BUILD UP SKILLS

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ECOLOGICAL TRANSITION OF THE BUILDING INDUSTRY

DIAGNOSIS OF REQUIREMENTS IN TERMS OF JOBS, PROFESSIONS AND SKILLS UP TO 2030

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EXECUTIVE SUMMARY

The building sector is facing major challenges: to achieve the carbon neutrality targets set by the European Union and France for 2050, it will be necessary to mobilise the sector's professionals in sufficient quality and quantity. Under the joint coordination of Alliance Villes Emploi (AVE) and ADEME (Agence de la Transition Énergétique), the Build Up Skills 2 (BUS2) project brings together players in the fields of construction, renovation, building operation, employment and training to put in place a common strategy to address these issues.

The diagnosis presents an overview of the challenges facing the building sector, energy and climate policies relating to buildings, and employment and skills policies. It proposes an estimate of the jobs, trades and skills required between now and 2030, with a view to achieving national energy and climate objectives. It was developed and shared with stakeholders through group and individual interviews, an in-depth literature review, an assessment of the Build Up Skills 1 project and several national and local workshops. The diagnosis, summarised here in 12 key lessons, lays the foundations for the roadmap to 2030, to be jointly developed with stakeholders in the building, employment and training sectors.

Priority 1: Support demand for efficient renovation

1. The ecological transition of the built environment is based on a number of levers, including the efficient renovation of buildings.

A number of levers can be activated: sobriety, optimising the use of buildings, energy efficiency, decarbonisation of energy vectors (heat and electricity) and construction, and high-performance renovation.

The low-energy actions carried out during the winter of 2022/2023 showed that controlling usage and consumption by raising awareness and optimising energy systems is an effective way of significantly reducing the energy consumption of the building stock. Between the second half of 2021 and the second half of 2022, the energy efficiency plan has helped to achieve energy savings of almost 9% in the housing sector and 10% in the commercial sector. At the level of the building stock, sobriety can also be understood as the optimisation of available space to reduce the need for new buildings. At the same time, it is essential to take action on energy efficiency and limiting greenhouse gas (GHG) emissions from new buildings, as well as on decarbonising energy carriers.

The main source of energy savings and GHG emission reductions lies in energy renovation, with approaches tailored to the specific technical and organisational constraints of each segment (residential or tertiary, public or private, small or large buildings), because the existing stock cannot be considered as a homogeneous entity.

To meet France's commitments in the fight against climate change, while at the same time protecting the public from rising energy prices, it is vital that by 2030 we see a massive increase in energy-efficient renovations (achieving class A or B on the Energy Performance Diagnostic - DPE), either as a whole or in several coordinated stages (rather than the one-off renovations that are still in the majority today). These high-performance renovations will have to target energy slums as a priority. At the same time, it will still be necessary to step up the drive to phase out the use of fossil-fired boilers in buildings that are already relatively well insulated.

If energy-efficient renovation is to become widespread, the entire renovation value chain needs to be mobilised, including companies, financial institutions, the property sector and support services. Efficient energy renovation requires close cooperation between all these players and rigorous controls during and after the renovation work, to guarantee the quality of the work and that the performance targets are met.

At the same time, to achieve the objectives of the ecological transition, it is vital to show building owners, tenants and occupants the importance and benefits of efficient renovation.

2. Renovation needs to be seen as an integral part of private decision-making and public policy.

Support and funding schemes for energy renovation focus on energy and carbon issues at the time of the work. Yet there are many other issues at stake in the ecological transition, in particular adaptation to climate change, long-term maintenance of equipment, the circular economy and the re-use of materials, and the use of bio-sourced materials. Renovation policies seem to lack an integrated vision of these different issues, to which the protection of the built heritage must also be added.

With regard to housing more specifically, there are social issues in addition to environmental ones, which are no less urgent: bringing buildings up to standard (related work), combating run-down housing, adapting to the ageing population (non-connected work), and indoor air quality. It's also about preserving the quality of life.

By taking social and environmental issues into account, it is possible to finance all the necessary work by prioritising and calibrating renovation policies (support schemes, regulations, etc.), and by providing greater support for certain households and players.

As a result, energy renovation needs to be approached from an integrated perspective, taking into account as far as possible all the issues involved, both in private decisions and in public policies. In addition to national schemes, the regional or sub-regional level can be used to consolidate the approach, based on the specific local characteristics of the renovation process.

3. The ecological transition of the private housing stock requires the development of support services.

In order to promote energy-efficient renovation on a large scale, households need support. However, it is rare for households to hire a project manager to carry out energy renovation work. What's more, the best kind of support has three main dimensions: technical, financial and human. The technical aspect of this support is aimed at highlighting the benefits of energy-efficient renovation and helping households choose energy-efficient renovation work with a view to achieving performance and identifying work contractors. The financial dimension of the support aims to specify the necessary investments and propose a financial package that is consistent with the household's means (necessary grants and loans, associated financial operator). The human dimension aims to support the household in its choices and facilitate decision-making.

Until recently, support for energy renovation was mainly aimed at households on modest and very modest incomes, who received financial support from the Agence Nationale de l'Habitat (Anah) through the MaPrimeRénov' Sérénité scheme. The report by Olivier Sichel, "For a massive, simple and inclusive energy renovation of private homes", published in 2021, recommends the introduction of technical, financial and even social support to encourage homeowners to undertake this work with confidence. These recommendations have been translated into the Mon Accompagnateur Rénov' scheme, which will become compulsory from 1er January 2023 for work eligible for the MaPrimeRénov' Sérénité grant and Anah grants for subsidised landlords under the Loc'Avantages scheme, whether in detached houses, single-ownership properties or private parts of condominiums. From 1er January 2024, support will be compulsory for all renovations financed by the future "Performance" pillar of MaPrimeRénov'.

Faced with the challenges of mass-scale energy-efficient renovation, an entire industry needs to be structured to meet the needs of renovation support, in particular through mass recruitment and dedicated training programmes.

This support needs to be structured specifically for households in single-family homes on the one hand, and condominiums on the other.

4. The ecological transition of the tertiary sector is mainly driven by regulatory deadlines.

The tertiary sector covers almost a billion m² in France. Like the residential sector, it is characterised by a wide diversity of uses and building owners, which will determine the strategies required for the ecological transition of this segment. For the majority of building owners in the tertiary sector, there are two main frameworks for action. In the short term, the BACS (Building Automation and Control Systems) decree will require commercial buildings to be equipped with automation and control systems from 1er January 2025.

This measure will encourage rapid action to optimise existing systems. The Tertiary Eco-Energy scheme sets energy consumption reduction targets for buildings over 1,000 m² by 2030, 2040 and 2050. To comply with these regulations, it will therefore be necessary to go beyond simple energy-saving and optimisation measures, and to organise more substantial works over time.

Public buildings account for around 40% of the total surface area of commercial buildings, most of which are owned by local authorities. The diversity of uses, even for the same client, makes it difficult to analyse and define an action plan. The methodologies adopted are based in particular on diagnostics and the establishment of an energy master plan, closely linked to asset and financial management. However, not all local authorities are equipped to meet these requirements, either in terms of skilled human resources or the ability to attract available funding. They therefore need to acquire a better understanding of the energy issues affecting their buildings and receive support to help them achieve the targets set.

In the private sector, many major players have taken on these regulations and incorporated them into their property policies. However, some owners are not aware of their obligations, which are largely dependent on the actual users of the premises concerned. To ensure that these regulations are effectively applied, checks need to be put in place and the penalties for non-compliance clearly displayed.

Finally, a large proportion of tertiary sector premises are not currently covered by the Tertiary Eco-Energy Scheme ("small tertiary sector") and require specific support, particularly in terms of energy-saving measures. The sharp rise in energy costs in 2022 could lead to a widespread adoption of energy-saving measures in this sector.

Priority 2: Encourage the recruitment and retention of workers in the sector

5. Energy-efficient renovation of buildings will require almost 200,000 more FTEs than at present. The various sources of recruitment for these jobs are young people, jobseekers, workers interested in retraining, and women, who are still not very present in the sector.

Energy-efficient renovation of housing is the building segment that will provide the most direct jobs between now and 2030 (more than construction and renovation in the tertiary sector). The various scenarios forecasting employment needs by 2030 (France Stratégie, BUS2, négaWatt) are relatively convergent, with an estimated additional need for between 170,000 and 250,000 Full Time Equivalents (FTEs) compared with today.

The BUS2 scenario, based on ADEME's "Coopérations territoriales" ecological transition scenario, estimates this additional need at 197,000 FTE[1] for the energy renovation of an average of almost 1,181,000 homes per year between 2022 and 2030. Low-energy building (BBC) renovations, which are virtually non-existent between 2012 and 2021, are expected to account for the bulk of the renovations required (911,000 renovations per year) to achieve the 2050 decarbonisation targets and a stock renovated to BBC or equivalent standard on average by 2050. At the same time, almost 270,000 non-BBC energy renovations would be carried out each year.

To these needs must be added the jobs required to renovate vacant homes and second homes, and to carry out the work associated with energy renovation, which is often part of the project and can account for around half of the renovation costs.

For energy renovation alone, unskilled building finishers, skilled painters and building finishers, and bricklayers will be mobilised for envelope renovation work (insulation, replacement of joinery), while plumbers, heating engineers and electricians will respond to the massive deployment of various heating, domestic hot water (DHW) production, ventilation and air conditioning equipment in single-family homes and collective housing. Plumbers and heating engineers are the category that is expected to see the biggest increase in the number of FTEs needed per year, from 33,000 between 2012 and 2021 to 83,000 between 2022 and 2030, followed by site supervisors (+22,000), unskilled finishing workers (+21,000), skilled painters and building finishers (+18,000) and electricians (+16,000).

[1] Direct FTEs in the building (NAF 41 and 43) and technical support (NAF 71) sectors

This additional workforce, which is needed to achieve the renovation targets, will not only come from young graduates and apprentices entering the market, but also from workers undergoing retraining, more women entering the sector, jobseekers and foreign workers.

It will also come from people who already work in the building and public works sector, but who still do very little, if any, work on energy renovation projects. Finally, it should be remembered that this is an additional need, on top of the manpower requirements resulting from the large-scale retirements, early retirement and retraining expected between now and 2030.

Numerous public policies and public action instruments are designed to mobilise these different levers, with the help of training and integration players (CFA[2] , Constructys, France Compétences, Pôle Emploi, local missions, employment centres, etc.). Some are aimed at specific target groups, such as the Employment and Skills Development Commitments (EDEC), the France 2030 Plan to enhance the skills of people already working in the sector, or the Youth Commitment Contracts and Single Integration Contracts, which are mainly aimed at young people under the age of 26. Others, such as the skills investment plan, can affect several groups. Few tools focus on integrating women into the building trades, which also requires changes in practices and conditions on building sites. Generally speaking, if these levers are to be mobilised, existing schemes need to be strengthened or new ones created to remove obstacles to training.

6. The construction sector needs to make itself more attractive in order to recruit and retain workers.

The recruitment pressure that is being felt in virtually all areas of the construction industry (7 out of 10 companies say they are finding it difficult to recruit) could worsen over the next few years. The sector, which currently employs more than 1,350,000 people, needs to create jobs to meet the demand arising from the new challenges facing the sector as a result of the ecological transition, while at the same time replacing people who are retiring or moving to other sectors. With more than a quarter of the workforce currently over the age of 50, France Stratégie estimates that between 2019 and 2030, around 478,000 building and civil engineering professionals (potentially 400,000 in construction alone) are likely to retire, end their careers due to occupational illness or move voluntarily to other sectors of activity.

Promoting the integration and well-being of the youngest people entering the sector is a particular challenge for the building industry. It's a challenge both for companies, which need to ensure that a new generation of professionals develops their skills, and for the students and apprentices themselves, who legitimately expect satisfactory reception conditions and opportunities for advancement. The rate of students (including apprentices) leaving without a degree was 27% in 2016, compared with 13% in other courses. What's more, only 44% of young people trained in building and civil engineering had their first job in the sector, a figure that falls to 39% after 3 years.

The difficulties in recruiting and retaining workers in the sector are linked to a lack of attractiveness of the industry. These factors include, first and foremost, working conditions, which are anticipated and perceived negatively by apprentices and students from the time of their initial training: demanding and physical, often working outdoors, with working hours that are unsuited to family constraints, and often leading to disability before the legal retirement age. Pay is often perceived as low. Considered a failure at school, training in the building and public works sector suffers from a poor reputation in schools. Finally, environmental issues and new standards such as the 2020 Environmental Regulations (RE2020) are virtually absent from training courses (particularly in vocational courses), despite the fact that they are a way of highlighting the contribution of buildings and professionals to social and environmental issues on a national and global scale.

These factors all represent levers that the players involved can use to reverse the trend. The players are working to improve working conditions on building sites, under the guidance of the Organisme Professionnel de Prévention du Bâtiment et des Travaux Publics (OPPBTP). One of the challenges facing the sector is the possibility of moving on to less physically demanding jobs during one's career, which should be made possible by the Compte Professionnel de Prévention (C2P). Other players are working on the sector's image, promoting the importance and role of the building and public works sector in the ecological transition, and the value of the new trades and skills involved in the transition (new materials, recycling, adaptation, thinking about uses, etc.), through numerous initiatives and innovative training formats (web series, schools specialising in the ecological transition, platforms facilitating career guidance).

[2] CFA: Apprentice Training Centre

Priority 3: Developing training

7. The new construction sector (companies and assets) will be undergoing change as a result of new environmental requirements and a shift towards heavy rehabilitation and renovation, and training will need to adapt.

The various scenarios anticipating the need for jobs between now and 2030 (France Stratégie, BUS2, négaWatt) differ in their assumptions about the pace of new construction and the corresponding jobs, ranging from virtual stability (France Stratégie) to a sharp fall (BUS2, négaWatt) in order to reduce emissions from new buildings and the artificialisation of land, and in line with demographic trends (up to a 70% fall in new construction). The initial trajectories presented by the Secretary General for Ecological Planning (SGPE) forecast a more moderate fall in new housing construction (between 2 and 18%).

The BUS2 target scenario, based on ADEME's "Coopérations territoriales" scenario, projects a significant reduction in construction from 2023 onwards, in favour of exploiting the existing stock, in particular by focusing on the rehabilitation of vacant dwellings and second homes. Investment in new housing construction would fall considerably, from €35 billion a year between 2012 and 2021 to €10.6 billion a year between 2022 and 2030, accompanied by an overall reduction of 182,200 direct full-time equivalents (FTEs) on average between 2022 and 2030, compared with an average of 259,200 FTEs over the 2012-2021 period. If new construction methods are taken into account (leading to more expensive and labour-intensive projects), the reduction in employment requirements over the period 2022-2030 would be 179,700 FTEs.

Despite these divergent assumptions, it is accepted that the entire industry needs to undergo considerable change to adapt to the environmental challenges of the next decade. Some companies have already begun this essential transformation:

- Increasing design skills to comply with the RE2020: with the systematic use of Life Cycle Analyses (LCA), design offices need to increase their skills in this area. Architects also need to adapt their designs and develop new skills related to adapting buildings to climate change, water management and the circular economy. To meet these environmental challenges, the entire design value chain needs to develop its skills.
- Transition to low-carbon systems: the massive shift to low-carbon systems, such as heat pumps, will also require the industry to adapt in terms of the installation and maintenance of heating, ventilation and air conditioning (HVAC) equipment.
- Changes in occupations: some sectors could see a significant reduction in the number of FTEs, particularly bricklayers and structural workers, due to a combination of a reduction in the built area and changes in construction systems.
- Changes in business models and client organisation: in addition to the profitability of the construction industry (social landlords, developers, town planners, etc.), the training and organisation of companies must now focus on the challenges of rehabilitation, particularly in the major restructuring of housing or the conversion of tertiary buildings into housing, with a view to reducing the use of land. Off-site prefabrication is another promising avenue. Some major companies in the sector are already making the transition to renovation, and it is therefore crucial to plan now for the changes needed to enable workers to gradually develop their skills in other methods of construction or work on a building.

The entire industry will have to adapt to cope with a potential decline in construction, a surge in renovation work and the growing integration of environmental issues. This transition represents a major challenge for the construction sector and will require careful planning and concerted efforts to meet these environmental challenges while ensuring the sustainability of the sector's economic activity. This requires a rapid transformation of the entire construction chain, making possible and attractive the transition from construction to more extensive rehabilitation and renovation.

8. The ecological transition of buildings requires the reinforcement of skills (initial and continuing training) of professionals in the building industry and related sectors such as real estate. Continuing training must be encouraged and adapted to the constraints of professionals.

The integration of knowledge and skills relating to the ecological transition into initial and continuing training is still in its infancy, and is encountering a number of obstacles: the financial and technical resources needed to train trainers in the challenges of the transition, differences in professional culture between those involved in new build and renovation, and between large and small companies, access to continuing training, etc.

Within initial training related to the construction sector, enrolment in secondary education has fallen slightly since 2012, while enrolment in higher education has risen slightly. Apprenticeships, on the other hand, are growing very rapidly (+41% between 2020 and 2021), mainly as a result of the financial aid linked to the recruitment of apprentices. 77% of apprenticeships are in construction companies with fewer than 20 employees. Training courses from the baccalauréat upwards are just beginning to incorporate the challenges of the energy transition, and changes in the names of training courses are incorporating the fields of renewable energy, energy efficiency and sustainable development. Vocational training courses, meanwhile, are taking little or no account of these issues, and it may take several years to change the references for these courses as the 2030 deadline approaches.

As far as continuing training is concerned, few trades are not affected by the need to upgrade skills or improve knowledge. Many of these new skills can be acquired via existing training courses nearby, or via additional modules, but key training courses are still lacking, such as those on external thermal insulation or the use of new materials. In addition, the Employment and Skills Development Commitment Agreements (EDEC) signed at national level with the construction industry do very little to address the ecological transition. However, new professional qualifications linked to the ecological or digital transition have recently appeared, such as "BIM[3] manager" or "Energy renovation project manager".

The propensity of companies to train their employees depends on a large number of factors: size, market segment, surrounding training offer, etc. The increase in the number of micro-businesses and the rise of self-employment are making it more difficult to access channels for renewing skills through training. As a result, the number of trainees in the construction industry has been falling since 2012. Another indicator is the number of RGE (Reconnu Garant Environnement) qualified companies, which has stagnated at around 65,000 a year for some years now.

To facilitate training, a growing number of initiatives are attempting to adapt to the constraints of businesses. The RGE "worksite by worksite" scheme allows non-RGE-qualified companies to carry out renovation work eligible for subsidies up to three times, after which the work will be checked by a qualification body. Since 2018, the AFEST (Action de Formation En Situation de Travail - on-the-job training) scheme has enabled professionals to enhance their skills on their building sites by having an expert assess the professional practices of an employee/trainee, and by taking a step back from these practices. Another example is Integrated Workplace Training (IWT), which is being trialled in the Hauts-de-France region and aims to train building professionals by equipping worksites with teaching platforms.

Some players and initiatives are going some way to filling the gap in training on the new challenges facing the building industry by offering an initial theoretical or practical introduction to the use of new materials and techniques, for example, or by focusing on target groups that are particularly difficult to attract or train for the building trades, or by targeting related trades such as property professionals. While these initiatives still have a localised impact, they are an initial approach that could facilitate the development of training recognised by the public authorities. The question then arises as to how best to scale them up or replicate them.

[3] Building Information *Modeling*

Priority 4: Steering the BUS2 roadmap

9. National policies and mechanisms for stimulating markets, employment and skills must be complemented by a massification of good practices in the territories and increased communication between stakeholders.

The diagnosis lists the various national public policies that stimulate demand for renovation and eco-construction (financial aid, incentives, obligations, technical support), as well as the supply side of these projects (investment in training, job-seeker integration schemes, etc.). The pace of change in demand-stimulating measures seems to be accelerating, which is a source of regret for those involved in the construction industry, who describe the instability of legislation and regulations as blurring the long-term outlook. In addition, initial and continuing training is only just beginning to evolve into a comprehensive system serving the ecological transition of buildings.

As a result, expanding and scaling up positive experiments in local areas, carried out by a wide range of public, private and community players, can provide significant leverage for the ecological transition of the building sector. At national level, this requires support for the widespread use of successful local experiments, as well as financial and technical support for the structures behind them to increase the number of projects.

The BUS2 project is an example of the large-scale implementation of a local experiment: the construction of a shared diagnosis with building industry players (from both the market and the training sector) on a national scale and in 4 focus areas is inspired by a consultation process tried out in the Cambrésis region in northern France.

Successful implementation also depends on the establishment of several channels of communication: between stakeholders at local, regional and national level, and between the State and local project sponsors (local authorities, resource centres, local federations, associations, businesses, Councils for Architecture, Town Planning and the Environment - CAUE, etc.).

10. The future BUS2 roadmap requires two ministerial co-pilots until 2030: one for the ecological transition of buildings, one for employment and skills, and the mobilisation of a network of regional co-pilots.

The energy transition challenges facing the building sector require a concerted roadmap to be drawn up in the areas of employment and skills. This objective forms the basis of the BUS2 project. It is therefore essential that this roadmap has political backing, as well as being shared by all the players in the markets and skills sectors.

The resulting recommendations will inevitably impact both the organisation of the market to meet demand and the transformation of training and development methods in the sector. With this in mind, it is crucial that this roadmap is adopted and promoted jointly at national level by the two bodies overseeing the market and skills, namely the Ministry of Ecological Transition and Territorial Cohesion and the Ministry of Labour, Employment and Integration.

Beyond this national supervision, the development of trades and skills relies on a network of local players, who face significant territorial challenges. As a result, it is imperative that this supervision is also ensured at regional level, with the roadmap being adapted to take account of the employment and skills needs specific to each region and territory.

11. Local ownership of the issues involved in the ecological transition of buildings requires greater coordination of decisions between the State and local authorities.

A key condition for facilitating local ownership of national issues and measures is not to pit local employment issues against the ecological issues raised by current national legislation and measures such as Zero Net Artificialisation, application of the RE2020, etc. To achieve this, a process of iteration to define these measures with the regions upstream is a prerequisite, which must be accompanied by concerted implementation adapted to the regions. Adapting national policies to each region requires the development of detailed knowledge, through the monitoring and evaluation of public policies at national and local level. In this way, it will be possible to demonstrate and promote the environmental and socio-economic benefits of these measures for local areas,

in terms of quality of life, the creation or development of jobs and skills, reduced dependence on imported resources and resilience, etc.

Preparatory work is also needed at local level, involving training local and community elected representatives and their technical departments in building issues (adaptation, uses, materials, layout, etc.), consistency between the various policies, starting with the Territorial Climate-Air-Energy Plan (PCAET), the Local Housing Plan (PLH) and the inter-community Local Town Planning Plan (PLUi). These policies must be as ambitious as the region's potential contribution to national objectives.

These two improvement processes within the State and the regions can be coordinated and brought together within already structured dialogue platforms such as associations of local authorities, or conferences of mayors, regions and departments.

12. The work of deepening knowledge and crossing visions must continue (particularly within the framework of BUS2), and be organised in synergy with the actions for implementing the BUS2 roadmap for building performance.

The aim of BUS2 is to provide a forum for coordination and consultation between players and professionals in the building industry. The resulting diagnosis is intended both as a summary of existing past work and as a basis for reflection on scenarios for the development of job requirements for renovation and eco-construction, with precise figures for the latter. BUS2 therefore fills a gap in the visibility of the human resource requirements that will be needed to achieve the renovation and construction objectives.

BUS2's work is coordinated with that of France Stratégie and the SGPE. The work is relatively convergent on energy renovation, but differs greatly on the trajectory of new construction. In any case, the various scenarios show that the building sector will undergo a change in its activity, particularly in connection with the boom in high-performance renovation, and it will be necessary to organise the recruitment and training of professionals to meet the challenges of the ecological transition of buildings.

We need to continue and develop the work needed to gain a better understanding of changes in the challenges facing the construction sector, employment and training, in order to help national and regional players calibrate their policies: forward-looking work at national level, but also at regional level, observation, monitoring and ex-ante evaluation systems.

This work, which is constantly subject to improvement, should be carried out in parallel with the implementation of actions, so as not to delay the latter. In fact, some actions can already have a significant impact based on current knowledge of major trends.

1 INTRODUCTION

1.1 EUROPEAN TARGETS FOR THE BUILDING SECTOR UP TO 2030

As part of the European Climate Pact and the "Fit for 55" proposals, the building sector, which is the second largest consumer of final energy (27.9%) in the European Union after transport (29.2%)[4] , has been the focus of particular attention, with a stated objective of doubling the renovation rate by 2030 to 35 million renovated buildings. To achieve this, 160,000 new jobs would need to be created in the construction sector in Europe[5] . Europe therefore aims to support employment in this sector in all EU countries through various plans and measures.

The Pact for Skills, the first flagship measure of the European five-year plan "The European Skills Agenda"[6] from 2020, supports the upgrading of skills of European public and private bodies as part of the digital and environmental transition[7] . For the construction industry, this pact sets the goal of increasing the skills and retraining of at least 25% of the construction workforce by 2025.

But employment and skills in the construction sector have already been an issue in European work since 2011, when the Build Up Skills strategic initiative was launched as part of the Intelligent Energy Europe programme. The aim of this initiative is to improve the skills of building professionals. It has resulted in projects focusing on employment and skills by 2020 in 30 European countries. In France, the Build Up Skills project has focused on drawing up an inventory of the current situation and a roadmap of the actions needed to boost the skills of players in the sector up to 2020. At the end of this timeframe, a 2ème wave of updates to the strategies developed through the project was launched as part of the LIFE Clean Energy Transition (CET) programme.

Figure 1-1 Timeline of the Build Up Skills (BUS) strategic initiative

Source: LIFE CET Info Day (2023)

1.2 A LOOK BACK AT BUILD UP SKILLS FRANCE 1

Following France's commitments on energy renovation under the Grenelle 2 law, the need for massive training of craftsmen and workers in the building sector has become a necessity if these commitments are to be met. Faced with the obstacles and barriers to effectively reaching all these players, France joined the European "Build Up Skills" call for projects in March 2012. This project is structured around 4 players, ADEME, Alliance Villes Emploi, AFPA (Agence nationale pour la Formation Professionnelle des Adultes) and CSTB (Centre Scientifique et Technique du Bâtiment), selected for their complementary skills, with the aim of :

[4] Eurostat data 2021. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_statistics_-_an_overview#Primary_energy_production
[5] https://climate-pact.europa.eu/about/priority-topics/green-buildings_en
[6] https://ec.europa.eu/social/main.jsp?catId=1223
[7] https://pact-for-skills.ec.europa.eu/index_en

- Establish a complete diagnosis of the training needs of craftsmen and construction workers at national and regional level.
- Draw up a roadmap setting out the actions to be taken between now and 2020 to facilitate and accelerate the skills upgrading of craftsmen and construction workers.

The roadmap proposed in 2013[8] , was drawn up at a number of national and inter-regional meetings with stakeholders and by steering, editorial and reading committees. It is built around 3 main strategic areas:

- Stimulating skills development through the market;
- The development of training and services to help companies in the sector improve their skills;
- Managing the workforce of professionals in the sector.

Although the management of the action plan and the monitoring of these actions have not been formally organised, this work has given rise to actions in various areas.

- BUS1 created a dynamic and climate of trust during the works.
- Tools and methods are recognised as having been inspired and/or nourished by BUS1.
- The lack of dedicated resources and coordinated management of the action plan meant that it could not be implemented as planned.

The key lesson is the absolute need to put in place an organisation and the human and financial resources to ensure that the action plan is implemented under the right conditions.

1.3 BUILD UP SKILLS 2

BUS2 is an update of BUS1, enriched by feedback from experience, developments in the sector and the challenges it faces. This new version, which looks ahead to 2030, aims to :

- Taking into account the new challenges to be met in order to improve the performance of the French building stock, whether they be :
  - Digital ;
  - Linked to the circular economy, resource saving ;
  - A comprehensive approach to renovation ;
  - Industrialisation with off-site prefabrication;
  - Adapting to climate change and the associated risks.
- Taking account of local, regional and national issues
- Involvement of all those involved in the construction and renovation of buildings, including technicians and managers.
- Precise monitoring of actions and the roadmap to ensure it is applied and effective.

The project aims to be ambitious and unifying around :

- A national diagnosis of the renovation and construction market and of current needs and needs up to 2030 in terms of jobs, trades and skills.
- The co-construction of a national roadmap for building performance involving building professionals, employment players, apprenticeship and training players, the State, public agencies, local authorities and the regions that implement public policies.
- A platform open to public and private players in the field of renovation and high-performance construction to optimise their coordination.

[8] Build Up Skills (2013), Roadmap. https://librairie.ademe.fr/cadic/4541/feuille-de-route-build-up-skills-2013.pdf

In order to carry out the diagnosis, the consortium was structured around ADEME and Alliance Villes Emploi and three service providers chosen for their respective expertise:

TRANSITIONS, a sustainable development strategy consultancy, carries out assignments in France and around the world with public institutions, local authorities, businesses, agricultural cooperatives and sectors, and civil society organisations, to support the changes needed for the emergence of more sustainable, inclusive and mutually supportive models of production, consumption and territorial organisation. In particular, its Territories division supports the development and implementation of energy and ecological transition strategies.

IN NUMERI: a consultancy specialising in data production, processing and analysis, modelling the socio-economic impact of energy transition policies and carrying out major surveys. IN NUMERI brings to the table its experience in studies of the impact of energy-climate scenarios on the economy, jobs and professions, as well as its mastery of the TETE tool (Ecological Transition - Territories - Jobs) set up by ADEME and Réseau Action Climat (RAC).

POUGET Consultants: experts in energy performance in the property sector. POUGET Consultants provides studies, consultancy, support and training in energy management, carbon audits and adaptation to climate change to a wide range of players in the building sector, whether through project management assistance, energy consultancy or project management.

2 OBJECTIVES AND METHODOLOGY

The update of the diagnosis carried out in 2011, which constitutes the first stage of the Build Up Skills 2 project, was carried out in three phases: establishing the current state of the construction sector, estimating the jobs and skills requirements for 2030, and sharing the complete diagnosis formed by the two previous stages.

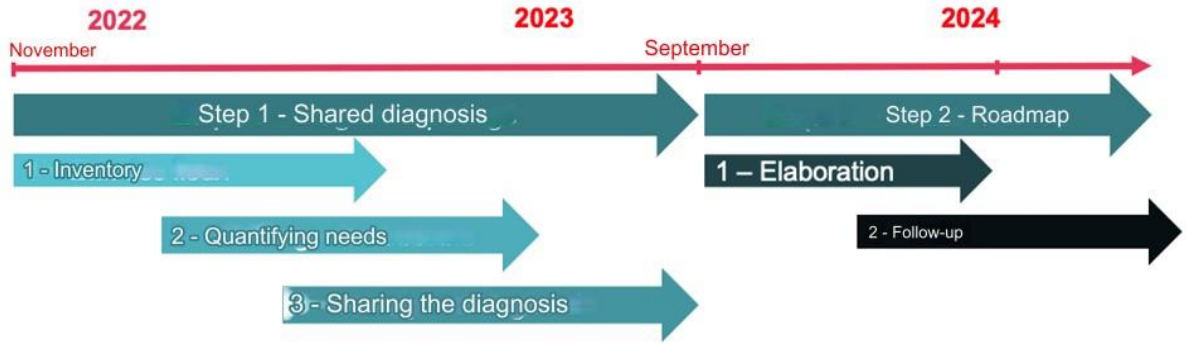


Figure 2-1 Timetable for the BUS2 diagnosis

The first step was to gather a wide range of recent technical and scientific literature on the building sector, as well as the most up-to-date data, in order to establish an overview of the progress made since 2011. This progress is measured both in terms of the renovation and construction targets for 2030 (market demand), and in terms of the development of skills and jobs to meet future demand and the challenges facing the sector (supply of jobs and skills). The compilation of existing reports and databases has resulted in the most exhaustive possible summary and database of the trends at work in the building sector, both in terms of developments in the various market segments and in initial and continuing training related to the building trades.

The literature review was accompanied by feedback from around twenty players in the building sector, who were interviewed by means of remote semi-directive interviews lasting one to two hours, using an interview grid shared by the consortium partners. This material, which enables us to understand the progress of the past decade and the needs identified for the one to come, was then compiled into a summary and integrated into this current inventory.

Structure	Name of person(s) interviewed
AFPA	Anne-Valérie AUDOIN, Ralf LESCA
Anah	Quentin AMY, Vincent FEUILLETTE
OPUN	Arnaud REBY
IsoTop	Christian DE BENOIST
The Shift Project	Yannick SALEMAN, Rémi BABUT
Practee Training	Benjamin FEDOR
CNOA	Valérie FLICOTEAUX, Julie FERNANDEZ, Séverine VERHAEGHE
ADEME	Christina NIRUP, Roselyne FORESTIER, Thomas GAUDIN, Jonathan LUIS
CDC	Olivier SICHEL
Banque des Territoires	Nicolas TURCAT
Sonergia	Florence LIEVYN
GEIQ BTP Hauts-de-France	Sabrina LARGILLIÈRE
Lille Avenirs	Karine DELSART
Immo France	Juliette DUBOIS
BPI	Pascale COURCELLE
CINOV	Damien RACLE
DGEFP	Brigitte PREUNG
FNSCBA - CGT	Bruno BOTHUA
Qualibat	Éric JOST
ATEE	Catherine GILLET
HQE-GBC Alliance	Estelle REVEILLARD, Juliette ROCCA
AQC	Philippe ESTINGOY
CEREMA	Bassam MOUJALLED, Cédric LENTILLON, Romuald JOBERT
Constructys	Renan SEGALEN
CSTB	Jean-Christophe VISIER
Compagnons du Devoir	Philippe DRESTO
Effinergie	Marie GRACIA, Sébastien LEFEUVRE
ISOTOP	Christian DE BENOIST
Building Plan	Julie LODEWYCKX, Pauline BEDOLIS
Saint-Gobain	Mickael DE CHALENDAR
USH	Alban CHARRIER
AFPAC	Ludovic FESTOU
Home Improvement Club	Philippe DRESTO, Jean Pascal CHIRAT

As well as disseminating the content of this inventory to the building industry via online workshops and validating it with them, a second phase of the project was launched, consisting of putting a precise figure on job requirements at national level. Firstly, job requirements were quantified retrospectively, over the period 2012-2021, using historical "physical" data (m² or number of homes renovated, new homes and premises built, number of joineries installed, number of[9] equipment installed, photovoltaic capacity installed, etc.). A large number of sources were used for this purpose:

- Statistical Data and Studies Department (SDES) of the Ministry of the Environment
- Observ'ER, Renewable Energy Observatory
- Uniclima, trade union for the heating, air-conditioning and refrigeration industries
- AFPAC, French Heat Pump Association
- AFPG, French Association of Geothermal Professionals
- ADEME, National Agency for Ecological Transition

[9] Heating, domestic hot water production, ventilation and air conditioning equipment

- CEREN, Centre for Economic Studies and Research on Energy
- SITADEL, data from construction, demolition and development operations.
- TREMI survey on energy-efficient renovation work on individual houses
- BBC Effinergie observatory on BBC renovations (homes, surface areas, costs)
- ONRE, National Energy Renovation Observatory
- BâtiÉtude, research institute specialising in the construction, energy and materials markets
- Eurostat, data on market structures for equipment and materials
- ESANE, annual business statistics
- INSEE, French National Institute for Statistics and Economic Studies

Two scenarios for the development of the building stock up to 2030 (a baseline scenario and a target scenario in line with European objectives) were then drawn up and put to the building industry for discussion. The target scenario is essentially based on one of ADEME's four "Territorial Cooperation" scenarios, which combine technical and economic aspects with assumptions about changes in lifestyles. On the basis of the target scenario, job requirements are estimated over the prospective period 2022-2030, then compared with past trends and the trend scenario.

To quantify these needs, expressed initially in full-time equivalents (FTEs), our consortium used the statistical tool "Transition Écologique - Territoires - Emplois; TETE". The physical data mentioned above represent the input data for this tool. In parallel, using the TETE tool also requires several variables: unit cost per sector (solar thermal, heat pumps, insulation, joinery, ventilation, etc.), and per activity (installation, sales, servicing and maintenance, works, etc.); changes in unit costs; productivity rate; specific import rate in the case of equipment and materials; job location coefficient.

All these data and variables are used (see Appendix 1):

1) To estimate, initially, the investment and maintenance expenditure (expressed in M€);

2) Estimate the number of direct and indirect jobs required to carry out the various activities (expressed in full-time jobs - FTE; all sectors of activity combined) based on employment ratios [output/FTE] calculated from ESANE or national accounts data;

3) To isolate only the direct FTEs of the building (NAF[10] 41 and NAF 43) and technical support (NAF 71) industries;

4) To break down the direct FTEs in the building and technical support branches by building trade, based on the breakdown of the building workforce by Professional Families (FAP) and on expert opinion as to the trades to be furnished for the implementation of each action.

