and skilled staff should receive such training. Similarly, labour inspectors make sure companies follow national regulations.

Increased activity in the construction sector will mean that existing labour administration inspectorates should cover additional number of worksites and companies, and ideally more should be recruited to cover the same amount of workers. Figures on labour inspection visits, number of labour inspectors and number of

14 In 2Q2022, technicians and associate professionals (10.05%); service and sales workers (0.7%), craft and related trades workers (56.77%); and plant and machine operators and assemblers (6.36%) comprise 73.88% of the 13,727,300 construction workforce. Assuming half of them require specialised technical training this makes 37% of the total workforce would require specialised EE trainings. Consequently, the assumption of 35-45% specialised training needs falls broadly within the occupational parameters in the EU.

15 Construction Blueprint (2018): Results of the questionnaire on skills needs of construction companies in: digitalisation, energy efficiency and circular economy. Pertaining to WP4 Watchtower of skills needs in the construction industry. Available [here](#).

16 There is not a clear methodology of calculating training OSH needs, so estimations are broadly made.

inspection visits to workplaces are available in Annex 5. There is no precise ILO recommendation on how many labour inspectors are needed but there is a general reference on the point 4.1.8 of the ILO guidelines for inspection to determine the number of inspectors in a given country.¹⁷ The concrete number of labour inspectors needed is determined by criteria specific to the national context, including:

- the number and nature of the functions assigned to the inspection system;
- the number, nature, size and situation of the workplaces liable to inspection; the number of workers;
- the number and complexity of legal provisions to be enforced;
- the material and financial resources available to the inspectorate;
- and the practical conditions under which visits of inspection must be carried out in order to be effective.

A ratio exclusively based on the number of labour inspectors per thousands of workers does not take into consideration all the elements identified by Article 10 of ILO Convention No. 81 and should not be used as a benchmark. However, an approximation can be done assuming two construction site inspections per week, each taking two days.¹⁸ (See Table 2 for calculations on labour inspector needs.)

TABLE 2.
CALCULATIONS OF LABOUR INSPECTOR NEEDS

a	Working weeks	= 40
b	Construction site inspections per week	= 2
c	Construction site inspections per year	= (a × b) = 80
d	Renovated Houses	
e	Construction site target	
f	Target labour inspections	= (d × e)
g	Demand for labour inspectors	= (f ÷ c)

17 ILO (2022): Guidelines on general principles of labour inspection. Available: https://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---lab_admin/documents/genericdocument/wcms_844153.pdf

18 ITC-ILO (2009): Inspecting Occupational Safety and Health in the Construction Industry. Available here: <https://www.itcilo.org/sites/default/files/inline-files/Inspecting%20Occupational%20Safety%20and%20Health%20in%20the%20Construction%20Industry.pdf>

Direct, indirect and induced employment through Input-Output tables

Input-Output Economics is a widely used method in policy impact studies, i.e the effect of stimulus packages on sectors and regions. The FIGARO¹⁹ tables are the most recent input output tables for economic modeling.²⁰ With this methodology we can estimate the impact in terms of direct, indirect and induced employment. A distinction between this and other job terms is available in Box 2.

A detailed account of all the calculations and formulas used is included in Annex 6.

BOX 2. JOBS TERMINOLOGY

DIRECT JOBS: Jobs generated from a change in spending patterns resulting from an expenditure or effort (e.g. construction jobs for a retrofit project).

INDIRECT JOBS: Jobs generated in the supply chain and supporting industries of an industry that is directly impacted by an expenditure or effort.

INDUCED JOBS: Jobs generated by the re-spending of received income resulting from direct or indirect job creation in the affected region.

GROSS JOBS: The total number of jobs supported by an industry and its supply chain.

NET JOBS: The number of jobs created by an industry and its supply chain compared to a “business as usual” reference scenario.

Methodology limitations

The study calculates direct and indirect job impacts of the RRF as well as training and labour needs to achieve the renovation wave. These estimates depend on modeling assumptions, some of which have important policy implications. Information is dispersed and many times not consistent across EU members and thus certain assumptions can be contested. Estimates assume that there are no labour market frictions. In particular, the labour force is assumed to adapt to the structural change in skill requirements associated with the transition to a low-carbon economy. The faster the change, the more likely it is that there may be frictions that leave some workers temporary unemployed²¹ and some demands for new skills unmet, preventing the full potential benefits from being realised. Moreover, the appreciable investment required assumes that there are no barriers in accessing the finance necessary for this transition. Finally, although FIGARO is the most up-to-date Input-Output database, it models the European economy always in T-2.

The digital transition is also necessary to achieve the Renovation Wave. Unfortunately, no consistent data was available to calculate the digital training needs linked to the Renovation Wave. These are however acute in the construction sector. Renewable energies also play a role. Most information related to the Renovation Wave is linked to the construction sector, as it would be complex to add another economic activity into surveys and models. Finally, the circular economy information was not available.

19 FIGARO stands for ‘Full International and Global Accounts for Research in Input-Output Analysis’ and comprises the EU inter-country supply, use and input-output tables (EU IC-SUIOTs). It is available [here](#).

20 Other considered IO Databases are WIOD, OECD, EXIO and FIDELIO. WIOD is more widely used but its most recent update is from 2016.

21 As new skills, and knowledge of green technologies and green products become “the norm” for construction workers then some companies may decide to fire workers that do not learn the new skills.

SCENARIO DESCRIPTION

FIRST SCENARIO:

Investments under the EU Recovery and Resilience Facility

This report calculates employment (direct, indirect and induced) effects according to three distinct scenarios. The first scenario estimates employment creation under current agreed Recovery and Resilience financing. Table 3 shows total investment in energy efficiency renovations committed by Member States in the context of the Recovery and Resilience Facility. These were calculated making use of the National Recovery and Resilience Plans (NRRPs) and a study by E3G commissioned by the Renovate Europe Campaign.²²

More than 38 billion Euros will be spent by EU Member States as direct funding (grants and loans) for energy renovations. This corresponds to approximately 8% of the total RRF funding. This is lower than the estimates of the European Commission. Unfortunately, in most NRRPs funding allocation does not include a corresponding target for number of buildings nor area to be renovated per year. This however is not an impediment to calculate the total number of jobs created under the funding.

SECOND SCENARIO:

Renovation Wave – 2% Energy Renovation and pre-crisis job creation

The Renovation Wave strategy estimates that the additional investment needed for renovation to meet the new 55% target, including decarbonising heat in buildings, is 275 billion Euros per year to 2030 – the largest climate investment gap in any sector. This means that the total investment needed until 2030 is over 3.5 trillion Euros, including public and private spending.²³ This large investment corresponds to around 2.3% of the total worth of the European building stock (150 trillion Euros).

According to a BPIE report, the 2% annual renovation rate objective of the Renovation Wave Strategy will deliver CO₂ emission reductions of around 46% compared to 1990, or a 42% reduction compared to 2015. This means that the assumed changes in policies and technology deployment under this scenario are far from being aligned with a 55% GHG emissions reduction target.²⁴ BPIE advocates for a 3% energy renovation rate but the scenario could not be assessed due to lack of costing.

²² E3G. (2021). Renovate2Recover: How transformational are the National Recovery Plans for Buildings Renovation? Numbers were cross-checked with several parties. Discrepancies were reported by different parties. This is due to differences in interpretation and unclear funding lines, i.e. EE renovations are sometimes under the same concept with normal building renovations or with renewable energy programmes.

²³ EC (2020), Renovation Wave Strategy, and Green Finance Institute: Unlocking the Trillions: Public-private innovation to deliver the EU's renovation wave ambition. Available at: <https://www.greenfinanceinstitute.co.uk/programmes/ceeb-europe/>

²⁴ The scenario assumes that of all the renovations taking place, 10% are shallow renovations, 70% are medium and 20% are deep renovations. The EUCalc model defines shallow renovations as renovations that achieve a 30% reduction of energy demand in a given building, with medium renovations achieving a 40% reduction and deep renovations at least 60%. With the assumed renovation rate, 31% of the building stock will be renovated by 2030, while 62% is left unrefurbished; 7% of the building stock in 2030 is newly built. Of the total floor area in 2030, shallow renovations cover 3%, medium renovations 22% and deep renovations 6%.

TABLE 3.
TOTAL AND ENERGY EFFICIENT (EE) BUILDING RENOVATION INVESTMENT ALLOCATIONS
IN NRRPS, 2021–2026

COUNTRY ABBREVIATION	NRRP TOTAL ALLOCATION (BN €)	EE BUILDING RENOVATION ALLOCATION (BN €)	SHARE OF BR ON TOTAL NRRP ALLOCATION (%)
EU 27	503.9	38.56	7.65 %
BE	5.9	0.967	16.39 %
BG	6.5	0.947	14.57 %
CZ	7.85	0.806	10.27 %
DK	1.6	0.16	10.00 %
DE	25.6	2.577	10.07 %
EE	0.9693	0.0921	9.50 %
IE	0.989	0.155	15.67 %
EL	30.5	4.097	13.43 %
ES	69.5	3.42	4.92 %
FR	39.4	5.82	14.77 %
HR	6.3	0.7988	12.68 %
IT	191.5	8.6	4.49 %
CY	1.206	0.089	7.38 %
LV	1.82	0.231	12.69 %
LT	2.22	0.218	9.82 %
LU	0.093	0	0 %
HU	7.2	0.766	10.64 %
MT	0.3164	0.06	18.96 %
NL	4.7	0.8493	18.07 %
AT	3.46	0.1064	3.08 %
PL	36	3.857	10.71 %
PT	16.6	0.61	3.67 %
RO	29.2	2.27	7.77 %
SL	2.466	0.086	3.49 %
SK	6.6	0.776	11.76 %
FI	2.1	0.07	3.33 %
SE	3.289	0.13175	4.01 %

Source: Renovate Europe and authors review of indicators

Investments to achieve the renovation wave are not quantified in each country but are across the entire EU. The decision to allocate EU funding among different states is political and therefore it is best to calculate employment effects on the entirety of the EU.

As shown in Figure 2, housing investments (including renovations and maintenance) summed up 819 billion Euros. Covering the financing gap of 275 billion Euros represents a 34 % increase of investments in Europe. Conversely, the financing gap represents 1.88% of the entire EU GDP while housing investments represent 5.6 %.

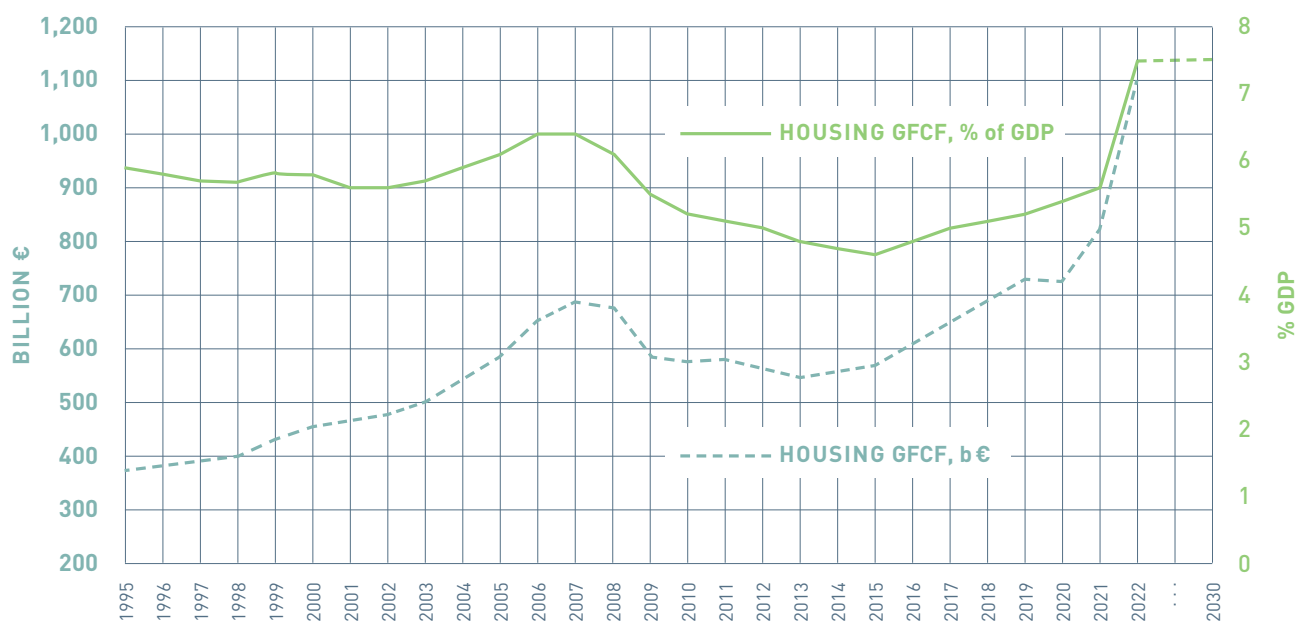
Housing investments according to the European Commission should increase to 7.48% of GDP. The closest the housing sector has reached that figure was between 2006 and 2008, when it reached a peak of 6.4 % of GDP. The financing gap thus exceeds by far maximum housing investments reached in the period with highest employment rates in the European Construction sector (nearly 16 million). Consequently, the set scenario underestimates the employment needs of the Renovation Wave. But it is still useful to identify minimum training and labour market entry needs.

THIRD SCENARIO:

Renovation Wave – 2% Energy Renovation and CEDEFOP forecasted job creation

The third scenario makes use of a CEDEFOP study assessing the impacts of the Renovation Wave and relies on the Cambridge Econometrics e3me macro-econometric model.²⁵ The assumptions of the study incorporate the efficiency gains and the financial cost of 275 billion Euros as well as changes in the EU emissions trading system aimed at accelerating the renewable energy transition in road transport, and policies encouraging less carbon-intensive technology. The impacts of future price increases of polluting energy sources (through taxation) on road transport and buildings are also incorporated.