At the same time, our consortium was able to extend this approach to 4 focus areas (the Aix-Marseille-Provence Metropolitan Area, the Cotentin Metropolitan Area, the Cambrésis region and the Greater Lyon Metropolitan Area), in collaboration with the local employment centres and the local players they were able to involve. All the results are available in chapter 8 of this report.

A third action, initiated in parallel with the first phases, consisted of discussing and sharing the results of this diagnosis with as many stakeholders as possible. Ensuring that all those involved in the building sector take ownership of the diagnosis should facilitate a common vision and a shared scenario of the resources to be deployed on an operational level. This is a prerequisite for the formulation of a roadmap, which will guide the sector's demands and recommendations to both public and private decision-makers.

[10] NAF: Nomenclature de l'Activité Française (French business classification)

3 NATIONAL POLICIES AND STRATEGIES FOR THE BUILDING SECTOR

In France, the construction industry is important to both the economy and the environment. Successive governments have introduced various national policies and strategies to encourage the development of a more responsible and sustainable industry, while ensuring that jobs and skills are in line with these objectives. The aim of these measures is to respond to current environmental challenges, such as reducing greenhouse gas emissions and cutting energy consumption, while encouraging business competitiveness and technological innovation. This political will is reflected in the introduction of stringent regulations, such as the 2012 Thermal Regulations (RT2012), as well as the promotion of renewable energies and the introduction of support schemes for the energy renovation of buildings. This chapter presents an overview of the various public policies related to energy and climate issues, as well as those focused on developing employment and training within the construction industry.

3.1 STRUCTURE OF FRENCH ENERGY AND CLIMATE POLICIES AND STRATEGIES

3.1.1 Grenelle 2 Law (2010)

Following on from the commitments made in the Grenelle 1 law of 2009, the enactment of the Grenelle 2 law in 2010 led to the introduction of operational measures, with two of the six major projects set out in the law focusing on the construction industry: the "Buildings and urban planning" project and the "Energy" project. The Grenelle Environment Round Table defined the objectives to be achieved and the measures to be taken by 2020:

- Reduce the energy consumption of the building stock by 38% by 2020, by implementing the following actions:
  - Renovate 400,000 homes a year from 2013;
  - Renovate the 800,000 social housing units that consume the most energy by 2020;
  - Encourage renovation in the tertiary sector, particularly for public establishments;
- Promote the construction of low-energy buildings from 2013, and positive-energy buildings from 2020;
- Develop renewable energy sources so that 23% of gross final energy consumption comes from these sources by 2020.

The Grenelle 2 law also introduces the Schémas Régionaux Climat-Air-Énergie (SRCAE - regional climate, air and energy plans) to strengthen the territorial dimension of climate and energy policies.

3.1.2 Energy Transition Law for Green Growth (LTECV; 2015)

Adopted in 2015, the LTECV creates the National Low-Carbon Strategy (SNBC) and the Multiannual Energy Programme (PPE). It also supplements the SRCAEs with Regional Energy Efficiency Plans (PREE), which set out the energy renovation targets at local level.

The LTECV sets the following targets for the building sector:

- Reduce the energy consumption of buildings by 28% by 2030 compared with 2010, and renovate 500,000 homes a year;
- Reduce fuel poverty by 15% by 2020;
- To achieve a building stock that meets low-energy building standards by 2050;
- To recover 70% of waste from the building and public works sector by 2020, through recycling, reuse or backfilling.

To achieve these objectives, the law includes the following measures:

- Energy renovation of existing buildings, particularly major works such as re-roofing, facade renovation or loft conversions, to significantly improve energy performance;
- Improving the energy and environmental performance of new buildings, starting with new public buildings and promoting positive energy or high environmental performance buildings;

- Combating fuel poverty, in particular by creating an energy voucher to help low-income households pay their energy bills.

Pursuant to Article 14 of the LTECV, the so-called "on-board works" decree[11] makes it compulsory to carry out thermal insulation work during major renovations to buildings used for housing, offices, shops, schools and hotels.

According to the ADEME study on the markets and jobs linked to energy efficiency and renewable energies[12] , the implementation of this law was expected to create **75,000 jobs in the building sector**. No assessment of the real impact on employment has yet been carried out.

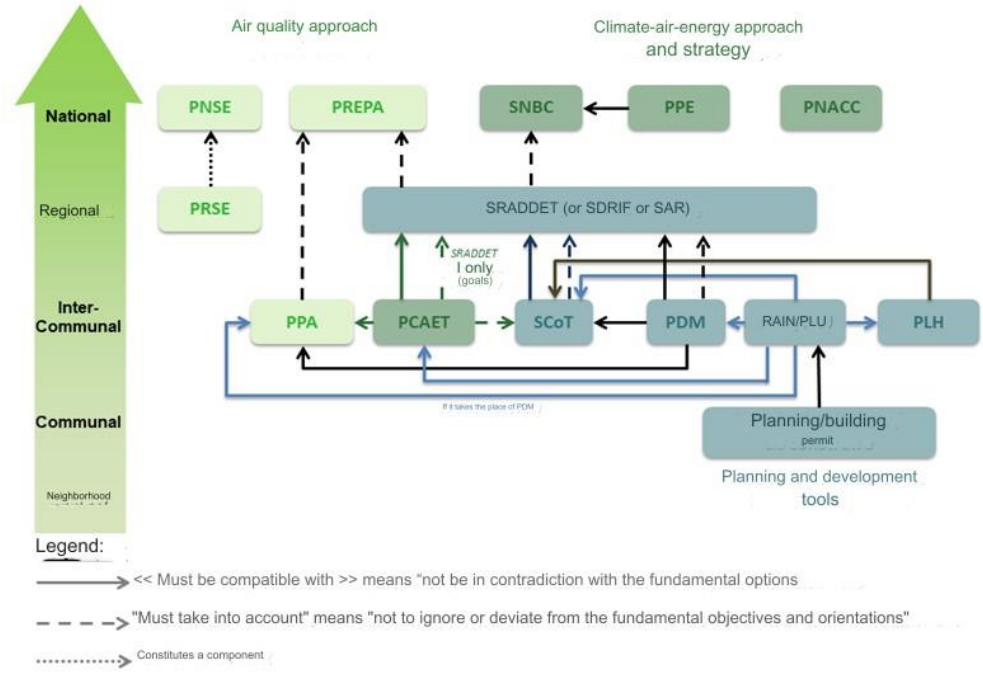
3.1.3 Law on the New Territorial Organisation of the Republic (NOTRe) and creation of SRADDETs (2015)

Promulgated on 7 August 2015, the NOTRe law (New Territorial Organisation of the Republic) redefines the powers of the various levels of local government and introduces a fundamental document for the territorialisation of the French Energy-Climate strategy: the Regional Plan for Spatial Planning, Sustainable Development and Equality (SRADDET). Incorporating the pre-existing SRCAE, this is a planning document which, at regional level, sets out the strategy, objectives and rules laid down by the Region in a number of areas of regional development:

- Managing space sparingly and combating the artificialization of land;
- Housing (number of renovations, reduction in energy consumption and greenhouse gas emissions);
- Managing and exploiting energy and developing the use of renewable and recovered energy sources;
- Combating climate change and improving air quality;
- Waste prevention and management.

It is binding on other planning documents such as the Mobility Plan (PDM), the territorial climate-air-energy plan (PCAET), the charter of the Regional Natural Parks (PNR) and the Schéma de Cohérence Territoriale (SCoT). The Local Town Planning Scheme (PLU) itself must be compatible with these various documents, and planning and building permits depend on the PLU.

Figure 3-1 Diagram of the relationship and conformity between urban planning documents following the promulgation of the NOTRe law



Source: ADEME

[11] Decree no. 2016-711 of 30 May 2016 on insulation work in the event of façade restoration work, re-roofing or conversion of premises with a view to making them habitable

[12] ADEME (2016), Marchés et emplois liés à l'efficacité énergétique et aux énergies renouvelables: situation 2013-2014 et perspective à court terme. https://www.territoires-climat.ademe.fr/ressource/101-34

3.1.4 National Low-Carbon Strategy (SNBC2) and Multiannual Energy Programme (PPE2; 2019)

Adopted in 2015 and revised in 2019, the SNBC is France's roadmap for combating climate change. It sets out the general and sectoral guidelines for the national transition to carbon neutrality by 2050. For the periods 2019-2023, 2024-2028 and 2029-2030, the SNBC sets carbon budgets by sector. The targets for buildings are as follows:

- Reduce emissions by 49% compared to 2015 by 2030 and achieve total decarbonisation by 2050;
- Maximise the production of low-carbon energy sources best suited to the type of building;
- Encourage the use of low-carbon construction products and equipment with good energy and environmental performance, including, in some cases, those derived from the circular economy or bio-sourced. This involves performance targets in terms of the carbon footprint of buildings over their life cycle, for both renovation and construction;
- In the residential sector, achieve a rate of at least 370,000 equivalent complete renovations per year by 2022 and 700,000 equivalent complete renovations on average per year from 2030. The eradication of "heat loss properties" is scheduled for 2028.

France's carbon budget, revised in 2019, is set for three 4-year periods:

- 2015-2018: 441 $MtCO_2$ eq, including 79 $MtCO_2$ eq for the building sector
- 2019-2023: 398 $MtCO_2$ eq, including 63 $MtCO_2$ eq for the building sector
- 2024-2028: 357$MtCO_2$ eq, including 47 $MtCO_2$ eq for the building sector

It is important to specify that the building sector taken into account in the SNBC only concerns emissions linked to the residential and tertiary use of buildings, excluding the construction phase and the manufacture of materials.

The Pluriannual Energy Programmes (PPE) formalise the operational planning of the energy policy defined by the law on energy transition for green growth. A PPE is drawn up for mainland France and one for each non-interconnected zone (ZNI). They express the guidelines and prioritise the actions to be implemented by the public authorities. The objectives set by the EPPs are reflected in the SNBC scenario.

The future Energy and Climate Programming Act, due to be adopted in 2023, will aim to redefine the orientations of the EPP and the SNBC for the ten-year period from 2024 to 2033. These three documents will form France's overall energy and climate strategy. In particular, this law will specify the targets for reducing greenhouse gas emissions, in line with the European "Fit for 55" objective.

3.1.5 Tertiary Eco-Energy Scheme (2019)

Decree no. 2019-771 of 23 July 2019, also known as the "Tertiary Decree", constitutes the legal framework determining the terms and conditions for reducing energy consumption imposed on tertiary buildings. This decree reflects the obligation, stemming from the law on the Evolution of Housing, Development and the Digital (ELAN) enacted at the end of 2018, to carry out work aimed at saving energy by 2030 for tertiary buildings. Only tertiary buildings with a surface area of 1,000 m² or more are subject to this decree and are required to comply with a gradual reduction in their energy consumption according to the following deadlines:

- 40% reduction by 2030
- 50% reduction by 2040
- 60% reduction by 2050

The reduction in energy consumption is calculated in relation to a 12-month reference period chosen after 2010 by the building owner. To put these requirements into practice, the Decree is being implemented through the Éco Energie Tertiaire scheme, which is based on the OPERAT platform (Observation de la Performance Énergétique, de la Rénovation et des Actions du Tertiaire). This platform collects and monitors consumption data for buildings in the tertiary sector.

3.1.6 RT2012 and RE2020

Coming into force in 2022, the 2020 Environmental Regulations (RE2020) will replace the 2012 Thermal Regulations (RT2012) for new buildings. RT2012 was based primarily on three criteria:

- The minimum energy efficiency of the building, translated into the Bbiomax (bioclimatic building requirement) ;
- The maximum conventional consumption of primary energy, Cepmax, which includes heating, cooling, lighting, domestic hot water production and auxiliaries;
- Summer comfort in non-air-conditioned buildings, which limits the conventional indoor reference temperature (TICREF) during a period of 5 days of high summer heat.

According to the Centre d'Études et d'Expertise sur les Risques, l'Environnement, la Mobilité et l'Aménagement (CEREMA) (Centre for Studies and Expertise on Risks, the Environment, Mobility and Town and Country Planning), interviewed as part of this study, RT2012, by introducing the obligation of results and means, and the introduction of air-tightness controls, has made it possible to overcome the inertia of companies and to mobilise all players in the sector, particularly manufacturers.

With the aim of continuing to improve the energy performance and comfort of new buildings, while reducing their carbon impact, the RE2020 is based on three main pillars:

- The RE2020 goes beyond the performance requirements of RT2012, placing particular emphasis on the performance of insulation, regardless of the type of heating system installed, by strengthening the requirements for the bioclimatic need indicator, Bbio.
- It aims to reduce the impact of new buildings on the climate by taking into account all of the building's emissions over its life cycle, from the construction phase through to the end of its life (construction materials, equipment), including the operating phase (heating, domestic hot water, air conditioning, lighting). To achieve this, it requires a life-cycle analysis to be carried out.
- It focuses on summer comfort, as buildings will need to be better prepared to cope with the more frequent and intense heatwaves associated with climate change.

The RE2020 will be implemented gradually: from 1er July 2022 for single-family homes and collective housing, then in stages for offices, primary and secondary education establishments, and specific tertiary buildings such as hotels, shops, gymnasiums, etc.

The RE2020 will lead to a gradual evolution in construction techniques, industrial sectors and energy solutions, with the aim of controlling construction costs, promoting environmental criteria (including the reduction of greenhouse gases and the development of bio-sourced materials) and ensuring that professionals in the sector develop their skills. A number of players have also pointed out that these regulations have brought about a change in the approach taken by technical consultancies, which are no longer just making thermal calculations, but also multi-criteria environmental calculations.

3.1.7 Energy-Climate Act (2019)

Promulgated on 8 November 2019, the Energy and Climate Act sets out a number of ambitious targets for France's climate and energy policy, including achieving carbon neutrality by 2050. For the building sector, this law introduces a number of important changes aimed at combating energy-hungry housing, including the following measures, which are now enshrined in law:

- The concept of energy decency in housing[13] : from 1er January 2023, a maximum final energy consumption threshold of 450 kWh per square metre per year must be met for a home to be considered energy decent.
- Gradual eradication of "heat sinks": from 2021, owners of properties considered to be "heat sinks" will be prohibited from increasing the rent between lettings without carrying out renovation work. In addition, there will be an obligation to carry out work in heat leakage properties, with the aim of achieving energy class E by 2028.
- The obligation to carry out an energy audit: from 2022, when selling or renting a home considered to be an energy sink, it will be compulsory to carry out an energy audit to provide precise information on the home's energy performance.

[13] Decree no. 2021-19 of 11 January 2021 on the energy performance criterion in the definition of decent housing in mainland France

Finally, the Energy-Climate Act strengthens controls aimed at combating fraud involving Energy Savings Certificates (EECs), which provide substantial financial support for many energy renovation projects.

3.1.8 Climate and Resilience Act (2021)

Adopted in 2021, the Climate and Resilience Act aims to reduce GHG emissions and strengthen the country's resilience in the face of climate change. It reiterates the goal of carbon neutrality by 2050, as set out in the SNBC, and provides for various measures, including the creation of a fund dedicated to the ecological transition and schemes to support initiatives to reduce emissions. In line with the policy of decentralisation, the law also provides for the establishment of local steering committees and an observatory to monitor the implementation of the law.

With regard to the building sector, the law provides for a number of specific measures:

- Introduction of financial incentives and a support fund to promote and support the energy renovation of private buildings.
- Obligation to comply with energy performance criteria and eliminate buildings described as "heat leakage". The energy efficiency of a building is assessed using the Diagnostic de Performance Energétique (DPE). Dwellings considered to be decent must meet minimum energy performance standards, while requirements in terms of energy decency have been strengthened.
- From 2023, owners of homes classified as "thermal flats" will not be able to increase the rent on their rental property unless they carry out energy renovation work. The measures will be progressively strengthened, with a ban on renting out the worst-insulated homes: from 2025 for those with a G rating on the DPE, from 2028 for those with an F rating, and from 2034 for those with an E rating.
- From 1er January 2023, new commercial buildings with a surface area of more than 500 m² and office buildings with a surface area of more than 1000 m² will have to either plant part of their roof or install photovoltaic panels covering at least 30% of the roof surface.
- The law also requires condominiums over 15 years old (housing, offices and shops) to draw up a Pluriannual Work Plan (PPT): from 1er January 2023 for complexes with more than 200 lots, from 1er January 2024 for those with between 51 and 200 lots, and from 1er January 2025 for those with fewer than 50 lots.

Lastly, the Climate and Resilience Act sets the objective of achieving a total absence of net artificialisation of land by 2050, commonly known as "Zero Net Artificialisation - ZAN", taking care not to disrupt the pace of new construction. In addition, it sets an initial intermediate target aimed at halving the rate of land consumption over the next ten years (2021-2031).

According to several of the stakeholders interviewed for this study, renovation is a relatively recent issue that is not sufficiently addressed by current regulations. In terms of consideration of environmental and energy issues, new construction is the driving force behind renovation. Consideration could be given to establishing requirements for results, and not just means, similar to those applied to new build.

These observations are also in line with the recommendations made by the Economic, Social and Environmental Council (CESE) in 2022. First of all, the CESE suggests that the governance of renovation policies and subsidies should be coordinated with the Regions, within a single ministry or an interministerial delegation under the authority of the Prime Minister[14] . The EESC also recommends assessing the obstacles encountered by the various players involved in renovation and estimating the national solidarity effort required to renovate the entire building stock, with a view to incorporating this effort into the future French Energy and Climate Strategy (SFEC). This approach would make it possible to extend the renovation obligation in an equitable and fair manner[15] .

[14] CESE (2022), Opinion - Towards more sustainable buildings through an ambitious renovation policy
[15] *Ibid.*

3.1.9 Outlook

While the objectives of France's energy and environmental transition have been set out in national strategy documents, the implementation of these actions and the approaches needed to achieve these objectives are far from set in stone. Initiatives by a number of political and industry players are fuelling debate and the construction of new frameworks.

The roadmap for decarbonising the building industry (May 2023)[16] , the result of consultation between all the players in the building and public works sector, overseen by the Centre Scientifique et Technique du Bâtiment (CSTB) and the Plan Bâtiment Durable, includes 25 levers to be mobilised to decarbonise the sector, including : optimising m², speeding up construction and access to environmental data, massively increasing overall renovation, measuring performance, defining protocols for assessing the quality and suitability for re-use of building materials, ensuring an optimum balance between dismantling and renovation.

The report by the parliamentary committee of enquiry into energy renovation[17] , presented at the beginning of July 2023 and the result of a lengthy committee of enquiry involving more than 170 people, should help to accelerate the pace of effective renovation. Its 23 proposals are organised around 4 axes:

- Area 1 - Define a stable, ambitious and mutually supportive strategy ;
- Area 2 - Restoring confidence, making tools more reliable, anchoring renovation in local areas ;
- 3 - Guarantee financing for renovation ;
- Axis 4 - Structure a French industrial sector for renovation.

The government's announced target of 200,000 major renovations per year by **2024**, compared with around 90,000 at present, is accompanied by an increased budget for high-performance renovation. MaPrimeRénov' aid, the main form of aid excluding the Energy Saving Certificate, is set to evolve, as announced by the Ministers for Energy and Ecological Transitions and for Town and Country Planning and Housing, from January 2024, and will be based on 2 pillars:

- A "performance" pillar that will focus on financing high-performance renovations (as defined in the "Climate and Resilience" Act of 21 August 2021; see 5.1.2.1), with larger amounts for the most modest households.
- An "efficiency" pillar that will guarantee support for changes to heating systems and smaller work packages.

The Mon Accompagnateur Rénov scheme will provide more **support to households as they renovate** (becoming compulsory for renovations under the "performance" pillar), with larger amounts of aid allocated.

A public consultation on ways to accelerate the decarbonisation of heating systems in buildings and reduce gas consumption (in particular by banning the installation of new gas boilers) was launched and closed at the end of July 2023.

3.2 ADEQUACY WITH EUROPEAN OBJECTIVES

The European Commission has set itself the target of becoming climate neutral by 2050 and reducing greenhouse gas emissions by 55% in 2030 compared with 1990 (Fit for 55), and through its REPowerEU Plan to reduce energy consumption by at least 13% in 2030 compared with the projections in the 2020 reference scenario. The building sector is expected to make a significant contribution to these targets.

Fit for 55

The General Secretariat for Ecological Planning (SGPE) has coordinated the drafting of a guidance document on decarbonisation of the building sector for consultation[18] . It will feed into the revision of the national low-carbon strategy, which is in line with the European Union's climate objectives for 2030, which aim to achieve a 55% reduction in net greenhouse gas emissions compared with 1990 (*Fit for 55*), and, as regards buildings specifically, the new European directive on the energy performance of buildings[19] .

[16] Roadmap for decarbonising the construction industry, Article 301 of the "Climate and Resilience" Act
[17] https://www.senat.fr/notice-rapport/2022/r22-811-1-notice.html
[18] SGPE (2023), Green planning in buildings
[19] See Directive (EU) 2018/844 of the European Parliament and of the Council of 30 May 2018.

The targets submitted for consultation by the SGPE aim to reduce emissions by 61% in 2030 compared with 2019, with around 60% of the effort to be made in the residential sector, mainly by decarbonising vectors (gas, fuel oil) and insulating the most energy-intensive homes.

REPowerEU[20]

On 20 April 2023, France officially submitted a request to the European Commission to amend its National Recovery and Resilience Plan (NRRP), mainly in order to add a chapter on REPowerEU, the European mechanism set up in response to the Russian invasion of Ukraine to, among other things, reduce the Union's dependence on fossil fuels.

This update aims to finance two major priorities for the energy transition, including the energy renovation of private and public buildings: for private buildings, via the MaPrimeRénov' scheme, which would receive €1.6 billion in funding; for public buildings, via the Résilience I and Résilience II calls for projects - aimed at government buildings alone - which would receive €100 million.

The Ministry of the Economy specifies that "the impact of these investments will be strengthened by the implementation of three key reforms", which would also be included in the PNRR: the Renewable Energies Acceleration Act, the Energy Sobriety Plan and the creation of the General Secretariat for Ecological Planning.

In addition, a number of activities have been carried out in France in connection with the implementation of the Energy Performance of Buildings Directive and the Renewable Energy Directive for the building sector :

- Implementing the Energy Renovation Plan for Buildings

- Take action to combat energy flaws (F or G performance diagnoses) in three phases (Law No. 2019-1147 of 8 November 2019 on energy and the climate)

- For public buildings:
  - Set up a task force to speed up the renovation of school buildings. Educational buildings (schools, collèges, lycées) account for around 50% of the buildings owned by local authorities.
  - As part of the Major Investment Plan 2018-2022, financing tools totalling €3 billion are available to local authorities for the energy renovation of their own buildings.
  - From 1er January 2020, ban the purchase of new oil-fired boilers or major repairs to such boilers in State buildings, and schedule the phasing out of oil-fired heating in State buildings by 2029 (excluding operational issues);
  - Make available in open data the list and/or map of buildings owned by the State, specifying their surface area and the type of energy used to heat them. All willing public bodies (local authorities, hospitals, etc.) could also be invited to join the initiative;
  - A plan to renovate 39 administrative buildings in France.

- For professionals:
  - Working with building and property professionals, non-governmental organisations (NGOs), local authorities and energy companies under the FAIRE banner to better identify appropriate renovation solutions for households, to encourage people to take action by increasing their knowledge and confidence, and to better coordinate existing support and funding;
  - Implementing the new environmental regulations for buildings.

- For individuals:

  - Increase the use of the eco-rate zero-interest loan (eco-PTZ);
  - Maintain the rate of Value Added Tax (VAT) at 5.5% for energy renovation work;
  - Better inform households about the energy performance of their homes and the renovation work they should undertake. To this end, through MaPrimeRénov' and the SARE programme (Service d'Accompagnement pour la Rénovation Énergétique), co-finance home support and diagnostics, particularly for low-income households owning homes that are thermal flats (F or G performance diagnostics) and support comprehensive home renovations (Habiter mieux sérénité).

[20] https://www.banquedesterritoires.fr/la-france-veut-ajouter-un-chapitre-repowereu-son-plan-de-relance?pk_campaign=newsletter_quotidienne&pk_kwd=2023-04-24&pk_source=Actualit%C3%A9s_Localtis&pk_medium=newsletter_quotidienne

4 OVERVIEW OF THE CONSTRUCTION SECTOR

4.1 GENERAL CONTEXT OF THE BUILDING SECTOR

This section gives an overall picture of the building sector in terms of activity and employment between 2012 and 2030: the current state and changes since BUS I (2012 to 2022), the challenges, and projections to 2030.

4.1.1 General context of the renovation and construction market

- France has around 30 million homes, of which only 5% are classified A and B, and 15% are classified F and G and therefore considered to be heat sinks. To achieve a building stock that is renovated to BBC (Bâtiment Basse Consommation) standard or equivalent by 2050, 700,000 high-performance renovations a year are needed. However, only 35,000 low-energy building renovations per year are currently recorded. 80% of renovations are carried out by hand.
- There will be 542,000 condominiums by 2022, and they are considered to be the blind spot in public policy on renovation.
- In the tertiary sector, the total surface area is estimated at 1 billion m² of heated space, 40% of which belongs to the public sector. Approximately 65% of this floor space is covered by the "Eco-énergie tertiaire" scheme, which comes into force in 2023 and requires businesses and public sector bodies to reduce their energy consumption by 40% by 2030 and 60% by 2050.
- Small commercial buildings (< 1,000 m²), which account for 27% of floor space, are not covered by the regulations, and private owners receive virtually no support in renovating their premises.
- In the construction sector, the decline in population growth, the expected reduction in the amount of land being developed, and changes in household structures are forcing the market to adapt: recycling of land, fewer building sites, modular and prefabricated construction.
- Regulations, particularly those relating to renovation, are changing rapidly, forcing the building sector to redefine itself rapidly. This can lead to a lack of visibility for players. It should be noted, however, that public subsidies and policies are one of the main drivers of demand for renovation and sustainable construction.

The BUS2 forecasts give the following results:

- The renovation of an average of 900,000 homes per year between 2022 and 2030, compared with an average of 14,000 per year between 2012 and 2021. In a trend scenario, this average rises to 85,000, with the majority of renovations remaining non-BBC.
- The renovation of tertiary premises will increase from 21.5 million m² per year over the historical period, to 22.8 million m² per year between 2022 and 2030 in a trend scenario, and 27 million m² in a target scenario.
- Construction is slowing sharply, in line with demographic trends and the optimisation of the use of the existing stock; renovation is offsetting the expected fall in the construction of new housing and commercial premises.

4.1.2 General context of human resources and training :

- The building sector employs around 1.3 million people, or 1.8 million including self-employed tradespeople.
- Changes in the structure of the construction sector clearly show an increase in the density of small businesses, with a 44% increase in the number of small businesses (< 50 employees) since 2012 and a 72% increase in the number of self-employed entrepreneurs.
- The number of employees is increasing only slightly (+5%) after a dip over the 2012-2019 period. Only 12.1% of employees in construction companies are women.
- The number of students in training from the Certificat d'Aptitude Professionnelle (CAP) to the Brevet de Technicien Supérieur (BTS) in the building and public works sector has been rising slightly since 2018, after falling between 2012 and 2018, and will reach 87,000 in 2021. The number of students taking construction-related courses in higher education has also been rising since 2014, reaching around 38,000 in 2021-2022.
- Apprenticeship training is on the increase and now involves 44% of students. The biggest increase is in higher education.

- However, the sector suffers from a higher attrition rate than other sectors: 27% of those who start studying construction leave before graduating, compared with 13% for the rest of the sectors.
- More generally, a lack of attractiveness linked in particular to working conditions (hours, distance, arduousness, conditions on the site, pay) makes it more difficult to recruit and train young beginners. As a result, only 44% are actually working in the construction industry after graduating, and 39% three years after leaving school.
- However, efforts and actions are being taken by companies and public authorities to improve the perception of the sector, and to promote its social and environmental benefits (reducing emissions, fuel poverty, etc.).
- As far as continuing training is concerned, the State ensures the quality and content of training courses, with 81 professional titles and 75 professional qualification certificates relating to the building and public works sector.
- The FEEBAT (Formation aux Économies d'Énergie dans le Bâtiment) energy-saving training programme is considered by industry players to be the best way of organising and disseminating training programmes. Few professionals are currently taking FEEBAT training courses (3,000 a year), but the programme is diversifying to include students, teachers and other building professionals. 98% of FEEBAT training courses concern the "Reconnu Garant de l'Environnement" certification of companies, required to qualify for public grants.
- On-site training programmes are being developed (PRAXIBAT, on-the-job training, etc.), partly in response to the requirements of the building trades.

The forecast job requirements for the period 2022-2030 are :

- The various energy renovation and new construction projects carried out between 2012 and 2021 require an average of 974,000 direct and indirect FTE/year across all sectors of activity. The need increases in the Target scenario, with an average of 998,000 direct and indirect FTE/year between 2022 and 2030 (+2%).
- This increase is driven by energy renovation needs (BBC and non-BBC): from 429,000 direct and indirect FTE/year on average between 2012 and 2021 to 754,000 direct and indirect FTE/year on average between 2022 and 2030, i.e. 325,000 additional direct and indirect FTE each year (multiplied by 1.8). This figure is almost 200,000 FTE for direct jobs alone. Conversely, requirements for new construction are falling.

4.2 DEVELOPMENTS, ENERGY-CLIMATE ISSUES AND PROSPECTS FOR THE BUILDING SECTOR

According to the Fédération Française du Bâtiment (FFB), the building sector generated €149 billion worth of work in 2021, or 6% of the country's Gross Domestic Product (GDP). Of this volume, almost a third is devoted to the construction of new buildings, while the remaining two-thirds is allocated to the maintenance and improvement of the existing stock. Production, maintenance and improvement in the residential sector account for 59% of business sales, or €88 billion, without distinguishing between work aimed at improving energy efficiency and other types of work.

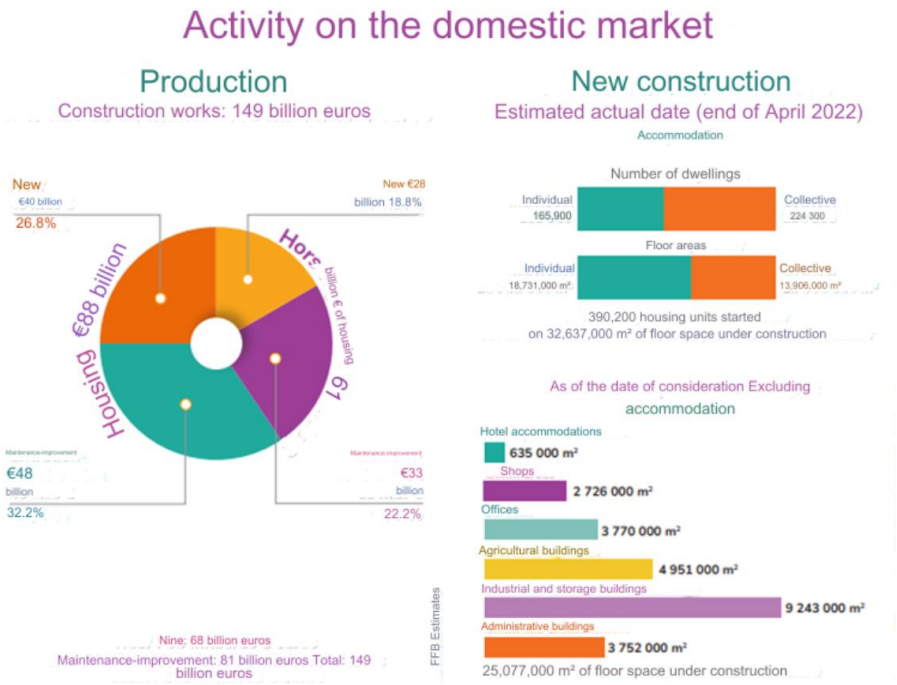
4.2.1 Key figures for a highly diversified portfolio

The building sector is responsible for producing, maintaining and operating a wide variety of buildings for different uses. Markets have organised themselves to meet these needs, adopting very different structures. It is therefore essential to have a complete picture of the state of the building stock and how it has changed over the last few years, in order to project a trajectory in terms of jobs, trades and skills.

4.2.1.1 Residential and tertiary segments of equal importance

Both segments of the housing stock, in terms of market and energy consumption, are equally important. According to the FFB's key figures, housing-related work will account for 59% of total production in 2021.

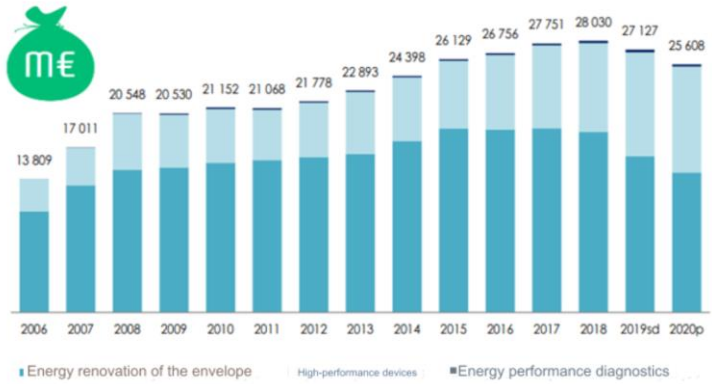
Figure 4-1 Key market figures for the building sector in 2021



Source: FFB (2022), Building in figures 2021

According to the 2022 edition of ADEME's study "Markets and jobs contributing to the energy transition in the residential building sector", the residential renovation market[21] represented €25.6 billion in 2020, down 8% on 2018. Renovation of the building envelope accounted for €14.5 billion in 2020 (-22% compared with 2018), while the market for efficient appliances reached €10.9 billion (+19% compared with 2018).

Figure 4-2 Market trends in sectors contributing to the energy transition in residential construction (millions of euros)



Source: ADEME (2022), Markets and jobs contributing to the energy transition in the residential building sector.[22]

[21] Through energy-efficient renovation of the building envelope (insulation of opaque walls, replacement of windows and doors, installation of controlled mechanical ventilation for renovation), efficient heating and hot water production equipment for renovation (individual wood-burning heating appliances, solar thermal energy, heat pumps, thermodynamic water heaters, condensing gas boilers, heating control equipment, energy-efficient household appliances), as well as energy performance diagnostics in residential buildings.

[22] https://librairie.ademe.fr/urbanisme-et-batiment/5844-marches-et-emplois-concourant-a-la-transition-energetique-dans-le-secteur-du-batiment-residentiel.html

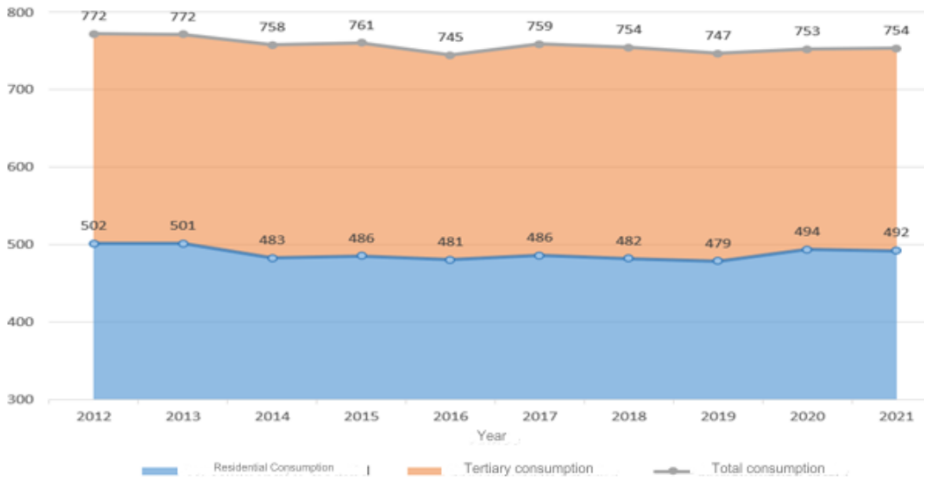
The residential sector accounts for 492 TWh of final energy consumption, while the tertiary sector consumes 262 TWh, giving a total for the building sector of 753.7 TWh in 2021. The building sector thus accounts for 46.5% of final energy consumption in France[23] .

This consumption has fallen by 2.3% compared with 2012 in 2021, but has remained almost constant in recent years, mainly due to the increase in floor space per person in housing, despite the various policies and strategies that have been put in place.