FIGURE 2.
HOUSING INVESTMENTS IN THE EU



²⁵ Cedefop (2021). The green employment and skills transformation: insights from a European Green Deal skills forecast scenario. Luxembourg: Publications Office. <http://data.europa.eu/doi/10.2801/112540>

MAIN FINDINGS AND CASE STUDIES

Worker training, recruitment and retention needs

To achieve the ambitious objectives of the Renovation Wave, the building construction and renovations sector should recruit and maintain in the sector workers with all kinds of trades. We can distinguish four types of jobs that will not only be affected, but are essential to the Renovation Wave. These categories are highly important and need to be taken on board:

- **THYROID OCCUPATIONS.** These are Research and Development (R&D) positions that typically draw candidates from the STEM profile and are central for designing, developing and implementing technological advancements necessary for the green transition.
- **OCCUPATIONS DIRECTLY RELATED TO EE IN THE BUILDING CONSTRUCTION AND ENERGY RENOVATIONS SECTOR.** These include mostly blue collar workers directly related to building construction and renovations and applying the technologies and materials needed for energy savings (See Box 3 for concrete examples). These include insulation, airtightness, ventilation, heat and cool pumps, photovoltaics, smart home automation, geothermal energy, smart meters, aerothermal energy, biomass, and wind energy. Some work profiles are new (Energy auditors and certifiers, BIM managers, deep renovation specialists), others are emerging (material passport producers), and some do not form part of the construction sector but are critical (photovoltaic solar system and renewable energy installers).

- **OTHER OCCUPATIONS IN BUILDING CONSTRUCTION AND ENERGY RENOVATIONS SECTOR.** These include all categories of workers, from CEOs to site managers and some skilled occupations i.e. finishers and plasterers.

BOX 3. BLUE COLLAR OCCUPATIONS WITH ENERGY EFFICIENCY TRAINING NEEDS

THE BUILD UP SKILLS programme financed skills anticipation studies for Energy Efficiency works related to the blue-collar workers.²⁶ The blue collar occupations that require the largest amount of Energy Efficiency trainings across the EU are:

- Bricklayers and stonemasons
- Electricians
- Roofers, plasterers and glaziers
- Insulation workers, Plumbers (including installers of heat pumps boilers, biogas systems, central heating, sanitary and thermic equipment)
- Carpenters and joiners
- Technicians (including Heating, Ventilation, and Air Conditioning – HVAC)

Other blue collar occupations requiring EE trainings include:

- Glaziers
- Concrete placers, finishers and related workers
- Plasterers
- Floor layers and tile setters

Source: Build Up Skills Status Quo and Roadmap Reports.

²⁶ Status Quo Reports are available here: <https://www.buildup.eu/en/skills/bus-projects>

A detailed account per country of the quantified skills needs per occupation across European countries is available in the Annex 4.

- **SUPPORT OCCUPATIONS.** These include Occupational Safety and Health Managers and Labour Inspectors in the public sector. Changing risk profiles led by the green transition will require OSH practitioners to learn and adapt to the changing needs and challenges derived from smaller employment per worksite.

Training, recruitment and retention needs in the second scenario: Renovation Wave – 2% Energy Renovation and Pre-crisis job creation

To find out the total number of workers that will be needed in 2030, we need to estimate the number of new workers needed by the industry for that date. If demand in the EU were to grow to meet the 2030 targets, we can say that all new workers would engage in conducting work related to energy efficiency renovations in construction, except for a small group dedicated to the finishing touches of the undertaken works.

Employment in Energy Efficient construction and renovations was around 8,536,000 workers as of 2021²⁷ (detailed estimates in Annex 7). To estimate the number of workers needed we compared the current employment levels with those with similar investment levels. We have previously established that housing investments should reach 7.5% of GDP, which is beyond the maximum reached between 2006-2008, 6.4%. In 2007, the estimated number of workers directly related to EE renovations was 10,085,000 workers, and we can safely assume employment levels should reach those levels to deliver the Renovation Wave. It takes 1,549,000 more workers to meet the European targets for 2030.

RECRUITMENT NEEDS DUE TO WORKER RETIREMENT – According to the CEDEFOP Skills Intelligence database, 2.1% workers will retire each year – 179,950 building construction and renovation workers. Approximately 1,259,647 workers will retire between 2023 and 2030 and will need to be replaced. The figure does not

include recruitment needs derived from workforce leaving jobs in the sector and into others.

Therefore additional recruitment needs between 2022 and 2030 will be 2,808,647 workers.

SPECIALISED ENERGY EFFICIENCY TRAININGS – As laid out in the methodology section, between 35% and 45% of the buildings construction and renovation workforce will need specialised EE trainings, between 3,529,759 and 4,538,262 workers. The trainings would be aimed primarily to the workers more directly related with EE renovations. They cover both the new workers and those already engaged in such activities.

BASIC CLIMATIC LITERACY AND ENERGY EFFICIENCY TRAININGS – 10,085,026 workers (100%) of the building renovations sector would need general trainings on basic climatic literacy and applied aspects of EE. From CEOs, to team leaders, design and calculation professionals, site managers as well as specialised and non-specialised staff require basic trainings on climate literacy and EE to be able to maximise energy savings.

Training, recruitment and retention needs in the third scenario: Renovation Wave – 2% Energy Renovation and CEDEFOP forecasted job creation

The third scenario makes use of a CEDEFOP study assessing the impacts of the Renovation Wave. The study estimates an additional 486,600 jobs in construction by 2030 compared to a baseline scenario without the Green Deal. These include: highly skilled non-manual occupations (122,500), skilled non-manual occupations (28,600), skilled manual occupations (305,200) and elementary occupations (30,400).

RECRUITMENT NEEDS DUE TO WORKER RETIREMENT – According to the CEDEFOP Skills Intelligence database, 2.1% workers will retire each year – 179,950 building construction and renovation workers. Approximately

²⁷ Employment in EE construction and renovations represents 64.8% of total employment in the construction sector as of 2021.

1,259,647 workers will retire between 2023 and 2030 and will need to be replaced with new recruitments.

Therefore additional recruitment needs between 2022 and 2030 will be 1,746,247 workers. The figure does not include recruitment needs derived from workforce leaving jobs in the sector and going into others.

SPECIALISED ENERGY EFFICIENCY TRAININGS –

As laid out in the methodology section, between 35 % and 45 % of the buildings construction and renovation workforce will need specialised EE trainings. In the third scenario, between 3,157,871 and 4,060,230 workers. The trainings would be aimed primarily to the workers more directly related with EE renovations. They cover

both the new workers and those already engaged in such activities.

BASIC CLIMATIC LITERACY, ENERGY EFFICIENCY AND CIRCULAR ECONOMY TRAININGS –

9,022,488 workers (100 %) of the building renovations sector would need general trainings on basic climatic literacy, applied aspects of EE as well as Circular Economy aspects related to waste disposal. From CEOs, to team leaders, design and calculation professionals, site managers as well as specialised and non-specialised staff require basic trainings on climate literacy, EE and Circular Economy to be able to maximise energy savings.

Results of the Renovation Wave scenarios are summarised in Table 4.

TABLE 4. SUMMARY OF TRAINING AND RECRUITMENT NEEDS OF THE RENOVATION WAVE

SECOND SCENARIO: 2 % Energy Renovation and pre-crisis job creation)		THIRD SCENARIO: 2 % Energy Renovation and CEDEFOP forecasted job creation)	
Building Construction and Renovations Employment, 2030	10,085,026	Building Construction and Renovations Employment, 2030	9,022,488
Employment needs from the Renovation Wave	1,549,000	Employment needs from the Renovation Wave	486,600
Employment needs from worker retirement	1,259,647	Employment needs from worker retirement	1,259,647
Total recruitment needs	2,808,647	Total recruitment needs	1,746,247
NUMBER OF WORKERS TO BE TRAINED IN BASIC CLIMATIC LITERACY, ENERGY EFFICIENCY AND CIRCULAR ECONOMY TRAININGS			
100 %		100 %	
10,085,025		9,022,488	
NUMBER OF WORKERS TO BE TRAINED IN SPECIALISED EE TRAININGS			
35 %	45 %	35 %	45 %
3,529,759	4,538,262	3,157,871	4,060,120
WORKERS TO BE TRAINED PER YEAR (2023 TO 2030)			
504,251	648,323	451,124	580,017

Source: Author’s elaboration based on sources mentioned in footnotes.

Combining the results from the two mentioned scenarios, between 3,157,871 and 4,538,262 workers will require specialised Energy Efficiency trainings. All the buildings construction and energy renovations workforce (10,085,026 workers) will require basic climatic literacy, EE and circular economy trainings.

Labour demand for OSH managers and labour inspectors

The role of Occupational Safety and Health (OSH) managers, labour inspectors and an integrated OSH system is of great importance to deliver an effective protective environment for workers rights and working conditions. To highlight the importance of investing in a prevention culture for workers we have estimated broad recruitment and retention needs for OSH managers and labour inspectors.

Calculating the additional demand for OSH managers is complex, as it depends on the OSH recruited capacity, national legislation and the increased business. In some European countries

OSH managers are required by law in companies with over 10 employees. Assuming an OSH manager is hired for every additional 90 construction workers, around 17,211 OSH managers would be needed under scenario 2. Under scenario 3, 5,407 OSH managers would need to be additionally recruited to deliver the Renovation Wave. Taking into account all the building construction and renovations sector, total OSH managers would be 112.056 and 100.250 respectively in scenarios 2 and 3.

Additional recruitment and retention requirements for labour inspectors under the Renovation Wave depend on the number of existing labour inspectors, tasks performed and overall targets for the sector. Figures in Table 5 constitute therefore an approximation of overall labour inspection needs tied to the renovation wave.

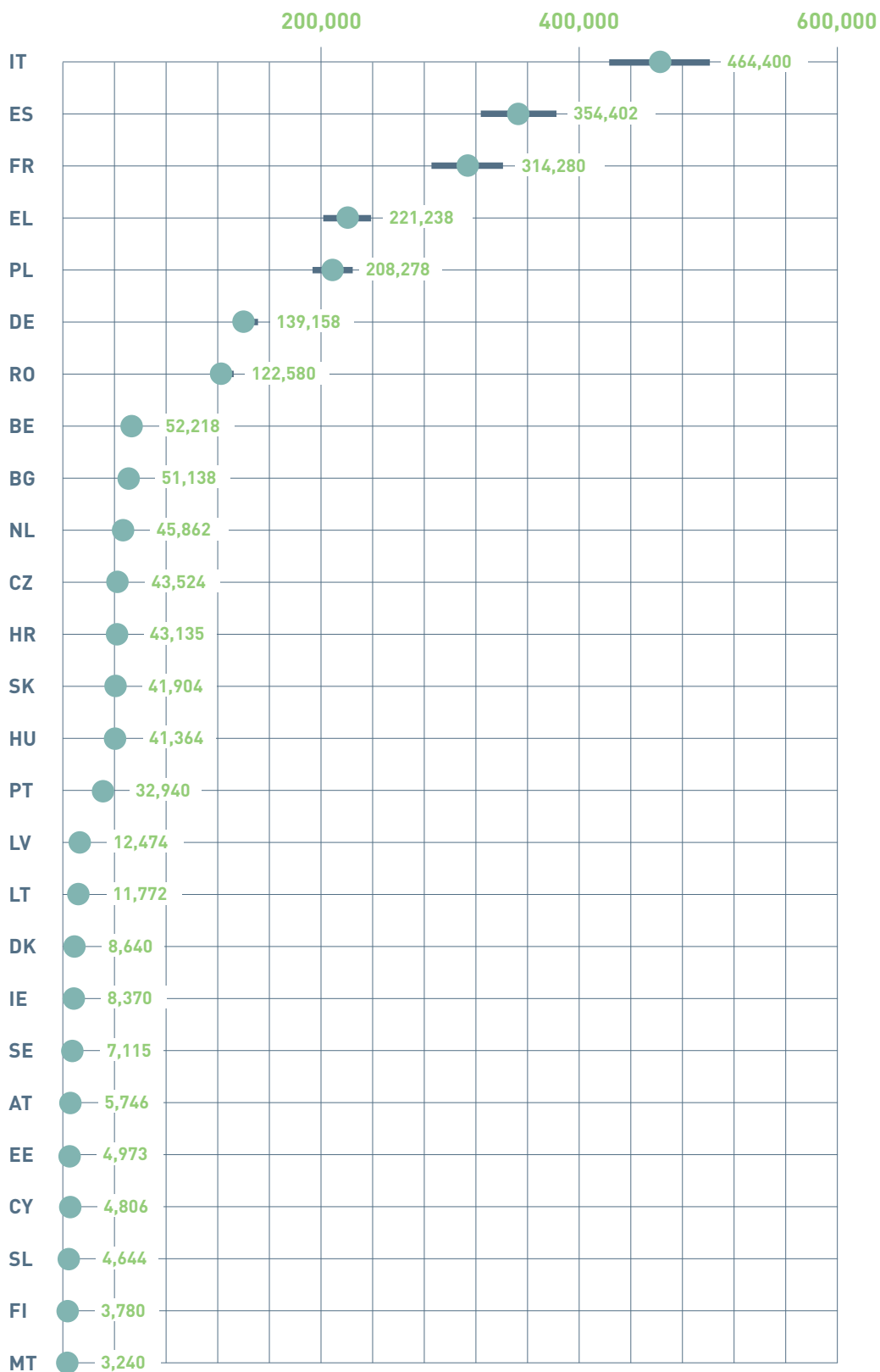
Assuming 30 million buildings will require EE renovations and between 0.5% and 10% of all buildings will be inspected once, between 268 and 5,357 labour inspectors will be required to ensure labour rights and working conditions are effectively respected in construction worksites.²⁸

TABLE 5.
LABOUR INSPECTOR NEEDS TIED TO THE RENOVATION WAVE

a	Working weeks		40
b	Construction site inspections per week		2
c	Construction site inspections per year (a × b)		80
d	Renovated buildings per year (Total 30 Million 2023-2030)		4,285,714
LOW INSPECTION TARGET SCENARIO		HIGH INSPECTION TARGET SCENARIO	
e	Construction site inspection target	0.5%	Construction site inspection target 10%
f	Target labour inspections (d × e)	21,429	Target labour inspections (d × e) 428,571
g	Demand for labour inspectors (f ÷ c)	268	Demand for labour inspectors (f ÷ c) 5,357

²⁸ Note: 43.2% of all EU companies have been inspected in the last 3 years according to EU-OSHA. This equals to 14.4% per year. A construction company typically works on several construction sites/buildings. In most countries labour inspections in construction are prioritised due to their increased risk profile and thus inspections are likely to be higher.
<https://visualisation.osha.europa.eu/osh-barometer/osh-infrastructure/enforcement-capacity/establishments-inspected/AT>

FIGURE 3.
MINIMUM, AVERAGE AND MAXIMUM DIRECT JOBS
IN ENERGY EFFICIENT RENOVATIONS SUSTAINED BY NATIONAL
RECOVERY AND RESILIENCE PLANS (NRRPS), 2021-2026



Source: Authors' own calculations.