This general fall in consumption conceals disparities between building types: energy consumption in offices fell by 8.5% (or 146 kWh/m²), in residential buildings by 9.5% (or 183 kWh/m²), while that of shopping centres rose by 20% to 131 kWh/m²[24] .

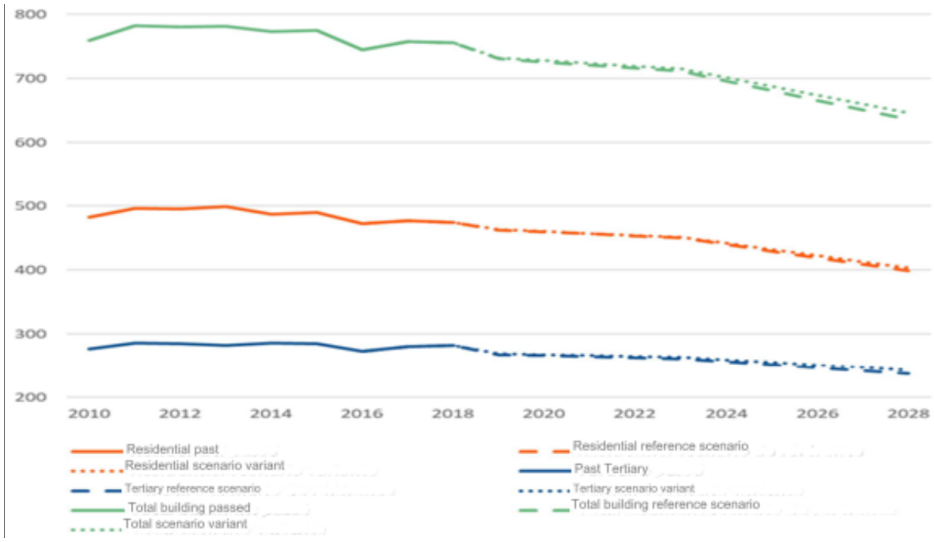
Although the trend trajectory is close to the forecasts in the multi-annual energy programme (PPE), the acceleration in the reduction in consumption forecast from 2023 does not appear to be the current trend. The gap between trend consumption and that forecast to meet the 2030 and 2050 targets in the residential and tertiary sectors could therefore widen over the next few years if no changes are made.

Figure 4-3 Trend in final energy consumption in buildings (residential and tertiary sectors) between 2012 and 2021 (TWh)



Source: SDES (2022), Key energy figures

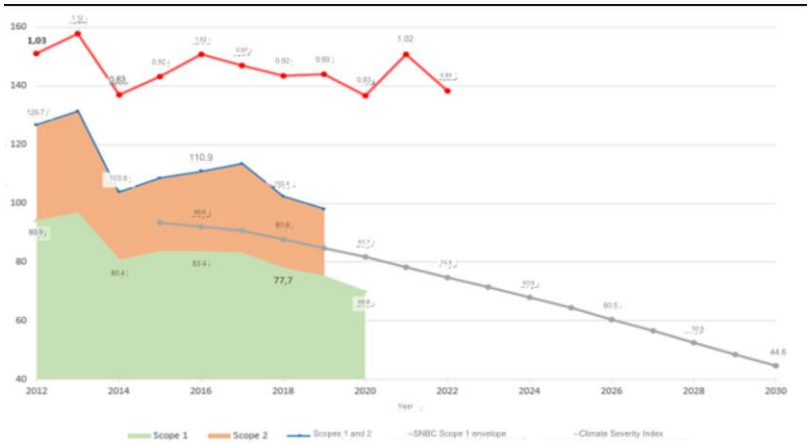
Figure 4-4 2010-2018 trend and 2019-2028 projection for final energy consumption in the residential and tertiary sectors (TWh)



Source: Ministry for Ecological Transition, Decree no. 2020-456 of 21 April 2020 on the multiannual energy plan.

[23] SDES (2022), Key energy figures
[24] Sustainable property observatory (2022), Barometer of the energy and environmental performance of buildings. https://o-immobilierdurable.fr/events/conference-presentation-des-resultats-du-barometre-2022-de-la-performance-energetique-et-environnementale-des-batiments/

Figure 4-5 GHG emissions from the residential and tertiary sectors since 2012 and carbon budget up to 2030 (MtCO e)$_2$



Source: Ministry of Energy Transition, Greenhouse gas emissions from the building sector in France (scope 1 and 2).[25]

Despite the name "Buildings" used in the graphs and data of the SNBC, the sector taken into account for the calculation of GHG emissions does not correspond exactly to the buildings sector as defined in certain regulations or by the profession. Emissions linked to new construction are not included in this sector, but are classified under manufacturing industry and construction. Land artificialisation is included in the LULUCF sector (Land Use, Land-Use Change and Forestry). The emissions presented in this graph therefore only concern scopes 1 and 2, i.e. emissions linked to energy consumption.

In 2019, GHG emissions from this sector amounted to 75 $MtCO_2$ e in scope 1 and 98 $MtCO_2$ e in scopes 1 and 2, representing 22% of France's total emissions (436 $MtCO_2$ e in 2019). However, these figures are not adjusted for climate variations. This sector is strongly influenced by climatic conditions, as they impact energy consumption and, consequently, CO_2 and pollutant emissions. The difference in emissions between 2014 and 2015 is a striking example of this, since this year saw particularly mild temperatures overall in winter. This makes the analysis of these figures more complex.

4.2.1.2 Variety of residential parks

Architectural and technical disparities

There are many architectural and technical disparities in the housing stock, which means that interventions need to be adapted, particularly when it comes to energy renovation. Numerous studies have been carried out to classify this housing stock according to the energy issues at stake[26] .

In 2021, the French housing stock will consist of 37.2 million homes, 82% of which will be primary residences, 10% secondary residences and 8% vacant homes. Growth in the housing stock has been slowing since 2007[27] .

In 2021, almost 54% of existing homes were built before the first thermal regulations, which imposed minimum insulation requirements in 1974[28] . Of these, older buildings, mainly built before 1948, account for 32% of homes in France. This is an essential part of our architectural and cultural heritage, but it also represents a major challenge in terms of energy renovation. The specific characteristics of these buildings often make them difficult to thermally insulate without altering their aesthetic and historical features.

[25] https://indicateurs-snbc.developpement-durable.gouv.fr/emissions-de-gaz-a-effet-de-serre-du-secteur-du-a32.html
[26] For example, the "Detailed analysis of the housing stock" study carried out as part of the PROFEEL programme, run by the AQC (Agence Qualité Construction) and the CSTB (Centre Scientifique et Technique du Bâtiment), provides a map of the housing stock comprising almost 40 types.
[27] SDES (2022), Key housing figures
[28] INSEE (2017), Housing conditions in France

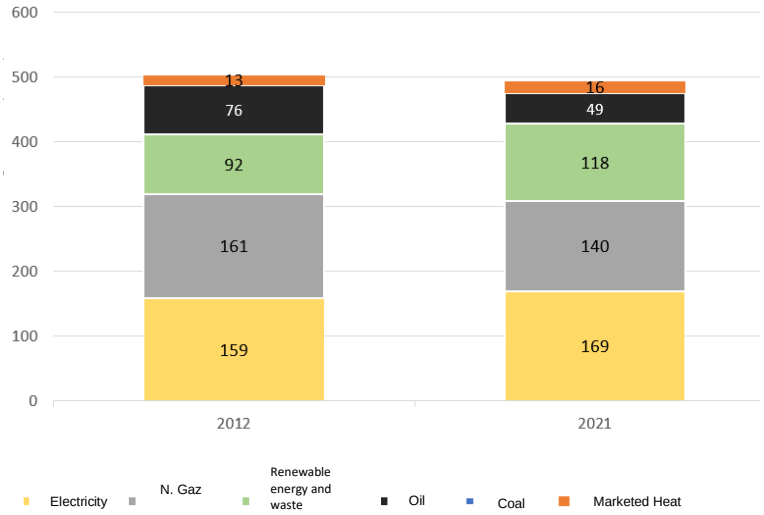
Renovation must respect the architectural and technical characteristics of the building, using materials that are compatible with its age and style. In such cases, the solutions may involve greater constraints than for the renovation of more recent buildings, as in the case of external insulation. There are a number of resources available for dealing with these constraints:

- The Effinergie collective is studying the introduction of an Effinergie Patrimoine label to take account of the special features of older buildings[29] ;
- The CREBA resource centre (Centre de Ressources pour la Réhabilitation Responsable du Bâti Ancien) is aimed at building professionals[30] .

This means that the market needs to be adapted to meet the specific needs of this sector, both in terms of training companies in the issues involved and the specific support that needs to be offered to project owners. In this context, architects and project managers are likely to play a more prominent role, and it is also essential to develop products tailored to these issues, among which biobased insulation plays an important role.

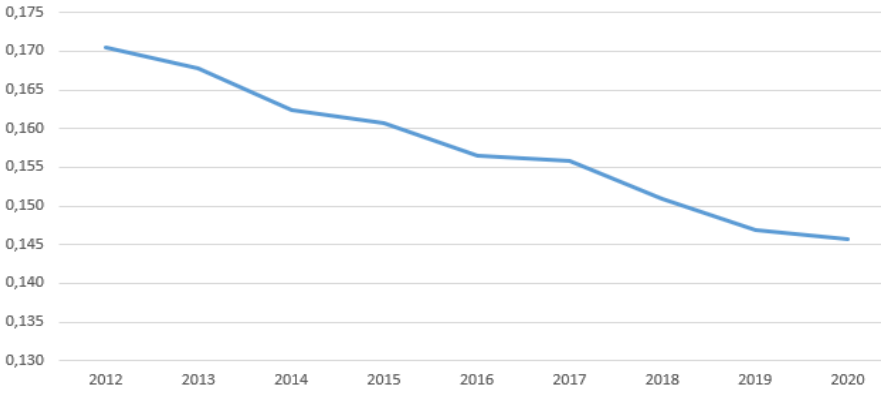
In terms of residential energy use, electricity accounts for 34% of consumption, followed by natural gas at 29%. Renewable energies account for 24%, while oil accounts for 10%. At the same time, consumption of petroleum products is declining in favour of electricity and renewable energies. Final energy consumption in the residential sector accounts for 30% of the total in France, making it the second most energy-intensive sector after transport.

Figure 4-6 Final energy consumption of the residential sector in 2012 and 2021 (TWh)



Source: SDES (2022), Key energy figures

Figure 4-7 Average CO emissions$_2$ per kWh in dwellings (kgCO_2 /kWh)



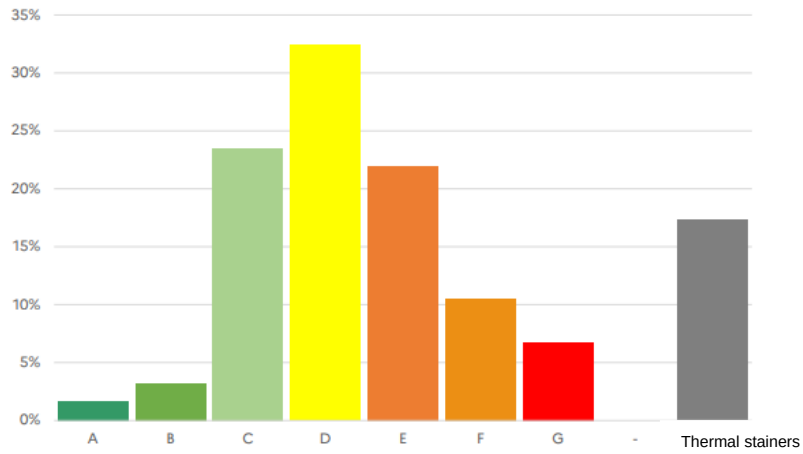
Source: SDES (2022)

[29] https://www.effinergie.org/web/labels/patrimoine
[30] https://www.rehabilitation-bati-ancien.fr/

While energy consumption in the residential sector (and buildings in general) has fallen relatively little, the same cannot be said for greenhouse gas emissions. The effects of public policies aimed at reducing these emissions and decarbonising the energy mix are visible, with a 15% reduction in average emissions per kWh in housing in 2020 compared with 2012. This reduction accelerated in 2017 thanks to the various laws and strategies put in place in 2015 (LTECV, SNBC).

In terms of energy efficiency, of the 30 million primary residences in France, a further 5.2 million are considered to be "thermal flats", i.e. they have a DPE label rated F or G. By contrast, only 5% of the housing stock (1.5 million) has a low energy consumption rating, corresponding to an A or B label.

Figure 4-8 Breakdown of ECD labels for main residences



Source: ONRE (2022), Housing stock by energy performance class at 1er January 2022

As part of the decarbonisation of the residential sector, a significant proportion of homes heated by fossil fuels will have to change energy source within 30 years. This is essential if France is to achieve its goal of carbon neutrality by 2050. However, the switch to decarbonised energy sources raises challenges for the building sector and the jobs, trades and skills associated with it, which will require in-depth assessment. Nevertheless, certain issues can already be identified:

- The ability to integrate decarbonated energies depends very much on the structure of the building in question. For example, there are currently no affordable decarbonisation solutions for certain configurations, such as apartment blocks with individual gas heating.
- New technologies, including heat pumps, therefore need to be deployed in other markets that are better suited to them. This is particularly true of existing single-family homes that are currently heated with gas or oil. However, these are also the markets where project owners receive the least support. In these cases, contractors play an essential role, and must be fully trained in the installation and maintenance of heating systems.

Organisational disparities

In addition to the technical and architectural disparities in the housing stock, it is also worth highlighting its diversity in terms of owners and their methods of organisation[31] . The possibilities for intervention are closely linked to the owner, and contracts must be adapted to the owner's specific constraints.

[31] ADEME (2020), Energy and environmental renovation of tertiary buildings. https://librairie.ademe.fr/urbanisme-et-batiment/487-renovation-energetique-et-environnementale-des-batiments-tertiaires-9791029715389.html

Figure 4-9 Condominiums as a proportion of the housing stock (%)

Social housing	11.8
Other accommodations	88.2
Condominiums	28.1
Single-ownership housing	60.1
Together	100.0

Field: Metropolitan France.
Reading: 28.1% of housing belongs to a joint ownership, excluding social housing.

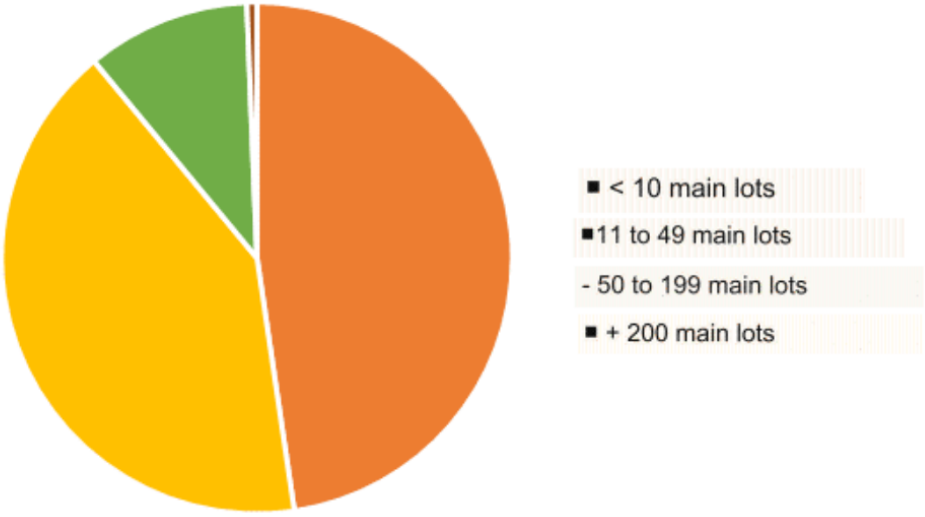
Source: Filicom (2013)

Through their tendering procedures, social landlords mainly maintain relationships with medium-sized to large companies. They play a leading role in promoting ambitious solutions, whether by obligation or by choice, both in terms of the performance levels targeted during renovation and the systems and technologies implemented in the buildings.

Private homeowners, whether or not they occupy their own homes, are a priority target for energy and climate policies because of the potential energy savings they represent. There are many issues at stake in this segment, and the markets are evolving rapidly to meet renovation needs, both for construction companies and for diagnosticians, auditors and renovation consultants.

In the private housing sector, there will be 541,903 co-ownerships registered in France in 2022, representing 28% of the housing stock[32] . This market is highly diverse, particularly in terms of the companies involved in running and renovating these properties, which can vary considerably in size. Small condominiums with fewer than 10 units account for almost half of all condominiums in France.

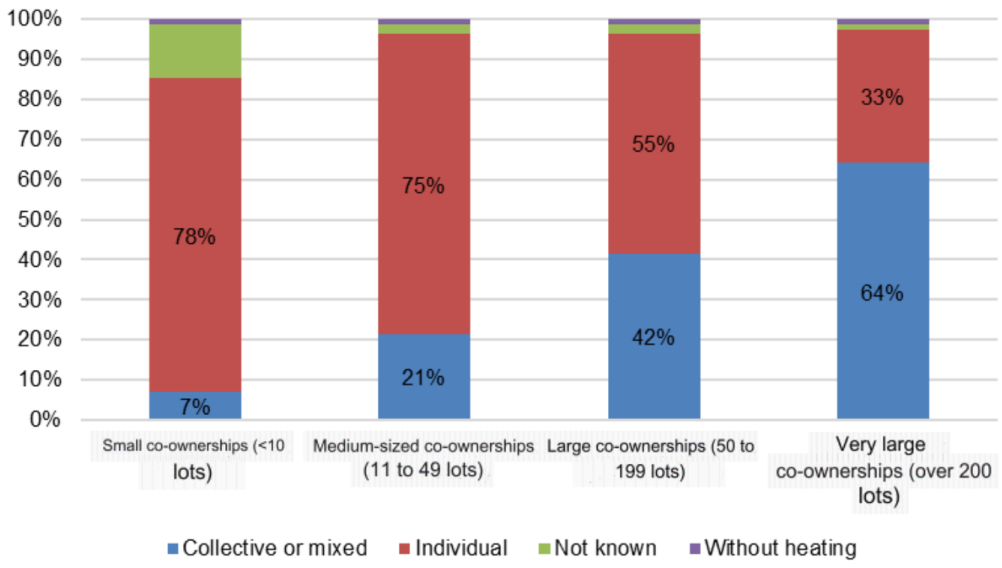
Figure 4-10 Distribution of condominiums in France



Source: Anah, According to the co-ownership register

[32] Register of co-ownerships. https://www.registre-coproprietes.gouv.fr

Figure 4-11 Heating systems by type of condominium (%)



Source: Anah, According to the co-ownership register

Most small condominiums have individual heating systems. The larger the number of units in a condominium, the more it is supplied by a collective heating system.

Special case of small co-ownerships

Small condominiums represent a major challenge for energy renovation. In fact, sociologist Gaëtan Brisepierre described them as the blind spot in energy renovation in his report on small condominiums and energy renovation[33] .

Half of France's condominium stock is made up of small properties with fewer than 10 lots, and almost 85% with fewer than 20 lots. What's more, 80% of these small condominiums are heated by an individual system. 35% of condominiums with fewer than 10 lots were built before 1949.

Small co-ownerships in particular are at stake: they often combine the difficulties associated with single-family homes (high cost of studies and works, because the cost of works, partly independent of the number of dwellings, is divided by a small number of co-owners, and the share per co-owner is much higher than in a large co-ownership) and co-ownership (complex collective management requiring a vote on works). What's more, small co-ownerships are often the most run-down and dilapidated (of the 100,000 buildings identified as vulnerable, 75% are co-ownerships with fewer than 11 lots). The fact that heating is often individual means that it is impossible to take action to improve the efficiency of communal areas. For all these reasons, specific support must be defined to facilitate the treatment of these buildings.

Focus on fuel poverty

Poor energy performance can put households in a situation of fuel poverty. This is defined by the Observatoire National de la Précarité Énergétique as a situation in which a person *"experiences particular difficulties in obtaining the energy supply necessary to satisfy their resources or living conditions"*[34] . During the winter of 2020-2021, 20% of French people said they had suffered from the cold for at least 24 hours, and 36% of them attributed this situation to financial constraints. What's more, 60% of French people said they had turned down the heating at home to avoid high bills[35] . In 2021, because of the health situation, a quarter of French households had difficulty paying their energy bills. The 18-34 age group is particularly hard hit, with 46% in 2021, compared with 32% in 2020.

The Energy Effort Rate (TEE_3D) is estimated annually by the French government. A household is in a situation of fuel poverty when its energy expenditure on housing exceeds 8% of its income and it is one of the

[33] G. Brisepierre (2023), Les petites copropriétés et la rénovation énergétique : une première approche. https://politiquedulogement.com/2023/01/les-petites-coproprietes-et-la-renovation-energetique-une-premiere-approche/
[34] ADEME (2023), La précarité énergétique suivie par l'ONPE au sein de l'ADEME. https://expertises.ademe.fr/batiment/quoi-parle-t/precarite-energetique-suivie-lonpe-sein-lademe
[35] ONPE (2022), Key figures on fuel poverty

lowest 30% of households. The weather-corrected indicator, as shown in the graph below, neutralises the effect of the weather on heating consumption from one year to the next.

Figure 4-12 Change in the percentage of French households in fuel poverty between 2010 and 2020

Source: ONPE (2022), Tableau de bord de la précarité énergétique, According to the TEE_3D tool

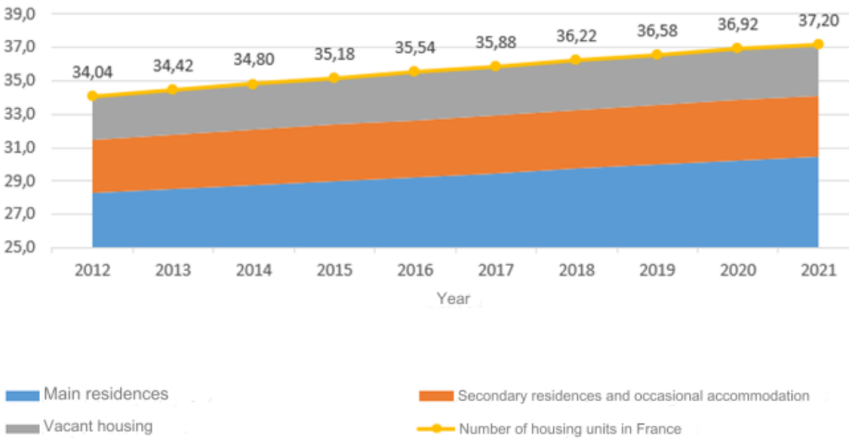
At local level, the Slime programme, set up in 2013 by the CLER energy transition network, takes a more practical approach than a statistical one. Its aim is to help local authorities identify households in fuel poverty and support them in improving their situation.

This issue is of particular importance in the current context, especially in view of the energy crisis in 2022-2023, which could have led to a significant increase in energy bills for households without the application of the tariff shield on energy supply contracts. The end of this tariff shield, combined with energy costs that may not return to pre-crisis levels, could lead to a significant increase in the fuel poverty rate, as well as energy saving measures and demand for energy renovation work.

4.2.1.3 Towards a slowdown in the new-build sector housing

The number of homes in France has risen almost linearly since 2012, reaching over 37 million in 2021 (+9% on 2012), of which 30 million are primary residences. Over this period, the residential sector has undergone significant changes to comply with the numerous regulations that have been introduced. Indeed, national carbon neutrality targets have led to the adoption of a strategy aimed at reducing consumption and emissions, with the building sector clearly identified as one of the key sectors.

Figure 4-13 Change in the number of dwellings in France between 2012 and 2021 (millions of dwellings)



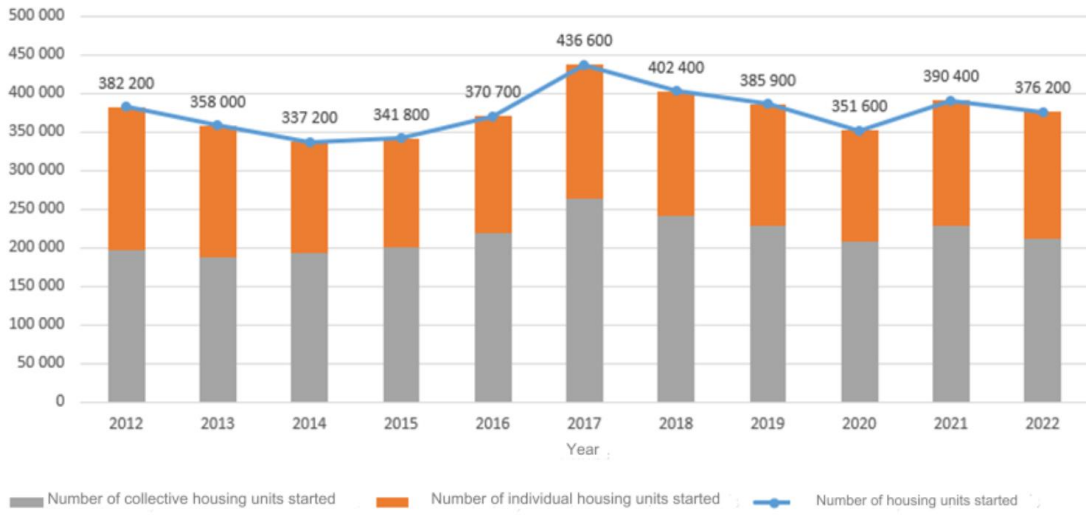
Source: SDES (2022), Key housing figures

These findings have given rise to targets for decarbonising and improving the energy performance of buildings, focusing primarily on the residential sector. Various plans and regulations, both for construction (RT2012, RE2020) and for existing buildings (LTECV, Plan de rénovation énergétique des bâtiments, Loi Climat et Résilience), have established energy performance criteria and thresholds. Public policy has changed direction, moving from incentives to obligations. In particular, this has resulted in an increase in the importance of the DPE, which has become the main tool for assessing the performance of existing buildings, and which has been associated with renovation obligations, aimed in particular at eliminating homes described as "thermal wastes".

Homes built since 2012

As a result of the 2008 property crisis, the total surface area of buildings started each year fell until 2015, when it reached a level below 52 million square metres. From 2016 onwards, the building sector began to recover, resulting in an increase in the surface area of construction projects, in both the residential and tertiary sectors. Between 2017 and 2019, this surface area stabilised at around 60 million square metres, before declining in 2020 as a result of the health crisis (a 12% fall in surface area under construction compared with 2019).

Figure 4-14 Number of housing starts per year between 2012 and 2022



Source: SDES (2022)

Following the end of the health crisis, the construction sector has seen a rebound. Since 2021, the total surface area of construction projects under way has stabilised, although the number of housing starts appears to be on a downward trend. From 2022 and early 2023, many industry players are reporting a significant decline in the new housing construction market[36] . In 2022, construction of new homes fell by 31%, while multi-family housing fell by 14%. At the same time, the rate of sales cancellations has increased. This significant fall can be attributed to a number of factors, including banks' cautious approach to granting loans, the abolition of the Aide Personnalisée au Logement (APL) for first-time buyers, the reduction in the PTZ in certain areas, and the rising cost of building materials. The climate of inflation and uncertainty about purchasing power has ultimately deterred the most modest households from going ahead with their property projects. According to the FFB, this downturn could lead to the loss of 100,000 jobs by the end of 2023[37] .

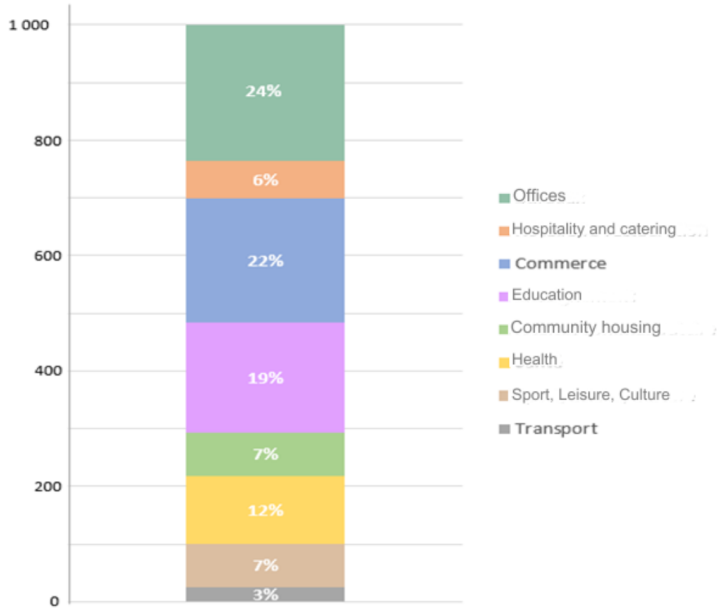
A number of players are already reacting to these forecasts to develop their businesses. In an interview with Le Moniteur, the Chairman of the Management Board of the GCC Group predicts that by 2030, half of the construction sector's activity will be devoted to renovation and refurbishment, compared with the current figure of 25%[38] .

4.2.1.4 Commercial park with a variety of uses and occupancies

The tertiary sector currently covers a heated surface area of more than one billion square metres and contributes 17% of the country's total energy consumption, or 261 TWh in 2021. The public sector accounts for almost 40% of the total surface area of the country's tertiary buildings. The various activities within this sector can be broken down as follows:

[36] FPI (2022), L'hiver du logement neuf : un marché sans offre et sans demande ; FFB (2022), Bilan 2022 et prévisions 2023
[37] Batiweb (2023), The new housing crisis could destroy 100,000 jobs, according to the FFB. https://www.batiweb.com/actualites/vie-des-societes/la-crise-du-logement-neuf-pourrait-detruire-100-000-emplois-selon-la-ffb-42114
[38] Le Moniteur (2023), Renovation will account for half of construction activity in 2030. https://www.lemoniteur.fr/article/entreprise-la-renovation-pesera-la-moitie-de-l-activite-construction-en-2030-francois-teste-du-bailler-president-du-directoire-de-gcc.2265371

Figure 4-15 Breakdown of commercial property by type of premises (floor area in millions of m²)



Source: CEREN (2020)

Figure 4-16 Tertiary sector consumption per m² per year in 2015 (kWh/m²)

	Total	Heating
Industry average	**233**	**111**
Administration, offices	260	120
Shops	240	90
Cafes, hotels, restaurants	370	138
Education	140	95
Health	239	119

Source: CEREN (2017), Monitoring energy consumption in the tertiary sector, mainland France (climate-corrected data)

Heating remains the main use in the tertiary sector, accounting for 47% of energy consumption in 2015, although some uses can vary considerably depending on building occupancy. Retail, offices and education account for the largest areas heated. Offices, in particular, cover almost a quarter of the total surface area. However, uses can vary greatly for certain occupancies, such as shopping centres or large offices, where lighting and air conditioning account for the majority of the building's energy consumption.

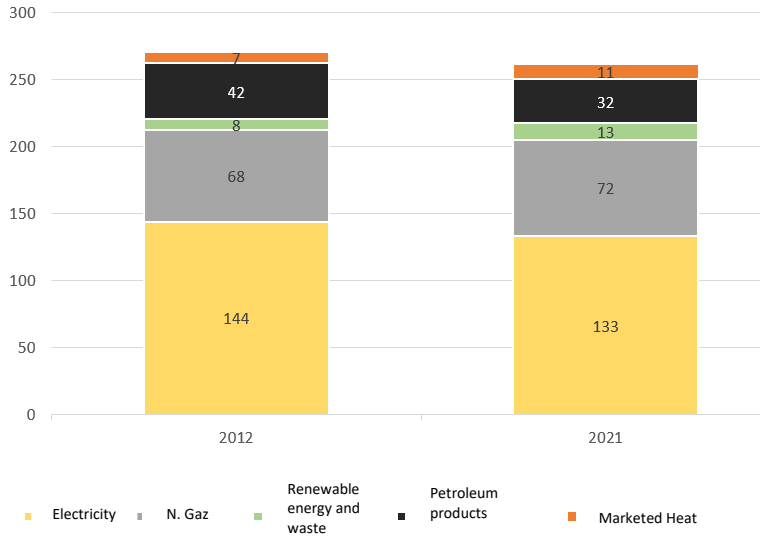
As in the residential sector, the size of commercial buildings and premises has a major impact on the resources available for action.

The proportion subject to the tertiary sector decree corresponds to around 68% of the total surface area of the tertiary sector, according to the estimate in the impact study for the Tertiary Eco-Energy Decree (DEET), which will be updated following the declarations in OPERAT[39] .

[39] This estimate is based on the ratio between the surface area of exclusively tertiary buildings in single ownership (548 million m²) and the total surface area of exclusively tertiary buildings in single ownership (809 million m²). As DEET does not only apply to single-ownership tertiary buildings, we will wait for the figures from the OPERAT declarations to know more precisely what surface area is concerned. Source: Decree on obligations to reduce energy consumption in tertiary buildings. https://www.legifrance.gouv.fr/contenu/Media/Files/autour-de-la-loi/legislatif-et-reglementaire/fiches-d-impact/fiches-d-impact-decrets/2019/fi_logl1909871d_2019_04_23.pdf.pdf

The "Analysis of the stock" study by the Programme de la Filière pour l'innovation en faveur des Économies d'Énergie dans le bâtiment et le Logement (PROFEEL) provides a map of the tertiary sector stock not subject to the tertiary sector decree.

Figure 4-17 Final energy consumption of the tertiary sector in 2012 and 2021 (TWh)

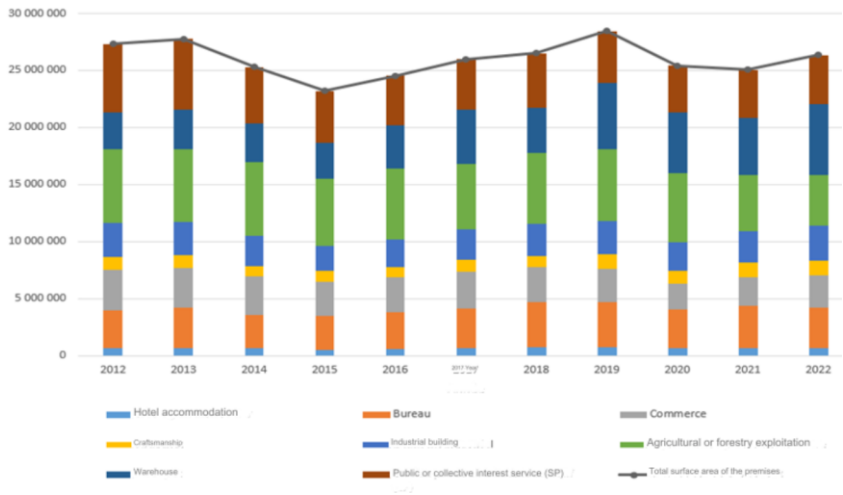


Source: SDES (2022), Key energy figures

Electricity accounts for just over half of the tertiary sector's energy mix (52%), gas for 28%, oil for 13% and renewable energies for 4%, which is as much as district heating, which also makes up 4% of the sector's energy mix.

While the sector has been heavily involved in improving energy performance since 2019, it has also been impacted by changes in usage that have been accelerated by the health crisis and the various periods of confinement. To adapt to changing working patterns, offices are being reorganised. The spread of teleworking and digital tools is redefining the working environment and office property. Today's office buildings need to be more flexible and service-oriented than ever before. Office space is shrinking, leaving space for existing buildings to be converted. The surface area of warehouses being built is increasing, while that of retail premises is decreasing, reflecting the change in consumer habits, with more and more people ordering from online platforms.

Figure 4-18 Floor area under construction in France by type of commercial building (m²)



Source: SDES (2022)

4.2.2 Energy-climate challenges for the existing housing stock

In recent years, the number of dwellings has risen steadily since 2012. However, there has been growing concern about the energy efficiency of existing homes. As previously mentioned, statistics for the year 2022 indicate that 17% of primary residences are classified as energy flats.

4.2.2.1 Definition of high-performance renovation and comprehensive renovation

Renovation to the Bâtiment Basse Consommation (BBC) label is currently regarded as an ambitious benchmark by many players in the construction industry. This requirement is set out in the decree of 29 September 2009, articles 2 and 3 of which define the minimum performance levels depending on the use of the building.

Under the "Climate and Resilience" Act of 21 August 2021, an energy renovation is defined as **efficient** when the following conditions are met the "Climate and Resilience" Act of 21 August 2021:

- The property is class A or B according to the energy performance diagnosis (DPE);
- The six areas of renovation work were studied: wall insulation, underfloor insulation, roof insulation, replacement of external joinery, ventilation, heating and domestic hot water production.