These will be mobilised from the existing labour inspection cadres and from recruitment processes – naturally also bearing in mind that the hiring of more inspectors is a political-financial decision of each country.

Job creation in energy and resource-efficient renovations sector in different scenarios

SCENARIO 1. JOB CREATION UNDER THE NATIONAL RECOVERY AND RESILIENCE PLANS, 2021–2026

The most recent bibliography and statistical findings available have been taken into account to calculate job creation projections. All formulas and key numbers are outlined in the Annex 8 and in the scenario building sections above mentioned.

Energy Efficient renovations of the European Building stock linked to National Recovery and Resilience Plans will have a positive effect on direct job creation in the EU, generating around 2.4 million jobs²⁹. Figure 3 shows the job creation disaggregated per country. The countries with most direct jobs creation corresponds logically to those with highest investment; Italy (464,400 direct jobs), Spain (354,402), Greece (221,238), and Poland (208,278). As forecasted estimates, confidence intervals were calculated with maximum and minimum values. It is worth noting that countries include important EE Renovation packages aside from the funds allocated by the EU. These are however not part of the study.

There are also important indirect and induced employment effects produced by Energy Efficient Renovations (Table 6). Indirect employment is

generated by backward linkages generated by increased production in other sectors of the economy (e.g. insulating materials or cranes). A total of 7.5 million indirect jobs will be created in the EU due to the funding supported by NRRPs. This equals to 1.25 M jobs per year between 2021 and 2026. Indirect job creation is highest in Greece (1.6 M Jobs), followed by Italy (1.1 M), Poland (1 M), Spain (805,316), Romania (659,720) and France (659,720).

Induced employment is due to the increased income generated by direct and indirect employment. Between 2021 and 2026, Energy Efficient Investments in NRRPs will create a total of 4.6 M induced jobs, equalling around 760,000 per year. Estimated induced employment is highest in Greece (1.5 M jobs), Italy (596,860), Spain (374,537), Poland (371,563), Romania (334,414), France (309,614) and Bulgaria (293,372).

SCENARIO 2 AND 3. JOB CREATION OF EE RENOVATIONS ACCORDING TO EUROPEAN COMMISSION FINANCING ASSESSMENT NEEDS, 2022-2030³⁰

There is a huge financial gap that, if fulfilled, would generate large numbers of jobs for Energy Efficiency in the European Union. An increase of 275 billion Euros investment between 2022 and 2030 would have the potential to sustain around 44.5 million direct jobs in the same period (see Table 7). This is more than 3 times the current employment in the sector (13.4 million). Equally important is the impact on indirect jobs in all other sectors, 106.8 million jobs. Finally, around 61 million induced jobs would be sustained between 2022 and 2030.

²⁹ Different scenarios have been constructed to construct confidence intervals.

³⁰ A scenario with 3% energy renovation rates was considered on earlier drafts based on a paper from BPIE. However, there are no investment figures provided. It is not possible to calculate employment figures without this. Therefore, the third scenario (previous text) only covers construction figures.

TABLE 6.
DIRECT, INDIRECT AND INDUCED JOBS IN ENERGY EFFICIENT RENOVATIONS
SUSTAINED BY NATIONAL RECOVERY AND RESILIENCE PLANS (NRRPS), 2021-2026

COUNTRY	DIRECT JOBS	INDIRECT JOBS	INDUCED JOBS	TOTAL JOBS
EU27	2,251,981	7,469,246	4,558,612	14,279,839
EL	221,238	1,569,277	1,523,542	3,314,057
IT	464,400	1,083,159	596,860	2,144,419
PL	208,278	1,001,121	371,563	1,580,961
ES	354,402	805,316	374,537	1,534,255
RO	122,580	659,720	334,414	1,116,714
FR	314,280	488,426	309,614	1,112,320
BG	51,138	514,747	293,372	859,257
DE	139,158	177,897	136,973	454,028
HR	43,135	215,353	100,245	358,733
HU	41,364	194,053	116,770	352,187
CZ	43,524	172,006	78,654	294,183
PT	32,940	140,669	70,958	244,567
BE	52,218	98,227	62,798	213,243
SK	41,904	113,843	50,242	205,989
NL	45,862	50,611	32,758	129,231
LV	12,474	64,336	32,144	108,955
LT	11,772	26,075	11,913	49,760
EE	4,973	18,025	10,222	33,221
CY	4,806	15,168	10,701	30,675
DK	8,640	8,974	7,368	24,982
IE	8,370	9,304	6,916	24,589
MT	3,240	12,074	7,649	22,963
AT	5,746	8,900	6,699	21,345
SL	4,644	10,959	4,732	20,336
SE	7,115	6,346	4,060	17,520
FI	3,780	4,661	2,908	11,349

TABLE 7.
DIRECT, INDIRECT AND INDUCED JOBS
IN ENERGY EFFICIENT RENOVATIONS
IN SCENARIO 2 IN EU27, 2022-2030

	EU27
MIN DIRECT JOBS	40,837,500
MAX DIRECT JOBS	48,262,500
DIRECT JOBS	44,550,000
INDIRECT JOBS	106,816,779
INDUCED JOBS	61,311,409
TOTAL JOBS	212,678,189

Source: Authors' own calculations

Main Findings

The impacts of the Renovation Wave on construction employment have not been studied in depth. Available information is scarce. Nevertheless, it was possible to bring together and analyse the data presented in this Report. The policy recommendations are within the limits of such data. Construction sector training needs were last estimated in 2012, and only for blue collar workers. By the end of 2023, countries participating in the Build UP Skills programme will conduct *Status Quo* analyses and roadmaps, quantifying worker and training needs for white as well as blue collar workers.

There are three interrelated elements key to the successful delivery of the Renovation Wave, the Fit for 55 and the EU Green Deal targets: access to financing, technical assistance addressing demand for renovations, and most importantly, worker skills. Financing of worker upskilling and reskilling has however not been addressed in a consistent way in the Recovery and Resilience Facility Plans. Most countries do not include any upskilling and reskilling financing. Long term renovation strategies of Member States mention a number of programmes that can address the skills challenge. However, it seems that these

remain largely targeted to specific training areas and are not mainstreamed along the entire construction sector value chain.

To bring out system innovations – concerted action among knowledge institutions, education and training, trade unions, government, contracting authorities and contractors is needed.

Government, trade union and employer organisations social dialogue is important to establish ambitious training and employment action plans.

Regular training to develop professional skills for energy auditors, designers and architects, installers of heating, cooling and other technical building systems, energy service companies, building firms, project supervisors and other experts, are essential to ensure the market's continuous development. Moreover, the industry should be enabled to absorb specialised professionals with compatible skill sets. These include those with experience in relevant declining industries.

Addressing energy efficiency of buildings, and in particular the Renovation Wave constitutes an important opportunity to address standing decent work deficits in the European construction sector. Environmental protection has a human rights ethos. So has decent work. It is contradictory not to respect the rights of the very workers involved in the renovation programmes. This line of argument can be used in negotiations to address issues related to decent work deficits. For example, to remove once and for all asbestos from the old EU building stock, to include MSMEs in public investments, increase the accreditation and value of competencies of construction workers, reduce the length of subcontracting chains, reduce the incidence of bogus employment and attract women and youth in the sector through digitalisation of the sector.

EFFECTS OF RW ON OSH

The Renovation Wave will have wider effect on the supply chain, generating demand for renewable energy solutions and the replacement of fossil fuels. The structural change will cause changes on the workplace risks tied to the construction supply chain.

- In the wind turbine sector: exposure to epoxy resins, styrene, solvents, harmful gases, vapours and dusts, physical hazards from moving parts, manual handling, dust and fumes from fibreglass, hardeners, aerosols and carbon fibres (common health related problems include dermatitis, dizziness, sleepiness, liver and kidney damage, blisters, chemical burns, and reproductive effects); as well as risk of falls from heights, musculoskeletal disorders, awkward postures, physical load, electrocution, and injuries from working with rotating machinery and falling objects;
- In the solar energy industry and the later recycling of its parts (such as photovoltaic panels): exposure to cadmium telluride and gallium arsenide;
- In the manufacture of fluorescent light bulbs: exposure to mercury poisoning;
- Risks as a result of substitution for more environmentally friendly substances, for example: the substitution of solvent-based for water-based paints has included the addition of biocides, and the substitution of hydrochlorofluorocarbons for chlorofluorocarbons has increased the risk of exposure to carcinogens, as well as to fire hazards.

However, coal mining deaths, injuries and diseases may be reduced as fossil fuels are replaced with renewable energy, not least as mining has always been a particularly hazardous occupation and one that is often carried out in the informal sectors of developing economies by vulnerable groups of workers. Similarly, farm

workers' exposure to pesticides and other agrochemicals may come down as organic farming expands.

OSH-RELATED JOB CREATION

The increased volume of construction works will create demand for labour inspector recruitment. Assuming a labour inspector takes one day to inspect a construction enterprise and another day to prepare the corresponding reports, then about 10 cases should be inspected each month by each labour inspector, say 2 construction enterprises and 8 construction sites (considering a distribution 20% and 80% for inspections to enterprises and to sites). Assuming 40 working weeks, one labour inspector has the capacity of inspecting 320 worksites per year.

DIGITALISATION TRAINING NEEDS

The role of digitalisation is key to the delivery of the Renovation Wave.³¹ Particularly, Building Information Modeling (BIM) and digital twins are two examples of technologies that can assess and predict energy and material requirements for a given energy-efficient renovation. The use of drones, 3D printing, artificial intelligence or the Internet of Things can also support the efficient and cheaper building and renovation processes the Renovation Wave requires. Less than 9% of EU construction companies have ICT specialists, ranking lowest among all sectors.³² Similarly, construction companies are among the least likely to analyse big data, only 13%.

31 It can be calculated making use of the Eurostat Community Statistics on Information Society (CSIS) and Labour Force Surveys. Access to CSIS microdata was requested but did not arrive on time

32 EC (2021). Digital Economy and Society Index (DESI) 2021 Integration of digital technology.

Case Studies

This section includes case-studies from two countries, Germany and Spain. These may serve as inspiration to other contexts in Europe that may replicate the models following country-specific adaptations. Additional information leading to other case-studies is included in the Recommendations and also in Annex 1.

Germany

The German case first presents how low energy and climate literacy have been embedded into vocational education and training in construction in the country. This is followed up by specific illustrations of just transition to clean energy in two German regions.

EMBEDDING LOW ENERGY AND CLIMATE LITERACY INTO VET (VOCATIONAL EDUCATION AND TRAINING) IN CONSTRUCTION³³

The EU's flagship initiative Build UP skills (2010-2017), launched to develop NZEB competencies in the workforce, illustrated the complexity and the sheer scale of the task facing the industry (EC, 2014, 2016b, 2018). Across the EU, millions of construction workers have low levels of general education and lack formal VET and qualifications³⁴, with 'skill shortages' a common and persistent theme³⁵.

The Build-up Skills (BUS) programme initiated by the European Commission in 2010 and

covering 30 European countries revealed that VET systems are adequately equipped to integrate LEC competences into existing programmes in only a small number of European countries, such as Germany where significant progress has already been made in mainstreaming LEC competences³⁶.

Germany's approach rests on a statutory framework, social partnership, recognised qualifications, comprehensive, broad, and recognised VET programmes, multi-dimensional competence, occupational capacity and knowledge, general and civic education, permeability, and educational standards related to curriculum content. This is called an "occupational" approach, as opposed to a 'skill-based' approach, resting on weak statutory framework and stakeholder involvement and characterised as employer-based, with poor labour market currency, fragmented narrow skill sets, a functionalist-behaviourist conception of competence built on task descriptors, minimal underpinning knowledge, lack of permeability, and learning outcomes as performance criteria related to defined workplace tasks.

Germany, has the advantage of a stepped programme of gradual specialisation, helping trainees to understand the whole building envelope, as well as covering climate change relating to different occupations, but is challenged by low unionisation and dependence on individual employers to take on trainees.

VET for LEC is based on the principle that LEC-related competencies are incorporated or mainstreamed into existing occupational profiles and curricula of each occupation.

33 This sub-section is based on: Clarke L., Gleeson C., Sahin-Dikmen M., Winch C. and Duran-Palma (2019) Inclusive Vocational Education and Training for Low Energy Construction: VET4LEC, a) Final Report; b) Country Summaries, European Federation of Building and Woodworkers and European Construction Industry Federation, Brussels.
Available at: <https://www.fiec.eu/our-projects/completed-projetcs/vet4lec>

34 Ibidem.

Clarke L and Sahin Dikmen M. (2019) 'City Building (Glasgow): inspirational model of low energy construction and direct labour', Scottish Left Review, 113, September/October. European Commission (EC) (2014) Build-up Skills: EU Overview Report, Staff Working Document, Intelligent Energy Europe, Brussels

35 CEDEFOP (2019): Construction workers: skills opportunities and challenges.

36 Clarke L., Gleeson C., Sahin-Dikmen M., Winch C. and Duran-Palma (2019) Inclusive Vocational Education and Training for Low Energy Construction: VET4LEC, a) Final Report; b) Country Summaries, European Federation of Building and Woodworkers and European Construction Industry Federation, Brussels. Available at: <https://www.fiec.eu/our-projects/completed-projetcs/vet4lec>

Germany's construction VET system has a 'dual' nature, being regulated by the social partners with the state responsible for setting the legislative framework and supervision and unions and employers associations involved formally in training and education bodies at all levels. The system covers over 20 construction occupations, whereby trainees apply to a company and levy-funded training is spread roughly equally between three locations: the company, training centre and vocational school. The three-year VET programme is stepped, whereby trainees begin in the first year with a broad introduction to all the different construction occupations, then specialise in the second year into finishing, building or civil engineering, and only concentrate on a particular occupation in the final year³⁷. This has the advantage of providing an overview of the work of different construction occupations and their interactions, so conceiving the building envelope as a single unit, though building services belong to a different sector from building, and hence come under different social partners.

LEC elements are mainstreamed into VET programmes of existing construction occupations, and national curricula for each construction occupation (including building services) incorporate these and provide detailed syllabi through pedagogic materials. For example, the textbook for the plasterers (Stukkateur) includes the purpose of insulation, internal climate control, costs of heating and energy use, environmental protection, and thermal bridging as well as explanations of the nature of climate change, so necessary for developing climate literacy (Handwerk und Technik, 2014: 172-9). VET programmes are constantly reviewed and adjusted, taking account of technological changes, economics, the legal framework and social conditions.³⁸ Social partnership structures ensure the representation of all relevant perspectives and inclusion of

critical elements, overseeing curricula and publishing detailed pedagogic materials covering both practical and theoretical elements of VET for LEC.

The law makes provision for wide-ranging trade union involvement in the design and implementation of VET. Trade unions and employer organisations are involved formally in training and education bodies at all levels; at the national level they are members of the Board of the Federal Institute for Vocational Education and Training, at the regional level they are on Regional Committees for Vocational Training, and at the local level they are on Vocational Training Committees of the 'Competent Bodies'.

In sum, Germany stands out as one of the more advanced European countries in embedding LEC elements into curricula, and to incorporate the wider context of climate change. For Germany, BUS recommended only specific changes, including strengthening systems thinking and interdisciplinarity (EC, 2014). A high proportion of the existing workforce is skilled and holds a recognised qualification, signifying workers possess basic knowledge and competence to master new concepts and techniques. Its VET system is resourced and up to date, combining school based and practical learning through a substantial off-site, workshop-based component as well as work placements. Their broad-based occupational capacity provides a suitable framework for developing knowledge and understanding of energy efficiency, a holistic view of construction to enhance occupational coordination, and transversal abilities.

JUST TRANSITION IN PHASING-OUT COAL MINING

Beyond electricity, coal has been an essential raw material for iron and steel production and is the key energy fuel used in the production of aluminium and other highly energy-intensive

37 Clarke L., Gleeson C., Sahin-Dikmen M., Winch C. and Duran-Palma (2019) Inclusive Vocational Education and Training for Low Energy Construction: VET4LEC, a) Final Report; b) Country Summaries, European Federation of Building and Woodworkers and European Construction Industry Federation, Brussels. Available at: <https://www.fiec.eu/our-projects/completed-projects/vet4lec>

38 Clarke L., Sahin-Dikmen M. and Winch C. (2020b), 'Overcoming diverse approaches to vocational education and training to combat climate change? the case of low energy construction in Europe', *Oxford Review of Education*, 46/5: 619-636

industrial products essential to the construction industry. Also, there is still coal in the cement industry in Europe.³⁹ I.e. the energy sector, including carbon/coal, relates to construction as part of the downward linkage of the value chain.

Therefore, phasing-out coal mining has implications for jobs in the production of construction materials. Moreover, sometimes materials are substituted due to their high energy-intensity, such as aluminium. This has implications for the occupations which deal with different materials on-site.

Many regions across the EU are in the midst of dealing with the shutdown of carbon-based fuel extraction, such as coal, and trying to support the workers that are directly affected by this while also trying to plan for economic diversification and the transition to greener energy production. While each region is unique in terms of its history, infrastructure and other characteristics, there are many shared challenges.

PHASE-OUT OF HARD COAL MINING IN THE GERMAN RUHR DISTRICT (RUHRGEBIET)

The Ruhr District is a large, densely populated and heavily urbanised region in the German state of North Rhine-Westphalia (NRW). The Ruhr developed economically through its historical dependence on coal mining, coal power generation and coal-reliant heavy industries such as steel production: hard coal has been central to the culture of the state of NRW and Germany for 200 years. From 1990, Germany started to reduce coal subsidies, which led to a tripartite agreement in 2007 to completely phase out hard coal mining in the Ruhr and adjacent regions by 2018. Employment in hard coal mining in the area was radically downsized, from 473,000 in 1957 to 11,448 by the end of 2013 and then to zero by 21 December 2018. The area has undergone permanent

structural change over the last 60 years. It has achieved a fundamental transformation from coal production and steel to a knowledge-based economy in a region of 5.4 million inhabitants that, until 1962, had no university. The regional economy now has a diverse profile, including environmental compliance, ecotourism, several leading universities, renewable energy manufacturing and high-tech hubs.

The Ruhr shows that the phase-out of coal mining is possible in a just way, with an emphasis on no worker left behind, clear social benefits for a region and environmentally sustainable alternatives. The Ruhr is also an example of a just-in-time just transition policy that phased out fossil fuels in a socially responsible manner in keeping with the Paris Agreement requirement to keep emissions below 2 to 1.5 degrees Celsius.

SKILLS AUDIT IN THE GERMAN RUHR DISTRICT

A skills audit was conducted of the region and workers in the coal and steel industry in the Ruhr district, uncovering a regional 'hidden' knowledge base that was skilled and innovative in renewable technology, energy efficiency, renewable resources, recycling and waste combustion. These skills had been honed after decades of work in building mining components, managing the energy resources needed by the coal and steel industries, and mitigating the environmental waste they produced. A map of existing and future skills demand was used to set up skills objectives and develop model projects. For each affected worker, an individual re-employment strategy was developed in cooperation with the regional government, the company management, the works councils and social partners. Workers also received qualification/requalification through training and on-the-job certification via the coal and steel companies.⁴⁰

39 https://cembureau.eu/media/kuxd32gi/cembureau-2050-roadmap_final-version_web.pdf

40 Source: NESG report: Four Case Studies on Just Transition: Lessons for Ireland. Report No. 15, May 2020 <https://www.nesc.ie/publications/four-case-studies-on-just-transition-lessonsfor-ireland/>

PHASE-OUT OF LIGNITE MINING AND COAL-FIRED POWER GENERATION IN LUSATIA, GERMANY

Lignite, or brown coal, is the lowest rank of coal and a highly inefficient fossil fuel due to its high moisture content. The process of lignite mining requires surface, open-cast mining that can have a dramatic impact on the landscape. The region of Lusatia has already undergone much restructuring, with the reunification of west and east Germany. Work in lignite mining was a source of pride as it powered eastern Germany, but reunification and privatisation in 1989 meant greater competition, with higher productivity levels in the West. This led to a 90% drop in employment within 10 years. In 1990, 80,000 people worked in the Lusatian lignite industry, dropping to 20,000 by 1995. At present, the remaining four mines and four power plants in Lusatia are owned by Czech energy company LEAG, which operates four opencast mines. Overall, in Lusatia 13,245 jobs are directly or indirectly related to the brown-coal sector. Direct jobs in the energy sector in Lusatia are of high quality and are paid well compared with other employment prospects in the region. Under the Coal-Exit Commission, a number of employment and skills recommendations for federal actions have been put forward for the region, which include: job guarantees for employees and apprentices, including binding collective agreements to ensure placement in skilled jobs and compensation for lower wages and provide apprenticeships and further training; compensation for financial losses or early retirement; assistance in obtaining adjustment benefit; and compensation for pension deductions or other early retirement factors.

There are also down factors which should also be taken into consideration. The choice of compensating companies for potential profits forgone has been one of the most significant criticisms of this phase-out. Energy-intensive companies will also be compensated if their running costs increase when cheap lignite is

phased out, which also discourages energy efficiency measures and undermines potential carbon taxes. This leads to a precedent for expensive 'just transition'.

In sum, the cases of phasing-out coal mining have direct implications for the workers along the construction value-chain, as they are related to construction materials. This is an important reason for unions from other countries to learn about the German experience.

Spain

The case of Spain starts with an overview of good practices in the overall VET system, followed by a specific analysis of the Labour Foundation of the Construction Sector.

OVERALL VOCATIONAL EDUCATION AND TRAINING (VET) SYSTEM⁴¹

VET in Spain is organised by the state in close collaboration with social partners. The General Council for Vocational Training is the national government body leading on VET policy. It comprises representatives of national and regional public authorities as well as social partners, such as employers' organisations and trade unions. The National Institute of Qualifications (INCUAL) is in charge of designing all VET qualifications in the VET system in all sectors of the economy and creating a National Catalogue of Professional Qualifications along with the participation of stakeholders. As a result, the INCUAL through the National Qualification Framework (NQF) defines qualifications and related training content, which the Ministry of Employment and the Ministry of Education translates first into vocational certificates (vocational training) and second into vocational diplomas (vocational education).

In this way, vocational training also stems from the National Catalogue of Professional Qualifications. Vocational training has a higher

41 Main source for this sub-section: Clarke L., Gleeson C., Sahin-Dikmen M., Winch C. and Duran-Palma (2019) Inclusive Vocational Education and Training for Low Energy Construction: VET4LEC, a) Final Report; b) Country Summaries, European Federation of Building and Woodworkers and European Construction Industry Federation, Brussels. Available at: <https://www.fiec.eu/our-projects/completed-projects/vet4lec>

workshop and work-based learning element, with classroom learning making up 43%, and completers are awarded certificates endorsing their professional skills, rather than diplomas. Vocational Certificates can be gained in all the professional families indicated below.

Initial Vocational Education and Training (IVET) is nationally organised and college-based, encompassing upper secondary to EQF level 5, with substantial work-based learning (up to 65%) elements within it. It is organised into Basic Vocational Education, Mid-Grade Vocational Education and High-Grade Vocational Education. Basic VET programmes are offered from age 15 and target students at risk of leaving education. After this 2-year training, they can continue onto mid-grade VET or take general school leaving examinations. Mid-grade programmes start at 16 years old and allow access to higher level VET. There are 26 strands ('professional families') in the VET system. The Ministry of Education and Vocational Training is in charge of the design and approval of the minimum training contents for each diploma of vocational education. VET at all three grades involves work-based learning (20%), together with practice in a workshop (32%) and theoretical learning in the classroom (48%). There are also recent initiatives to introduce a dual system.

Finally, CVET is provided by public and private organisations. All companies can have access to the CVET system, including micro companies, though not all appear to take advantage as in 2017 there were about 4 million participants out of a working population of 18 million. The State Foundation for Training in Employment (FUNDAE) funds and manages further education courses, acting on behalf of the Ministry of Employment, Migrations and Social Welfare. Funds for training come mainly from a quota paid by companies (0.6%) and employees (0.1%) on their salary payroll. These courses aim to support workers to train or re-train for jobs in growing sectors and respond to the needs of companies. Most of CVET is organised and provided by private companies, and FUNDAE provides a volume of information on this.

LABOUR FOUNDATION FOR THE CONSTRUCTION SECTOR⁴²

The FLC is an interesting case study because of its national implementation, and sectoral nature, with the participation of both employer and trade union representatives and its focus on CVET and LLL. Moreover, the social dialogue aspect of the FLC has contributed greatly to its success in educational outcomes, because the levies made VET free for the workers themselves. Furthermore, the social dialogue has unified the construction sector in promoting professionalism, health and safety, and employment opportunities.

The 'Fundación Laboral de la Construcción' (FLC) is a paritarian organisation that was established in 1992. The FLC aims at providing businesses and workers in the construction sector with the necessary skills and knowledge to develop a more professional, qualified and educated workforce. The goals of the FLC are:

- Provide training for needed qualifications in construction
- Improve access to VET for all groups of workers in the sector
- Retain skilled workforce
- Improve working conditions
- Provide relevant construction sector training for unemployed persons
- Improve employment and health and safety in the construction sector

The FLC is a national partnership which involves nation-wide actors and addresses target groups across the country. The main actors involved in the Foundation are Spanish employer organisations and trade unions. It is funded through levies of its member organisations and public money, without additional contributions from workers engaged in CVET.

FLC is specialised in VET courses within the Vocational Training for Employment, which includes continuous training for the employed

⁴² This sub-section is based on EUROPEAN COMMISSION Directorate-General for Employment, Social Affairs and Inclusion (2017). Business cooperating with vocational education and training providers for quality skills and attractive futures. EC: Brussels.