This law also introduces the concept of comprehensive renovation: a high-performance renovation is said to be comprehensive when it is carried out within the following timeframes:

- Eighteen months for single-dwelling buildings or parts thereof
- Twenty-four for the others

The definition of comprehensive renovation differs from that used under MaPrimeRénov'. In this scheme, comprehensive renovation is defined as work resulting in an energy improvement of 35% for low-income and very low-income households, and 55% for others. These same definitions are also used in the standardised operation sheets for energy saving certificates (CEE) BAR TH 164 "High-performance renovation of a detached house (mainland France)" (55% gain in energy consumption) and BAR TH 145 "Overall renovation of a collective residential building" (35% gain in energy consumption)[40] .

According to the ADEME study[41] on energy-efficient renovation in stages, there is a correlation between energy-efficient renovation and the number of stages required to achieve it. In general, the simple juxtaposition of energy-related work does not make it possible to achieve long-term energy performance, and each additional stage of work reduces the ability to achieve this performance. Achieving a BBC or equivalent level of renovation in the long term by following a path comprising 4 or more stages, at an acceptable cost and by 2050, seems unrealistic. This performance can be achieved in 1 to 3 stages, but only under strict conditions. The probability of achieving this performance decreases as the number of stages increases.

For single-family homes, the BBC targets set out in the SNBC will therefore be impossible to achieve through partial renovations involving too many different stages. In the case of phased energy-efficient renovations, coherent planning of the work is essential. In particular, the challenge lies in coordinating the various trades involved at different stages of the work, so that the interfaces between the elements essential to achieving optimum energy performance are properly addressed.

The "BBC by stages" programme[42] , winner of the ADEME's "Towards Sustainable Buildings" call for projects and supervised by POUGET Consultants and the Effinergie collective, also recommends that if renovation by stages is envisaged, the first group of works should be substantial and prioritise the treatment of the building envelope and ventilation. To achieve this, it is essential to provide training and specific tools for dealing with interfaces.

In 2022, the Institut du Développement Durable et des Relations Internationales (IDDRI) and ADEME called for the concept of energy-efficient renovation to be extended beyond energy criteria. This proposal aims to take into account aspects such as adaptation to climate change, the environmental impact of the materials used, the fight against fuel poverty, as well as the living comfort and health of occupants.

[40] BAR TH : Residential buildings - Thermal
[41] ADEME (2021), Efficient renovation in stages
[42] https://www.bbc-par-etapes.fr/

The report recommends that this new approach to high-performance renovation should be clearly defined, and that financial support should be progressively and massively directed towards this type of renovation. It also suggests increasing this support and mobilising private funding. At the same time, a major communication campaign aimed at raising public awareness of BBC renovation should be put in place[43] .

Some players in the building industry, noting the difficulty of creating a lasting momentum, are expressing doubts about the possibility of making comprehensive renovation the norm across the country. They feel that mass renovation is a priority if the national targets are to be met, even if they do not meet the criteria for high-performance comprehensive renovation.

A number of studies have also highlighted the reasons why technicians' vision of comprehensive renovation only partially meets the needs of households[44] . Without claiming to be exhaustive, sociology identifies several obstacles, such as the construction of a renovation path that depends on a life project and is therefore not predictable, the risk of debt generated by energy work, and the need for openness, perspective and enlargement of the home, which can be contradictory with the logic of reducing energy consumption.

The following boxes present ways of developing high-performance renovation.

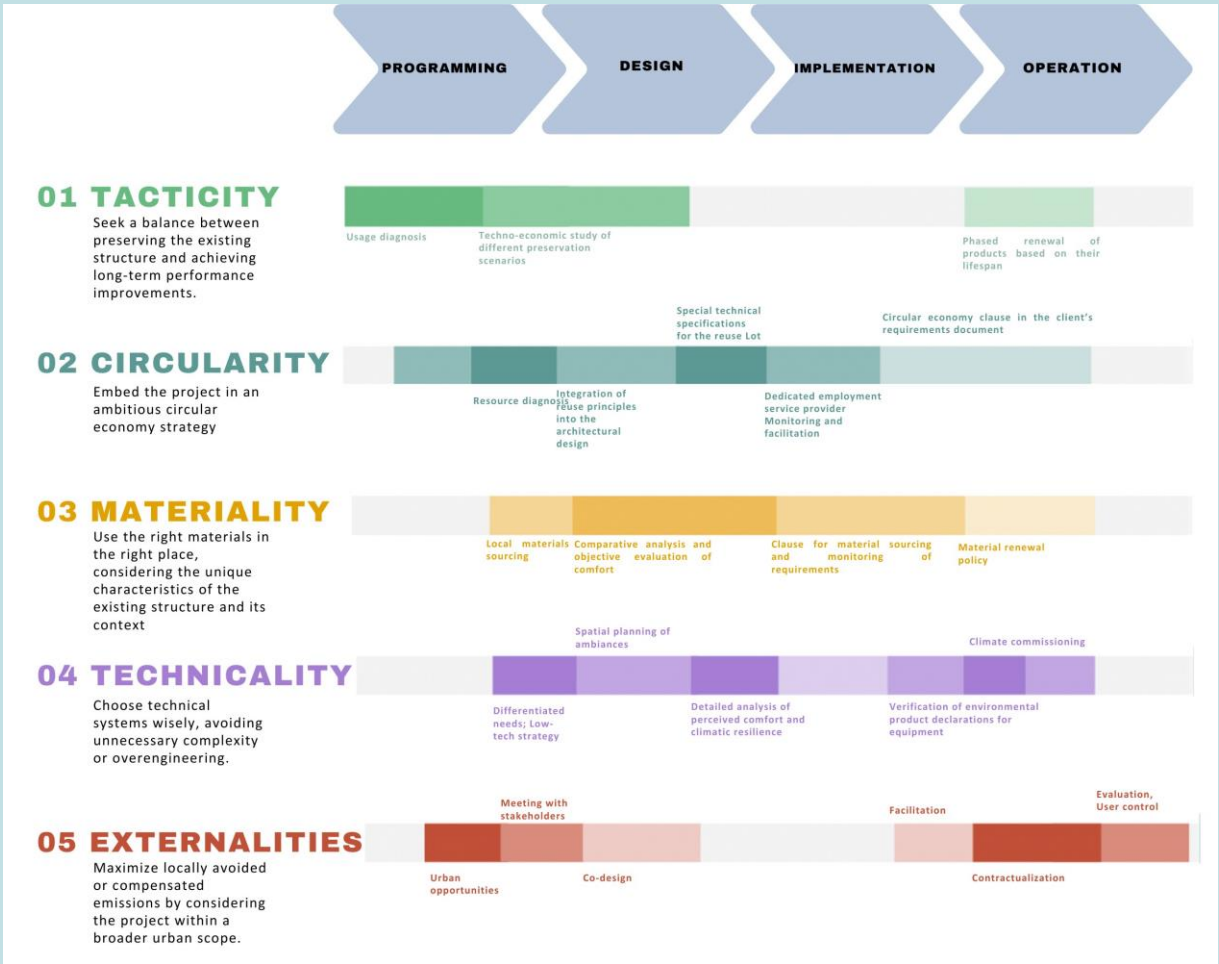
[43] IDDIR (2022), What are the priorities for implementing ecological planning in the energy renovation sector? https://www.iddri.org/fr/publications-et-evenements/billet-de-blog/quelles-priorites-pour-mettre-en-oeuvre-la-planification
[44] Viviane Hamon, Leroy Merlin for ADEME (2020), Explorer le temps du chantier ; Viviane Hamon, Lionel Rougé, Hortense Soichet, Leroy Merlin for ADEME (2022), Réenchanter le pavillonnaire urbain des années 50-70 (Reenchanting the urban housing of the 50s and 70s).

Net Zero Carbon Renovation Programme

In January 2020, the Alliance Haute Qualité Environnementale - Green Building Challenge (HQE-GBC) launched the Net Zero Carbon (NZC) programme, which includes a renovation component. The aim of the programme, funded by the REDEVCO Foundation, is to identify a method for reducing carbon emissions in the French renovation market. The work therefore deals with LCAs of renovation work carried out for 7 cases under study, representative of the diversity of building typologies, assets, locations and project scales in France. The study identified 5 levers for genuinely low-carbon renovation:

- Tactical: striking the right balance between preserving existing assets and improving performance over the long term
- Circularity: making the project part of an ambitious circular economy strategy
- Materiality: integrating the right material in the right place, drawing on the unique features of the existing building and its context
- Technicality: choose technical systems with discernment, avoiding complex or additional systems
- Externalities: maximise the emissions avoided or offset locally as a result of the project by surveying a wider urban area.

These levers come into play at different stages of the renovation process.



Source: Alliance HQE (2022), Low-carbon levers booklet

Third-party financing company

Third-party financing companies are public or semi-public bodies offering integrated technical, financial and support solutions for energy-efficient home renovation. They are defined in articles L. 381-1 et seq. of the French Construction and Housing Code. They have been set up mainly on the initiative of local authorities, and their status enables them to offer technical and economic support to individual homeowners and co-ownerships.

In addition to the technical offer, third-party financing companies provide the project owner with a financing service for the renovation project, either through direct financing (as an exception to the banking monopoly from which they benefit), or indirectly through their status as bank intermediaries (brokerage).

Their range of financing solutions makes it possible to carry out a high-performance renovation project by offering financing solutions tailored to the needs of households:

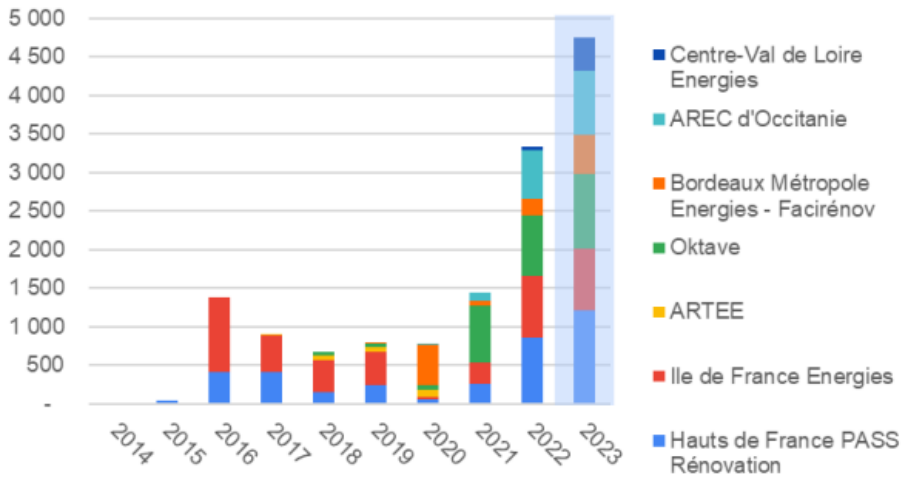
- Pre-financing of grants and loans ;
- The energy savings generated by the work are taken into account in the financing plan, and repayment periods are spread out (15 to 25 years depending on the work);
- Group loans to condominiums, which are currently not widely distributed by the banking sector.

The organisations are grouped together within the Serafin association (territorial renovation, support and financing service). This network is made up of Third-Party Financing companies (STF) and a number of partners who provide them with technical, economic or organisational support. In 2023, there will be 6 third-party financing companies:

- The Hauts-de-France Region's Public Service for Energy Efficiency (SPEE) regional authority
- Île-de-France Energies
- Bordeaux Métropole Énergies, which is developing its offer under the FaciRénov brand.
- Oktave in the Grand-Est Region
- Centre-Val de Loire Energies
- The Agence Régionale Énergie-Climat (AREC) of the Occitanie Region with its Rénov' Occitanie offer

The number of renovation projects carried out by these companies has risen sharply since 2020.

Figure 4-19 Total number of renovation projects undertaken by third-party financing companies



Source: Serafin Association (www.serafin-renov.fr)

4.2.2.2 The private residential energy renovation market is heavily dependent on financial aid

Over the past decade, France's energy renovation support schemes have evolved significantly, playing a central role in boosting the market for energy improvements to the housing stock.

Table 4-1 Amounts allocated in 2022 through the various energy renovation support schemes (€M)

Financial assistance for energy renovation	Amount allocated in 2022 (€M)
MaPrimeRénov'	2 326,5 (2022)
MaPrimeRénov' Sérénité	592 (2022) [45]
Zero rate eco-loan (Eco-PTZ)	No data
Helping you save energy	See if data
CEE	See if data
5.5% VAT	No data
De Normandie device	No data
Exemption from property tax	No data
Local aid	No data

Sources: Anah; Serafin Association (www.serafin-renov.fr)

In 2013, the Tax Credit for Energy Transition (CITE) was introduced to encourage homeowners to undertake energy renovation work in their homes. Then, in 2014, the zero-rate eco-loan was introduced to make it easier to finance this work. In 2015, the Energy Savings Certificate (CEE) scheme was strengthened to encourage energy suppliers to promote energy renovation.

In 2019, the CITE was replaced by a flat-rate bonus called MaPrimeRénov', accessible to all homeowners, regardless of their tax situation. In 2021, MaPrimeRénov' has been strengthened and extended to include condominiums, landlords and low-income households, who will benefit from a special scheme. At the same time, the CEE scheme has also been strengthened in 2021, by encouraging a comprehensive approach to work with a minimum energy savings target, as well as the energy renovation of tertiary buildings.

What's more, some local authorities can provide additional financial support, as is the case with the Normandy Region and its Chèque Éco-Energie, which has funded more than 6,000 renovation projects since 2018, 15% of which were aimed at BBC level, or the Effilogis scheme run by the Burgundy-Franche-Comté Region.

To sum up, energy renovation support schemes in France have evolved over the last decade, from a tax credit to a flat-rate bonus, with additional measures to encourage energy renovation in condominiums, rental housing and tertiary buildings.

It is difficult to accurately assess the real effectiveness of the various aid schemes. Although data on the number of renovations benefiting from financial aid is available, grant application files may not provide detailed information on the initial energy source and the surface area of the dwellings. Furthermore, without data on actual energy consumption after the work has been carried out, it is impossible to assess the real effectiveness of the renovation, or even the extent of any rebound effect. The energy savings indicated are generally based on conventions, but the performance gain from a renovation depends on a number of criteria, such as the type of building, the type of renovation (phased, comprehensive, or as part of a renovation programme towards BBC or "BBC compatible" level), and the quality of the work carried out.

It should be emphasised that a heating system cannot achieve optimum performance without insulating the building envelope, which should be considered the first and most important step in any energy renovation process. The Observatoire National de la Rénovation Énergétique (ONRE) has carried out a study to estimate the total number of renovations carried out and the associated theoretical energy gains as a function of the number of measures taken. It should be noted that the simple sum of the measures taken does not make it possible to achieve BBC level without adequate coordination of the work. Consequently, it is not possible to simply add up the energy savings to achieve this standard[46] .

[45] Anah (2022), Key figures
[46] ONRE (2022), La rénovation énergétique des logements, Bilan des travaux et des aides entre 2016 et 2019. Final results

In order to present a clear and detailed picture, the following section provides an in-depth analysis based on various available data. This data includes the number of homes benefiting from financial assistance as well as the energy savings achieved according to the specific aid scheme (the years covered may vary according to each programme). Particular attention will be paid to 2019 and the results of the study carried out by ONRE.

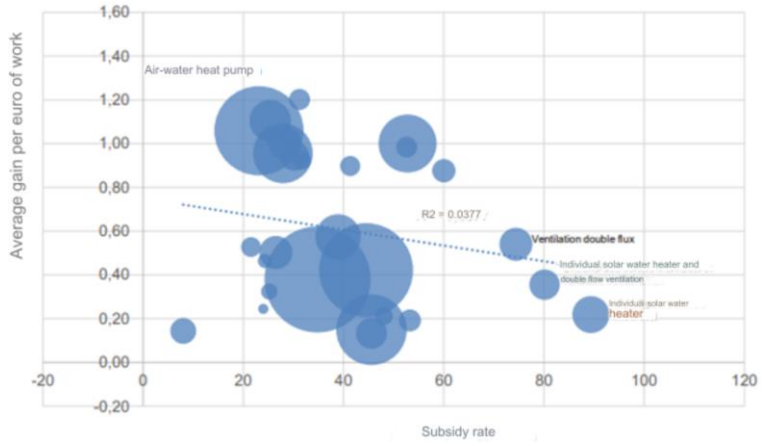
Table 4-2 Number of homes supported (thousands) and energy savings (TWh) by support scheme

Type of aid		2016	2017	2018	2019
CITE	No. of homes (in thousands)	1 196	1 398	916	876
CITE	Energy savings (TWh)	2,7	3,3	2,8	3,4
CEE	No. of homes (in thousands)	717	916	1 012	1 789
CEE	Energy savings (TWh)	2,2	2,6	2,9	5,8
Habiter mieux Sérénité	No. of homes (in thousands)	39	48	46	44
Habiter mieux Sérénité	Energy savings (TWh)	0,6	0,7	0,7	0,7
Total aid	**No. of homes (in thousands)**	**1 730**	**2 106**	**1 750**	**2 407**
Total aid	**Energy savings (TWh)**	**4,8**	**5,9**	**5,6**	**8,2**

Source: DGFiP, Anah, DGEC, renovation aid files, SDES calculations

As the CITE will be gradually replaced by MaPrimeRénov from 2020, then abolished in 2021, it is difficult to establish a diagnosis for 2020. From 2021 onwards, excluding the CEE, MaPrimeRénov' (including MaPrimeRénov' Sérénité (ex-Habiter mieux Sérénité) and MaPrimeRénov' Copro) will become the main form of public assistance, with 401,500 energy improvements assisted, representing a saving of almost 2 TWh/year[47] . The MaPrimeRénov' scheme mainly finances changes to heating systems or domestic hot water (DHW) systems (75.6% of projects assisted, including 21% for heat pumps) and, according to the France Relance Plan evaluation committee, 83% of projects undertaken in 2020 and 2021 involve a single project. By the first half of 2022, this figure will have fallen to 78%, while 16% will involve two actions. The figure below shows that the systems that generate the greatest energy gains are not those that receive the most subsidies.

Figure 4-20 Average grant awarded under MaPrimeRénov' per euro energy efficiency (kWh//€/year)



Source: France Relance (2022), Second Report of the Evaluation Committee

The renovation market is therefore very strongly structured around these subsidies. Their fluctuations have a direct impact on the associated sectors. One example is the insulation sector, which has been hit hard by changes to the CEE insulation grants and the CEE price in 2021, at the start of the 5ème CEE period.

[47] Anah, SDES calculations, Detailed data/TH 2020/TREMI 2020

The envelope renovation market fell by 22% between 2018 and 2020[48] . As a result, according to the Symbiote trade union, companies in the sector have shed 13,000 jobs in 6 months between 2021 and 2022[49] .

4.2.2.3 Focus on how public support for energy renovation in private homes takes performance into account

The evaluation of the MaPrimeRénov' scheme[50] highlights the fact that it mainly supports single-step renovations, with 83% of applications approved in 2021 (representing 55% of the amount granted). However, this proportion is declining (91% of applications approved in 2020 and 78% in the first quarter of 2022), and one of the challenges of the scheme is to increase the number of comprehensive renovations.

In order to achieve this objective, the BUS2 working groups agreed on the need for stability in the regulations, an increase in incentives for comprehensive renovation work, and simplification of the renovation process (subsidies and carrying out the work), potentially including greater support. To address this last point, Decree no. 2022-1035 of 22 July 2022 and the Order of 21 December 2022 set up the "Mon Accompagnateur Rénov' (MAR)" (My Renovation Accompanist) support service of the Service Public de la Performance Énergétique de l'Habitat (SPPEH), based on a number of principles:

- A support service offering unified technical, administrative, financial and social services;
- An approval procedure for operators wishing to provide this support service. The provision of this service is therefore reserved for accredited operators;
- Households will be required to seek assistance to qualify for certain government grants for work (MaPrimeRénov' (MPR) work packages worth more than €10k, MaPrimeRénov' Sérénité grants, Anah grants for landlords under the Loc'Avantages scheme).

According to several of the stakeholders consulted, it is imperative to ensure systematic funding of support for the comprehensive renovation of single-family homes for all households. It is also essential that the skills mobilised as part of this support include an in-depth analysis of the work planned, particularly in the context of single-family homes, where there is currently no one responsible for managing the interfaces between the different parts of the project, in order to achieve an overall performance objective. Normally part of the project manager's remit, this task does not seem to be considered essential by private individuals, and results in an increase of around 10% in the cost of the work.) For some low-income households, this type of work should therefore be covered, at least in part. However, proper management of these interfaces is a sine qua non for guaranteeing the quality of the work carried out. This aid could be linked to minimum objectives, or even concrete results. It has already been introduced at local level in some regions.

Figure 4-21 Renovations carried out by households in single-family homes, by number of actions and items renovated between 2017 and 2019

Households reporting between 2017 and 2019	Headcount (in thousands)	As a % of
No action (non-renovating households)	9 739	60
At least one action (renovating households)	6 431	40
Of which: 1 gesture	*3 147*	*20*
2 or 3 gestures	*2 260*	*14*
4 gestures or more	*1 024*	*6*
Package	**16 169**	**100**

Source: SDES (2020), Survey of energy renovation work in single-family homes (TREMI)

In 2021, according to estimates by the General Secretariat in charge of the Recovery Plan, 2,026 MaPrimeRénov' comprehensive renovation projects had been launched and almost 60,000 homes had undergone comprehensive renovation through the "Habiter Mieux Sérénité" scheme (which will become MaPrimeRénov' Sérénité in 2022) and MaPrimeRénov' Copropriétés scheme.

[48] ADEME (2022), Marchés et emplois concourant à la transition énergétique, Situation 2018-2020, Estimation préliminaire 2021, Objectifs 2023. https://www.connaissancedesenergies.org/sites/default/files/pdf-pt-vue/marche-emplois-generale-2022-synthese.pdf
[49] https://www.batiactu.com/edito/fin-coup-pouce-isolation-secteur-isolation-aurait-perdu-63617.php
[50] France Relance Plan Evaluation Committee, Second report, December 2022

The SNBC aims to achieve a current rate of 370,000 equivalent complete renovations per year, rising to 700,000 by 2030.

4.2.2.4 Self-renovation, a key issue for energy renovation in private homes

According to the TREMI survey ([51]), self-renovation now accounts for 29% of renovation work. Given the scale of the work to be carried out, this large proportion of renovation work should be studied as a means of speeding up the number of renovations, while at the same time controlling the quality of the work.

In practice, there are several types of self-renovation:

- Autonomous self-renovation, when the renovation work is carried out entirely by the homeowner, without any intervention by a building professional;
- Accompanied Self-Renovation (ARA), when the project owner undertakes work in which a company or craftsman is involved. ARA can take 2 forms:
  - Mixed self-renovation: the owner and the contractor carry out different renovation tasks or different phases of these tasks. For example, the owner dismantles the windows and carries out the finishing work (plastering and painting).
  - Cooperative self-renovation: the contractor and the professional work together on the same renovation project, at least at one stage of the project.

According to the ADEME study on international self-renovation models[52] , the perception of professionals is twofold. On the one hand, self-renovation is feared because of the risk of competition and the lack of qualifications among self-renovators. On the other hand, given the over-solicitation of craftsmen in their day-to-day work, it would not be perceived as a threat. The interviews conducted as part of this study confirm this dual perception.

An ADEME study on the economic impact of self-renovation[53] carried out interviews and surveys which show that the companies offering SCR services are building tradesmen and companies. In the majority of cases, the companies that provide SCR services are responding to a request from their customers to do the work themselves, to contribute to the project: the work that is done under SCR would not be done or would be done as a stand-alone self-renovation project. For a professional, carrying out part of a project using an ARA approach is a lever for positioning conventional services carried out by professionals on their own, thanks in particular to the savings made by the client.

While there are a number of obstacles to the development of assisted self-renovation (lack of a legal framework, lack of support and recognition for the practice, lack of financial assistance, lack of insurance cover), the system could be a major lever for mass-scale energy renovation work. However, this sector needs to be structured around the players who are most in contact with homeowners:

- Craftsmen and building and civil engineering companies, whose roles could change under certain conditions. Assisted self-renovation could, for example, make it possible to limit the arduous workload of employees and craftsmen, against a backdrop of potentially longer working hours.
- DIY superstores: in recent years, DIY superstores have developed services to help households install renovation products.
- Associations and training bodies already working on this issue.

The study of international self-renovation models referred to above has identified recommendations for France, with a view to rolling out assisted self-renovation under optimum conditions of quality and safety, while guaranteeing new markets for building professionals. The following guidelines are proposed for the training of self-renovators and accompanying tradespeople:

- Create training content aimed specifically at tradespeople who want to support private individuals who have volunteered to get involved in renovating their homes;
- Train self-renovators, targeting in particular those whose work has given rise to a vocation and who wish to retrain in energy renovation. At present, the few training courses aimed at private individuals are run by private initiatives or associations, but a home renovation project can also provide a training platform for

[51] https://www.statistiques.developpement-durable.gouv.fr/tableau-de-suivi-de-la-renovation-energetique-dans-le-secteur-residentiel
[52] Énergies Demain, Pouget Consultants pour ADEME (2022), Étude comparative internationale sur l'auto-rénovation. https://librairie.ademe.fr/urbanisme-et-batiment/5992-etude-comparative-internationale-sur-l-auto-renovation.html
[53] ADEME 2023. Assisted self-renovation. Impacts and economic prospects for construction companies

new tradespeople. The ARA worksite - as the first stage in a training programme - is still little exploited in France by the building professions and training bodies, even though it offers great potential for retraining.

4.2.2.5 RECIF programme: to support demand for renovation in condominiums

The Renovation of Co-ownership Buildings in France (RECIF) programme is run by Île-de-France Énergies and financed by Energy Savings Certificates. The programme is aimed at local authorities, with a view to mobilising and engaging them in the energy renovation of condominiums. Its aim is to *"stimulate demand for condominium renovation at an interregional level"*[54] by identifying condominiums in need of renovation, training trustees in condominium energy renovation and getting local authorities to sign commitment charters. It comprises 5 actions:

- Market analysis with the creation of tools to raise awareness and demonstrate the local dynamic
- Mobilisation of local authorities with the signing of a commitment charter
- Raising awareness among co-owners
- Raising awareness among property managers
- MOOC[55] "Réno copro" to provide free training for co-owners and property professionals. The MOOC is free and online (over 7,400 people have already signed up for the first 3 sessions). [56]

The programme is divided into 2 phases. The first phase of RECIF from 2018 to 2021 was deployed in 4 regions (Île-de-France, Hauts-de-France, Nouvelle-Aquitaine and Grand-Est) with a budget of €2,845,000. It has enabled:

- Save 1,420 GWh or 271,737 tonnes of CO_2
- 49 communities to benefit from the programme
- Analysis of 91 regions (including 65 in the Paris Region)
- Reaching 317,275 homes, in particular through letters sent to 4,360 condominiums and 1,365 letters sent to property managers
- Organising 159 events attended by over 4,000 people

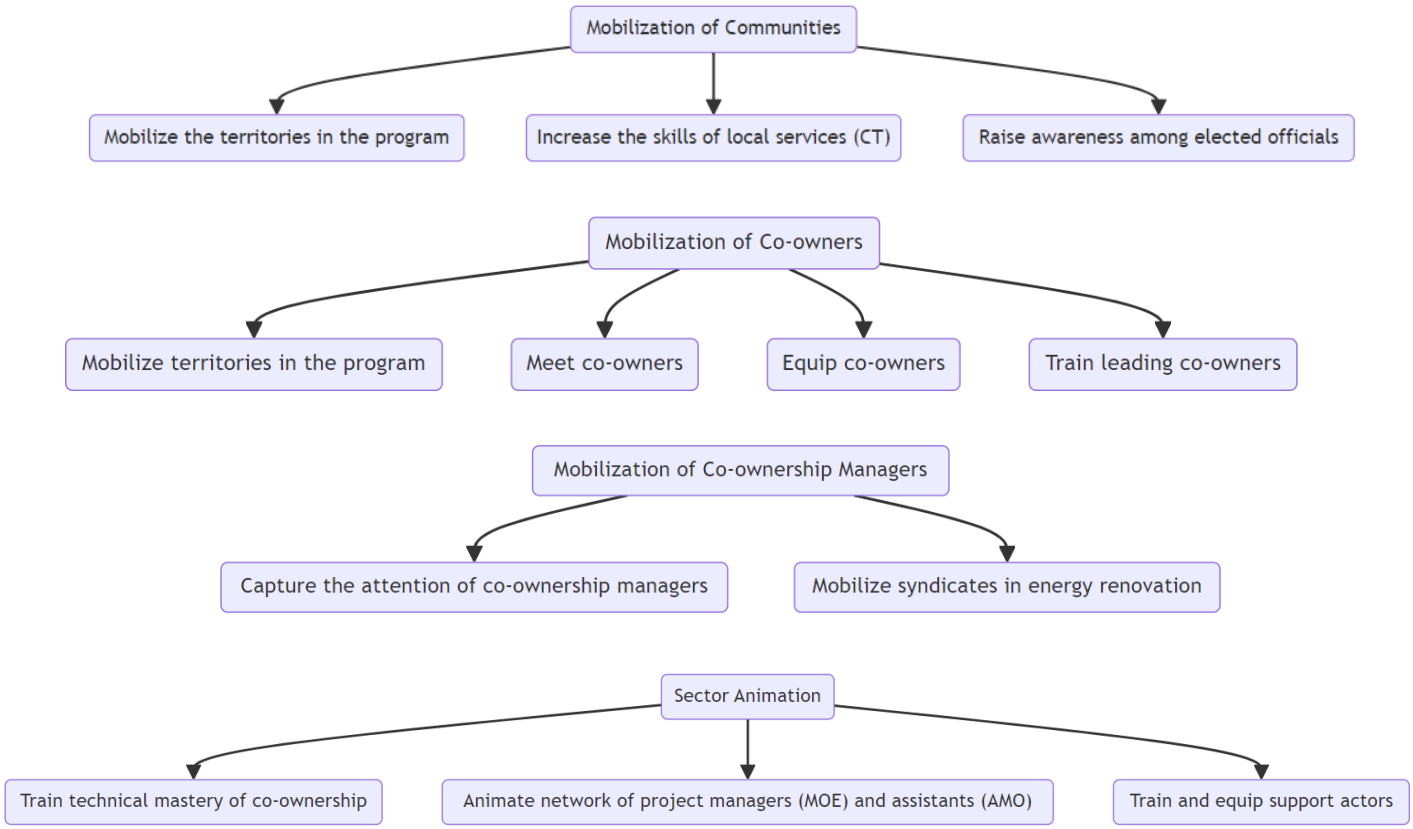
A total of 306 condominiums, or 20,567 homes, have undergone renovation as a result of the RECIF programme.

The second phase of RECIF (RECIF +) has an allocated budget of €14 million. This phase is even more ambitious than the first, with a dedicated volume of 1,957 TWh cumac over the period 2021-2023. The programme is funded by Antargaz, Électricité de France (EDF), Enercoop and Gaz Européen. The aim of this phase is to consolidate and roll out RECIF throughout France. The co-ownerships targeted are those with more than 10 lots, whereas those previously targeted were those with more than 50 lots.

[54] https://www.facirenov.fr/programme-recif/
[55] MOOC: Massive Open Online Course
[56] Île-de-France Énergies, RECIF: from season 1 to season 2. https://www.iledefranceenergies.fr/recif-de-la-saison-1-a-la-saison-2/

RECIF + is organised around 4 themes:

Figure 4-22 RECIF + programme: four areas of focus



Source: Île-de-France Énergie[57]

The main objectives of the programme are as follows

- Mobilise 60 local authorities and their associated operators, selected under a Call for Expressions of Interest (AMI) launched on 11 October, with turnkey action programmes;
- Training and raising awareness among local authority employees and elected representatives;
- Reach 15,000 condominiums and 1,125,000 homes by mail;
- Organise 360 awareness-raising events;
- Offer 500 days of training to condominium managers;
- Train 2,500 people through the Réno Copro MOOC, the 4th session of which opened on 9 November;
- Organising and leading the energy renovation sector for condominiums: project management assistance, project managers, design offices, architects.

4.2.2.6 Renovation challenges for social housing

Social rented housing is described by the government as "among the most exemplary" in terms of energy performance, with only 25% of dwellings having an EPD class of E, F or G (compared with 41% for the existing residential stock)[58] . According to a study by the Agence Nationale de Contrôle du Logement Social (ANCOLS) published in 2022, 10% of social landlords' housing stock has undergone renovation work including thermal improvements over the last 5 years. This renovation of the social housing stock is also well spread across all the landlords. The cost of thermal renovation varies widely (from less than €5,000 to €35,000 per dwelling), which can be explained by the differences in the scale (performance and volume) of the work carried out.

[57] https://www.iledefranceenergies.fr/recif-de-la-saison-1-a-la-saison-2/
[58] MTE (2021), Energy renovation of social housing: 10 projects have been selected to facilitate the development of an industrial offering for the renovation of social housing. https://www.ecologie.gouv.fr/renovation-energetique-du-parc-logements-sociaux-10-projets-ont-ete-selectionnes-faciliter

However, it should be noted that the majority (54%) of renovations carried out by landlords cost between €5,000 and €15,000 per home. As part of the same study, the questionnaire sent out to landlords enables us to find out more about their renovation strategies, their motivations and the implementation of projects. The following are some of the key findings:

- 59% consider that their strategy is to treat as many homes as possible, while 25% aim for performance and a significant improvement in the efficiency of the homes renovated.
- For 80% of respondents, this strategy is motivated by the landlord's political will to improve the energy performance of its properties and, to a lesser extent (60%), to combat fuel poverty. Fewer than half (44%) believe that this approach is linked to conventional constraints on eliminating the most energy-intensive housing.
- The main obstacle to renovation, in the opinion of landlords, remains the financing of operations.
- When it comes to their energy renovation projects, landlords are most interested in the skills of thermal engineers, ahead of architects (who are involved in operations to modify the building envelope or layout). The difficulty of finding these skills is minimal.
- Unlike in the private sector, the main areas renovated are ventilation, external wall insulation and replacement joinery. One possible explanation for this is that the majority of renovations carried out in social housing are accompanied by support, and are therefore aimed primarily at improving the performance of the building envelope.

The levers for improvement for the social housing stock relate to the proportion of individual dwellings that have undergone less renovation, as well as analysing the performance actually achieved after renovation.

The various types of **financial assistance available** to social housing landlords are as follows:

- Reduction in property tax on built-up properties (TFPB) and reduced VAT (5.5% for energy-related work);
- State subsidies ;
- CEE ;
- Eco-conditioned financing such as Eco-PLS.

One of the major challenges facing social housing is the proportion of homes heated with gas (58% according to ANCOLS). In addition to the need for energy renovation, energy switching is a major challenge for the sector, as identified by the players interviewed.

The social housing sector also has a dedicated continuing professional development centre for its employees and managers called AFPOLS (Association pour la Formation Professionnelle Continue des Organismes de Logement Social), which trains more than 12,000 people a year. The association organises more than 300 inter-organisation training courses covering all the structural changes in the sector, including social contracting for the rehabilitation and improvement of housing assets, sustainable construction, the circular economy and biodiversity.

4.2.3 Energy-climate issues for the existing tertiary sector

Until 2019, less attention was paid to the energy performance of buildings in the tertiary sector even though, in terms of GHG emissions, the sector ranks at the foot of the podium after transport, residential and industry. Enacted at the end of 2018, the ELAN law included an obligation in the Construction and Housing Code to reduce the energy consumption of tertiary buildings. Decree no. 2019-771 of 23 July 2019 sets out the conditions for applying this measure. For public or private tertiary buildings with a surface area of 1,000 m² or more, the expected energy gains are:

- By 40% in 2030
- By 50% in 2040
- By 60% in 2050

The reduction is calculated in relation to a 12-month reference period chosen between 2010 and 2019 by the building owner. The decree has been translated into operational terms by the Eco Énergie Tertiaire scheme, based on the OPERAT platform, which collects and tracks consumption data for the tertiary sector. Actions aimed at reducing energy consumption in buildings subject to the tertiary sector decree are currently mainly focused on optimising energy systems (see section 5.1.10.7 on the digital challenge of BACS) and reducing energy use. However, for the majority of uses, reaching the highest thresholds will undoubtedly require an increase in the number of measures taken to renovate the building envelope, particularly for uses requiring significant heating consumption.

4.2.3.1 Focus on Energy Performance Contracts

Energy Performance Contracts (EPCs) are an important tool in the transition to more energy-efficient buildings. They aim to improve the energy efficiency of buildings by guaranteeing energy savings over a given period. Since 2016, ADEME, CSTB and CEREMA have been working together within the Observatoire National des Contrats de Performance Énergétique (National Observatory of Energy Performance Contracts) to conduct an analysis of the French CPE market and make the most of feedback. All the data cited in this article and the documents produced by the observatory can be downloaded free of charge from the "observatoirecpe.fr" website.