(CVET), and occupational training for the unemployed. Besides this, it also offers Initial Vocational Training (IVET) programmes, mainly aimed at young people before entering the labour market. The Foundation works exclusively in the construction sector, although it is interested in increasing its training offer for other related sectors (e.g. metal, renewable energies).

The FLC provides over 200 different training tracks in 50 training centres with over 1400 teachers which are located throughout the country, and it has developed over 140 study manuals on subjects relevant to the construction sector. Consequently, the FLC has welcomed hundreds of thousands of construction workers into its training centres, preparing them for new technologies, and improving knowledge of health and safety standards. The FLC promotes social inclusion and mobility of VET in the construction sector, by offering free qualification opportunities to unemployed persons. Educational efforts of the FLC mostly focus on the development of curricula by incorporating new practices in the field in VET training for the sector (feedback loop).

All in all, the FLC case study shows that the involvement of sectoral social partners can be a very relevant factor in increasing quality and attractiveness of VET.

Membership of the FLC includes the CNC (National Confederation of Construction), representing the employers' associations, and 50% is owned by the construction federations of the two main trade unions in Spain: UGT and CC.OO (UGT-FICA: Industry, Construction and Agro Trade Union. CCOO Hábitat: Construction and Services Trade Union).

Additional partners include construction companies in the country. Every company in the industry pays a levy corresponding to 0.35% of its mass salary to contribute to the sustainability of the FLC. All SMEs of the construction industry are involved. Furthermore, as part of FLC's strategy, it has agreements with vocational

education institutes, universities, professional colleges, and public administration departments (Education, Training, Labour, Health and Safety) about the training of construction workers.

The organisation and its projects are implemented in a paritary way at most levels. The organisation's structure and activities are the outcome of the Spanish social dialogue in the construction sector. The FLC performance is monitored by a steering committee which meets every month. Additionally there are 17 paritary regional councils that govern the institution at the regional level.

From the managerial perspective, there is a Managing Director that rules FLC. Professional structure is based in a matrix that includes managers at the national level (for training, health & safety, human resources, etc.), and 17 regional managers. Every national manager has several departments, and the same structure is developed at the regional level.

LINKAGES WITH EU RE. GREEN CONSTRUCTION

The challenge that the initiative attempts to solve is a gap in professional training in new technologies, workplace safety, and innovative sustainable building methods that current workers have enjoyed. Recent and fast changes in construction technologies like the increased use of 3-D Building Information Models (BIM), had rendered parts of the construction workforce in need of training.

With regard to European Commission initiatives for green employment, clean energy and the energy performance of buildings, the Foundation participates in the Social Dialogue FIEC-EFBWW project for inclusive VET for low energy construction, and in the Erasmus+ project for Building up green skills for trainers from the construction industry. The objectives for these programmes are, respectively to improve the link between VET and low-energy construction and to design a European sectoral 'green skills' standard for construction trainers in South Europe.

The main components of the implementation are work-based learning, as the learning programmes are mostly of a dual nature where current workers receive CVET or pupils receive IVET, combined with an apprenticeship. To a certain extent, the courses that are offered prepare learners for a new age in which ICT is more important than ever, even in construction. Specifically, the need for digital skills requires training construction workers in the use of virtual, 3D building models, and different sensors on-site, as well as the management of different digital documents and models in the execution of building plans.

The FLC attempts to ensure that qualifications at the end of their education tracks are transferrable to other countries through cooperation in European networks of social partners in the construction sector. Consequently, the FLC aims to improve the mobility for workers in the Spanish construction sector through their education programmes. By offering training to unemployed people who aspire to work in the construction sector, the FLC aims to contribute to improving social inclusion in VET.

SAFETY AND HEALTH

The FLC issues 'professional cards' that attest to each construction worker's experience with health and safety training, experience in the sector, as well as their professional qualifications. These professional cards are awarded after completion of one or more courses, and thus reflect a worker's continued education and training. Additionally, the FLC engages in worksite visits, in which advice is given to construction companies regarding health and safety practices. There are 21 Health and Safety practice centres. They are 'real', unfinished buildings where workers can perform construction tasks under supervision in order to practise health and safety standards.

SUSTAINABILITY AND REPLICABILITY

Since the start of the FLC, its indicators have been monitored by the organisation, although a thorough evaluation that includes an analysis of the implementation of the chosen approach seems to be missing. However, according to Spanish regulations, The Ministry of Education has established a Protectorate, so that FLC performance is under surveillance by public administration institutions. Additionally, the board of patrons meets annually in order to evaluate the results achieved by FLC. During this meeting, the managing director explains all the outputs and outcomes attained during the year. Customers, pupils and trainees evaluate the FLC's education when they complete a course, so there is constant feedback on the education and training efforts. According to the strategic plan for 2016-2020, the FLC has to carry out an evaluation to assess the actual impact of the organisation's activities.

POLICY RECOMMENDATIONS

Renovations pertaining to the Renovation Wave should be implemented in a comprehensive socially driven manner. Around 6.9% of the total EU population is unable to keep their houses adequately warm. Tackling not only energy efficiency aspects but also structural and maintenance issues are important for poorer households in the EU. For instance, A staggering 14.8% of the population lives in houses with leaking roofs. In Romania, 21.2% of the population lives in houses without a toilet, shower or bath.⁴³ FeNEAL UIL has highlighted the increasing high seismic and hydrogeological risks the Italian built environment is facing. This session presents sets of policy recommendations to improve the situation, with a specific focus on the labour aspects.

EU and national policy

Establishing ambitious EU-level strategies and legislation packages transposed to national legislation is an important aspect of delivering the EU Renovation Wave. The Renovation Wave, the Fit for 55 package and the EU Climate Law set ambitious goals for the reduction of GHG emissions and energy demand of buildings. EFBWW and national affiliates can strategically advocate for the reduction of escape clauses diluting the ambitious goals set by the directives, focusing on the governments that are most opposed to an ambitious agenda. Practical options include:

- Advocate for more ambitious Energy Performance of Buildings directive and the Energy Efficiency directive, with more ambitious renovation targets of public and

private buildings, references to health and safety hazards such as asbestos, and social issues such as energy poverty and building leakages – sometimes linked to seismic and hydrogeological risks.

- Hold advocacy events and build partnerships with other civil society organizations to promote greater buy-in of national governments.

Governance and social dialogue

Co-governance generates improved and sustainable changes. Social dialogue is important, inter alia, to discuss the impact of technological change. Given the fact that changes in construction have been happening fast and are due to continue, a constant mechanism of social dialogue should remain in place.

The way in which the construction industry operates is an important factor in delivering the EGD. Trade Unions can play a pivotal role with the creation of the sustainability delegate figure and Sustainability Committees. The ultimate goal is to co-govern the green transition by implementing transversal action plans that cover issues such as sustainable material use, mobility plans, and green transition/energy efficiency training. Sustainability Committees also serve to monitor the effectiveness of environmental policies and provide workers inputs, mobilise workers support to changes in workplace policies and improve operational procedures.

⁴³ <https://ec.europa.eu/eurostat/cache/digpub/housing/bloc-1c.html?lang=en>

Expanded (tripartite plus) social dialogue is also instrumental to bring out system innovations (noted in the previous section on Main Findings). I.e. concerted action among knowledge institutions, education and training, trade unions, government, contracting authorities and contractors.

Unions should have clear policies, action plans and trainings that focus on:

- Appointing TU sustainability representatives and recognition at company and national levels. Trade Unions need to proactively map green TU representatives and support them with championing programs including coaching/mentoring and encourage best practice exchanges.
- Set up Sustainability Committees with clearly established membership criteria, operational procedures (frequency, chairing, relationship with other bodies), and ToRs.
- Negotiate an environmental agreement or policy.
- Build alliances that tie further the needs of workers to the climate and wider social agenda (e.g. access to housing). Alliances should take place across regional, national and local levels and areas of intervention.⁴⁴
- For smaller companies where worker representation is lacking, it is important to deliver adapted strategies that have worked in other labour issues. E.g. similarly to Area-based trade union representatives for OSH, also have representatives for green transitions.
- Promote local social dialogue to involve local authorities, as they have an important stake in construction and social dialogue at the national level not always grasps local specificities.

New Jobs

To recap, the impacts of the Renovation Wave on construction employment have not been studied in depth, available information is scarce, and the figures seem to be underestimated. This Report strove to update such figures and found that between 486,600 and 1,549,000 additional workers will be needed in the buildings construction and energy renovations sector between 2023 and 2030. Around 1,259,647 additional job posts will need to be covered to replace the ageing of the workforce in the same period. The Renovation Wave will also require the participation of OSH Managers and labour inspectors. Between 100,250 and 112,056 OSH managers will be required in the building construction and renovations sector. Additionally, assuming between 0.5% and 10% of all the 30 million renovated buildings will be inspected once, between 268 and 5,357 labour inspectors will be required to ensure labour rights and working conditions are effectively respected in construction worksites.

Investments in Energy Renovations under the Recovery and Resilience plans already have important employment effects in the construction sector and supply chains. We estimated that around 2,251,981 direct jobs will be created between 2021 and 2026. 7,469,246 indirect jobs and 4,558,612 induced will be sustained in the same time period. The multiplicative factor of the construction sector is therefore confirmed. An important recommendation is that policies should take into consideration that real figures are higher than existing estimations. This has different implications, for example:

- Unions should plan their awareness raising and advocacy campaigns taking into consideration the actual number of entrants in the industry.

⁴⁴ Alliances with research organisations in civil society such as IHRB could be formed. IHRB has a Built Environment programme performing action research and constructing narratives for social justice in the construction sector.

<https://www.ihrb.org/focus-areas/built-environment/>

An example of national level alliances of trade unions and housing associations can be found in Germany:

http://www.xinhuanet.com/english/2019-08/22/c_138329896.htm

An example of alliances with local governments can be found in the construction of Oslo's Munch Museum:

<http://www.nordiclabourjournal.org/i-fokus/in-focus-2018/a-properly-regulated-labour-market/article.2018-09-05.9215100414>

- Planning for training needs to take into consideration not only upskilling and reskilling, but also the entrants.
- Make sure that the 2023 *Status Quo* analysis to be conducted by the Building Up Skills programme be accurate as possible in quantifying Energy Efficiency, Circularity and training needs for white as well as blue collar workers.
- There are different institutions working on different elements, which can cross-reference and support the above (e.g. ITEC, labour-oriented university departments, etc.).
- Campaign to the creation of local, inclusive, and decent work, so that new green jobs are not outsourced.

Calculations on training needs

Lack of skilled workers is a key limiting factor affecting the Renovation Wave. Although there is a wide consensus on this, policies related to the Renovation Wave do not include estimations nor concrete plans to address the skills gap. Skills needs assessments are seldomly updated and there are no consistent EU wide methodologies to calculate them. Making use of conservative assumptions and the (scarce) information available, we have estimated between 3,157,871 and 4,538,262 workers will require specialised Energy Efficiency trainings to achieve the Renovation Wave. Additionally, all the buildings construction and energy renovations workforce (10,085,026 workers) will require basic climatic literacy and Energy Efficiency trainings. Our estimations are consistently higher than those found in other studies. However, consistent information at the EU level is required to formulate EU-wide policy recommendations. In the first quarter of 2023, further information will be made available from the Construction

Blueprint Observatory⁴⁵ and CEDEFOP Skills Forecast⁴⁶ survey. The Build Up Skills project will also update training needs of the sector regarding EE Renovations.

Specific points

- Skills needs assessments do not quantify training needs for the different workprofiles. Skills profiles and general training needs are developed but there is no quantification of the number of workers in each occupation. Existing surveys provide *ad hoc* methodologies to quantify skills needs.
- All workers in the buildings construction and energy renovations sector require basic climatic literacy, circular economy and energy efficiency trainings. Trends show higher dependency and coordination needs between occupations and hierarchical levels in businesses. This implies that all workers need a basic understanding in order to maximize climatic outcomes.

Financing upskilling

Despite their importance, upskilling and reskilling financing have not been addressed in a consistent manner in the Recovery and Resilience Facility Plans. National programmes remain largely targeted to specific training areas. They are neither funded through other EU financing streams and national budgets. Asbestos removal is also not financed in many countries. Some exceptions are found in Poland⁴⁷ and recently in Spain⁴⁸. It is imperative to take action now because asbestos across the EU is reaching its lifespan since EU countries banned its use around the 2000s. It is also important to specifically allocate funds for asbestos removal to avoid having self-employed informal operators without any knowledge nor regards for removal procedures nor safety protection.

45 <https://constructionblueprint.eu/observatory/>

46 <https://www.cedefop.europa.eu/en/tools/skills-forecast>

47 The Polish Asbestos Removal Programme includes both EU and National funds making it free for house owners to remove Asbestos. The only cost is to add the new roof/pipes. The programme additionally finances.

48 Royal Decree 853/2021, from 5 October, regulating the support programs on residential and social housing rehabilitation of the Spanish National Recovery and Resilience Plan. The Decree establishes financing of 1000 € per house dwelling and 12000 € per building for asbestos removal.

- Trade Unions should campaign and advocate for policies which finance upskilling and reskilling along the entire construction sector value chain. The negotiation of National Recovery and Resilience Facility Plans constitute a financial opportunity already explored by several countries and Trade Unions. Another untapped channel is the European Social Fund Plus which has not had a sectoral focus until now. The EU Just Transition Fund could be further financed, and social bonds could further be used in a European instrument for temporary Support to mitigate Unemployment Risks in an Emergency (SURE) program⁴⁹ to address the upskilling and reskilling of workers in the construction green transition.
- Trade Unions should campaign and advocate for EU-wide access to funds for the removal of Asbestos. In order to guarantee the correct identification, removal and management of this waste, avoiding its reintroduction into the cycle as recycled material, avoiding its dumping in illegal landfills or ending up in non-hazardous waste treatment and management centers; funds should cover the identification of buildings containing asbestos, sensitisation campaigns, grants for asbestos removal, and the creation of landfills for its disposal. Asbestos removal should also be a pre-condition for solar panel installation and renovations, as roof reparation already is. Regulations in other less known hazardous chemicals present in construction materials such as formaldehyde should also be explored.⁵⁰

Training

According to the CEDEFOP Skills Intelligence database, 277,726 workers will retire each year in the construction sector. Approximately 2,200,000 workers will retire between 2022 and 2030. Many job advertisements in the coming years will be thus triggered by replacement

demand in the sector, not only by new demand. Attracting youth is therefore important to deliver the Renovation Wave.