EPCs are used in both the public and private sectors, with a variety of buildings involved such as schools, administrative buildings, sports and cultural facilities, hospitals, etc. Over the past six years, more than 500 EPCs have been implemented in France, demonstrating the growing adoption of this contractual model.

The results of EPCs are encouraging. On average, buildings that have benefited from an EPC have managed to reduce their energy consumption by around 30%, often exceeding the targets initially set. These energy savings were achieved by implementing measures such as thermal insulation, replacing heating and lighting systems, optimising equipment and raising occupant awareness.

An analysis of the types of EPC reveals a variety of approaches to setting up these contracts. Some EPCs are based on guaranteed results, where the energy savings achieved are contractually taken into account. Other EPCs are based on guarantees of means, where the service providers undertake to implement specific measures to improve the energy performance of the buildings. This variety of contractual models offers flexibility and adaptation to the specific needs of each project.

The EPC Observatory plays an essential role in monitoring and evaluating EPCs. It enables data to be collected and analysed, providing a global view of building performance and energy savings achieved. This data-driven approach also facilitates learning and the exchange of experience between the various players in the sector. However, there are still challenges to deploying EPCs. Access to finance, administrative complexity and the need for specific technical skills are all factors that can hamper their implementation. It is therefore important to continue to support and promote these contracts, by simplifying procedures and strengthening financial incentives, in order to accelerate their widespread adoption.

4.2.3.2 Focus on Diag Perf'immo: advice on reducing the energy consumption of private tertiary buildings

The Diag Perf'immo[59] , launched in February 2023, is aimed at companies in the tertiary sector that own buildings for tertiary or mixed industrial and tertiary use and have plans for their energy renovation.

This is a 6 to 8 month consultancy assignment, carried out by a consultancy specialising in the energy performance of buildings and approved by Bpifrance (Banque Publique d'Investissement). A diagnosis is drawn up with an initial support phase (energy balance, definition of energy performance targets and energy consumption reduction scenarios, declaration on the OPERAT platform), followed by an action plan based on the building energy performance diagnosis and the energy renovation project on a trajectory in line with the objectives of the tertiary sector decree.

4.2.3.3 Focus on Baisse les Watts: an awareness-raising scheme for small businesses

The "Baisse les Watts" programme is aimed at small and very small businesses (< 250 employees). Its aim is to help them control their energy consumption. To achieve this, the programme offers a system for monitoring consumption to identify energy efficiency measures, as well as training to teach good practices, raise awareness of energy saving and become self-sufficient in terms of energy consumption. The programme includes 3 support schemes:

- An energy logbook to monitor consumption and identify needs for reducing consumption
- Support from an expert advisor
- A training programme

The programme will end on 31 December 2025.

[59] Diag Perf'immo, consulting services to reduce the energy consumption of your buildings. https://www.bpifrance.fr/catalogue-offres/transition-ecologique-et-energetique/diag-perfimmo

4.2.3.4 Specific features of the public service sector

There are 190,000 state-owned buildings and 99 million square metres spread across the country. Local and regional authorities have an estimated 225,000 buildings[60] and 280 million square metres. Taken together, these 2 types of building make up the public building stock, which accounts for 37% of the tertiary sector stock and, according to the Banque des Territoires, is characterised by being very old and consuming a lot of energy. Of these public buildings, 52,455 are public educational establishments, including 44,902 schools (covering around 50 million square metres), 5,290 collèges (covering 39 million square metres) and 2,263 lycées (covering 41 million square metres).

The annual energy consumption of the State's building stock in 2019 was 16 TWh[61] , while that of local authorities was estimated at 39.6 TWh in 2017[62] . According to France Rénov', 76% of the energy consumption of local authorities is related to buildings, half of which are school buildings (which account for 30% of this consumption and are therefore the most energy-intensive building type for local authorities).

To meet the target of reducing the energy consumption of the State's building stock by 15% by 2022 compared with 2010, then by 40% by 2030 and finally by 60% by 2050 (SNBC target for public and private tertiary buildings, confirmed by the tertiary decree), the State has had two plans since 2018: the Grand Plan d'Investissement, which provided for a budget of €4.8 billion over 5 years (2018-2022), and the Plan de Relance, which supplemented this approach with a budget of €4 billion. The latter investment was monitored by the France Relance Plan evaluation committee[63] .

The main elements of this evaluation report are :

- 4,214 projects to renovate government buildings have been selected, representing a total cost of €2.8 billion and savings of 600 GWh/year. Looking at all the projects selected, the main energy renovation work supported for government buildings is heating/air conditioning (35% of the projects selected include this type of work), roof or façade insulation (31%), window insulation (29%) and lighting replacement (22%).
- For local authorities, of the 6,212 committed projects, 3,423 offer energy savings estimated at 329 million kWhEF/year saved[64] .

4.2.3.5 Schemes for the public tertiary sector: SDIE, CEP, third-party financing

To help local authorities plan the renovation of their public housing stock, ADEME is encouraging them to draw up Property and Energy Master Plans (SDIE) by funding support for their implementation. The SDIE is a tool for managing built assets, enabling :

- In-depth knowledge of property assets
- Improving its value in use
- Adapting buildings to changing needs
- Controlling operating costs
- Optimising energy performance

The SDIE defines a short-, medium- and long-term asset strategy supported by a multi-year investment and maintenance programme.

ADEME also finances the "Conseil en Énergie Partagé - CEP" scheme, which enables :

- Pooling skills as part of a regional approach ;
- Objective, independent advice: priority is given to energy management without favouring any particular energy solution;
- A cost potentially offset by savings ;
- A network of energy advisers throughout France, trained, equipped and run by ADEME;
- Long-term support and technical assistance.

[60] France Relance 2020
[61] Ministère de l'économie et des finances (2022), Sobriété énergétique, Press kit
[62] ADEME (2019), Dépenses énergétiques des collectivités locales, États des lieux en 2017 (Local authorities' energy expenditure: an overview in 2017).
[63] Evaluation Committee for the France Relance (2022) Plan, Second Report
[64] Final energy (kWhEF) is the quantity of energy available to the end user.

More recently, to facilitate and accelerate the energy renovation of public buildings, the law of 23 March opened up third-party financing to the State, local authorities and their public establishments with a view to massively renovating their buildings. The law provides for a five-year trial of an ad hoc derogation scheme enabling the State and local authorities to pay off their debts only once the work has been completed and the energy savings made. This system makes it possible to remove a barrier to public procurement by using deferred payment in the context of EPCs, in the form of a global performance contract for the renovation of one or more of their buildings. Until now, deferred payment has only been possible under a public-private partnership contract. The challenge now is to make it easier for public bodies to use this system[65] .

4.2.3.6 ACTEE programme: raising awareness among local authorities

ACTEE (Action des Collectivités Territoriales pour l'Efficacité Énergétique) is a CEE programme run by the Fédération Nationale des Collectivités Concédantes et Régies (FNCCR). Its aim is to provide local authorities with decision-making tools to help them develop projects to renovate public buildings. The programme helps local authorities to manage their public assets and reduce their energy consumption. The project stakeholders are :

- The Ministry: guarantor of EWCs
- ADEME involved in the CEE scheme
- Main sponsor : FNCCR
- Partner and funder: EDF, which is contributing to the development of the website and the energy simulator. EDF is funding the project to the tune of €12.5 million, and is then paying them for a volume of 2.5 TWh.

The programme has 2 levers for action:

- A resource site for local authorities and information for carrying out work
- Calls for expressions of interest (AMI) to grant financial packages

The programme is based on reducing costs through inter- and intra-departmental energy pooling by bringing together energy syndicates and communities of conurbations or metropolises. The aim of the project is to bring together those with similar projects in order to bring together local authorities in the same area.

To provide specific support depending on the type of public building, the programme has several sub-programmes:

- ACT'EAU: reducing water and energy consumption in public aquatic facilities
- ETRIER (Energy, transition, rural, idea, desire, renovation): support for isolated rural communities
- LUM'ACTE: improving public lighting consumption
- Eff'ACTE: supporting the reduction of electricity consumption in tertiary buildings

4.2.3.7 Focus on BAPAURA: support for the energy renovation of public service buildings for small municipalities

BAPAURA[66] is a European project funded by the Horizon 2020 programme and coordinated by ADEME, the French Environment and Energy Management Agency. Its aim is to demonstrate the relevance of an energy renovation support service for public service buildings in small local authorities, and to develop a sustainable business model that can be replicated in other areas and regions.

The project has two dimensions:

- A regional coordination/sharing dimension ;
- A regional support dimension.

It aims to :

- Simplify financial arrangements, in particular by setting up a one-stop shop for suitable grants and loans;
- Guaranteeing energy performance and adapting to small-scale projects (support services);
- Mobilise local companies for the work to be carried out by all the project partners;
- Designing a toolbox to help project owners and contractors with their planning and work.

[65] Banque des Territoires (2023), Energy renovation: the Senate votes for the text opening up third-party financing to the State and local authorities.
[66] https://bapaura.fr/

4.2.4 PROFEEL programme: A scheme to speed up energy renovations and make them more reliable s

The PROFEEL programme (industry programme for innovation to promote energy savings in building and housing) is a concrete expression of the building industry's commitment to helping speed up energy renovations and make them more reliable. It is financed under the Energy Savings Certificates (EEC) scheme.

Under the impetus and guidance of 16 professional organisations, 9 projects led by the Agence Qualité Construction (AQC) and the CSTB were carried out between 2019 and 2021 as part of PROFEEL. They have led to the emergence of a set of innovative tools that are helping to improve professional practices in the energy renovation market and promote the launch and scale-up of high-performance operations.

The collection of practical tools produced is available on the website: https://programmeprofeel.fr/

In view of the many collective challenges that still need to be met if we are to achieve the targets set for the renovation of our homes and commercial buildings, the industry's representatives have decided to pursue their collective commitment to this dynamic with the new PROFEEL 2 programme. To this end, a new action programme has been jointly drawn up. It is based in part on tools already produced, as well as on lessons learnt since 2019 as part of the approach. Its aim is to continue to provide practical responses to the priority needs identified by professionals in the field.

The PROFEEL 2 programme focuses on the following areas:

- Determine heritage renovation strategies for a given area or park;
- Define performance specifications to secure energy savings;
- Facilitate and secure professional practices and the emergence of credible, replicable solutions through toolkits;
- Guarantee that the desired energy performance is achieved.

The PROFEEL 2 programme comprises 8 projects:

- GO-RENOVE 2, led by the CSTB. Its aim: to broaden the target audience and functionalities of GO-Renove decision-making services and to create an ecosystem of players around the National Buildings Database (BDNB).
- QUARTET (QSE 2), led by CSTB. Its aim is to support the industry in deploying and optimising the QSE method, and to capitalise on data on the "energy-health-comfort" performance of renovations.
- RENOPTIM, supported by CSTB. Its aim: to curb the growth in air conditioning consumption in social and private housing and reduce tenants' overall energy bills.
- RENO'BOX, supported by AQC. Its aim: to promote and facilitate access to all the practical tools for energy renovation and to continue to meet the changing needs of professionals.
- RESTORE EVAL, supported by CSTB. Its aim: to develop innovative technical solutions for comprehensive renovation and evaluate their performance in real-life conditions.
- INTERFACES, supported by AQC. Its aim: to make use of the results of RGE work control audits and provide practical solutions for dealing with interfaces in the renovation of single-family homes.
- OMBREE 2[67] , supported by the AQC. Its aim: to support innovative inter-ocean initiatives and develop new practical tools for professionals in the French Overseas Territories.
- SEREINE 2[68] , supported by AQC. Its aim is to measure the actual performance of new or renovated buildings on delivery, using an operational solution to objectively assess the effectiveness of work carried out on the building envelope and systems.

This programme will end on 31 December 2025.

[67] Overseas programme for resilient, energy-efficient buildings
[68] SEREINE: Solution for Assessing the Intrinsic Energy Performance of Buildings

4.2.5 Energy and climate issues

4.2.5.1 2020 environmental regulations

The 2020 environmental regulations, also known as the RE2020, will come into force from 1er January 2022 for residential buildings, then gradually for the other tertiary uses covered by the regulations. These regulations represent a major change, based on the systematic inclusion of two indicators relating to greenhouse gas emissions. The first indicator concerns the carbon impact of the materials and equipment used in construction (construction carbon index - ICconstruction), while the second relates to the carbon impact of the building's energy consumption (heating, DHW, ventilation, lighting, etc.).

In addition to these criteria, the RE2020 incorporates the principles of RT2012 and strengthens the assessment of the risk of discomfort in buildings by introducing a new indicator for summer comfort during heatwaves.

To enable the entire construction industry to adopt the life-cycle analysis method and develop building systems and technical solutions, the RE2020 provides for a gradual reduction in the threshold limits for indicators relating to greenhouse gas emissions from the construction and operation of housing.

The thresholds for the indicator relating to emissions from products and equipment used in construction (ICconstruction) will change over several periods: from 2022 to 2024, from 2025 to 2027, from 2028 to 2030, and then from 2031 onwards. While the value for the first period does not imply any major change in construction methods, the subsequent values will gradually force developers to favour increasingly low-carbon construction solutions. These include changes in construction methods (using wood or concrete construction systems with reduced environmental impact), the selection of bio-sourced finishing products or products with an optimised production process, and the decarbonisation of HVAC (heating, ventilation and air conditioning), plumbing and electrical equipment. It is difficult to estimate how much of this will naturally come from reducing the impact of construction products by optimising processes (recycling steel, reducing transport, integrating bio-sourced materials into products, etc.), but it is certain that current construction methods will have to evolve between now and 2028 in order to comply with the regulations. As a result, companies will have to adapt to these new construction methods.

The introduction of an "ICénergie" indicator will also have a significant impact on the equipment market and on the installation and operation companies associated with these products, by favouring thermodynamic, biomass or heat network-connected production. From 2025, the installation of heating and domestic hot water production systems that run exclusively on gas, as was mainly the case with RT2012, will no longer be permitted for collective housing.

According to a study by POUGET Consultants[69] carried out for the French Directorate-General for Planning, Housing and Nature (DGALN), the gradual integration of heat pumps into the new-build market for multi-family housing, alongside their presence in the renovation market, raises a number of issues for the industry.

There is currently a range of solutions available for integrating heat pumps into new apartment blocks, but some of these solutions are still emerging and lack maturity. Certain developments could make it easier to handle certain segments of the market. In addition to the challenges associated with the availability of suitable solutions, the study shows that the main obstacles relate to the development of skills throughout the industry and the risk of recruitment difficulties. To remedy this, it is essential to implement the following actions:

- Deploying a training offer tailored to companies;
- Making installation and operation jobs more attractive;
- Measuring performance to share feedback with the industry;
- Set up a commissioning and performance guarantee scheme tailored to small buildings.

4.2.5.2 Cap 2030

In addition to the RE2020, the Cap 2030 project will start in September 2023, with the aim of building a common reference framework for the buildings of tomorrow over a 2-year period, through technical working groups open to all willing stakeholders and regular consultation phases.

[69] DGALIN (2023), Étude sur les freins et les leviers à la diffusion de la pompe à chaleur en logement collectif. https://rt-re-batiment.developpement-durable.gouv.fr/etude-sur-les-freins-et-les-leviers-a-la-diffusion-a713.html

The aim is to encourage voluntary players to go beyond the Environmental Regulations for new buildings (RE2020) and to propose a way forward for future buildings. The project is being run by the Groupement d'Intérêt Écologique (GIE), with scientific and technical support from the CSTB, backing from the Plan Bâtiment Durable and support from the DGALN and ADEME.

The shared vision is based on 3 pillars:

- **Supporting environmental building regulations and preparing for their** development
  - Supporting the implementation of the RE2020: synergy and consistency with the RE2020 to inspire the development of the RE2020 in the medium term;
  - Prepare the regulations that will succeed the RE2020 by deploying the common frame of reference and exploring new themes beyond energy and carbon;
  - Provide inspiration for future work on existing building regulations.
- **From local to international**
  - Use local dynamics to build the common frame of reference and involve local authorities in its implementation;
  - Ensuring that the Common Frame of Reference is recognised at international level.
- **A method for mobilising people around the Common Frame of Reference**
  - Co-construction and consultation to involve all stakeholders in a governance system that remains open;
  - A system that is easy to read, accessible, freely usable by all and transparent;
  - Build on existing expertise and know-how and put associations at the heart of the system;
  - Getting on board, supporting the industry.

Biomimicry to save energy, water and resources and adapt to climate change

Biomimetics is an approach that draws inspiration from living organisms and the way biological systems function, to find solutions to practical problems. This approach is recognised by a standard (ISO 18548; 2015). In the building sector, biomimicry makes it possible to *"develop construction systems, adapted materials, energy management methods and facades in line with the principles of living organisms and the major terrestrial biogeochemical cycles of water, carbon, phosphorus and biodiversity"*[70] . A bio-inspired building ideally integrates these three criteria:

- Design: incorporating biological principles or properties of living systems.
- Components: materials, envelopes or ventilation systems inspired by biological forms, functions or processes.
- Ecosystems: the building is integrated into the major natural cycles like an organism evolving in its environment.

This approach is therefore an avenue for action for the sector, both in terms of reducing emissions and adapting to climate change, as well as helping to safeguard the surrounding biodiversity. This is why ADEME has produced a guide, which is also a collection of solutions and examples of bio-inspired buildings that respond to one of the following 6 themes:

- Optimising primary energy consumption;
- Promoting summer comfort ;
- Optimising and sustaining existing facilities;
- Optimising water consumption;
- Lighter structures ;
- Designing buildings that have a positive impact on all living things.

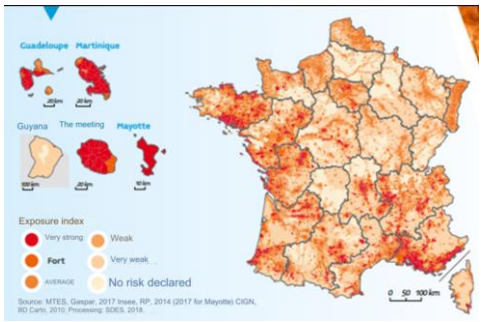
For more information: ADEME (2022), S'inspirer du vivant pour la transition écologique des bâtiments.

4.2.6 Natural risks and vulnerabilities in the construction sector

4.2.6.1 French exposure to climate risks

Climate change will exacerbate the natural hazards already present in France. Depending on the scenario, warming could reach 3.9°C compared with the current climate in mainland France if no action is taken (RCP scenario[71] 8.5) or 2.2°C if action is taken to mitigate emissions (RCP scenario 4.5). In the first scenario, by 2100 almost all summers will be scorching, and droughts will last much longer than at present. Climate models predict a reduction in the number of rainy days, but an increase in the volume of precipitation, leading to more intense rainfall, which is likely to cause flooding. By 2050, all the French overseas territories will be in the thermal discomfort zone, and French Guiana will be in the danger zone. By 2100, all the territories will be in the danger zone linked to humid heat for the RCP 8.5 scenario. They are also particularly exposed to flooding phenomena.

Figure 4-23 Population exposure to climate risks



Source: Météo France, DRIAS (2020), New reference climate projections for mainland France

[70] ADEME (2022), Drawing inspiration from the living world for the ecological transition of buildings
[71] RCP: Representative Concentration Pathway

According to the Observatoire National sur les Effets du Réchauffement Climatique (ONERC), 62% of the French population is highly or very highly exposed to climate risks. These risks are already having a major impact, particularly on housing. For example, the floods of October 2020 in the Alpes-Maritimes resulted in €210 million in claims, 72% of which was for damage to housing. Medium to high exposure to clay shrinkage and swelling is changing rapidly, affecting 48% of soils in mainland France in 2021, compared with 20% in 2017. According to the Fédération Française de l'Assurance (FFA), Cat Nat claims are expected to increase threefold between now and 2040. To limit the impact of these hazards on buildings, they need to be adapted to reduce their vulnerability and improve their resilience.

4.2.6.2 The challenge of summer comfort

While mitigating global warming by reducing greenhouse gas emissions, the spearhead of various national and European climate strategies, is vital if we are to limit the extent of global warming and climate change, adaptation is a subject that is still little discussed. The stakes are high, however, because even in the intermediate scenario (RCP 4.5), by the end of the century the increase will be at least 2.2°C in summer in median value (+3.3°C for the 95e percentile) compared with the 1976-2005 reference period[72] . This means an increase in the number of heatwave days (number of days with +5°C above the reference temperature for at least 5 days) and in the number of tropical nights (number of nights when the temperature does not fall below 20°C). While in the baseline climate these two numbers were limited (3 days and less than 10 nights on average per year (excluding the Mediterranean region, the Aude and the Rhône valley), for the RCP 4.5 scenario, the number of heatwave days will be multiplied by 3 to 4 by the end of the century and the number of tropical nights will reach between 15 and 25 per year (excluding the Mediterranean region, where it will be higher).

The challenge for the thermal comfort of residents is therefore very real. However, because of its historical climate, France has done little to develop the resilience of its buildings. This is reflected in the regulations, which boil down to the RE2020 (which incorporates and modifies the RT2012 method), which takes into account an indicator representing the level of discomfort perceived by occupants (Hourly Degrees of Discomfort - DH).

There are no equivalent regulations for existing buildings. Improving the resilience of buildings to global warming is an approach that is beginning to be taken, particularly in new projects, but the national dynamic still seems to be in its infancy. The sector is more focused on improving energy performance. In the Provence-Alpes-Côte d'Azur (PACA) region, which is most at risk when it comes to summer comfort, several associations are working together to define a comprehensive renovation standard for the south of the country, taking this parameter into account.

In the coming years, the building industry will have to systematically introduce summer comfort into renovation and construction projects. This will probably require an increase in the skills of project owners, architects and design offices to recommend and implement effective solutions to combat discomfort.

Adapting the working conditions of building professionals to climate change

Buildings are not the only issue affected by global warming, but workers and all construction professionals are and will be increasingly affected by the rise in average temperatures and the intensity and frequency of heat waves. Abnormally high temperatures can rapidly degrade workers' productivity, leading to fatigue, exhaustion, loss of concentration and nervousness, as well as accidents at work and periods of invalidity[73] .

According to a study carried out by France Stratégie, of the 23 occupations most exposed to high temperatures, at least 7 are directly linked to construction. More than half of the workers questioned said that their work presented a disadvantage linked to high temperatures, more than 80% in the case of skilled public works and building shell workers. Heat can also affect the working environment itself (faulty equipment), or exacerbate other vulnerabilities of workers (health problems, exposure to toxic substances).

Finally, it is interesting to note that exposure to these risks is not necessarily linked to climate, and it is not just the southern regions that are affected. Exposure depends on the structure of the local economy and employment. For example, Épernay, in the Grand-Est region, is considered to be one of the areas where workers are most vulnerable.

[72] Météo France, DRIAS (2020), The new DRIAS 2020 reference climate projections for mainland France
[73] France Stratégie (2023), Le travail face aux changements climatiques. https://www.strategie.gouv.fr/sites/strategie.gouv.fr/files/atoms/files/fs-2023-na123-adaptation_changement_climatique-juin_3.pdf

4.2.6.3 Clay shrinkage and seismic risks

The phenomenon of Clay Shrinkage and Swelling (CSW) is specific to clay soils, as its name suggests. It causes the volume of the soil to vary according to its water content. This can pose a risk during periods of drought (when the clay settles) and specifically for detached houses with shallow foundations. The consequences can be manifold: detachment of jointed elements (garages, terraces), cracking, distortion of joinery, burst pipes or even dislocation of paving and partitions. Since October 2020, the ELAN law has introduced a jurisdictional requirement for this hazard in medium- and high-risk areas:

- The seller of undeveloped land is responsible for carrying out a preliminary geotechnical study to inform potential buyers of the RGA risk;
- A geotechnical design study, to be carried out by the project owner, prescribing construction measures for the project or compliance with regulated construction techniques. In both cases, these measures must be communicated to the builder, who undertakes to follow them.

Opportunities for the building sector in the face of climate change

In the face of global warming, the industry needs to reinvent itself, particularly through new trades and skills. In the opinion of the majority of players, the building sector suffers from an unattractive image among students. However, many believe that it is necessary, in order to attract young people, to highlight the importance of the building trades in the ongoing energy and environmental transition. This demand echoes the new HR considerations of students. The survey conducted by Ernst & Young (EY) and the Palladio Foundation as part of the 7th Panorama de l'immobilier et de la ville reports that 57% of the students questioned would be prepared to turn down a job offer if the actions taken by the company were not sufficient. 78% said they would like to get involved in environmental initiatives.

Seismic risk is defined in 5 zones according to the level of seismicity (from very low to high). The reference regulation for earthquake-resistant construction is Eurocode 8. Depending on the category of building and the zone in which it is located, it may be subject to obligations in terms of works. In the case of existing buildings, the main requirement is that the vulnerability of the structures must not be increased when the work involves structural elements (walls, roofs, floors). This condition may prevent some older buildings in high seismic risk zones from being renovated.

4.2.7 Other cross-sector issues in the building sector

In addition to energy issues, the building industry is at the crossroads of a number of issues that are of great concern to companies. Some of these issues are also covered by compulsory company training (e.g. site safety), and the corresponding training courses account for the bulk of employee training time, leaving little time for training in energy efficiency or environmental performance.

4.2.7.1 Asbestos

The costs incurred by all the regulatory provisions relating to asbestos weigh significantly on the overall budget for renovation projects, and therefore on the implementation of building renovation policy. In fact, the costs of some asbestos work can be so high as to call into question certain energy renovation projects. To alleviate this problem, the government is seeking to support these projects through an asbestos research and development plan aimed at improving asbestos detection and measurement, as well as improving works management. An Anah grant may also be awarded to landlords and homeowners, depending on their financial situation, to carry out a technical diagnosis, if this is followed by recommended work to eliminate or insulate materials containing asbestos. Landlords can also claim a tax deduction for asbestos-related expenses.

Owners of certain buildings are obliged to identify materials and products containing asbestos. This survey is carried out by a survey operator, who must be certified by an accredited body.

Figure 4-24 Main asbestos detection obligations for owners of built-up buildings

<table>
<tr><td rowspan="9">Building permit issued before July 1st, 1997</td><td colspan="3">Residential buildings</td><td rowspan="2">Other Buildings</td></tr>
<tr><td>Single-Family Homes</td><td>Private Areas of Multi-Unit Buildings</td><td>Common Areas of Multi-Unit Buildings</td></tr>
<tr><td colspan="4">General Obligations</td></tr>
<tr><td rowspan="3">NA</td><td colspan="2">Conduct a survey based on list A (spray-on insulation, thermal insulation, and false ceilings)</td><td colspan="2">Conduct an extended survey based on lists A and B</td></tr>
<tr><td colspan="2">Create and maintain the "asbestos - private areas" file</td><td colspan="2">Create and maintain the DTA file</td></tr>
<tr><td colspan="2">In some cases, dust measurement and remediation work must be carried out</td><td colspan="2">In some cases, dust measurement and remediation work must be carried out</td></tr>
<tr><td colspan="4">Obligations in case of sale</td></tr>
<tr><td colspan="4">To be exempt from the guarantee against hidden defects, the seller must provide a statement of presence or absence of asbestos (Since 01/04/2013, this statement requires, in particular, the survey of new materials from list B)</td></tr>
<tr><td colspan="3">This statement is constituted by a report drawn up on the basis of an extended survey based on lists A and B</td><td>This statement is constituted by the summary sheet of the DTA created and kept up to date</td></tr>
<tr><td colspan="4">Obligations in case of demolition</td></tr>
<tr><td colspan="4">Conduct a survey of all materials based on list C</td></tr>
</table>

Source: Ministry of Ecological Transition

Training and qualifications in the asbestos sector

At 1er January 2021, there were 34 certified training organisations with 54 teaching platforms and 1084 companies at least at the pre-certification stage[74] .

The latest list of training bodies is available on the websites of the certification bodies: Institut de Certification (Icert), Certibat and Global certification. AFNOR (Association Française de Normalisation), GLOBAL and QUALIBAT are three certification bodies accredited by the Comité Français d'Accréditation (COFRAC) to certify companies involved in asbestos removal and encapsulation. Certification of companies involved in the removal or encapsulation of asbestos or asbestos-containing materials is compulsory for all projects for which the tender documents are published on or after 1er July 2014. Updated lists of accredited asbestos bodies are available on the COFRAC website.

4.2.7.2 Lead

Lead in buildings (paint, pipes) is a well-identified health risk in French homes. A Lead Exposure Risk Report (CREP) is compulsory for all residential buildings built before 1949, in communal areas and in homes, as part of any property transaction. This report focuses on lead coatings, which it identifies and describes (condition, possible factors of deterioration). To carry out this diagnosis, property owners must use the services of certified professionals. The diagnosticians must carry out a thorough inspection of the premises and measure the lead content of the coatings. A grant from the Agence nationale de l'habitat (Anah) may be awarded to landlords and owner-occupiers, depending on their level of precariousness, to help them carry out the diagnosis if it is followed by the recommended work, as well as work to remove or insulate paint and coatings containing lead salts, including finishing[75] .

[74] Ministère du Travail, du Plein Emploi et de l'Insertion (2023), Asbestos. https://travail-emploi.gouv.fr/sante-au-travail/prevention-des-risques-pour-la-sante-au-travail/article/amiante

[75] Ministère de l'Écologie, du Développement durable, des Transports et du Logement (2011), Le plomb dans les peintures : Quelles obligations pour les propriétaires?

The Organisme Professionnel de Prévention du Bâtiment et des Travaux Publics (OPPBTP) is organising two training courses devoted to managing the risks associated with the presence of lead during rehabilitation work: a two-day module for supervisors and a one-day module for operators.

4.2.7.3 Indoor air quality

A subject of growing interest to the health authorities, particularly in the wake of the Covid-19 health crisis, the obligations relating to indoor air quality in buildings are, for the time being, heavily concentrated around Establishments Receiving Public Access (ERP). Since 2012, a number of decrees have been issued on the assessment of ventilation systems and the measurement of pollutants, defining certain thresholds.

The latest came into force on 1er January 2023. Decrees no. 2022-1689 and no. 2022-1690 reinforce the obligations relating to air quality in establishments open to the public.

The first involves changes to the compulsory monitoring of air quality, which includes :

- An annual assessment of ventilation systems in buildings, to be carried out by 2024 at the latest, including direct measurement of carbon dioxide levels in indoor air;
- A self-diagnosis of indoor air quality, carried out at least every four years, covering :
  - Identifying and reducing sources of pollutant emissions, particularly with regard to site materials and equipment and the activities carried out on the premises;
  - Maintenance of the establishment's ventilation systems;
  - Reducing occupants' exposure to pollutants resulting, in particular, from building work and cleaning activities;
- A campaign to measure regulated pollutants should be carried out at each key stage in the life of the building that could have an impact on indoor air quality;
- An action plan, taking into account the annual assessment of ventilation resources.

The second decree sets out the terms and conditions of this monitoring.

Interviews with stakeholders highlight the growing importance of these issues for them. This is one of the challenges for the future. Changes in regulations are leading to changes in skills, with the creation of qualifications for indoor air quality diagnosis[76] . A new system will come into force on 1er January 2023 to govern the monitoring of indoor air quality in certain public buildings, particularly those used by children. Monitoring is based on an annual assessment of ventilation systems, a self-diagnosis of indoor air quality every 4 years, measurement of regulated pollutants, and an action plan to improve air quality. Some local authorities, such as the Normandy Region, require this type of inspection as part of the additional grants they award for low-energy building renovations.

4.2.7.4 Site safety

The construction and public works sector is particularly exposed to the risk of accidents, especially on building sites. In 2021, 89,000 accidents at work were recorded in the building and public works sector, compared with 107,715 in 2012 (down 17% in 9 years)[77] . In 2019, the number of deaths in the construction sector was 176, up sharply on 2018 (although this figure is highly cyclical). Young people under the age of 25 account for a higher proportion of deaths than in other sectors (10%, compared with 5%).

Certain sectors are particularly prone to work-related accidents, especially roofing and carpentry, with a frequency index of over 100 lost days per 1,000 employees.

[76] OPQIBI, Fiche de qualification : Diagnostic qualité de l'air intérieur. https://www.opqibi.com/nomenclature-fiche/0908#:~:text=%C3%89tude%20en%20vue%20de%20l,li%C3%A9s%20%C3%A0%20l'activit%C3%A9%20humaine
[77] Assurance Maladie (2021), Livret statistique de la sinistralité AT-MP

Figure 4-25 22 construction and public works sectors with more than 1,000 employees and the highest number of accidents at work in relation to the number of employees in 2021

NAF2 Group	NAF Code	NAF Code Description	Employees 2021	AT in 1st settlement in CTN B			Frequency Index in CTN B				% of employees of the relevant	
				Number of AT events in 2021	Frequency Rate in 2021	evo. 2021/2020	Recall IF AT 2019	Average IF AT 2021	Average IF 2019-21	evo. 2021/19-21	% of employees belonging to CTN B	% of employees relevant to another CTN
439	4391A	Structural Carpentry Work	31,947	3,272	13.3%	6.3%	104.3	102.4	103.4	-1.8%	96%	
439	4391B	Roofing Work	48,266	4,548	15.3%	-0.4%	101.8	94.2	98.0	-7.4%	98%	
47	4752A	Retail sale of hardware, paints and glass in small areas (less than 400 m²)	1,653	128	4.9%	-5.2%	85.0	77.4	81.2	-8.9%	10%	86% in CTN G
433	4332A	Joinery work in wood and PVC	88,108	6,669	18.2%	1.3%	80.7	75.7	78.2	-6.3%	87%	
16	1623Z	Manufacture of roof trusses and other structural woodwork	4,173	315	-10.8%	-16.4%	90.1	75.5	82.8	-16.3%	21%	72% in CTN F
431	4313Z	Drilling and boring	2,771	209	20.8%	23.7%	70.2	75.4	72.8	7.5%	98%	
433	4332B	Metal joinery and locksmithing	43,696	3,208	15.6%	-1.3%	76.8	73.4	75.1	-4.4%	82%	
39	3900Z	Remediation and other waste management services	6,774	493	20.5%	0.6%	72.7	72.8	72.7	0.1%	68%	
25	2511Z	Manufacture of metal structures and parts of structures	9,9	720	11.8%	-1.0%	75.9	72.7	74.3	-4.2%	19%	77% in CTN A
46	4673A	Wholesale trade (trade between companies) of wood and construction materials	2,303	161	16.7%	-18.7%	88.4	69.9	79.2	-20.9%	3%	84% in CTN G
439	4399B	Erection of metal structures	12,456	849	23.2%	6.7%	73.4	68.2	70.8	-7.2%	85%	
22	2223Z	Manufacture of plastic components for construction	1,323	90	-5.3%	-10.9%	71.1	68.0	69.6	-4.3%	5%	80% in CTN E
81	8122Z	Other building cleaning and industrial cleaning activities	1,425	93	31.0%	-7.9%	70.2	65.3	67.7	-7.0%	2%	94% in CTN I
439	4399C	General masonry and structural work for buildings	230,507	14,757	11.3%	-0.6%	69.6	64.0	66.8	-8.0%	99%	
432	4322A	Plumbing and gas installation work in all premises	71,934	4,271	14.5%	0.9%	64.5	59.4	61.9	-7.9%	98%	
433	4331Z	Plastering	49,445	2,932	17.8%	3.3%	62.8	59.3	61.1	-5.6%	99%	
25	2512Z	Manufacture of metal doors and windows	3,953	232	1.8%	-15.6%	70.5	58.7	64.6	-16.7%	18%	68% in CTN A
439	4399D	Other specialized construction work	21,522	1,209	20.9%	7.8%	57.8	56.2	57.0	-2.7%	91%	
433	4333Z	Floor and wall covering work	39,455	2,209	15.7%	-0.2%	59.6	56.0	57.8	-6.0%	97%	
88	8899B	Social action without accommodation nca	1,028	57	-5.0%	-1.7%	57.1	55.4	56.3	-3.0%	1%	69% in CTN I
439	4399A	Waterproofing work	22,754	1,26	19.3%	1.0%	58.1	55.4	56.7	-4.7%	98%	
77	7732Z	Rental and leasing of machinery and equipment for construction	6,04	333	18.9%	7.8%	55.5	55.1	55.3	-0.6%	27%	68% in CTN G

1 "Grouping of NAF codes (NAF level 2 or 3) to which the final NAF code belongs; the grouping may only be partially represented here; this is the grouping that was used in Table 3 p. 19 and in Figure 10 p.20."

"(*): Employees in activity or in partial unemployment."

"(**): The penultimate column indicates the share of employees of the NAF code belonging to CTN B and the last column specifies the CTN in which there are the most employees of this NAF code if it is not CTN B. For prevention purposes, it may indeed be interesting to know the other CTNs where preventive measures specific to these activities can be implemented, especially since the NAF codes that appear to be among the most accident-prone in CTN B may also appear among the most accident-prone in other CTNs."

Source: Assurance Maladie (2021), Livret statistique de la sinistralité AT-MP (Statistical booklet on occupational injuries and diseases)

In order to prevent the risk of accidents on construction sites, the French Labour Code sets out a number of obligations on the part of the project owner, the coordinator, the project manager, the contractor and the worker or subcontractor[78] . The Labour Inspectorate may issue a temporary work stoppage notice in the event of an imminent risk linked to the absence or failure of protective devices and mechanisms. Safety rules include the following:

- The site prevention plan, a document formalising the preventive measures required for all participants on the site;
- The Safety Data Sheet (SDS), which focuses on chemical risks when substances hazardous to health or the environment are present on site;
- The different types of safety equipment.

In addition to these rules, a number of new training obligations have been imposed on construction workers since 2012, depending on their task. The main compulsory and regulatory training courses are as follows[79] :

- **Autorisation d'Intervention à Proximité des Réseaux (AIPR).**
- **Electrical clearance.**
- **Scaffolding** (for people who use, erect or dismantle scaffolding).
- **Working at height** (use of harnesses or other height protection systems).
- **First aid at work (SST).** The presence of an employee trained as an SST is compulsory in every workshop where dangerous work is performed and/or on a worksite employing twenty workers for a period of more than fifteen days where dangerous work is performed.
- **Certificat d'Aptitude à la Conduite d'Engins en Sécurité (CACES).** To provide certain site machinery.
- **Asbestos.** For all workers likely to be exposed on a worksite.

Although essential for guaranteeing personal safety, these various regulations and obligations are seen as "suffocating" for some players in the sector, especially when they are superimposed on other qualification obligations relating to energy performance or other issues. However, this remains an important issue for the contractors and project managers interviewed. Although there are health and safety coordinators on every site, some employee unions complain that there are too few of them, with one person in charge of safety for several hundred or even thousands of employees on the largest sites. This contrasts with the fact that the number of site supervisors is on the increase. Another issue related to safety and responsibility that has also been raised by stakeholders is that of subcontracting. For some of the players interviewed, the subcontracting chain dilutes responsibility and, above all, leads to a reduction in the quality of working conditions, which encourages accidents and abuses.

What's more, according to company interviews, safety on construction sites is covered by compulsory training courses of considerable duration, which limits the number of hours available for more technical training, such as energy efficiency.

100 minutes for life" operation by the professional prevention organisation for the building and public works sector (OPPBTP)

The third edition of this national challenge, aimed at the construction and public works sector, attracted 16,000 participants (learners and 700 teachers/trainers) from 156 different establishments. Participants spend five weeks learning about occupational risk prevention through a series of health and safety questions and interactive challenges that earn them points. The top ten players in each region from apprentice training centres (CFA) and vocational high schools, as well as the top ten trainees from the AFPA, which is supporting the operation, are rewarded.

The OPPBTP has seen an improvement in commitment over the duration of the challenge, and also in the rate of correct answers.

[78] Ministère du Travail, du Plein Emploi et de l'insertion (2009), Principales obligations des intervenants sur un chantier
[79] https://www.capeb.fr/

4.2.7.5 Accessibility

Since the Disability Act of 11 February 2005, which not only redefined the main principles of the accessibility policy, but also provided a framework for the issue of accessibility in buildings, there have been regulations in place. However, implementation has been more complicated than expected. In 2011, reports highlighted the difficulties encountered in the field, particularly in relation to identical requirements for new and existing buildings. Ordinance 2014-1090 of 26 September 2014 rectified this problem by specifying the accessibility of public buildings, public transport, residential buildings and roads for disabled people. For buildings, it defines the programmed accessibility agenda (Ad'AP), which is a mandatory multi-year programming document. It is binding on the building manager, who must specify in it the nature of the accessibility compliance work to be carried out within a period of one to three years, as well as the cost. Accessibility obligations depend on the type of building and its use[80] .

- **New residential buildings:** blocks of flats and detached houses and their surroundings must be built and fitted out in such a way as to be accessible to disabled people, whatever their disability.
- **Existing residential buildings:** existing residential buildings are not required to be made accessible by a set date, as is the case for establishments open to the public and facilities open to the public. However, certain efforts must be made to ensure that the built environment is accessible, particularly when work is carried out that exceeds 80% of the value of the building. In all cases, existing single-family homes fall outside the scope of the regulations.
- **Establishments open to the public:** Establishments open to the public must be accessible to disabled people, whatever their disability, as soon as they are built when they are new, or after compulsory work has been carried out on existing establishments (except in the case of exemptions).

For the time being, existing residential buildings are virtually outside the scope of the regulations, given the difficulty of carrying out the work involved, but new residential buildings and the tertiary sector are heavily involved. Renovating existing buildings to make them suitable for use by people with disabilities can involve major renovation work (lifts, access ramps, showers and toilets, wall cladding, lighting and user information systems).

This issue has become increasingly important in recent years and is the subject of debate, particularly among social and service sector landlords.

In the case of low-income housing associations (HLM), expenditure on work carried out on the exterior of premises to make them more accessible, particularly in communal areas but also inside dwellings, is deductible from the property tax on built-up properties (TFPB) paid to local authorities. This is also the case for semi-public companies whose statutory purpose is to build or manage housing.

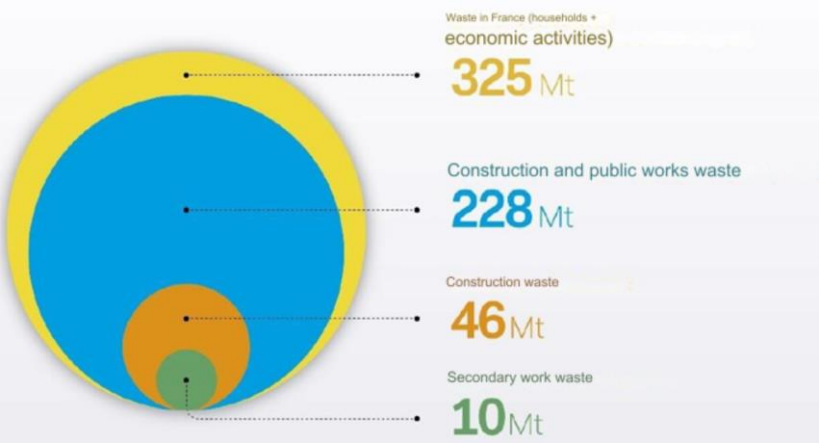
For private individuals, the Agence Nationale de l'Habitat (Anah), the Caisse d'Allocations Familiales (CAF) and pension funds can grant aid, loans or subsidies. There is also a tax credit for accessibility work, a loan from Action logement, etc.

4.2.7.6 Waste, reuse and the circular economy

According to the FFB[81] , the building and public works sector produces 70% of all waste in France, with 228 million tonnes produced each year. The majority of this waste comes from public works (182 million tonnes), but is largely inert and unpolluted, so is easily recovered. **The rest (46 million tonnes) comes from building demolition (49%), renovation (38%) and construction (13%) sites**. The recovery rate for building waste varies according to its origin: between 60 and 80% for demolition, 10 to 30% for renovation and 40 to 60% for construction, giving an overall rate of between 48 and 64%[82] . Renovation waste, particularly that from the finishing trades, which accounts for 10 million tonnes a year, is therefore not recycled to any great extent. While some materials, such as wood, plaster, rigid polyvinyl chloride (PVC), EPS and flat glass for windows, have perfected technical recycling processes, insulation, carpets and plastics are generally very poorly recycled.

[80] http://www.accessibilite-batiment.fr
[81] FFB and other players in the sector (2019), Study of scenarios for setting up an organisation to enable efficient management of construction waste as part of a circular economy. https://www.dechets-chantier.ffbatiment.fr/res/dechets_chantier/PDF/190606_Synth%C3%A8se%20EtudeFili%C3%A8re_RepriseD%C3%A9chetsB%C3%A2timent.pdf
[82] MTE (2020), Building waste. https://www.ecologie.gouv.fr/dechets-du-batiment#:~:text=Le%20programme%20pr%C3%A9voit%20ainsi%20une,(DAE)%20and%20du%20BTP.

Figure 4-26 Key waste figures for 2019 (millions of tonnes per year)



Source : FFB

In December 2015, the European Commission adopted new measures limiting the landfilling of all waste to 10% by 2030.

Since 2004, the FFB has been developing a website and an application to help tradespeople and contractors easily find a collection point for their waste. These have since been supplemented by information sheets providing further details on recycling solutions for waste from the building industry, sector by sector (plaster, PVC, windows, carpets, flat glass, WEEE[83]). This enables construction companies to better direct their waste towards circular economy channels.

In France, the circular economy policy was given fresh impetus in 2020 by the Anti-Waste for a Circular Economy Act (AGEC). This amended the waste production reduction rates (15% for the quantities of household and similar waste produced per inhabitant and 5% for the quantities of waste from economic activities per unit of value produced, particularly in the building and public works sector, in 2030 compared with 2010[84]). It also revives a concept that is 5 years old: Extended Producer Responsibility (EPR). This responsibility places the burden of managing the end-of-life of products on producers. Before 2020, this system based on the "polluter pays" concept was broken down into 14 channels covering the main product families. Financed by manufacturers, the eco-organisations for each sector managed the collection and recycling of the products concerned. The AGEC law adds 11 EPR sectors.

Before 2023, 3 EPR schemes concerned certain activities in the building sector:

- Waste electrical and electronic equipment
- Furnishings
- Refrigerants

Since 1er January 2023, the new EPR system for construction waste has required producers of construction products and materials in the sector to join (and therefore pay eco-taxes to) eco-organisations. The objective announced by the decree of 10 June 2022[85] is to reuse at least 5% of the total quantity of construction products and materials in the building sector by 2028, with 2 stages: 2% in 2024 and 4% in 2027. At the beginning of 2023, 4 eco-organisations were approved: Ecomaison, Ecominéro, Valobat and Valdelia.

The AGEC Act provides for the creation of a national observatory for re-use and recycling, whose remit is[86] :

- Collecting, analysing, centralising and disseminating information and studies on reuse and recycling to all players in the ecosystem;
- In conjunction with the eco-organisations, carry out any studies needed to assess the relevance of reuse and recycling solutions from an environmental and economic point of view;
- Working with eco-organisations, support the implementation of experiments in its area of expertise;

[83] WEEE: Waste Electrical and Electronic Equipment
[84] Environment Code, Chapter I: Waste prevention and management, Articles L541-1 to L541-50
[85] Order of 10 June 2022 on the specifications of the eco-organisations, individual systems and coordinating bodies of the extended producer responsibility sector for construction products and materials in the building sector, JORF n°0142 of 21 June 2022.
[86] ADEME (2023), Roadmap: National Reuse and Recycling Observatory

- With regard specifically to packaging, propose a national trajectory aimed at increasing the proportion of reused and reemployed packaging placed on the market compared with single-use packaging, and also assess the environmental impact of deposit systems for reusing glass;
- Coordinating the activities of those involved in these measures.

Some recycling channels are already operational, such as plaster and wood recycled into particleboard or reused as fuel. In the construction industry, concrete recycling is still rare, unlike in the public works sector, where inert materials such as concrete and rubble are widely reused as road sub-base. However, research projects such as Recybéton are under way.

From 1er January 2022, the law will require project owners to carry out a diagnosis of the management of products, equipment, materials and waste (PEMD) resulting from demolition work or major building refurbishment. This diagnosis must be carried out by a qualified professional. It provides the necessary information on products, materials and waste with a view, as a priority, to their reuse or, failing that, their recovery, indicating the recommended recycling channels and recommending additional analyses to ensure that these products and materials are reusable. It includes guidelines to ensure the traceability of these products, materials and waste. Where reuse or recovery is not possible, it specifies how the waste is to be disposed of.

To improve the circular economy in the building sector, the FFB is putting forward three recommendations[87] :

- **Strengthen the network of collection points.** Create dedicated areas for grouping, sorting and processing materials. Prioritise the development of a network for professional waste. Harmonise the conditions under which businesses and tradespeople can use public drop-off centres when the network of professional treatment centres is inadequate.
- **Improve the quality of recycled materials.** Improve the traceability of materials and combat illegal waste processing sites.
- **Take greater account of waste management in works contracts.** The contracting authority must take into account the additional costs associated with the disposal of building waste, otherwise it will be held liable.

In addition to this market challenge, it is essential to take into account the difficulty of sorting materials correctly on building sites, particularly in the presence of workers who do not necessarily understand this issue. The re-use of materials and systems has been identified by many players as an important issue that needs to be properly supported, and one in which the industry will have to develop its practices considerably. However, reuse currently faces a number of obstacles, including the lack of a large-scale industry and insurance problems. In order to qualify them, it is necessary to guarantee the good physical condition of the materials and the proper functioning of the systems taken back. Re-use requires a number of sub-operations: checking the condition, dismantling, sizing for the new home and validating the technical characteristics of the equipment at the new installation site. **Substantial manpower is required to carry out re-use operations**. Reconditioning and remanufacturing loops can be envisaged, but require reverse logistics loops. In-situ repair could be strengthened by making spare parts available.

The players in the re-use sector we interviewed confirmed these points. In their view, the biggest challenge facing the sector is the availability of reused parts and materials. Having materials available in large quantities, and if possible under guarantee and at the same cost as new parts, would be a major step forward for the sector. To achieve this, it is vital that French new car manufacturers invest in this new sector to encourage its development on a European scale.

The issue of insurance is also a stumbling block: insurers do not yet have any feedback from reuse projects and therefore do not have a risk matrix for the different materials used. What's more, according to the feedback from these players, it is still too difficult to hire people who are qualified and trained in reuse. In their view, reuse should be taught as part of initial training: the courses offered in engineering and business schools are still far from being linked to the SNBC. For some of the players interviewed, the issue of insurance is a "false" problem, as professionals can guarantee the quality and performance of products. The industry also suffers from prejudices about aesthetics.The creation of new skills or new trades would enable the sector to develop. Training is a major issue for this sector. A number of training courses are currently being developed, aimed at future re-use project managers: "Diag ressource", "Valoriste", as well as numerous webinars and MOOCs in continuing education.

[87] FFB (2016), Le bâtiment à l'heure de l'économie circulaire. https://www.ffbatiment.fr/revues-guides/bam/43-juin-2016/le-batiment-a-l-heure-de-l-economie-circulaire

Biosourced materials ambassadors in Eastern France

Supported by the Direction Régionale de l'Environnement, de l'Aménagement et du Logement (DREAL), this network is based on sharing knowledge and experience. Training courses are organised with the aim of presenting the main characteristics and technical performance of materials derived from plant or animal biomass or recycled products, so that participants have the information they need to encourage the use of these materials and reassure project owners.

Network members meet once or twice a year to exchange experiences and visit inspiring sites.

4.2.7.7 Digital

New techniques are finding their way into sector studies. In construction, computer modelling of building data (Building Information Modeling - BIM) is gradually becoming a standard in the project design phase. It enables all the different players involved to work together on a model, which means that once the necessary skills have been mastered by all, they can be organised and adapted to limit errors and incompatibilities between products.

The national dynamic is structured around the BIM 2022 Plan, which is itself a continuation of the Digital Transition Plan for the Building Industry (PTNB), which in 2015 was the first stage in defining a framework for digital technology in construction. The new plan, which will be extended to 2023, aims to make BIM more widely used in the sector, using appropriate tools.

The growing importance of BIM in the construction industry should lead to an increase in the skills of those involved and the widespread introduction of new professions, the professional titles of which have been created by the Ministry of Labour in 2019: **BIM modeller for the building industry and BIM coordinator for the building industry.**

The role and scope of the BIM coordinator or "BIM Manager" vary from project to project. Some training courses exist (CSTB, specialised Masters from the École Nationale des Ponts et Chaussées - ENPC or the École Spéciale des Travaux Publics - ESTP) but the range of training courses should continue to develop in order to meet the growing demand.

However, BIM is still restricted to the design phase. Projects designed in BIM do not make it down to site level, and in the vast majority of cases, the companies responding to the calls for tender have not consulted the model and have only received plans, sometimes in very large numbers, taken from the BIM models[88] . What's more, these models are not used on site, either by the site manager, the contractors or the project manager during site meetings. As a result, interfaces between trades are not handled as efficiently as they could be, and changes during the execution phase are rarely updated in the DCE (Dossier de Consultation des Entreprises) model. As a result, the digital Dossier des Ouvrages Exécutés (DOE) is generally that of the design phase, and does not reflect the actual state of the building at the end of the works. In fact, most companies do not have to design a model, or part of a digital model. What's more, the contracts signed by companies almost never include clauses requiring them to refer to the project model using a free viewer and the integrated tools.

Other new technologies that could be useful to the sector include the following:

- 3D printing, which can be used to produce even more accurate BIM models at lower cost.
- Augmented reality, facilitating decision-making and awareness-raising, as well as (virtual) immersion of the customer in the project.
- The use of drones to obtain a better view of the project during the construction phase or photometric data, or to survey existing buildings (from a cloud of points, a digital model of the existing project can be obtained without having to redo a ground survey).
- Artificial intelligence. Artificial intelligence enables the data collected to be put to good use by optimising the various phases in the life of the building. The ambition of the data acquisition systems (thanks to the sensors installed and their analysis by artificial intelligence) will enable the overall cost of the building to be controlled, equipment to be shared and consumption and the mix to be optimised.

[88] BIMplement project reference. www.bimplement-project-eu

Centralised management systems are known as BACS (Building Automation and Control Systems). Comprising a network of sensors and controllers that communicate with each other, they monitor and regulate heating, ventilation, air conditioning, lighting and security systems. They can be connected to artificial intelligence for more efficient, responsive management. BACS can be used to optimise energy consumption, making them a key tool for reducing consumption, particularly in commercial buildings. To this end, the BACS decree of 20 July 2020 requires owners of commercial buildings with an HVAC system rated at more than 290 kW to fit them with an automation and control system by 2025. A guide to implementing the BACS decree has been published by the government[89] . The aim of the guide is to provide details of how the decree applies and to share best practice in installation and management.

4.2.7.8 Off-site prefabrication and industrialisation of construction and renovation projects

In order to mass-produce renovation, improve the quality of the work and make up for the shortage of manpower on building sites, the industrialisation of prefabricated building sub-assemblies seems to be one of the solutions to be explored. It is important to specify that the notion of industrialisation goes further than that of off-site prefabrication. Off-site prefabrication involves moving part of the project to a different location from the site, but does not necessarily mean standardising the approach. Industrialisation, on the other hand, is the implementation of methods from the industrial sector to enable large-scale production with high labour productivity. In particular, it relies on digital design and monitoring, centralised and automated production sites, and lean *manufacturing*.

It is therefore difficult for the proposed industrialisation solutions to be economically competitive until a certain level of standardisation is implemented in the industry. However, off-site solutions can sometimes come up against an unfavourable preconception on the part of certain players in the industry, particularly architects, project managers and contractors.

In terms of renovating existing homes, the EnergieSprong scheme has gained momentum in recent years in Europe, with 6,400 homes delivered or undergoing an E=0 renovation (a zero-energy home means one that produces all the energy required to meet its own consumption needs). According to EnergieSprong[90] , 9.5 million homes could undergo an EnergieSprong renovation[91] .

As part of the PROFEEL programme, the Restore project involves field-testing reproducible renovation solutions tailored to specific types of single-family homes[92] .

The European Union is also interested in the subject and is funding several projects to boost the industrialisation sector, as shown in the figure below:

[89] Application guide for the BACS decree (2023). https://rt-re-batiment.developpement-durable.gouv.fr/IMG/pdf/guide_bacs_16052023.pdf
[90] EnergieSprong, Pouget Consultant, Énergie Demain (2020), Study of market potential by housing type
[91] EnergieSprong, Massification of renovation
[92] RESTORE project - RENOSTANDARD. https://programmeprofeel.fr/projets/restore-renostandard/

Project	Pre-Fab	BMS-ICT	RES	BIM BPSM	Multi-Benefit	HVAC	Advanced Geomatics	3D Print	Smart Connector
A2PBEER		✓							
ABRACADABRA	✓		✓		✓				
ADAPTIWALL	✓								
BERTIM	✓			✓			✓		
BRESAER	✓	✓	✓						
BuildHEAT	✓	✓	✓		✓	✓			
CETIEB		✓							
E2ReBuild	✓								
E2EVENT	✓	✓	✓			✓			
EASEE	✓			✓			✓		
Eensulate	✓								
HERB	✓		✓			✓			✓
IMPRESS	✓							✓	
INSITER							✓		
INSPiRe	✓		✓						
MeeFS	✓	✓	✓						
MORE-CONNECT	✓	✓	✓	✓	✓	✓	✓	✓	✓
NewTREND				✓					
NeZeR					✓				
P2ENDURE	✓			✓		✓	✓	✓	
OptEEmal	✓	✓		✓	✓		✓		
REFURB		✓	✓		✓	✓			
REnnovates	✓	✓	✓	✓	✓	✓			
RetroKit	✓	✓	✓			✓			
RE4	✓	✓		✓			✓		✓
smartTES	✓		✓			✓			
TES	✓		✓			✓			✓
TransitionZero				✓	✓		✓	✓	
VEEP	✓						✓		✓
ZEBRA 2020					✓				
4RinEU	✓	✓	✓	✓	✓	✓			

Figure 4-27 European projects looking at prefabricated solutions for the energy renovation of buildings

Source: D'Oca S & al (2018), Technical, Financial, and Social Barriers and Challenges in Deep Building Renovation: Integration of Lessons Learned from the H2020 Cluster Projects.[93]

While these projects have so far focused on developing technical solutions, the current Giga Regio Factory project[94] aims to propose solutions to stimulate the adoption of industrial solutions by the market and increase their acceptance by stakeholders. To achieve this, it aims to :

- Develop a tool to better qualify dwellings and develop a more intelligent aggregation strategy to launch large-scale collective industrial renovations at zero-energy level;
- Support companies that integrate and assemble industrial solutions to enable them to develop 100% industrialised offerings;
- Enabling solution providers to scale up to meet massive demand by supporting them in the development of their industrial tools.

This type of industrial approach began with social housing, because the way the industry is structured to place orders is well suited to this type of approach. In fact, these are the buildings targeted by pilot projects in France, such as the Mutualisation d'Achat au Service de l'Habitat (MASH) project, which aims to carry out the industrialised renovation of around 2,000 social housing units in the Pays de la Loire region by means of grouped orders[95] . In Hauts-de-France, a trial is planned for the renovation of 5 series-built single-family homes. A number of large-scale projects are also underway outside France. Bavarian social landlord Gewobau Erlangen has invested €40 million to renovate 6,000 flats using prefabricated solutions[96] . However, once the industrial and legal tools have been developed, the approach could be extended to other sectors, such as education, private housing and hospitals.

Off-site prefabrication makes more efficient use of the skills and know-how of construction workers. Companies can focus on specific tasks, which means that workers can develop highly specialised skills in their field, improving their expertise and productivity and therefore potentially increasing the attractiveness of the trades.

According to a survey of 700 companies carried out by the Observatoire du BTP in 2019, 60% of them routinely work with prefabricated solutions, and are planning to make increasing use of them: structures, interior fittings, electrical or HVAC equipment, renovation, etc. For each of these operations, the study details the specific skills that need to be mastered[97] .

[93] D'Oca S, Ferrante A, Ferrer C, Pernetti R, Gralka A, Sebastian R, Op 't Veld P. (2018), Technical, Financial, and Social Barriers and Challenges in Deep Building Renovation: Integration of Lessons Learned from the H2020 Cluster Projects. Buildings. 8(12):174. https://www.mdpi.com/2075-5309/8/12/174
[94] https://webgate.ec.europa.eu/life/publicWebsite/project/details/101077258
[95] https://www.energiesprong.fr/marche-collectif/marche-collectif-mash/
[96] https://www.report.at/bau-immo/21040-serielles-sanieren-klima-mammutprojekt-in-bayern-gestartet
[97] Observatoire du BTP (2019), Prefabrication and industrialisation - Uses, impacts and changes in skills in the construction industry

Industrialisation could therefore help to alleviate the labour shortage in the construction industry. In fact, it offers a solution by taking advantage of a greater number of specialised workers in a controlled environment, which can compensate for this labour shortage. Finally, it can help to increase the number of women in the building trades.

In the short term, the development of this sector does not appear to have the capacity to absorb all the needs of the renovation sector. But in the medium term, it could play a major role, according to many players, if the technical, economic and legal conditions are right to promote the change of scale needed to make them profitable.

4.2.7.9 Zero Net Artificialization : a challenge for new construction

The political stance taken on the issues of biodiversity and climate change has led to the emergence of soil artificialisation as a major concern for new public policies. Soil sealing and urban sprawl have accelerated in France in recent decades. In fact, in 30 years, the amount of artificial land has increased from 33,000 km² to 50,000 km² in 2020. Over the same period, total impermeable surface area in mainland France has risen from 20,000 km² to almost 33,000 km²[98] . This increase, mainly linked to individual housing, transport infrastructure and farm buildings, has been at the expense of forest and agricultural land. Between 2012 and 2020, 0.7% (495,000 hectares) of French metropolitan land will have been artificialised, with the share of artificialised land rising from 8.4% to 9.1%[99] . Over the same period, the number of vacant dwellings rose by 19% (+500,000 dwellings), reaching 3 million dwellings in 2020[100] .

Faced with this situation, the government has made an important political choice: the Biodiversity Plan of July 2018 announced a target of zero net artificial land cover, specified by the Climate and Resilience Act, which sets this target over time: to achieve zero net artificial land cover by 2050. To achieve this, the government is aiming to halve the rate of land artificialisation over the next ten years.

This decision is forcing the construction sector to rethink its market. Indeed, moving towards an end to urban sprawl goes hand in hand with a sharp decline in the construction of individual buildings. The players in the sector and in urban planning are turning their attention to the densification of towns and cities and the elevation of buildings (according to the Atelier d'Urbanisme Parisien, 9,000 building plots could be elevated[101] ; or to the regeneration of industrial areas. While this objective is in line with the national low-carbon strategy, which aims to reduce the volume of buildings constructed, it is also a source of potential for the sector, which needs to reconvert some of its activities and skills. ADEME's forward-looking study "What strategic visions for the new-build sector in a carbon-neutral France in 2050?" presents scenarios for transition to carbon neutrality and the impact on new-build construction[102] .

Building reversibility

It's still a faint signal, but the reversibility of buildings is now emerging as an alternative solution to urban sprawl, but also to the imperatives of energy, land and financial sobriety. Since the Covid-19 crisis and the rise of teleworking, many commercial buildings are now under-utilised.

On the public policy side, this is seen as a way of meeting the need to share facilities and ensure that the city evolves with its climate. The Bordeaux Aquitaine Urban Planning Agency has published a guide entitled "The recyclable city: the reversibility of buildings", which provides initial guidelines on the issue of the reversibility of community buildings, and the main technical, legal and regulatory levers and constraints of recyclable urban planning.

Link to the guide: https://www.aurba.org/productions/la-ville-recyclable/

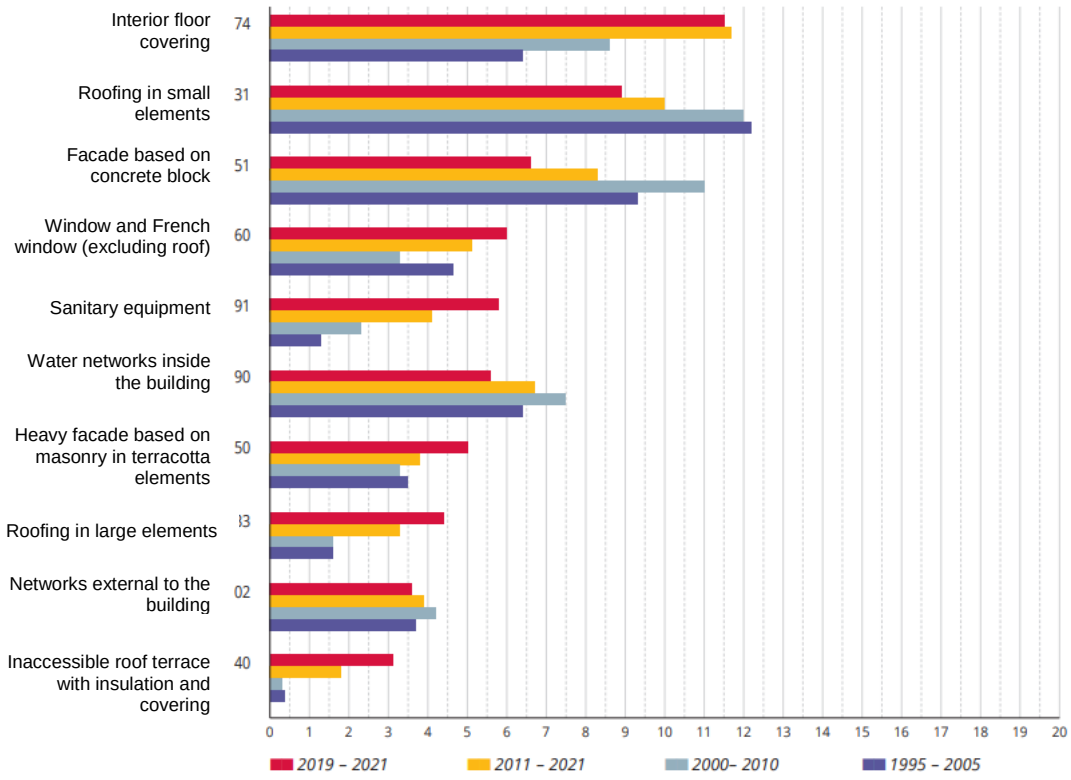
[98] Comité pour l'économie verte (2019), Les enjeux de l'artificialisation des sols : Diagnostic
[99] INSEE (2022), Land artificialisation
[100] SDES (2022), Key housing figures
[101] APUR (2016), Building better and more sustainably: Impact of the ALUR law on the development of Parisian buildings
[102] https://librairie.ademe.fr/urbanisme-et-batiment/5290-quelles-visions-strategiques-pour-la-filiere-construction-neuve-dans-une-france-neutre-en-carbone-en-2050-.html

4.2.8 The quality of the work carried out

Building defects

A defect or disorder is a fault or imperfection in a building resulting from poor workmanship. The players interviewed repeatedly mentioned the problem of the quality of the work carried out. Every year, the Agence Qualité Construction (AQC) publishes a list of the most frequent and costly defects in the construction sector[103].

*Figure 4-28 Breakdown of the number of disorders in single-family houses by type for three 11-year periods and one 3-year period, and changes in occurrences (%) *.*



(*) The disorder title is followed by the nomenclature code.
Source: AQC

A negative impact on demand for energy renovation

While these faults found during new construction or thermal renovation represent an energy issue (most often these faults do not reduce consumption as much as expected), an economic issue (the reduction in energy bills is not as great as expected) and an image issue (only 14.2% of RGE sites inspected reported at least one fault), the issue of the quality of the work crystallises the debates, tarnishes the image of energy renovation and raises doubts in the minds of private individuals.

For energy renovation, RGE certification is seen as a good way of bringing companies up to standard and achieving quality work in a secure environment. Nevertheless, all stakeholders agree that the RGE label needs to be reviewed, particularly with regard to the quality of the work, which is not yet fully compliant with national targets (even though 85.8% of the control audits carried out by Qualibat found no discrepancies).

[103] AQC (2023), "Observatoire de la Qualité de la Construction" report

Distinguishing between poor workmanship, fraud, scams and eco-crime, all of which have a significant impact on demand for energy renovation.

The general public does not distinguish between defects found after the building work has been completed and frauds or scams perpetrated by specialist eco-criminals.

The latter rip off private individuals, the State and sometimes even other professionals by making false declarations, receiving State aid without actually carrying out the work (this has been seen a lot with the "€1 insulation" schemes), taking out unsolicited consumer loans, aggressive canvassing, and so on.

It is these players who generate the most dissatisfaction and negative publicity (media, word of mouth, etc.), with the annual loss linked to these frauds estimated at more than €92 million by the Direction Générale de la Concurrence, de la Consommation et de la Répression des Fraudes (DGCCRF). We can see that the RGE label is not enough of a deterrent for these regulars, since 66% of the companies inspected by the DGCCRF in 2021 hold the RGE label.

While this phenomenon makes some private individuals hesitate when they need to call on contractors for their building projects, it also acts as a brake on certain professionals who fear that their image will be wrongly associated with these practices, which are damaging the sector (a finding shared by representatives of the Confédération de l'Artisanat et des Petites Entreprises du Bâtiment - CAPEB, FFB and France Rénov' as part of a working group led by ADEME).

It is therefore important to make a clear distinction between purely technical issues (which may come from people acting in good faith) and fraud and scams (which are aimed solely at the financial gain of these eco-offenders, with no desire to carry out the expected work). A number of measures exist to combat fraud (non-exhaustive list):

- France Rénov' brochure and website: "Protecting yourself against fraud" brochure and website https://france-renov.gouv.fr/fraudes
- DGCCRF fact sheets and brochure: general page of the DGCCRF website: https://www.economie.gouv.fr/dgccrf/Publications/Vie-pratique/Fiches-pratiques/conseils-pour-reussir-la-renovation-energetique-de-son-logement
- Guide d'orientation des particuliers face aux fraudes à la rénovation énergétique, guide à l'usage des services publics accompagnant les particuliers, published at the end of 2023 by ADEME.

Need for skills to reduce defects and improve quality

Increasing the skills of those working in the sector is one way of ensuring the quality and regulatory, energy and environmental compliance of the work carried out.

To achieve this, the players involved are working together to put a stop to these defects. The AQC, through its REX Bâtiments performants scheme, is helping to act directly on the source of faults in the built environment by sharing knowledge and increasing the skills of professionals working on site.

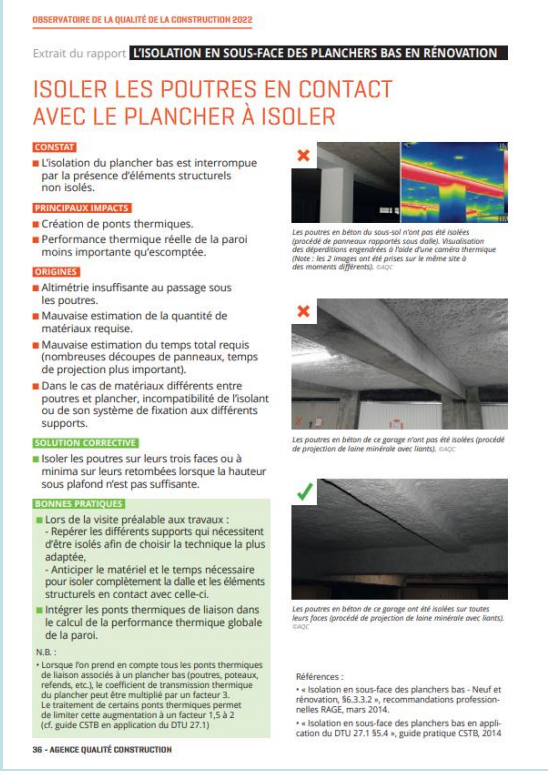
REX system for efficient buildings

Since 2010, the AQC has been capitalising on and developing feedback from construction and post-construction projects in order to share information and help professionals in the industry to move forward. Increasing the skills of those involved by raising awareness of the risks associated with changes in construction methods and by sharing experiments is a key factor in improving the quality of construction work.

"In concrete terms, this system consists of capitalising on experience feedback based on an on-site audit of pioneering buildings that go beyond the regulatory targets for energy and environmental performance, and on interviews with the players who took part in the various phases of their development".

Lessons learned and best practices are passed on to professionals so that they can learn from past mistakes. The practice sheets are structured as follows: identification of emerging risks; main impacts; origin; corrective solutions; good practice.

Figure 4-29 Example of a practical sheet for insulating beams in contact with the floor to be insulated.



OBSERVATOIRE DE LA QUALITÉ DE LA CONSTRUCTION 2022

Extrait du rapport **L'ISOLATION EN SOUS-FACE DES PLANCHERS BAS EN RÉNOVATION**

ISOLER LES POUTRES EN CONTACT AVEC LE PLANCHER À ISOLER

CONSTAT
- L'isolation du plancher bas est interrompue par la présence d'éléments structurels non isolés.

PRINCIPAUX IMPACTS
- Création de ponts thermiques.
- Performance thermique réelle de la paroi moins importante qu'escomptée.

ORIGINES
- Altimétrie insuffisante au passage sous les poutres.
- Mauvaise estimation de la quantité de matériaux requise.
- Mauvaise estimation du temps total requis (nombreuses découpes de panneaux, temps de projection plus important).
- Dans le cas de matériaux différents entre poutres et plancher, incompatibilité de l'isolant ou de son système de fixation aux différents supports.