According to a 2019 report commissioned by FIEC and EFBWW⁵¹: approaches to VET for LEC vary considerably, though countries face similar challenges and all need to ensure that VET is effective for meeting NZEB (near zero energy buildings) requirements, incorporates LEC-related KSC, and is sufficiently broad to cover transversal abilities and cross-occupational understanding. Deep integration of energy literacy into existing occupational profiles, curricula or syllabi at all levels is preferable to just adding LEC-related topics onto IVET programmes. CVET for LEC presents a challenge, particularly in the short term, as courses and a range of delivery methods are needed, catering to different existing training and qualifications levels. Course content must be carefully considered, where possible specific modules should be part of a comprehensive and longer CVET programme, and funding is essential for providing an upgraded, comprehensive and accessible VET programme. Factors hindering VET for LEC development and undermining efforts to achieve an integrated construction process need addressing, including limited work-based learning opportunities, low VET participation by the self-employed and small firms, low construction VET currency, often weak labour market regulation, and fragmented organisation of work on site.

Specific points:

- Update the list of specific professions for VET, related to the implementation of measures for energy efficiency improvement and the use of renewable energy in buildings. This may involve increasing, merging and/or updating the list. Example: Spain Energy Auditor.
- Mainstream in Educational Requirements by professions of new knowledge, skills and competences (KSC), related to the energy efficiency renovations. New qualification and

49 SURE Program: https://economy-finance.ec.europa.eu/eu-financial-assistance/sure_en

50 Neuhaus (2021). EU Taxonomy Regulation and Construction Products. <https://www.linkedin.com/pulse/eu-taxonomy-regulation-construction-products-thomas-neuhaus/>

51 Clarke L., Gleeson C., Sahin-Dikmen M., Winch C. and Duran-Palma (2019) Inclusive Vocational Education and Training for Low Energy Construction: VET4LEC, a) Final Report; b) Country Summaries, European Federation of Building and Woodworkers and European Construction Industry Federation, Brussels. Available at: <https://www.fiec.eu/our-projects/completed-projects/vet4lec>

areas of competence include waste management in construction sites, the use of innovative materials and technologies for thermo-modernisation of buildings on the existing thermal insulation requiring improvement of insulation.

- Improve training plans and programmes – for schools and vocational training centres, through participation of trade unions and companies.
- Consider joining the Pact for Skills, one of the flagship programmes of the European Skills Agenda.
- Add new themes in education which are not clearly mentioned in training programmes, in the frameworks, or in the vocational training centre courses.

Changes in the industry

The construction industry is changing rapidly to address environmental challenges and other challenges (such as demographic growth) and at the same time to incorporate the evolving digital technologies. Companies and workers that adapt to the latest technological and industry trends will with-hold higher gains, while unadapted companies and workers stand to lose their market share and jobs if they do not adapt. To reach the climate targets, the sector will need to deal with its structural atomisation, with many microenterprises. The new workers will need to enrol all types of enterprises (small and big). Thus, promotion of employment-led growth interventions may support this process. A labour-centred policy also entails higher investment in worker trainings, and not only in capital investments aiming to reduce worker costs. The session on the Main Findings noted specific sets of skills required. Changes in the industry will naturally create new demands for VET following new occupational profiles. Existing occupational profiles may also change. A non-exhaustive list of new, emerging and changing occupational profiles is available in Annex 9.

- Trade Unions need to support employment-led growth and worker-centred policies in Member States and explore policies that address the sector atomisation and digitalisation.

- Trade Unions need to keep abreast of the ever-changing industry and occupational profiles, and at the same time dialogue with VET institutions to make sure that they are aligned.

Good practices /case studies

There are other good practices, in addition to the ones presented in the Case Studies section. There are many programmes to upskill and train workers. References are included in Annex 1. It is not clear how many green jobs will be created (there is only little information in this account, such as from Romania), and whether these green jobs are new jobs or if they replace non-green jobs.

To give one example, the first document listed in Annex 1. (European Commissions' Staff Working Document – analysis of the long-term renovation strategies): it has one chapter (starting on page 45) specifically on creating green jobs, upskilling workers and attracting new talent. The information there is summarized, as the document itself recognizes it in page 8. But it gives orientation regarding where to go.

There are many specific programmes to upskill and train workers, although it is not clear how many green jobs will be created.

- Trade Unions should consult the good practices, which can serve as inspiration (with the necessary adaptations).
- Trade Unions should also bear in mind that to obtain existing and detailed data about case studies would entail finding institutions which have such appropriate information, (e.g the government agency responsible for green construction and/or similar in each country) or they should advocate to set up new one(s). Other useful documents are included in Annex 1.
- If the Workers' Unions in a given country do not have the necessary information, they can either set up a way to obtain it via a partnership and/or to refer to additional sources.
- Consider the establishment of an EU sustainable construction observatory with both employers and trade unions.

Business case

There is definitely a business case for energy efficiency in construction. Trade Unions and other organizations interested in green construction and its positive impact on labour can use this for advocacy.

First, there are more and more incentives for green construction and buildings. At the same time that there are taxes for construction and existing buildings which have a negative impact on the environment.

In addition, many individual and corporate clients are conscious of the benefits of green construction as opposed to the impact of environment-harming practices. They will choose to hire construction companies with a track-record in, and proven knowledge of, green techniques. Many corporate clients are also interested in the marketing benefits of occupying environment-friendly buildings.

- All in all, Trade Unions could consider disseminating the business case to possible uninformed entrepreneurs.
- While everything mentioned above is important, Trade Unions should particularly bear in mind in their advocacy that the environmental impact of construction and buildings has consequences for the health of construction workers. In specific regard to a business case (in addition to being a moral imperative), diseases have a significant toll on productivity at work, number of workdays lost from sick leave, as well as premature retirement and premature death. According to the World Economic Forum (2008), a study which compared the competitiveness of 31 industrial and developing countries clearly showed that better safety and health standards equal better national productivity. The results indicate that a low number of fatal accidents and high competitiveness are directly proportional making the most competitive economies register the lowest number of fatal accidents. Countries such as Switzerland, with just over 3 fatal occupational

accidents per 100,000 employees, are not only amongst the best countries with the highest standards of health and safety but are also amongst the most competitive national economies in the world. Many construction workers live in inappropriate accommodation and suffer from related environmental health problems, caused for example by poor insulation, inappropriate building materials, indoor air pollution. Such environmental health problems, combined with OSH deficits in construction sites, have a toll on the health of construction workers, and are detrimental to business. In regard to OSH specifically, activities related to the production of new/ green products and the assembly of new equipment (e.g. solar panels and wind generators) need specific provisions to protect the workers.

A holistic approach

Putting everything together, and quoting CIRT Team⁵², LEC (low energy construction) means a transformation of VET systems to encompass deeper knowledge of energy efficiency, higher technical and precision skills and, above all, a holistic approach so that the building envelope is conceived as a single thermal unit and the social interaction of different occupations is understood. The high-quality construction labour process required involves teamwork and cross-occupational coordination, which imply interdisciplinarity, as well as transversal abilities such as communication, project management, precision, problem solving and coordination. But over and above this, climate literacy is needed to give meaning to the knowledge, skills and competences acquired, so that trainees and workers are empowered and can appreciate why they are doing what they are doing and recognize their contribution to creating a safer and more equitable society. Climate literacy is tied to social equity and climate justice, comprising affirmation of the social contribution and responsibility construction workers, their unions, and the industry have to reduce emissions and the influence they have in determining policy direction.

⁵² CIRT Team (in print). Differing approaches to embedding low energy construction and climate literacy into vocational education and training. Chapter for the forthcoming book by Ofori, G. and Werna, E. (eds.), *The Built Environment at Work*. Routledge.

ANNEXES

	KEY ACRONYMS		COUNTRY ABBREVIATIONS
	BUS Build-Up Skills project		AT Austria
CCOO – Hábitat	Comisiones Obreras Hábitat – Construction and Services Trade Union		BE Belgium
	CE Circular Economy		BG Bulgaria
CEDEFOP	European Centre for the Development of Vocational Training		CY Cyprus
	CEO Chief Executive Officer		CZ Czech Republic
	CTVET Continuous Vocational Education and Training (IVET)		DE Germany
	EC European Commission		DK Denmark
EE Renovations	Energy-Efficient Renovations		EE Estonia
	EFBWW European Federation of Building and Woodworkers		EL Greece
	EGD European Green Deal		ES Spain
	EPC Energy Performance Certificates		FI Finland
	EU European Union		FR France
EU RRF	European Union Recovery and Resilience Facility		HR Croatia
	FIGARO Full International and Global Accounts for Research in input-Output analysis		HU Hungary
	FLC Fundación Laboral de la Construcción – Construction Labour Foundation		IE Ireland
GHG Emissions	Greenhouse Gas Emissions		IT Italy
	HVAC Heating, Ventilation, and Air Conditioning		LT Lithuania
	ILO International Labour Organisation		LU Luxemburg
ITUC-JTC	International Trade Union Confederation – Just Transition Centre		LV Latvia
	ITVET Initial Vocational Education and Training (IVET)		MT Malta
	KSCs Knowledge, Skills and Competences		NL Netherlands
	LEC Low Emissions Construction		PL Poland
	MFF Multiannual Financial Framework		PT Portugal
MSMEs	Micro Small and Medium Enterprises		RO Romania
	NQS National Qualifications System		SE Sweden
NRRPs	National Recovery and Resilience Plans		SL Slovenia
	NRW North Rhine-Westphalia		SK Slovakia
	NZEB Nearly Zero Emissions Buildings		
	OSH Occupational Safety and Health		
	RW Renovation Wave		
	STEM Science Technology Engineering, Mathematics		
UGT-FICA	Unión General de Trabajadores – Industry, Construction and Agro Trade Union.		
	VET Vocational Education and Training		

ANNEX 1.

REFERENCES TO FURTHER CASE-STUDIES

As noted in the analysis and findings, there are sound sources of good practices for case studies in addition to the ones presented in section Case Studies.

There are programmes to upskill and train workers. It is not clear how many green jobs will be created (there is only little information in this account, such as from Romania), and whether these green jobs are new jobs or if they replace non-green jobs. Useful documents are included below.

- **EUROPEAN COMMISSION STAFF WORKING DOCUMENT (2021) 635: ANALYSIS OF THE NATIONAL LONG-TERM RENOVATION STRATEGIES.**

- **RENOVATE EUROPE CAMPAIGN SKILLS REPORT:**
https://www.renovate-europe.eu/wp-content/uploads/2022/10/REC_E3G_Skills-brief_Final_Oct2022.pdf

- **EUROPEAN UNDECLARED FORMS OF WORK PLATFORM:**
<https://ec.europa.eu/social/main.jsp?catId=1307&langId=en>

- **OSH – NATIONAL ASBESTOS REMOVAL PLAN IN POLAND:**
https://projects2014-2020.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1502882280.pdf

Asbestos needs to be either mainstreamed or highlighted in the development of the RW. Asbestos-related deaths are expected to reach 120,000 by 2029. 35 million out of the 210 million buildings in the EU contain asbestos. Options include: specific provisions in Energy Performance of Buildings Directive, the approval of a European Strategy for the Removal of All Asbestos (this was proposed by some political groups in the EU Parliament but did not go

through). The alternative is the development of Asbestos Removal Plans. There is only one National Asbestos Removal Plan, so that could be the good practice. The Polish Asbestos Removal Plan includes mapping, disposal infrastructure and funding

https://projects2014-2020.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1502882280.pdf

- **NEW SKILLS QUALIFICATION SCHEMES**

The CraftEdu project created a national qualification and training scheme for energy efficient renovation in Czechia using an e-learning platform, aimed both at existing and future construction practitioners.

- **MICRO ACCREDITATION AND CONSTRUCTION SECTOR CARDS**

Malta developed the Skills Building initiative in the construction sector: by 2025, the government will develop a scheme to train and certify professionals and tradesmen of various levels in order to obtain a mandatory skill card which would need to be presented to work in the respective sectors. Certification will be extended to installers of several technologies and a life-long-learning approach will be adopted through regular training sessions addressed to skill card holders

Spain and Finland have also introduced the use of sector cards, but more linked to OSH.

- **ATTRACTING WOMEN AND YOUTH**

https://www.renovate-europe.eu/wp-content/uploads/2022/10/REC_E3G_Skills-brief_Final_Oct2022.pdf

Examples in page 4

ANNEX 2.

DETAILED OVERVIEW OF FUNDING INSTRUMENTS OF THE RENOVATION WAVE

↗ EUROPEAN STRUCTURAL AND INVESTMENT FUNDS (ESIF)	A total of 5.7 billion Euros will be spent by the EU until 2027 as part of the Cohesion Funds, 4.9 billion from the ERDF, and 183 Million Euros as part of the Interregional Fund. These are not included as part of the study
↗ HORIZON EUROPE	<p>Research and innovation funding programme until 2027.</p> <ul style="list-style-type: none">• the BUILD UP initiative, a portal for sharing knowledge on how to make buildings more energy-efficient• the BUILD UP Skills initiative, which aims to increase the number of qualified building professionals across Europe who can carry out building renovations that offer high energy performance as well as construct new near zero-energy buildings.• the 4RinEU project, which aims to provide new tools and strategies to encourage large-scale renovation of existing buildings and promoting the use of renewable energies (see “Home improvements for the planet”)
↗ ELENA FACILITY	<p>The European Local Energy Assistance (ELENA) facility, funded currently under Horizon 2020, has been proposed to be continued in 2021-2027 under the InvestEU Advisory Hub. Over the period 2014-2020, the facility was endowed with a total amount of EUR 282 million (including a reinforcement of EUR 97 million to support dedicated financing of building renovation in the residential sector, notably the social housing sector). A joint initiative of the Commission and the EIB, ELENA provides project development assistance in the form of grants to final beneficiaries’ for the preparation of large investment projects in energy efficiency, integrated renewable energy and sustainable transport in cities. The ELENA facility is complemented by the PDA calls managed by EASME to support smaller projects.</p>
↗ INVESTEU	<p>InvestEU programme (9.1bn €) will act as a single EU private investment support mechanism, replacing all existing centrally managed financial instruments. Backed by an EU guarantee, it will aim to support unlocking the necessary private financing, including for building renovation in Europe, mainly through its proposed Sustainable Infrastructure Window. Private Finance for Energy Efficiency (PF4EE).</p>
↗ LIFE PROGRAMME – CLEAN ENERGY TRANSITION	<p>LIFE programme 2021-2027 will include four sub-programmes, of which several are highly relevant for the building sector and renovation. The proposed LIFE Clean Energy Transition sub-programme, for which a total budget envelope of EUR 1 billion was proposed, will be providing tailored support to Member States and regions to holistically address the specific barriers to renovation identified in their territories.</p> <p>The market-uptake projects are currently funded from Horizon 2020 Energy Efficiency calls, and will continue under LIFE-Clean Energy Transition sub-programme. They aim at removing market barriers to buildings renovation, for instance by addressing structural or organisation obstacles, setting a favourable enabling framework and building capacity of public and private actors.</p>

↗ **SMART FINANCE
FOR SMART BUILDINGS
INITIATIVE**

Financing for building renovation- promoting the combination of a guarantee facility with grants and technical assistance. It has increased the funds available for project development assistance, and has promoted the use of energy performance contracts and the development of one-stop shops for building renovation.

↗ **EUROPEAN ENERGY
EFFICIENCY FUND**

Specific EU-led financial instrument for energy efficiency, providing market-based financing to public sector projects, including renovation of public buildings, and social housing units owned by public authorities. It is funded with 140M €.

Source:

<https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1603122391413&uri=CELEX:52020SC0550>

ANNEX 3.

SELECTED CONSULTED SOURCES AND FINDINGS

STUDY	FINDINGS
<p>EC-IPSOS (2019) Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU. ↗</p>	<p>On average, the average weighted energy renovation rate in the EU is of 1 % (both for residential and nonresidential buildings). There are 210 M buildings.</p>
<p>CEDEFOP (2021) Digital, greener and more resilient Insights from Cedefop’s European skills forecast. ↗</p>	<p>The ‘renovation wave’ (increasing energy efficiency and affordability of buildings) and the circular economy plan reducing resources used for building construction and maintenance) will not fundamentally alter the overall employment outlook, but merely redirect workers within the sector.</p>
<p>CEDEFOP (2019) Construction workers: skills opportunities and challenges. ↗</p>	<p>Construction % pa changes between 2010-2015, 2016-2020, 2021-2025 and 2026-2030 were and are forecasted respectively: -1.7, -0.2, 0.4, and 0.5. The study is from 2018 and thus does not account for Covid. However, the Skills forecast database is updated and could be used for calculating upskilling and reskilling needs.</p>
<p>RENOVATE EUROPE (2020) Building Renovation: a kick-starter for the EU economy</p>	<p>Review of 35 research reports finding that for every €1 million invested in energy renovation of buildings, an average of 18 jobs are created in the EU. The number of jobs created per €1 million invested varies across the EU depending on national circumstances and employment cost. The Study reports that those numbers are: Croatia, 29; Estonia, 17; Finland, 16; Italy, 15 and Spain, 18.</p> <p>At national level, the Study found that it costs an average of €14,000 to create a job in construction in Spain, whilst in the same country it costs €20,000 to support an unemployed worker.</p>
<p>PAGE. 2021 Modeling a Global Inclusive Green Economy COVID-19 Recovery Programme. ↗</p>	<p>E3ME impact analysis of a 1.6 trl € investment in EE Renovations between 2021 and 2023 would generate a 6 % reduction in energy use by households by 2023 and a 1.9% increase in construction employment compared to the baseline; 0.5% by 2030. Consequently, employment effects fade off over time.</p>
<p>ILO & OECD (2022) Skills for decarbonisation. Paper prepared for the Labour and Employment Ministerial Meeting under the German G7 Presidency</p>	<p>EXIOBASE impact analysis of a fully funded energy sustainability scenario forecasts more than 2.5 M construction jobs in the G7+EU, the single greatest sector in terms of job creation. Electrical and electronic trades workers, construction labourers also show important job creation potential. Effectively no job losses. Job losses are minimal and will be absorbed.</p>

Input-Output analysis of the FIGARO was performed primarily through the methodology proposed in:

EUROSTAT – EC (2019):
EU inter-country supply,
use and input-output tables [↗](#)

Full international and global accounts for research
in input-output analysis (FIGARO), 2019 Edition.

UN (2018):
Handbook on Supply, Use and Input-
Output Tables with Extensions and
Applications January 2018 [↗](#)

Publisher: UNITED NATIONS PUBLICATION,
Department of Economic and Social Affairs, Statistics Division.

ANNEX 4.

OVERVIEW OF ENERGY EFFICIENCY TRAINING NEEDS DERIVED FROM THE BUILD UP SKILLS PROGRAMME STATUS QUO REPORTS

BELGIUM	From 2012 to 2020, EE and RES training needs are of 33,400 workers. The occupational groups that require most training include bricklayers (19%), joinery (19%), roofers (8%), floor covering layer/plasterers and glaziers (7%), construction machinery operators (7%), CH Fitters (7%), plumbing installers (6%). Others include road workers, formworkers/steel fixers, insulation workers and rendering/pointing workers.
BULGARIA	Bulgaria did not provide specific skills needs related to energy efficiency.
CZECH REPUBLIC	Czech Republic did not calculate specific skills needs related to energy efficiency. General training needs are for 54,000 workers until 2020.
DENMARK	From 2012 to 2020, between 6195 and 13,113 skilled construction craftsmen were require. The occupational groups include carpenters/joiners (64%), bricklayers (23.5%), plumber/heating/air conditioning professionals (11%), and electrical installers (2%).
GERMANY	Germany did not provide specific skills needs related to energy efficiency.
ESTONIA	Estonia did not provide specific skills needs related to energy efficiency.
IRELAND	The expansion of the sector is predicted to require an additional 40,000 to 50,000 new construction workers until 2027. Moreover, there will be significant demand to replace workers who leave the labour market due to illness and retirement, which is estimated at about 36,000 skilled workers (including 3,840 apprentices) over 20162020. Specifically, in order to sustain the ambitious planned housing construction targets and infrastructural investments, skilled trades will be the most requested. Indeed, by 2020 there will be the need for 88,900 skilled craftsmen, including 30,800 carpenters and joiners, 15,200 electricians, 7,900 bricklayers and masons, 13,900 plasterers and tilers and 11,800 heating/ventilating engineers.

GREECE	Greece did not provide specific skills needs related to energy efficiency.
SPAIN	The ten most importance building occupations in Energy Efficiency (EE) and Renewable Energy Systems (EERR) with the major needs for training: operator for sealing joints, assembler of aluminium and PVC carpentry, installer of thermal solar installations, bricklayer, installer of heat generation systems: geothermal, installer of heat generation systems: biomass, plumber, installer of photovoltaic installations, installer for DHW and air conditioning systems. Bearing in mind the above list, the competencies that would require qualification and training according to the <i>status quo</i> memory would be carpentry and PVC aluminium, exterior enclosures, roofs: insulation, partition walls: insulation, ACS and airconditioning installations Plumbing installations, gas installations, electrical production equipment and electrical installations.
FRANCE	The annual continuing training needs include 130,000 entrepreneurs employees and craftsmen as well as 100,000 new annual entrants into the sector following training. An additional initial training is needed: 50,000 youth entering the sector each year need training and 20,000 entering the sector from other sectors. A total of 300,000 workers would need training. The occupations that require training include bricklayers, carpenter/woodworkers, roofers and painters and plasterers.
CROATIA	Croatia did not provide specific skills needs related to energy efficiency.
ITALY	Between 2012 and 2030 a total of 427,990 workers in the construction industry require Energy Efficiency trainings. The occupation with highest training needs in EE are masons 35.7%, carpenters (9.6%), workers installing insulation, windows and fittings (3%), painters (8.8%), other building workers (1%), floor layers, layers of lining and plasterers (0.9%), electricians (20.9%), plumbers and heating experts (11.1%), other plant workers (1.5%). Non specialised workers that require some EE trainings include non qualified workers (16.3%) and other workers (1.1%).
CYPRUS	The <i>Status Quo</i> report for Cyprus was not available.
LATVIA	Training needs in Energy Efficiency were not calculated in the Latvia <i>Status Quo</i> Analysis.
LITHUANIA	The construction sector is expected to need 35,000 to 40,000 workers to be trained in energy efficiency of buildings, even though no official data is available on the number of already trained workers. Nevertheless, according to a survey conducted among construction companies, it is reported that about 40% of workers have received training in energy efficient construction of buildings, while 30% have been skilled in renewable energy.
LUXEMBURG	A total of 14500 blue collar workers needed training from 2012 and 2020. These include construction builders (34.5%), carpenters, roofers and tinsmiths (10.3%), heating and sanitary specialists (13.8%), electricians (11.7%), and exterior joinery specialists (6.9%).
HUNGARY	Quantification of training needs in EE was not available in the <i>Status Quo</i> Analysis.
MALTA	Between 523 and 698 workers per year (2013 – 2020) need to receive some form of training related to energy efficiency or renewable energy sources.
NETHERLANDS	Training needs in Energy Efficiency were not calculated in the Netherlands <i>Status Quo</i> Analysis.

AUSTRIA	24,000 people within construction building services engineering by 2020. Including construction trade professionals (58%), construction industry (12.5%), timber construction workers (4%), heat pump (3%), solar thermal and biomass heating (3%), photovoltaics (4%), ventilation systems (2%), and heating system inspection professionals (12.5%). however, it states that this requirement is feasible due to the existing capacity of the educational institutions in Austria, with over 5000 people training per year in the areas of energy efficiency and renewable energy in the building sector.
POLAND	There is a shortage of employees in the field of low energy construction, project managers, construction managers and employees using BIM, specialists dealing with the recovery of building materials and waste management. Specific needs for energy efficiency trainings were not quantified.
PORTUGAL	Training needs in Energy Efficiency were not calculated in the Portuguese <i>Status Quo</i> Analysis.
ROMANIA	In Romania, between 33,789 and 87,333 workers need Energy Efficiency trainings between 2012 and 2020. There are mainly insulators and plumbers. Others include window system assemblers and installers, electricians, geothermal systems installers, thermal solar systems installers and renewable energy operators.
SLOVENIA	In Slovenia around 46,500 construction workers needed training between 2012 and 2020.
SLOVAKIA	Training needs in Energy Efficiency were not calculated in the Slovakian <i>Status Quo</i> Analysis.
FINLAND	Training needs in Energy Efficiency were not calculated in the Finnish <i>Status Quo</i> Analysis.
SWEDEN	Between 2012 and 2020, around 100,000 construction workers were deemed to have received energy efficiency trainings, including construction woodworkers, interior carpenters, HVAC technicians, installation electricians and ventilation fitters.

ANNEX 5.

MAIN LABOUR INSPECTION FIGURES IN EU COUNTRIES

	NUMBER OF LABOUR INSPECTION VISITS PER INSPECTOR	NUMBER OF LABOUR INSPECTION VISITS TO WORKPLACES DURING THE YEAR	NUMBER OF LABOUR INSPECTORS
BE	141	12,359	462
BG	320	118,128	367
CZ	376	133,623	364
DE	179	304	23
EE	97	9,507	319
IE	194	60,268	11
ES	225	39,874	260
FR	104	11,010	88
HR	339	136,178	391
CY	449	175,684	355
LV	203	69,401	2,775
LT	212	68,162	312
HU	195	57,699	126
MT	212	23,472	493
AT	15	5,555	58
PL	38	3,202	322
PT	85	1,769	165
RO	44	10,330	322
SL	137	108,789	269
SK	619	11,338	269
FI	144	1,021	22
SE	472	13,506	212

Source: ILOSTAT. Note: Information for Denmark, Greece, Italy, Luxembourg, and Netherlands was not available.

ANNEX 6.