SOLUTION CORRECTIVE
- Isoler les poutres sur leurs trois faces ou à minima sur leurs retombées lorsque la hauteur sous plafond n'est pas suffisante.

BONNES PRATIQUES
- Lors de la visite préalable aux travaux :
  - Repérer les différents supports qui nécessitent d'être isolés afin de choisir la technique la plus adaptée,
  - Anticiper le matériel et le temps nécessaire pour isoler complètement la dalle et les éléments structurels en contact avec celle-ci.
- Intégrer les ponts thermiques de liaison dans le calcul de la performance thermique globale de la paroi.

N.B. :
• Lorsque l'on prend en compte tous les ponts thermiques de liaison associés à un plancher bas (poutres, poteaux, refends, etc.), le coefficient de transmission thermique du plancher peut être multiplié par un facteur 3. Le traitement de certains ponts thermiques permet de limiter cette augmentation à un facteur 1,5 à 2 (cf. guide CSTB en application du DTU 27.1)

Les poutres en béton du sous-sol n'ont pas été isolées (procédé de panneaux rapportés sous dalle). Visualisation des déperditions engendrées à l'aide d'une caméra thermique (Note : les 2 images ont été prises sur le même site à des moments différents). ©AQC

Les poutres en béton de ce garage n'ont pas été isolées (procédé de projection de laine minérale avec liants). ©AQC

Les poutres en béton de ce garage ont été isolées sur toutes leurs faces (procédé de projection de laine minérale avec liants). ©AQC

Références :
• « Isolation en sous-face des planchers bas - Neuf et rénovation, §6.3.3.2 », recommandations professionnelles RAGE, mars 2014.
• « Isolation en sous-face des planchers bas en application du DTU 27.1 §5.4 », guide pratique CSTB, 2014

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Source: AQC (2022), "Observatoire de la Qualité de la Construction" report

4.3 LABOUR AND CONSTRUCTION COMPANIES

4.3.1 Number of companies in the construction sector

Between 2012 and 2021, the number of companies increased significantly, rising from 475,000 to 683,000, according to data from the Observatoire du BTP. However, this increase has not been evenly spread across the different sizes of company, with companies with fewer than 10 employees seeing the biggest increase (up 47%, or 309,000 companies). Medium-sized companies, on the other hand, declined over the period.

Table 4-3 Number of companies by number of employees in 2020 and change since 2012

Company size	Number of companies in 2020	Change since 2012
< 10 employees	657 998	+47 %
10 to 50 employees	23 768	-6 %
50 to 250 employees	1 543	-28 %
> 250 employees	195	+112 %

Source: Observatoire du BTP

In ten years, the number of micro-entrepreneurs or auto-entrepreneurs has doubled in the construction sector, rising from more than 251,000 to more than 495,000 (to qualify this development more accurately, we would need to know the detailed number of micro-businesses created and closed). This is the main increase, since in 2020, micro-entrepreneurs/self-entrepreneurs will account for 72% of construction businesses (compared with 58% in 2010).

Table 4-4 Number of companies with fewer than 10 employees by number of employees in 2020 and change since 2012

Company size (< 10 employees)	Number of companies in 2020	Change since 2012
0 employees	495 904	+72 %
1 to 2 employees	87 021	-4 %
3 to 5 employees	50 235	0 %
6 to 9 employees	24 838	0 %

Source: Observatoire du BTP

4.3.2 Workforce trends in the construction sector

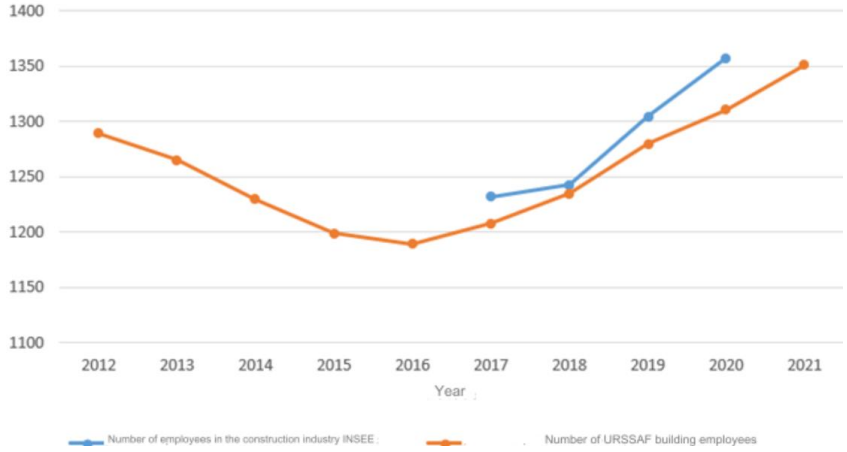
Since 2012, employment in construction companies in France has seen a marked change, partly linked to developments in the property and construction market. This period has been marked by a gradual recovery in activity in the construction sector, following a period of crisis that began in 2008.

From a statistical point of view, the "Construction" sector comprises 3 sectors of activity grouped together under code A88: Building Construction (41), Civil Engineering (42) and Specialised Construction (43). In order to obtain the most accurate data for the building sector, only sectors 41 and 43 should be considered. For salaried jobs (including temporary workers and companies with 0 employees), only two databases were found with this level of precision (A88):

- Fichier Localisé des Rémunérations et de l'Emploi Salarié (FLORES) by INSEE: based on social declarations and other sources from 2017 to 2020 (Connaissance Locale de l'Appareil Production - CLAP - in 2015);
- Union de Recouvrement des cotisations de Sécurité Sociale et d'Allocations Familiales - URSSAF (private sector): based on the DSN (Déclaration Sociale Nominative) since 2015, and before that on the Bordereaux Récapitulatifs de Cotisations (BRC).

The data from these 2 databases is presented in the graph below.

Figure 4-30 Change in the number of employees (including temporary workers) in the construction sector since 2012 (thousands)



Sources: INSEE[104] ; URSSAF

Initially, the figures for employment trends in construction companies were rather negative, with a fall of almost 7% between 2012 and 2015. This fall was largely due to the contraction in the property market and the reduction in public investment in construction. Companies in the sector have been forced to reduce their workforce and close certain subsidiaries to cope with this difficult situation.

However, from 2016 onwards, employment in companies in the sector began to recover gradually. This positive trend was underpinned by a number of factors, including government policies aimed at stimulating investment in construction and promoting the energy-efficient renovation of buildings. In addition, rising demand for housing and business premises has encouraged the development of new construction.

In 2017, for example, employment in construction companies rose by almost 1%, confirming the upward trend in activity in the sector. This trend continued in 2018 and 2019, with employment growth of 1.6% and 1.3% respectively.

However, the Covid-19 pandemic triggered a new crisis in the construction and property sector, leading to a fall in demand for housing and business premises. Businesses were forced to cut back and lay off staff to cope with the fall in orders. The pandemic, however, hampered this positive momentum and highlighted the fragility of the sector in the face of economic uncertainty.

The number of employees in the building industry derived from data from the Observatoire des métiers du bâtiment is based on the census by professional card of the Union des Caisses de France - Congés Intempéries dans le Bâtiment et les Travaux Publics (UCF-CIBTP). The method of calculation is not known to us, and the results differ from those of URSSAF and INSEE presented above. They show a significantly lower number of employees, in particular because they do not take into account work-study students in the "Building" sector, but with the same trend over the period 2015-2020. In order to control the data presented and maintain consistency, we will only use them to present the trend in the distribution of employees in the construction sector (see tables below).

[104] INSEE, Number of establishments and salaried employees by detailed sector of activity and by detailed number of salaried employees at the end of 2020.

Table 4-5 Ranking of the EPAs with the most companies in 2020 and changes since 2012

APE label	Number of employees in 2020	Change since 2012
General masonry work and building shells	125 526	+46 %
Electrical installation work on all premises	86 857	+42 %
Painting and glazing	81 251	+44 %
Wood and PVC joinery	61 759	+36 %
Water and gas installation work on all premises	52 324	+35 %
Plastering work	38 302	+77 %
Construction of single-family homes	35 011	+45 %
Floor and wall coverings	33 218	+49 %
Installation of heating and air-conditioning equipment	27 687	+26 %
Component roofing work	23 717	+51 %

Source: Observatoire du BTP

Table 4-6 Ranking of the EPAs with the slowest growth since 2012

APE label	Number of employees in 2020	Change since 2012
Other finishing work	5 165	-61 %
Legal support for programmes	3 144	+8 %
Office property development	553	+12 %
Housing development	12 334	+15 %
Metal joinery and locksmith work	20 042	+21 %

Source: Observatoire du BTP

In addition, the breakdown by socio-professional category remains constant over the period, with 71% of employees in 2021 being blue-collar workers, 21% white-collar workers, technicians and supervisors (ETAM) and 8% engineers and managers.

Focus on the proportion of local jobs in the regions

The Association of French Regions wanted to analyse the economic complementarities between the regions and, above all, to assess the share of and trends in "local" jobs[105] . By breaking down local employment into 4 categories, from those most dependent on local demand to those almost totally dependent on external markets, the study shows that the structure of employment is relatively homogenous from one region to another, with a predominance of so-called "local" jobs (construction, commerce, catering): these accounted for 82% of the total in 2018, compared with 79% in 2008, and included a high proportion of construction jobs, particularly craftsmen. The regions thus differ much more in terms of employment dynamics, with the loss of "productive" jobs being much greater in some regions. The differences between local jobs and globalised jobs are much greater at the level of the Établissements Publics de Coopération Intercommunale (EPCI), but the study concludes that, contrary to what is often thought, large EPCIs have fewer globalised jobs than expected, and that growth in globalised jobs is not necessarily correlated with the size of the EPCI. These metropolises therefore still play an important role, particularly for certain local service jobs, but remain dependent on the demographic and economic dynamism of the rest of the region.

[105] Régions de France (2022), Another look at economic complementarities between regions. https://regions-france.org/wp-content/uploads/2023/02/VF-Note2-Compl%C3%A9mentarit%C3%A9-des-Territoires.pdf

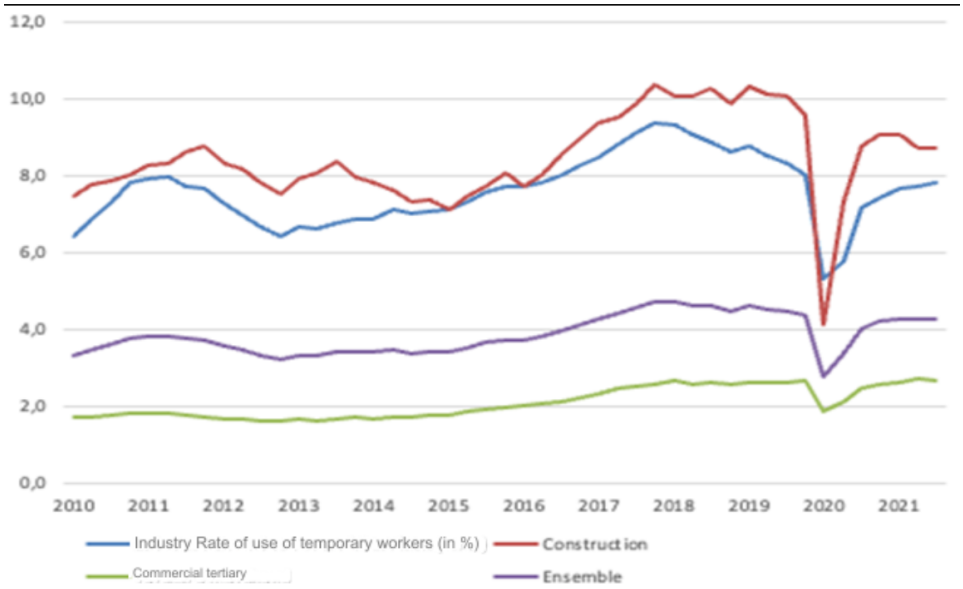
Focus on recruitment tensions

The recruitment pressure that is being felt in virtually all the sector's activities could increase in the coming years. According to the Observatoire du BTP, 7 out of 10 companies say they are currently finding it difficult to recruit, a figure that has risen sharply over the past 5 years[106] .

4.3.3 Rate of temporary work

The proportion of temporary workers in the workforce (including temporary agency workers) in the construction sector has historically been the highest among non-agricultural market sectors. It rose sharply between 2016 and 2019, exceeding 10% in 2018. The health crisis has had a major impact, with a 60% reduction in the number of temporary staff in 2020. However, the use of temporary staff will have returned to pre-Covid levels by 2021.

Figure 4-31 Temporary employment rates in the construction sector



Source: INSEE[107]

4.3.4 Number of women in the building and public works sector

According to URSSAF[108] , women will account for 14.2% of new hires under all types of contract (permanent contracts, fixed-term contracts) in 2022. The proportion of women currently on permanent contracts in the "building construction" sector is 15%, on fixed-term contracts of one month or more 12.5% and on fixed-term contracts of less than one month 9.8%. The building sector is one of the 5 sectors with the lowest proportion of women, along with civil engineering, specialist construction work, agriculture and transport.

The sector attracts very few women, who are poorly represented in the building trades (only 1.6% of manual workers, 20% of managers[109]). Women also account for only 11% of apprentices, according to Constructys[110] . According to the feedback from the players interviewed, there are several factors at play: hygiene conditions on building sites are poorly suited to women (changing rooms, lockers, toilets), but men's behaviour is also a problem, amplified by gender stereotypes and a view of trades often described as "men's trades".

[106] Observatoire du BTP (2021), Tight jobs in the building sector
[107] INSEE (2022), Employment, unemployment, earned income
[108] URSSAF (2023), Statistical compendium
[109] FFB (2022), La place des femmes dans le bâtiment. https://www.lebatiment.fr/tendances-batiment/la-place-des-femmes-dans-le-batiment
[110] Constructys (2021), Activity report

Organisations to improve the position of women in the construction sector

A number of organisations are working to give women a place in the building sector, in all trades, from design to construction. This involves, for example, organising single-sex training courses, or courses aimed primarily at women. Here are just a few examples of the many schemes being set up:

- Les Bâtisseuses is a group of people involved in the eco-construction sector who provide vocational training, disseminate knowledge, provide support for project management and use, and carry out worksites. They run training courses for people on the path to integration, particularly women.
- The Zaha School, the first inclusive school in the building industry, has set itself the mission of raising the profile of manual building trades and making them accessible to all. To achieve this, the school recruits a majority of women and builds an inclusive educational framework, providing training to help them become professionals, and giving them tools to help them overcome impostor syndrome, for example.
- The "We are all builders" training organisation is also rolling out more inclusive training courses, offering single-sex courses for women or adapting courses so that they can be taken by people with disabilities.
- CORIF (Conseil de Recherche, d'Ingénierie et de Formation pour l'égalité entre femmes et hommes - Research, Engineering and Training Council for Equality between Women and Men): an association that has been promoting professional equality for 40 years.

Today, the trades that employ the most women in the building and public works sector are eco-construction trades, or trades linked to ecological issues.

4.3.5 Career development and early retirement career

Working conditions are a major factor in the attractiveness of the sector, and the players involved, under the guidance of the French professional body for building and public works prevention (OPPBTP), are working to improve them. In the opinion of those involved, a large proportion of the trades, particularly construction workers, are still demanding and physical, working outdoors. One of the challenges facing the sector is the possibility of moving on to less physically demanding jobs during one's career.

Faced with the arduous nature of their jobs, employees in the building industry benefit from the professional prevention account (C2P), which allows them to finance :

- Training to help you retrain;
- A move to part-time work ;
- Early retirement at the end of your career.

Nevertheless, according to the construction trade unions, the majority of workers in the sector do not reach retirement age because they are declared unfit or disabled beforehand, which leads to their dismissal. In an opinion issued in November 2022 on construction policy, the EESC recommended stepping up social dialogue, including at local level to manage skills at the level of employment areas, in order to improve pay and working conditions[111] .

4.3.6 Retirements

Employment trends in the sector will be strongly influenced by forthcoming retirements: more than a quarter of the workforce in the construction sector is over 50. This increases current recruitment pressures and future employment needs (in addition to having to create jobs to meet demand linked to the sector's new challenges, it will also be necessary to replace those retiring).

[111] CESE (2022), Towards more sustainable buildings through an ambitious renovation policy

Focus on retirement and early retirement

France Stratégie estimates that between 2019 and 2030, 478,000 people in the building and civil engineering sector are expected to retire[112] , 400,000 of whom could potentially be building professionals alone[113] . Many more are expected if we consider the entire building and civil engineering sector, including cross-functional jobs such as accountants, sales staff, etc.). These departures also include early retirement due to occupational illness and people leaving the labour market.

Figure 4-32 Change in employment, end-of-career leavers, recruitment needs and young entrants in the building and public works sector (FAP) over the period 2019-2030 (thousands)

Professional Family = FAP	Dominant Qualification Level	Employment in 2019 (in thousands)	Reference				
			[1]	[2]	[1+2]	[3]	[1+2+3]
			Net Job Creations	Retirements	Recruitment Needs	Young Beginners	Partial Imbalance
Entire B sector - Construction, public works		1,821	119	478	597	433	165
BOZ: OPQ, structural work of building, public works, concrete and extraction	OPQ	180	-9	38	29	61	-32
B1Z: OQ, public works, concrete and extraction	OQ	92	7	30	37	17	20
B2Z: OQ, structural work of building	OQ	351	10	101	111	47	64
B3Z: OPQ, finishing work of building	OPQ	118	-6	24	18	31	-13
B4Z: OQ, finishing work of building	OQ	513	27	150	177	107	71
B5Z: Plant operators in construction and public works	OQ	73	4	22	26	13	13
B6Z: Technicians and AM of building and public works	PI	303	27	81	108	85	23
B7Z: Architects and managers of building and public works	Manager	191	58	32	90	72	19

Source: Dares

The table below shows that skilled building and construction workers are the two trades in the construction sector with the highest level of tension, i.e. the greatest imbalance between retirements, job creations and the arrival of young beginners.

Finally, the retirement of a large number of company directors and craftsmen could make the recruitment of future building professionals even more complex.

The pension reforms raising the legal retirement age from 60 to 62 in 2010 and from 62 to 64 in 2023 have rekindled these issues of career development and termination within the profession. Building professionals are particularly affected by the arduous nature of their daily tasks. What's more, they enter the labour market at a younger age on average, and may find it harder than average to find work after a certain age.

In Cherbourg, the Maison de l'Emploi conducts a survey on perceptions of the building and public works sector

At the Salon de l'Habitat en 2020, held in Cherbourg, the Maison de l'Emploi interviewed 70 visitors about the building sector in order to assess persistent misconceptions, estimate the need for upgrading, assess the level of knowledge about the environmental impact of building and pass on information.

Of this sample, 50% think that the building trades are hard and dangerous, and 32% think that employees are poorly paid. On the other hand, very few thought that the trades were not evolving, that only the worst performers were doing them, or that the quality of training was not important. A large majority recommend highlighting technological change and ecological benefits to give these professions a different image.

[112] France Stratégie, Dares (2022), Jobs in 2030
[113] We apply the same breakdown as for employees working in the building and public works sector, i.e. around 85% in construction and around 15% in public works.

4.3.7 Inventory of existing estimates on developments in the construction sector

A number of studies looking ahead to 2030 or 2050 have already been carried out on building trades and the construction sector.

In 2022, France Stratégie and Dares published a study[114] forecasting trades and qualifications in France up to 2030. The study forecasts the creation of almost one million jobs between 2019 and 2030, including 120,000 positions in the building trades.

In the reference scenario used for this study (based on demographic and socio-economic trends), between 2019 and 2030, 165,000 jobs would need to be filled in the building and civil engineering sector. These positions represent the balance between job creation, retirements and the arrival of young people entering the market. Most of this additional demand will be for technicians and managers (architects and engineers). The latter, for example, will account for half of the jobs estimated to be created between now and 2030. The construction sector is also likely to be one of the main areas of demand for people with higher education qualifications.

In a low-carbon scenario, the number of additional jobs to be filled rises to 245,000, i.e. an additional 80,000 jobs compared to the reference scenario. Most of this extra job creation would come from skilled building tradespeople, because renovation work requires major insulation and energy-supply work on buildings. The building and public works sector is one of the areas with the greatest shortage, along with transport and logistics and personal services.

As part of its "Transitions 2050" scenarios, in 2022 ADEME published a forward-looking vision for the new-build sector up to 2050[115] . This study begins with an inventory of the industry, then focuses on ADEME scenarios 2 and 3 in order to propose two prospective developments for new construction up to 2050. It also proposes accompanying measures up to 2030.

The Shift Project has also estimated the number of jobs needed in the housing sector to meet low-carbon targets by 2050. For this purpose, the state of play is set at 2018, with an estimated 890,000 FTEs in housing construction and renovation (460,000 in renovation maintenance, including 70,000 in thermal renovation, and 430,000 in construction). In order to meet the targets for the number of energy renovations between 2041 and 2045 (a plateau in the number of renovations per year), the study estimates that 110,000 additional jobs will be needed in thermal renovation (in order to reach 180,000 FTEs and therefore 570,000 for renovation maintenance). Employment in new construction is conditioned by the socio-economic choices made, but is presented as falling in the case of a sober choice.

Based on its 2022 scenario, Négawatt presents figures for job creation in the energy renovation sector. These are set to double from 170,000 in 2021 to more than 385,000 between 2029 and 2050. The scenario predicts weak growth in these jobs until 2025, due to renovations that are still mainly "gesture-based", followed by significant growth thanks to much more efficient renovations. However, there will be a slight reduction in the number of jobs from 2030 onwards because of a constant rate of renovation and an increase in labour productivity[116] .

A number of sectors have attempted to forecast the number of jobs needed to achieve the sector's climate-energy objectives. The table below summarises the various estimates available.

[114] France Stratégie, Dares (2022), Jobs in 2030
[115] Strategic Committee for the Timber Sector (2021), Plan ambition bois construction 2030
[116] https://www.ofce.sciences-po.fr/pdf/revue/01-176OFCE.pdf

Table 4-7 Current jobs by sector and projected trends

Building sectors	Current data	Forecasts to 2030
Wood and bio-sourced construction	174,345 direct FTEs in 2020 (+7% since 2017)[117]	30,000 new jobs by 2026[118]
Insulation	28,386 employees in 2021[119]	
Heat pump[120]	32,000 jobs in 2020	+20,000 jobs by 2020: 2,000 in industry and design, 3,000 in distribution and prescription, 5,000 in equipment installation, 10,000 in equipment maintenance
Concrete (extraction, manufacture)	55,000 direct jobs in 2019	
Architects	2019: 29,000 architects[121]	+58,000 more jobs than in 2019[122]
Waterproofing and cladding	2019: 21,000 employees, including 8,200 journeymen[123]	
Project Management Assistance (PMA)		An 8-10% increase in the number of construction, infrastructure and environmental engineering project management staff by 2027.

Sources: Filière Forêts Bois; CODIGAB; URSSAF; AFPAC; ADEME; Chambre Syndicale Française de l'Étanchéité; OPIIEC; France Stratégie

The aim of BUS2 is to refine these various estimates of job requirements, both for the energy renovation of buildings and for construction, and for the different market segments (residential, tertiary, social housing, etc.). The results of these models are detailed in part 7 of this report.

Skills needs linked to market developments Example of the PAC sector

As the flagship equipment for decarbonising building heating and cooling systems, heat pumps are benefiting greatly from the public support introduced in 2019. Sales took off in 2019 and the trend continued in 2020, according to AFPAC: sales of air-to-water pumps rose by 80% and air-to-air pumps by 25%. France is now Europe's leading market for domestic heat pumps.

However, as of 2019, the AFPAC has identified a skills shortage in the installation and maintenance of these heat pumps, which require specific skills. As a result, installation technicians, refrigeration engineers and maintenance technicians are already considered to be short-staffed occupations. It estimates that 95,500 journeymen will need to be trained by 2030, with an additional 20,000 jobs needed between now and 2030, from research and development (R&D) to maintenance. The AFPAC recommends that these skills be incorporated into the initial training curricula of the French Ministry of Education, CFAs and other organisations, as well as in continuing education, particularly in the FEEBAT programme. It currently lists fifteen diplomas leading to careers as energy systems technicians, delivered in 350 establishments, as well as several non-degree private continuing education courses and the RGE PAC qualification.

More recently, Uniclima (the French association of the heating, ventilation and air-conditioning industries) estimates that by 2030 more than 200 research engineers, 600 developers, 16,200 production workers, technicians and engineers, 20,000 installers, 10 maintenance technicians and 50 trainers will be needed to support innovation in the sector and increase production capacity. More than 15 training centres will need to be opened to meet these needs.

[117] VEM (2020), Forest-based industries, Key figures - Added value and employment
[118] CODIGAB (2021), Wood-Construction Ambition Plan 2030
[119] URSSAF, Number of employer establishments and number of employees in the private sector (APE insulation work)
[120] AFPAC (2021), Job Ambition Sheet CAP
[121] ADEME (2022), Quelles visions stratégiques pour la filière construction neuve dans une France neutre en carbone en 2050?
[122] France Stratégie (2021), Métiers 2030
[123] Chambre Syndicale Française de l'Étanchéité, Figures for 2019

5 NATIONAL POLICIES FOR EMPLOYMENT AND SKILLS OF BUILDING INDUSTRY PLAYERS

In view of the ambitious national targets for the construction sector, a number of policy measures have been implemented since 2012 to promote the development of employment and the adaptation of vocational and educational pathways to the development of skills in line with needs. Although these measures are not specific to the construction sector, they do have an impact on the construction industry and apprenticeships in particular, and many of them are essential to the sector's development.

In this chapter, we will review the main French national policies on employment and skills, examining their objectives, key measures and impact on the French economy. We also mention a few initiatives specific to the building industry that have been developed by professional federations to give the sector a direction for its transition.

5.1 OVERVIEW OF EMPLOYMENT AND SKILLS POLICIES SINCE 2012

5.1.1 Employment and skills development commitment (EDEC) and human resources consultancy services (PCRH)

EDECs and PCRHs are 2 schemes particularly promoted by the Ministry of Labour, Employment and Integration.

Annual or multi-year agreements signed between the State and one or more professional organisations or branches, EDECs can be signed at national level by the Délégation Générale à l'Emploi et à la Formation Professionnelle (DGEFP - General Delegation for Employment and Vocational Training) or even at regional or territorial level by the Directions Régionales de l'Économie, de l'Emploi, du Travail et des Solidarités (DREETS - Regional Directorates for the Economy, Employment, Labour and Solidarity) and the Directions Départementales de l'Emploi, du Travail et des Solidarités (DDETS - Departmental Directorates for Employment, Labour and Solidarity). Since 2005, these agreements have made it possible to provide technical and financial assistance in order to anticipate changes in jobs and qualifications and thus secure the career paths of working people. They lead to the implementation of an action plan with the aim of *"anticipating the consequences of economic, social and demographic change on jobs and skills and adapting training and qualifications to these changes".* To achieve this, the EDEC carries out forward-looking studies to observe changes in trades and skills and implement operational actions.

The ability of the EDECs to create consensus and concerted action within the professional branches, as well as the financial support they generate from the State, are particularly appreciated by the stakeholders in the various sectors. On the other hand, in the construction sector, due to opposition between the federations, no EDEC has been signed by all the players or at Constructys level, covering the ecological transition.[124] And yet the Climate and Resilience Act gives Skills Operators - OPCOs the task of "*informing companies about the challenges of sustainable development and supporting them in their plans to adapt to the ecological transition, in particular by analysing and defining their skills needs*".

Cooperation seems to be more fruitful at regional level. In Occitanie, in the construction sector, for example, two EDECs were recently signed with Constructys. One, renewed in 2022, concerns the digital transition, and aims to advise and support around forty companies in integrating digital tools into their work processes and organisation. The second, also signed in 2022, relates more specifically to the transition and aims to gain a better understanding of bio-sourced and low-carbon substitute materials, and to give greater consideration to waste recycling and energy savings.

The PCRH enables DREETS and OPCOs to offer VSEs/SMEs access to an HR consultancy service financed in whole or in part by public funds. The aim of this service is to jointly develop a diagnosis and an operational action plan shared by the company's stakeholders (management, employees and their representatives) on specific HR issues identified with the company, and to support the implementation of actions by making the company autonomous and enabling it to take ownership of the tools made available to it.

[124] Céreq Bref (2022), Transition écologique : l'État peut-il orienter l'action des secteurs professionnels ? NO. 429. https://www.cereq.fr/transition-ecologique-letat-peut-il-orienter-laction-des-secteurs-professionnels

This support is provided by a specialist external HR consultant. It is personalised, operational and linked to the company's economic development strategy.

What topics can be covered?

- Forward-looking management of jobs and skills (GPEC)
- Improving recruitment processes and supporting the development of attractiveness
- Integrating employees into the company
- Organisation of work
- Improving social dialogue
- Professionalising the HR function within the company
- HR support for the digital and ecological transitions
- HR support for cyclical situations involving variations in activity and/or linked to a particular economic context

5.1.2 Future jobs (2012)

The Act of 26 October 2012 created subsidised jobs for young people aged between 16 and 25 with few or no qualifications, living in disadvantaged urban or rural areas, or in overseas territories, as well as for low-skilled disabled people under the age of 30. Subsidised by the State for 3 years at 75% of the Minimum Growth Wage (SMIC), they were generally full-time, on permanent or fixed-term contracts. The government had set itself the target of creating 150,000 jobs for the future by 2014, including 100,000 from 2013.

According to the government, Future Jobs were a success, with more than 300,000 contracts signed between 2013 and 2016. However, the scheme was discontinued in 2018 and replaced by the Parcours emploi-compétence.

5.1.3 Youth Priority Plan (2012)

In February 2012, the first inter-ministerial committee on youth defined 13 projects for young people, broken down into 47 cross-cutting measures covering health, housing, living conditions and the place of young people in society and politics. 4 measures deal with youth employment:

- The generation contract, which allows companies with fewer than 300 employees to benefit from financial assistance from the State of 4,000 euros per year (8,000 euros in the case of simultaneous recruitment of a young person and a senior citizen), for three years, if they take on an employee under the age of 26 on an open-ended contract while retaining an employee aged 57 or over. In September 2015, 103,536 young people and seniors were benefiting from the Generation Contract. It was abolished in November 2017.
- Encouraging business start-ups through microcredit, loans, guarantees from the Public Investment Bank and the creation of a resource centre.
- Improve support for vocational integration by strengthening the partnership between vocational training establishments, the public employment service and the business world.
- Experimentation of 2,000 "emplois francs" (aid for the recruitment of a resident of a priority neighbourhood).

5.1.4 Employment-Skills Pathways (PEC) and Single Integration Contracts (CUI; 2018)

A new system of assisted contracts was introduced in January 2018. The "Parcours emploi-compétence" is the successor to the "contrats aidés" (subsidised employment contracts), which were criticised on a number of counts, the main one being that they pursued multiple objectives and vacillated between the social or professional integration of beneficiaries. The aim of the new scheme is to help people who have been excluded from the labour market into work, by providing them with work experience, easier access to training and the opportunity to acquire skills. It is aimed at anyone who has difficulty finding a job, and can be either an open-ended contract or a fixed-term contract of at least six months (in the general case) and at least 20 hours a week.

As part of the Skills Employment Pathway, employers in the non-market sector (local authorities, associations, public bodies, community interest cooperatives) can receive monthly work integration aid paid by the State of between 30% and 60% of the gross hourly SMIC in mainland France, and between 30% and 70% in the overseas departments, prorated according to the number of hours and duration of the contract covered. These parameters are set by order of the regional prefect.

For employers in the commercial sector, this type of aid is limited to young people (under 26 or under 31 if the worker is disabled), and the rate of aid is 47% of the minimum wage. It is open to the general public in overseas departments only.

5.1.5 Launch of the Skills Investment Plan (PIC; 2018)

The major investment plan for 2018-2022 contains a Skills component: the Skills Investment Plan (PIC), which will mobilise €15 billion over 5 years to train 2 million jobseekers with few or no qualifications and young people to meet recruitment needs for jobs in short supply. As vocational training was a regional responsibility, part of this plan consists of a contractual agreement between the State and the Regions, which undertake to implement actions in return for the budget allocated to them. In operational terms, this translates into the introduction of "regional pacts for investment in skills". According to the third report by the scientific committee assessing the ICP[125] , the ICP has "very probably" helped to maintain a high level of training entries despite the advent of the Covid-19 crisis over the period 2018-2021. CIP funding has also been used to strengthen pre-existing support programmes for young people and schemes for employees in work integration.

In 2016, the contractual pathway to employment and independence (PCAEA) became the sole contractual framework for the support of young people by local missions. It is made up of several phases of support that follow each other over a maximum period of 24 months. The support may take the form of periods of training or work experience, as well as other actions that may be useful in developing the beneficiary's autonomy. The Garantie Jeunes (replaced in 2022 by the Contrat d'Engagement Jeune) is a specific form of this pathway offering more intensive group support. The Contractual Support Pathway to Employment and Autonomy (Parcours Contractualisé d'Accompagnement vers l'Emploi et l'Autonomie - PACEA) concerns all young people aged 16 to 25 wishing to embark on a contractual support pathway. Over the 5-year period, the CIP will invest 280 million euros in the PACEA allowance and 2.7 billion euros in the Youth Guarantee allowance, in order to reach 785,000 young people on the PACEA and 500,000 on the Youth Guarantee.

By 2021, 420,000 young people will be receiving support under the PACEA and 200,000 under the Youth Guarantee[126] .

5.1.6 Law on the freedom to choose one's professional future

Enacted in September 2018, the law for the freedom to choose one's professional future reforms training via the Personal Training Account (CPF) as well as the conditions for apprenticeships. In effect it:

- The CPF will be converted from hours of training to euros.
- Promotes professional retraining, in particular through the PRO-A scheme, which facilitates access to work-linked training when retraining.
- Investing in improving the apprenticeship training pathway for young people: extending the age of entry to apprenticeship to 30; expanding the range of training bodies that can offer apprenticeship training; increasing apprentices' pay.

5.1.7 1 young person, 1 solution" plan

Implemented in 2020, the "1 young person, 1 solution" plan is a €9 billion investment by the State in youth employment. It includes a number of recruitment aids, training courses and support to help all profiles.

- Compensation of €4,000 for any young person recruited between 1er August 2020 and 31 March 2021;
- Aid of €5,000 to recruit a work-study student under the age of 18 or €8,000 to recruit a student over the age of 18;
- Setting up additional civic service missions ;

[125] CMPIC, Dares (2022), Third Report of the Scientific Committee for the Evaluation of the Skills Investment Plan
[126] https://travail-emploi.gouv.fr/

- New training courses leading to qualifications for the jobs of the future thanks to the CIP: 100,000 new training courses leading to qualifications or pre-qualifications offered;
- Digital training for young people without qualifications;
- Personalised pathways for school leavers aged between 16 and 18;
- Additional training places for higher education, CAP and BTS courses at the start of the 2020 academic year;
- Strengthening the PEC and CIE schemes ;
- Increase in the financial resources allocated to local missions to enable an increase in the number of PACEA entrants and the introduction of the Youth Guarantee. Doubling of the intensive support for young people (AIJ) introduced by Pôle emploi. **Impact on the socio-professional integration of young people: 80,000 PACEAs in 2021 (from 340,000 to 420,000 young people supported).**

According to the Ministry of Labour, Employment and Integration in 2021[127] **, in one year, more than 2 million young people have benefited from a solution under the plan since it was launched**. Half of this increase (a twofold increase compared with 2018) can be explained by the widespread use of the autonomous CPF[128] .

Still over the same one-year period, but with no immediate correlation with the implementation of the plan:

- 800,000 young people have entered a tailor-made integration programme;
- For example, 121,000 young people entered the Youth Guarantee scheme;
- 350,000 young people under the age of 30 have undergone training, including 90,000 in strategic sectors such as the ecological transition, digital technology, health and industry;
- 1.8 million young people under the age of 26 were hired on permanent or fixed-term contracts of more than 3 months between August 2020 and May 2021;
- 525,600 young people signed apprenticeship contracts in 2020[129] . This is 42% more than in 2019. In addition, 62% of young people who left apprenticeships in 2019 were in employment 6 months after leaving.

5.1.8 Plan to reduce recruitment pressures, implemented regionally through the PACTE programmes

Since 2021, the plan to reduce recruitment tensions has been aimed at facilitating employees' professional transitions and retraining, and their upgrading of skills in sectors where there is a shortage.