METHODOLOGICAL CALCULATIONS

Job creation calculations

$$\text{Direct jobs}_i = \text{Total EE Investments}_i \times \text{Emp Multiplier}_{\min, \text{mean}, \text{max}}$$

For country i. Minimum, mean and maximum Employment Multipliers are respectively 16.5, 18 and 19,5 jobs per Million Euros invested. These have been selected according to existing research available.⁵³ Total Energy Efficient Investments in Renovations are gathered in each of the scenarios. The first scenario assumes a leverage factor of 3 meaning that 1 euro of public investment gathers 3 Euros of private investments. EE renovation leverage factors vary between 1 to 1.5 and 1 to 4 according to existing research.⁵⁴

$$\text{Backward Linkages}_i = \text{Output Multiplier}_i \times \text{Total EE Investments}_i$$

For country i, output multipliers for the construction sector.

$$\text{Labour Productivity}_i = \frac{\text{Gross Value Added}_i}{\text{Employment}_i}$$

Gross Value Added of country i includes employee compensations, gross operating surpluses and other net taxes on production. Employment data for 3Q2020 was obtained from Eurostats. Data for Germany was not available and the 1Q2020 was used instead. Labour productivity is assumed to increase 0.5% per year.

$$\text{Indirect jobs}_i = \frac{\text{Backward Linkages}_i \times 1,000,000}{\text{Labour Productivity}_i}$$

For country i.

$$\begin{aligned} & (\text{Induced Jobs}) = (\text{Direct Jobs}_i + \text{Indirect Jobs}_i) \\ & \times \text{Exp Multiplier}_i \times \text{Avg Gross Earnings}_i \div \text{Labour productivity}_i \end{aligned}$$

For country i, Expenditure Multiplier is assumed to be 0.6 according to research available. Both labour productivity and gross earnings are assumed to increase at a 0.5% per year.

53 Renovate Europe (2021): Building Renovation: A kick-starter for the EU Recovery.

Available at: https://www.renovate-europe.eu/wp-content/uploads/2020/06/BPIE-Research-Layout_FINALPDF_08.06.pdf

54 BPIE (2020): Covid-19 recovery: Investment opportunities in deep renovation in Europe.

Available at: https://www.bpie.eu/wp-content/uploads/2020/05/Recovery-investments-in-deep-renovation_BPIE_2020.pdf

ANNEX 7.

ESTIMATED EMPLOYMENT IN ENERGY EFFICIENT CONSTRUCTION AND RENOVATIONS

	2006*	2007*	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
EU27	9,535.8	10,085.0	10,412.0	9,676.3	9,170.1	8,824.8	8,497.3	8,172.4	8,091.0	8,121.8	8,183.9	8,384.0	8,532.0	8,683.1	8,354.4	8,535.9
BE	192.3	198.2	212.5	208	207.1	219.1	205.8	209.3	208.7	206.6	212.7	203.3	208.4	219.9	208.2	199.9
BG	148.7	189.3	221.5	208.3	175.3	145.2	128.7	128.2	133.3	132.4	136.2	153.5	161	163.7	164.1	176.5
CZ	283.7	290.8	315.5	318.5	295.5	269.4	271.4	270.7	266.4	250.9	244.1	249.9	248.2	244.2	257	266
DK	141.5	138.5	141.8	124.6	109.3	105.2	104	107.6	107.4	107.4	100	108.4	114.9	114.7	116.1	124.7
DE	1,557.7	1,606.0	1,654.6	1,661.1	1,643.5	1,674.5	1,705.0	1,785.1	1,786.0	1,782.9	1,800.6	1,841.8	1,835.1	1,851.3	1,514.7	1,607.3
EE	39.9	50.9	51.1	35.5	29.4	36.4	35.3	32.8	35.9	37.6	37.3	36.1	36.4	36.4	37.3	35
IE	186.9	175.1	144.1	91.2	68.5	59	56.4	57.7	63.6	74.2	80.9	86.9	94.2	95	88	87.8
EL	249.2	270	271.2	248.9	213.3	161.6	127.8	102.2	95.3	92.2	91.1	88.2	88.6	86.4	87.8	91.4
ES	1,685.1	1,791.9	1,634.4	1,220.6	1,062.2	899.2	745.3	653.3	640.5	695.9	701.8	745.3	809.6	843.8	818.7	853.4
FR	1,120.0	1,151.7	1,257.5	1,229.9	1,248.8	1,240.8	1,222.6	1,143.8	1,130.0	1,098.5	1,090.8	1,118.5	1,141.2	1,162.7	1,180.8	1,150.9
HR	77.6	93.2	95.3	92	73.9	65.7	59.6	60.7	58.5	58.1	62.9	60.1	67.8	66.1	68.1	73.7
IT	1,237.4	1,270.8	1,310.4	1,280.3	1,264.6	1,211.0	1,147.0	1,044.2	994.5	988.5	943.6	950.8	946.8	902.2	911.8	964.2
CY	26.2	28.9	30.5	28.3	26.8	27.6	24	17.3	14.8	15.3	18.4	19.5	21.5	26.1	28.9	27.1
LV	57.7	72	72.5	41.7	32.2	34.8	37.4	38.4	40.9	40.2	37.5	34.8	40.8	46.2	44.7	41.7
LT	89.4	101.5	98.2	69.3	51.9	49.8	54.4	58.6	58.4	61.8	61.8	59.2	60.4	64.9	60.1	60.9
LU	9	10.2	9.6	8	9.3	9.2	9.6	9	7.3	9.6	9.5	8.4	9.8	10.4	10.2	10
HU	201.7	205.2	192.5	182.2	170.6	161.1	150.1	153.9	160.7	171	176.7	191.7	213.9	220.6	231.3	241
MT	8.5	7.9	8.4	8.1	8.3	8.1	7.6	8.1	8.3	8.8	9.5	10.3	10.4	12.2	10.8	12
NL	315.3	320.4	335.4	312.6	289.9	277.3	279.1	256.3	248.5	252	244.9	257	251.9	260.1	253.7	244.8
AT	192.2	196.1	225.9	214.6	211.9	223.8	234.7	230.5	228.6	221.8	217.8	210.2	212.3	221	212.9	197.2
PL	575.7	656.1	780	812.8	758.5	769.2	755	719.1	725.5	738.3	762.4	757.4	765.3	816.2	834	833.3
PT	356.3	369.2	361.1	316.8	288.5	261.5	215.5	177	168.3	171	183	195.3	196.4	196.3	190	191.7
RO	349	424.1	469.8	460.9	424.1	411.1	411.1	409.7	425	426.3	452.1	465	452.8	478.2	493.3	510.2
SL	33	34.7	39.4	37.3	35.4	33	35	34.6	32.8	33.6	32.5	34	36	35.6	37.1	32
SK	147.1	154.1	167.4	170	170.4	160.1	160.9	150.8	141.5	138.3	148.1	157	156.4	152.4	146.8	154.7
FI	102	109.5	118.6	109.7	109.7	113	111.4	112.1	107.6	108.7	117	120	127.6	123.8	120.9	121.6
SE	170.9	179	192.8	184.8	190.9	198	202.8	201.3	202.5	200.2	210.7	221	224.4	232.7	227.4	226.7

Source: Eurostat. Note: Employment in Energy Efficient Construction and Renovations is calculated by adding employment in NACE F41 (Construction of buildings) and NACE F42 (Specialised construction activities). Employment to NACE two digits is not available for all countries so it was approximated making use of the proportions available. i.e, 72% of Total Emp (F41+F42). *marks for estimates on NACE two digit figures, as these were not calculated before 2008. Workers directly related to energy efficiency and renewable energy installations in buildings include the following: 41.21 Construction of residential buildings, 41.22 Construction of non-residential buildings, 43.21 Electrical installations, 43.22 Plumbing, heating systems and air conditioning installations, 43.32 Carpentry installation, 43.34 Painting and glazing, 43.39 Other building completion, and 43.91 Roofing.
Source: Build Up Skills (2013): Spanish Construction Industry Status Quo report. Available here: https://www.buildup.eu/sites/default/files/bus_projects/build_up_skills_spain_roadmap_final_en_1.pdf

ANNEX 8.
KEY STATISTICAL INFORMATION FOR THE EU RENOVATIONS SECTOR

	PERIOD	EU27	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV
NRRP Total Allocation (M €)	2021-2026	503,879	5,900	6,500	7,850	1,600	25,600	969	989	30,500	69,500	39,400	6,300	191,500	1,206	1,820
EE Building Renovation Public Investments (M €)	2021-2026	41,703	967	947	806	160	2,577	92	155	4,097	6,563	5,820	799	8,600	89	231
Share of BR on Total NRRP Allocation (%)	2021-2026	8.28%	16.39%	14.57%	10.27%	10.00%	10.07%	9.50%	15.67%	13.43%	9.44%	14.77%	12.68%	4.49%	7.38%	12.69%
EE Building Renovation Total Public and Private Investments (M €)	2021-2026	125,110	2,901	2,841	2,418	480	7,731	276	465	12,291	19,689	17,460	2,396	25,800	267	693
Min Direct Jobs	2021-2026	2,064,316	47,867	46,877	39,897	7,920	127,562	4,559	7,673	202,802	324,869	288,090	39,541	425,700	4,406	11,435
Max Direct Jobs	2021-2026	2,439,646	56,570	55,400	47,151	9,360	150,755	5,388	9,068	239,675	383,936	340,470	46,730	503,100	5,207	13,514
Mean Direct Jobs	2021-2026	2,251,981	52,218	51,138	43,524	8,640	139,158	4,973	8,370	221,238	354,402	314,280	43,135	464,400	4,806	12,474
Indirect Jobs	2021-2026	7,469,246	98,227	514,747	172,006	8,974	177,897	18,025	9,304	1,569,277	805,316	488,426	215,353	1,083,159	15,168	64,336
Induced Jobs	2021-2026	4,558,612	62,798	293,372	78,654	7,368	136,973	10,222	6,916	1,523,542	374,537	309,614	100,245	596,860	10,701	32,144
Total Jobs (direct, indirect and induced)	2021-2026	14,279,839	213,243	859,257	294,183	24,982	454,028	33,221	24,589	3,314,057	1,534,255	1,112,320	358,733	2,144,419	30,675	108,955
Employment in the Construction Sector (Thousands)	3Q2020	10,519	315	246	397	183	:	66	132	139	1,240	1,789	115	1,342	44	77
Average National Annual Gross Earnings (€)	2021	51,328	9,372	17,230	60,750	52,800	18,489	51,750	19,614	27,570	39,971	14,539	32,058	23,424	15,276	18,560
Construction Output Multipliers	2020	2.33	2.529	1.99	2.04	1.649	1.709	1.649	1.608	1.788	2.121	1.761	2.047	2.12	1.509	2.059
Gross Value Added (M €)	2020	672,821	23,147	2,659	11,179	15,832	169,383	1,629	10,415	1,918	63,182	110,651	2,581	66,571	1,136	1,669
Labour productivity (€)	2020	52,400	73,412	10,793	28,188	86,705	72,966	24,835	78,958	13,762	50,966	61,868	22,382	49,624	26,104	21,793

	PERIOD	LT	LU	HU	MT	NL	AT	PL	PT	RO	SL	SK	FI	SE
NRRP Total Allocation (M €)	2021-2026	2,220	93	7,200	316	4,700	3,460	36,000	16,600	29,200	2,466	6,600	2,100	3,289
EE Building Renovation Public Investments (M €)	2021-2026	218	-	766	60	849	106	3,857	610	2,270	86	776	70	132
Share of BR on Total NRRP Allocation (%)	2021-2026	9.82%	0.00%	10.64%	18.96%	18.07%	3.08%	10.71%	3.67%	7.77%	3.49%	11.76%	3.33%	4.01%
EE Building Renovation Total Public and Private Investments (M €)	2021-2026	654	0	2,298	180	2,548	319	11,571	1,830	6,810	258	2,328	210	395
Min Direct Jobs	2021-2026	10,791	-	37,917	2,970	42,040	5,267	190,922	30,195	112,365	4,257	38,412	3,465	6,522
Max Direct Jobs	2021-2026	12,753	-	44,811	3,510	49,684	6,224	225,635	35,685	132,795	5,031	45,396	4,095	7,707
Mean Direct Jobs	2021-2026	11,772	-	41,364	3,240	45,862	5,746	208,278	32,940	122,580	4,644	41,904	3,780	7,115
Indirect Jobs	2021-2026	26,075	-	194,053	12,074	50,611	8,900	1,001,121	140,669	659,720	10,959	113,843	4,661	6,346
Induced Jobs	2021-2026	11,913	-	116,770	7,649	32,758	6,699	371,563	70,958	334,414	4,732	50,242	2,908	4,060
Total Jobs (direct, indirect and induced)	2021-2026	49,760	-	352,187	22,963	129,231	21,345	1,580,961	244,567	1,116,714	20,336	205,989	11,349	17,520
Employment in the Construction Sector (Thousands)	3Q2020	97	13	366	16	385	360	1,328	300	755	62	228	189	338
Average National Annual Gross Earnings (€)	2021	65,517	15,150	23,950	55,681	50,658	14,227	20,714	13,435	22,276	14,438	47,915	46,940	
Construction Output Multipliers	2020	1.428	1.728	1.567	1.954	1.979	1.876	2.434	2.367	1.85	1.895	1.33	1.875	1.518
Gross Value Added (M €)	2020	3,407	3,007	6,669	452	37,731	23,810	36,706	9,089	14,166	2,710	6,084	15,659	31,378
Labour productivity (€)	2020	35,201	229,522	18,235	28,625	97,901	66,121	27,646	30,257	18,763	43,849	26,720	83,025	92,917

ANNEX 9.

**CHANGING OCCUPATIONAL PROFILES
OF CONSTRUCTION WORKERS**

EXAMPLES OF WORK PROFILES

EXISTING PROFILES

Inclusive urban landscape architect,
building integrated bv installer,
finance specialist,
inspectors of heating systems and renewable technology installers

Specialists –
Construction electrician,
Construction plumber,
Insulator / Insulation worker,
Window system assembler and installer / Carpenter,
Thermal solar system installer,
Photovoltaic solar system installer,
Ground source exchanger installer,
Biomass thermal boiler installer,
Heat pump installer

EMERGING PROFILES

Material passport producer

NEW PROFILES

Energy auditors and certifiers,
BIM Managers,
deep renovation specialists

SKILLS AND QUALITY JOBS IN CONSTRUCTION IN THE FRAMEWORK OF THE EUROPEAN GREEN DEAL AND THE POST COVID RECOVERY

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