The sectors considered to be under pressure are :

- Care and support
- Early childhood
- Butchers and bakers
- Road haulage and ancillary activities
- Metallurgy

According to the DGEFP, interviewed as part of the study, the building sector is not yet one of the priority sectors, but would be on the list after the hotel and catering sector. The study by the Observatoire des Métiers du BTP (Building and Civil Engineering Trades Observatory) on occupations in short supply[130] and the fact that France Stratégie has regionalised employment requirements for energy renovation[131] show that the challenge for the building sector has been clearly identified.

[127] Ministère du travail de l'emploi et de l'insertion (2021), Bilan 1 an 1 jeune 1 solution
[128] CMPIC, Dares (2022), Third Report of the Scientific Committee for the Evaluation of the Skills Investment Plan
[129] Dares (2021), A very sharp increase in new apprenticeship contracts in 2020
[130] Observatoire des Métiers du BTP (2021), Les métiers en tension. https://www.metiers-btp.fr/nos-etudes/les-metiers-du-btp/
[131] In July 2023, France Stratégie held its second annual conference on careers, this time focusing on the employment and skills challenges of the ecological transition. The foresight exercise focused specifically on the energy renovation of buildings. The messages coming out of the report and the conference are more or less the same as the forecasting exercises carried out as part of BUS2, or by other players such as négawatt: an unprecedented need for investment to finance the acceleration of building renovation, in terms of both pace and performance (see part 7 of this document). These various 2030 scenarios (BUS2, France Stratégie, négaWatt) have sought to estimate the building sector's capacity to respond to this acceleration. The estimates are relatively convergent, with an estimated additional need for between 170,000 and 250,000 jobs between now and 2030, a relatively sharp fall in construction, and job creation almost everywhere in France, but particularly in the North East where there is a significant need for renovation to reduce heating requirements. France Stratégie (2023, Conférence annuelle des métiers et des compétences : résultats de la mission confiée à France Stratégie sur la rénovation énergétique des bâtiments. https://www.strategie.gouv.fr/actualites/conference-annuelle-metiers-competences-resultats-de-mission-confiee-france-strategie

5.1.9 France 2030 Plan

At the end of 2021, the government proposed a major 5-year €54 billion investment plan called France Relance. One of the ambitions of the plan is to meet the challenge of training and skills development in the sectors and professions of the future, whether for students or working people, whatever their level of qualification.

500 million euros should also be allocated over 5 years to the development of new low-carbon construction materials, in particular by renovating and modernising the wood industry's production facilities.

5.1.10 France Compétences / France Travail

Created on 1er January 2019 following the Law on the freedom to choose one's professional future, France Compétences is the national public authority responsible for **regulating and financing vocational training and apprenticeships**. It oversees **the transformation of training provision**, as it is involved in defining the professional qualifications and diplomas that it registers. France Compétences is made up of the State, employers' organisations, employees' unions, the regions and qualified individuals.

Figure 5-1 France Compétences' missions

FRANCE COMPETENCES- Institution for the regulation and financing of vocational training and apprenticeship

Fund Distribution	Distribute all vocational training and work-study funds among various stakeholders (OPCO, State, Regions, CPIR, CDC)
Quality Regulation	Regulate the quality of training actions through opinions, recommendations, information collection, and annual reporting
Certification Relevance	Ensure the relevance of professional certifications by updating the RNCP and RSCH, identifying evolving certifications, and integrating new skills
Cost Regulation	Regulate costs and reimbursement rules for public funders by establishing an observatory
CEP Organization	Organize and finance the Professional Evolution Counseling through localized calls for tenders
Public Debate Contribution	Contribute to public debate as a forum for dialogue and cross-sectional evaluation of training actions

CDC: Caisse des Dépôts et Consignations
CEP: Professional Evolution Counseling
CPIR: Regional Interprofessional Joint Commissions
RNCP: National Directory of Professional Certifications
RSCH: Specific Directory of Certifications and Qualifications

Source: Ministry of Labour, Employment and Integration

In 2023, the budget allocated to France Compétences will be €14.9 billion, which represents the State's total investment in vocational training and apprenticeship. Although this budget has been in deficit since its creation, the gap is narrowing, from €4.6 billion to €2.1 billion in 2023. To regulate this deficit, France Compétences is renewing vocational qualifications, combating CPF fraud and regulating the levels of funding for apprenticeship contracts (with the aim of reducing this by 10% by April 2023). This last measure has mobilised the players who had begun to structure themselves around the amounts resulting from the law on the freedom to choose one's professional future. According to France Compétences' projected income statement for 2023, the budget allocated to the Comité de Concertation et de Coordination de l'Apprentissage du Bâtiment et des Travaux Publics (CCCA-BTP) is €78 million.

In an attempt to fill job vacancies and respond to the recruitment problems of a large number of companies, the government has launched a project to overhaul Pôle Emploi and create France Travail. Although the future organisation is still at the prefiguration stage, one of the aims is to bring together those involved in employment and training: local missions, Cap Emploi, the departmental councils responsible for paying minimum social benefits, and the regional councils responsible for vocational training. Through this one-stop-shop approach, the government aims to simplify and speed up support for jobseekers.

5.1.11 Full employment objective of the Roadmap 2022

Presented on 12 September 2022, Olivier Dussopt and Carole Grandjean's roadmap sets the goal of full employment in France by 2027. To achieve this, it sets out a number of actions, including

- Continue to roll out the Contrat d'Engagement Jeune (CEJ), which replaced the Garantie Jeunes. Six months after its introduction in March 2022, 178,000 beneficiaries have signed a youth commitment contract, while the target number for 2022 is 300,000[132] ;
- Boosting the momentum of apprenticeships, with an announced target of one million apprentices;
- Continue to invest in skills enhancement schemes.

5.1.12 Other building-specific initiatives that could feed into national policies

Assises du BTP : In 2022, the government announced 13 measures resulting from the Assises du bâtiment et des travaux publics (Building and Public Works Conferences) to offset the rise in the price of materials and supply difficulties for companies, and to support the sector in its ecological transition[133] . The Assises brought together over 200 players from the sector in 6 working sessions. The 13 measures adopted by the government were also approved by the local authorities.

The first 4 measures concern companies' cash flow, advances, reimbursements and late payment penalties in the context of public procurement contracts, as well as the possibility of including increases in raw material prices during the course of a contract. Other measures are aimed at simplifying public procurement (only for over-the-counter contracts, shorter deadlines).

As far as the energy transition is concerned, measures are proposed to accelerate the calculation of the "extended producer responsibility" and to accompany it with a tolerance period for its payment. The government is proposing to extend the "RGE" label, site by site, beyond 31 December 2022. Finally, it is proposed to introduce a carbon score for materials, and to launch calls for tenders dedicated to high-performance renovation as part of France 2030.

The FFB's "Believe in the future" roadmap: On the basis of forward-looking scenarios, the FFB has drawn up a roadmap aimed at players inside and outside the sector. This roadmap offers companies of all types a number of interconnected avenues for development, which address both the challenges of digital technology in the building sector and the ecological transition[134] .

CAPEB white paper: "Craft firms in the building industry and Generation Z, a winning duo": Representing most of the future craftsmen who will make the ecological and digital transition in the building industry a reality, the Confédération de l'artisanat et des petites entreprises du bâtiment (CAPEB) (Confederation of Crafts and Small Building Firms) wanted to address the younger generations entering the job market.

This white paper, published in February 2023, addresses the issue of the image of the building and crafts sector among young people, and seeks to highlight the many societal challenges facing the sector, which correspond to the aspirations of part of this generation: new skills linked to digital technology and the ecological transition, modernisation of VSEs in the building sector, quality of daily life, etc.[135] .

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[132] Banque des territoires (2022), Youth Commitment Contract: 178,000 beneficiaries since March 2022. https://www.banquedesterritoires.fr/contrat-dengagement-jeune-178000-beneficiaires-depuis-mars-2022

[133] French Government (2022), The first 13 announcements from the Assises du BTP. https://www.ecologie.gouv.fr/gouvernement-annonce-13-premieres-mesures-issues-des-assises-du-batiment-et-des-travaux-publics

[134] FFB (2022), "2035, Believing in the future", Roadmap. https://www.ffbatiment.fr/revues-guides/ba/14-septembre-2022/batisseurs-de-futurs-une-feuille-de-route-strategique-pour-croire-en-l-avenir#:~:text=%2F-,B%C3%A2tisseurs%20de%20futurs%20%3A%20une%20feuille%20de%20route%20strat%C3%A9gique%20pour%20croire,internes%20ou%20externes%20au%20secteur.

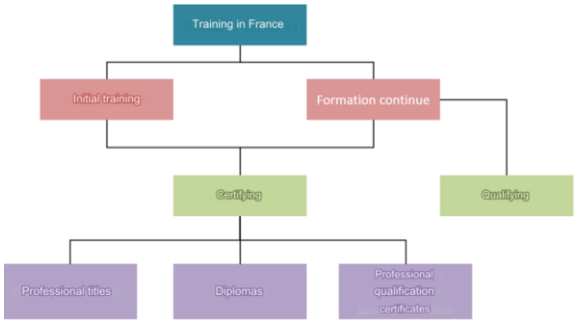
[135] CAPEB (2023), Entreprises artisanales du bâtiment et génération Z, un duo gagnant, White Paper. https://www.capeb.fr/actualites/-entreprises-artisanales-du-batiment-et-generation-z-un-duo-gagnant-la-capeb-publie-son-livre-blanc

6 GENERAL OVERVIEW OF TRAINING

6.1 OVERVIEW OF INITIAL AND CONTINUING TRAINING

In France, lifelong learning enables anyone to receive training during their school or working life. The French Labour Code makes a distinction between "*initial training, including apprenticeships, and subsequent training, which constitutes continuing vocational training, intended for adults and young people who are already in working life or entering it*"[136] . According to the Ministry of Labour, it enables people to "receive training throughout their career, to develop their skills and gain access to employment, remain in employment or change jobs"[137] .

Figure 6-1 Types of training in France



Source: TopFormation (2022), Diploma, Certificate, Qualification: What are the differences?[138]

There are several types of training: training leading to qualifications and training leading to certification[139] .

Training leading to certification results in the award of a certificate, which may be a diploma, a Titre Professionnel (TP) or a Certificat de Qualification Professionnelle (CQP)[140] . These three types of certification are grouped together in the Répertoire National des Certifications Professionnelles (RNCP), which includes some 2,700 certifications[141] .

- **The diploma**: this is awarded by a competent authority under the supervision of the State, such as the Ministry of Education or Higher Education, and attests to a level of competence and the ability to practise a profession, or to enter a competitive examination or training course. It is given as part of initial training or as part of continuing training in the case of professional retraining.
- **A vocational qualification is** a professional certificate issued by the Ministry of Employment. This certification attests to the skills of the holder. It also facilitates access to employment. In 2020, 70% of certified jobseekers were able to find a job within six months of obtaining their qualification. These qualifications cover all sectors, including construction. They are managed by France Compétences and are available at different levels of training. Professional qualifications can be obtained through vocational training, apprenticeship or Validation des Acquis d'Expérience (VAE) (a system for obtaining professional certification by validating acquired experience). It is mainly provided as part of continuing vocational training for :

    - School leavers wishing to acquire a qualification under a vocational training or apprenticeship contract;
    - People wishing to retrain;
    - Experienced people who wish to have their skills certified.

      It can also be provided as part of initial training for young people who already hold a level 3 diploma and wish to specialise in a vocational qualification via an apprenticeship.

[136] Légifrance, Code du travail, Article L6111-1. https://www.legifrance.gouv.fr/codes/article_lc/LEGIARTI000041412240
[137] Ministère du Travail, du Plein emploi et de l'Insertion (2023), La formation professionnelle: principes généraux. https://travail-emploi.gouv.fr/formation-professionnelle/article/la-formation-professionnelle-principes-generaux
[138] https://www.topformation.fr/guide/choisir-une-formation/diplome-certificat-qualification-8293
[139] Topformation (2023), Diploma, Certificate, Qualification: what are the differences? https://www.topformation.fr/guide/choisir-une-formation/diplome-certificat-qualification-8293
[140] Observatoire des métiers du BTP, Certifying courses. https://www.metiers-btp.fr/entrant-btp/entrant-btp/les-formations-certifiantes
[141] Défi Métiers (2022), Le système français de la certification professionnelle : points de repère. https://www.defi-metiers.fr/dossiers/le-systeme-francais-de-la-certification-professionnelle-points-de-repere

- **The Certificate of Professional Qualification (CQP)** attests to the particular skills required to practise a specific profession. It is not a diploma recognised by the French Ministry of Education, but is created by a professional branch and recognised by a collective agreement or branch agreement. In the building and public works sector, it is awarded by the Commissions Paritaires Nationales de l'Emploi (CPNE) du Bâtiment et des Travaux Publics. The CQP is available to young people wishing to complete their initial training, to employees or to people looking for work.

Qualifying training leads to a qualification issued by accredited bodies. These qualifications do not lead to certification or a diploma, but are recognised as part of collective branch agreements. They enable individuals on continuing vocational training to upgrade their skills by developing "new know-how linked to current issues"[142] .

6.1.1.1 Initial training

The French education system comprises 3 levels: elementary education, secondary education and higher education. These levels are divided into different cycles.

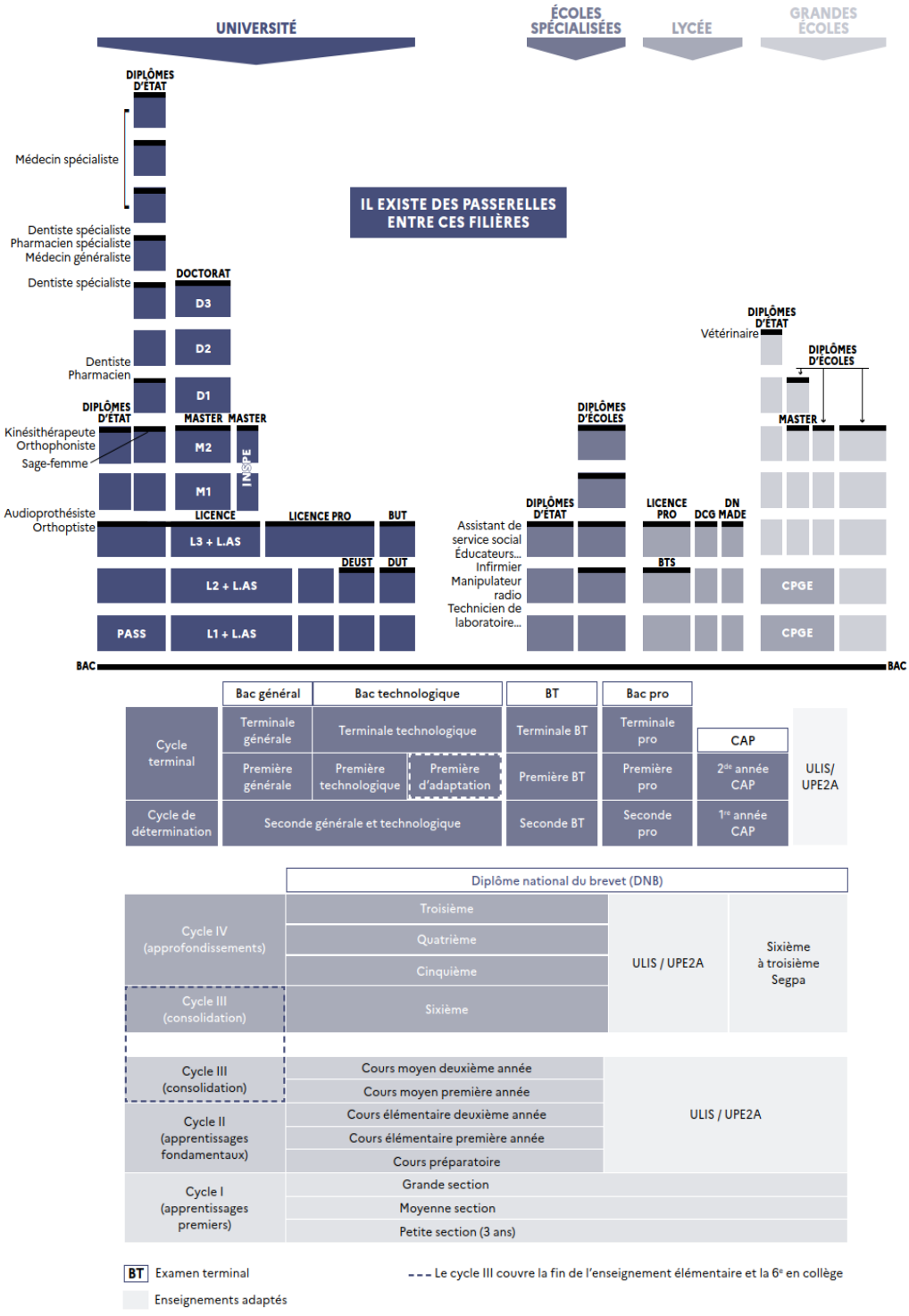
- Primary education is provided in nursery, elementary and primary schools. It consists of a first cycle in nursery school (petite section to grande section), a basic learning cycle from CP to CE2 and a consolidation cycle from CM1 to sixième.

- Secondary education is provided in collèges (lower secondary schools) and lycées (upper secondary schools). The "cycle des approfondissements" runs from the fifth to the third year, culminating in the Diplôme National du Brevet (DNB) in the final year of collège. The lycée then begins in seconde and is divided into three streams: vocational, general and technological. The final stage of secondary education is the baccalauréat.

- Post-secondary and higher education is provided either at university through a bachelor's degree, a master's degree, a doctorate or medical studies, or in lycées with preparatory classes and grandes écoles, or in specialised schools. Apprenticeship is a route into vocational education, either directly after the third year or later in the course.

[142] Certifiezmoi (2020), What is the difference between qualifying and certifying training? https://certifiezmoi.com/difference-formation-qualifiante-certifiante/

Figure 6-2 Organisation of the French education system



Source : Depp (2022), Repères et références statistiques[143]

[143] https://www.education.gouv.fr/reperes-et-references-statistiques-2022-326939

Initial education is compulsory from the age of 3 to 16. Managed by the Ministry of National Education and the Ministry of Higher Education and Research[144] , Domestic Expenditure on Education (DIE) amounted to €157.2 billion in 2019, or 6.8% of French GDP. This share is not increasing very much: it was 6.5% in 1980[145] .

In 2019, there will be 15.8 million pupils, students and apprentices in mainland France and the French overseas departments and regions (DROM), 50,000 more than at the start of the previous school year[146] . According to the key figures for national education for the 2020-2021 school year, there are 12,352,200 schoolchildren, including 645,900 in vocational lycées. These pupils are taught by almost 900,000 teachers.

Figure 6-3 Key figures for national education, 2020-2021 school year

STUDENTS	
Total number of students 12,352,200 (Primary, middle, and high school in metropolitan France and overseas departments, public and private sectors)	
Primary school students	6,653,200
Secondary school students	5,699,000
Middle school students	3,432,900
High school students	2,266,100
Vocational high school students	645,900
Students with disabilities integrated into mainstream education	361,200
EDUCATIONAL INSTITUTIONS	
Total number of schools 61,510 (Primary and secondary, public and private)	
Public schools	52,246 (Primary and secondary)
Primary schools	50,130
Middle schools	7,230
High schools and EREA	4,150
Vocational high schools	2,320
TEACHERS	
National Education staff 866,500 (Teaching primary and secondary students)	

Source: Ministry of National Education, Youth and Sport

Most initial education is provided by the free, secular French education system, which caters for 83% of pupils, with the remainder attending private, mainly Catholic, schools[147] . In 2019, there were 44,500 state schools and 5,700 public schools in mainland France and the French overseas departments and territories. The number of state schools continues to fall by around 1% on the previous year, while the number of public schools is up by 1.5%. The number of secondary schools in mainland France and the French overseas departments and territories will grow slightly in 2019, mainly due to the increase in the number of private secondary schools (+1.8%). Secondary education prepares students for the baccalaureate: they can opt for either the general and technological route or the vocational route. In France, 2,330 schools offer the vocational route, which trains students for a specific profession and provides more practical training with experience in a company.

[144] France Éducation, The French education system. https://www.france-education-international.fr/article/le-systeme-educatif-francais?langue=fr
[145] Direction de l'évaluation de la prospective et de la performance (DEPP, 2020), Repères et références statistiques : enseignements, formation, recherche. https://www.education.gouv.fr/media/70728/download
[146] *Ibid.*
[147] Enseignement catholique (2019), Les chiffres clés de l'enseignement catholique. https://enseignement-catholique.fr/wp-content/uploads/2019/03/chiffres_cles_2018_2019.pdf ; https://www.enseignement-prive.info/ecoles-colleges-lycees

The general and technological stream generally provides training in a large number of fields and a more theoretical curriculum. Vocational training leads to a vocational baccalauréat, a CAP or a vocational certificate.

Figure 6-4 Trend in the number of pupils and apprentices in primary and secondary education (thousands)

	1980	1990	2000	2010	2015	2018	2019	2020	2021	Change 2020/2021 (%)
Pre-elementary	2 456,50	2 644,20	2 540,30	2 532,80	2 552,00	2 473,10	2 441,80	2 375,00	2 337,40	-1,6
Elementary	4 810,00	4 218,00	3 953,00	4 071,40	4 175,70	4 180,20	4 160,80	4 138,00	4 090,00	-1,2
ULIS (Inclusive Schooling Units)	129,8	91,2	58,7	44,3	48,7	51	50,8	52,9	54,1	2,3
First level public and private schools (without contracts)	**7 396,30**	**6 953,40**	**6 552,00**	**6 648,60**	**6 776,40**	**6 704,30**	**6 653,50**	**6 565,80**	**6 481,50**	**-1,3**
First level private schools (without contracts) (1)				**15,6**	**28,8**	**45,9**	**50,3**	**51**	**57,1**	**12**
Middle school programs	3 376,90	3 368,10	3 400,00	3 213,50	3 308,90	3 361,50	3398,6	3 414,40	3 407,50	-0,2
- including adapted education for secondary level (Segpa) (2)	114,9	114,6	110,2	95,6	88,8	84,9	86,4	87,1	87	-0,1
Vocational training in high schools (3)	807,9	750	694,5	690,9	656,9	640,9	636,7	638,3	626,7	-1,8
General and technological training in high schools	1 124,40	1 607,60	1 493,90	1 417,60	1 543,20	1 614,00	1 611,70	1 604,40	1 620,60	1
Second level public and private schools (with contracts)	**5 309,20**	**5 725,80**	**5 588,40**	**5 322,10**	**5 509,00**	**5 616,40**	**5 646,90**	**5 657,00**	**5 654,80**	**0**
Second level independant private schools (without contracts) (1)			**26**	**31,1**	**27,5**	**28,6**	**29,5**	**28,8**	**31,4**	**9**
Agriculture secondary level (4)	**117,1**	**116,2**	**151,3**	**149,9**	**144,5**	**137,3**	**136,7**	**133,2**	**135,2**	**1,5**
Specialized health institutions (4)	**96,2**	**88,2**	**81,4**	**71,5**	**71,4**	**70,2**	**66,6**	**67**	**354,4**	**-0,6**
Apprentices in secondary education (5)	244,1	225,6	324,9	322,1	266,5	272,9	275	306,3	354,4	15,7
Total students and apprentices in primary and secondary education	13 162,80	13 109,20	12 723,90	12 560,90	12 824,00	12 875,60	12 858,50	12 809,20	12 781,10	-0,2

Notes:

- *Private schools, whether under contract or not, are only distinguished from 2000 onwards for primary education and from 2000 onwards for secondary education.*
- *Adapted education includes students in Segpa and EREA.*
- *Starting in the 1995 academic year, vocational training in high schools includes levels 3 and 4 programs.*
- *Without double-counting with the Ministry of Health. For institutions under the Ministry of Health, these are students in hospital and social-medical establishments, without double-counting with the National Education Ministry since 2008.*
- *Provisional data for the 2021-2022 academic year. Until 2018, this line included pre-apprentices*

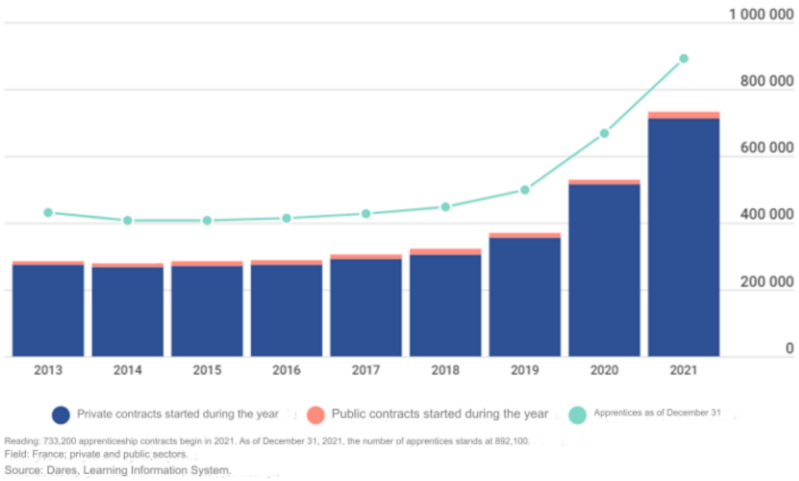
Source: DEPP (2022), Repères et références statistiques

Initial training has changed since 2013. More and more students are opting for level I to III qualifications (Bac+2 to doctorate). This figure rose from 33% in 2013 to 37% in 2016.

General information on apprenticeships

Apprenticeships were developed in France under the Sequin Act of 23 July 1987. Apprenticeships are a way of combining training with a professional activity, via apprentice training centres (CFA). It is considered as part of initial training and is aimed at young people aged between 16 and 30. In 2018, apprenticeships accounted for 7% of young people aged 16 to 25, compared with 15% in neighbouring Europe[148] .

Figure 6-5 Apprenticeship contracts started during the year and apprentices at 31 December 2021

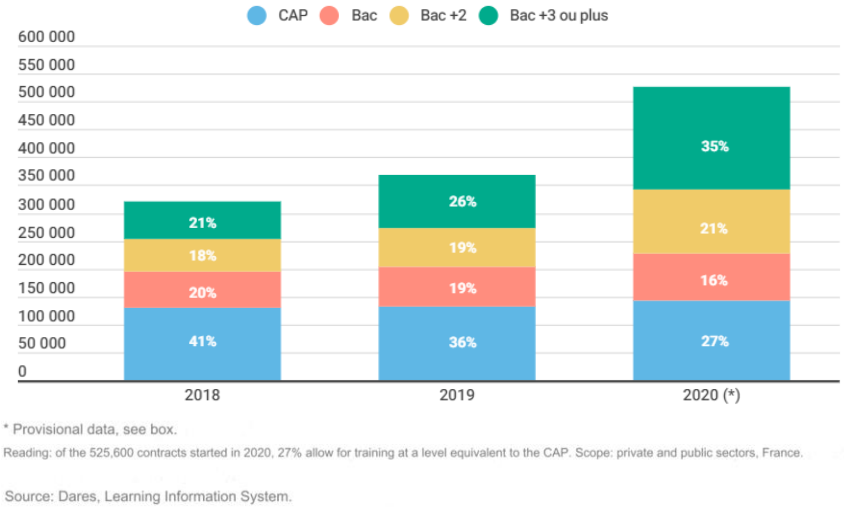


Source: Dares

[148] Ministry for Higher Education, Research and Innovation (2018), Transforming apprenticeships, Press pack. https://travail-emploi.gouv.fr/IMG/pdf/dp_apprentissagevdef2-_09022018.pdf

Apprenticeship numbers have been rising sharply since 2016. The Ministry of Labour, Employment and Inclusion reports a historic increase of 40% in 2020 compared with 2019. This trend will continue, with around 700,000 contracts in progress (all levels of apprenticeship combined) in 2021[149] , and 837,000 contracts in progress in 2022[150] .

Figure 6-6 Breakdown of apprenticeship entrants by level of training (%)

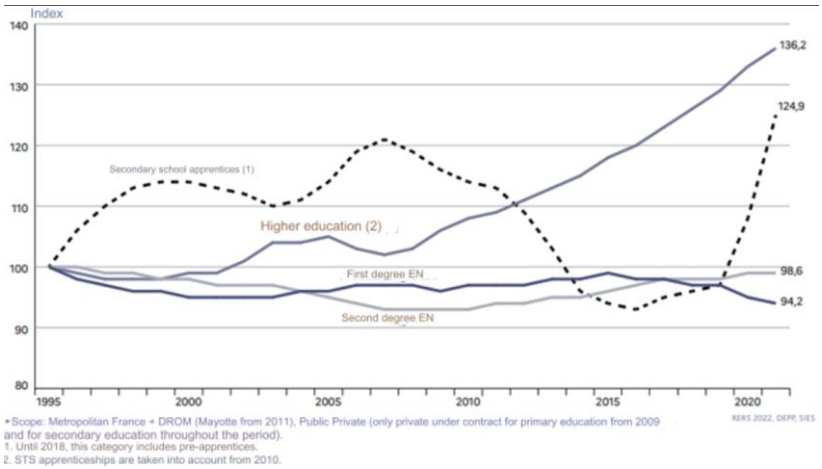


Source: Dares (2021), A very sharp increase in new apprenticeship contracts in 2020[151]

According to a publication by Dares on 8 July 2021, apprenticeship contracts in higher education accounted for just under 4 in 10 new entrants in 2018. By 2020, this figure had risen to 6 out of 10 entrants. The proportion of contracts at Bac+3 to Bac+5 level increased the most between 2019 and 2020, rising from 26% to 35%. The proportion of CAP-equivalent levels will fall by 9%, although the number of new hires at these levels will increase (+7%). It should also be noted that the proportion of 15 to 17 year-olds in new hires fell by 10% between 2019 and 2020, while that of 21 to 25 year-olds rose by 8% between the same dates.

Most of this increase was therefore driven by apprentices in higher education, but also by the tertiary sector and by companies with 10 or more employees.

Figure 6-7 Enrolment trends by level of education (Base 100 in 1995)



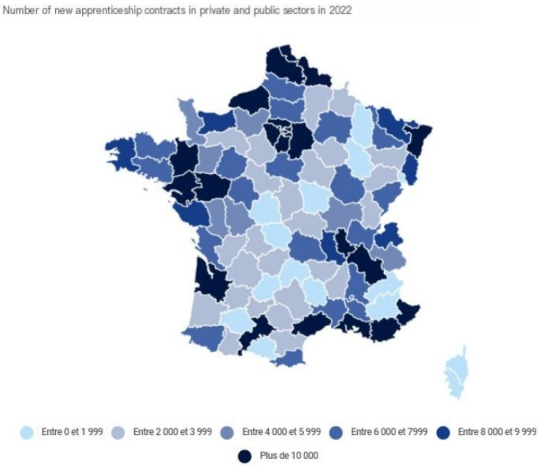
Source: DEPP (2022), Repères et références statistiques[152]

[149] Dares (2021), Une très forte augmentation des entrées en contrat d'apprentissage en 2020. https://dares.travail-emploi.gouv.fr/publication/une-tres-forte-augmentation-des-entrees-en-contrat-dapprentissage-en-2020
[150] Dares (2023), The apprenticeship contract. https://dares.travail-emploi.gouv.fr/donnees/le-contrat-dapprentissage
[151] https://dares.travail-emploi.gouv.fr/publication/une-tres-forte-augmentation-des-entrees-en-contrat-dapprentissage-en-2020
[152] https://www.education.gouv.fr/reperes-et-references-statistiques-2022-326939

Since the 2000s, apprenticeships in higher education have been growing steadily in France, with 51,000 apprentices in higher education in 2000. This number has tripled in 15 years to reach 152,000 apprentices. For 2017-2018, the increase is still around 6%[153] .

The sharp increase (16.4%) since 2019 in the number of apprentice training centres (CFAs) and the number of apprentices is explained by the implementation of the law for the freedom to choose one's professional future[154] . Indeed, the law of 5 September 2018 *"liberalised the creation of apprenticeship training bodies and provided for funding on a contract basis rather than by subsidy"*[155] . The "1 young person 1 solution" plan also contributed to this major increase.

Figure 6-8 Departmental breakdown of new apprenticeship contracts (private and public sectors) starting in 2022



Source: Dares[156]

The distribution of apprenticeship contracts varies from one département to another. The Île-de-France, Haut-de-France, Pays de la Loire and Provence-Alpes-Côte d'Azur regions recorded the most new contracts.

6.1.1.2 Diplomas from the Ministries of Education and Higher Education

As shown in the table below, the vocational diplomas awarded by the French Ministry of Education are broken down by level:

Figure 6-9 Nomenclature for level of qualification

Years after the Bac	Degree Title	Degree Level
-	CAP, BEP	Level 3 (formerly V)
Bac	Baccalaureate	Level 4 (formerly IV)
Bac + 2	DEUG, BTS, DUT, DEUST	Level 5 (formerly III)
Bac + 3	License, LMD License, professional license	Level 6 (formerly II)
Bac + 4	Mastery	Level 6 (formerly II)
Bac + 5	Master, DEA, DESS, engineering diploma	Level 7 (formerly I)
Bac + 8	Doctorate, qualification to supervise research	Level 8 (formerly I)

Source: Ministry of Higher Education and Research, Nomenclature relating to diploma level[157]

[153] Ministry of Higher Education and Research (2018), Transforming and developing apprenticeships in France. https://www.enseignementsup-recherche.gouv.fr/fr/transformer-et-developper-l-apprentissage-en-france-49224
[154] DEPP (2020), Repères et références statistiques. https://www.education.gouv.fr/media/70728/download
[155] Senate (2021), The future of apprenticeship training in the building and public works sector. https://www.senat.fr/questions/base/2021/qSEQ210522726.html
[156] Dares (2023), The apprenticeship contract. https://dares.travail-emploi.gouv.fr/donnees/le-contrat-dapprentissage
[157] https://www.enseignementsup-recherche.gouv.fr/fr/nomenclature-relative-au-niveau-de-diplome-45785

- **Level 3: skilled blue-collar and white-collar jobs**

There are around 200 Certificat d'Aptitude Professionnelle (CAP) specialities and 30 complementary specialities.

- **Level 4: highly skilled blue-collar, white-collar, technical and craft occupations**

There are approximately :

- 100 vocational baccalaureate specialities
- 60 vocational certificate specialities
- 20 specialities of the "brevet des métiers d'art
- 30 complementary specialities

- **Level 5: senior technicians**

There are approximately :

- 120 higher technician diploma (BTS) specialities
- 30 specialised craft diplomas

- **Level 6: University Bachelor of Technology (BUT)**
- **Level 7: Master's degree, engineering qualification**

The ENIC-NARIC France centre[158] , part of France Éducation International, is the national information centre for the academic and professional recognition of diplomas. The ENIC-NARIC France centre issues an attestation of comparability, which makes it possible to establish equivalence between a foreign diploma and a French diploma. "*There is no legal equivalence between qualifications and diplomas obtained abroad and French diplomas issued by the Ministry of National Education and the Ministry of Higher Education and Research. Only a certificate of comparability of the diploma with the French system can be obtained*"[159] .

There are 57 ENIC-NARIC centres in Europe.

For initial training: ECTS credits (European Credit Transfer System) are used to validate the knowledge and skills acquired by students during their years of study. 60 ECTS credits correspond to one year of study. These credits are calculated on the basis of the timetable (lectures, tutorials, practical work, work placements, dissertations).

The different levels of training are validated by a minimum number of ECTS credits:

- For a Bachelor's degree: 180 credits in six semesters
- For a Master's degree: 120 credits in four semesters after the Bachelor's degree
- The doctorate is then accessible after validation of 300 credits (180 in the bachelor's degree + 120 in the master's degree).

6.1.1.3 Continuing education

Continuing vocational training is designed for adults and young people who are already in work or who are starting out.

National regulations have evolved over time.

[158] ENIC-NARIC: European Network of Information Centres - National Academic Recognition Information Centres
[159] https://www.enseignementsup-recherche.gouv.fr/fr/la-reconnaissance-des-diplomes-dans-l-union-europeenne-46483

Figure 6-10 Trends in training regulations in France

Source : Artimon

The latest major text is the "Professional Future" law of 5 September 2018, which introduces[160] :

- "The generalisation of the concept of "***career path",*** which redefines the concept ***of*** "***training action***" by including, in particular, support and assessment actions;
- The creation of **France Compétences**, whose role is to collect training-related contributions, then redistribute and re-distribute them;
- The **monetisation of the Personal Training Account,** with rights acquired in euros from 1er January 2019."

The Personal Training Account (CPF) is a system for financing continuing training. It is active throughout an individual's working life and enables them to benefit from funding to take part in professional training courses. Employers are obliged to make a financial contribution to their employees' continuing training. To do this, they pay a contribution to each employee's CPF. This contribution varies according to the size and type of company.

[160] Artimon (2022), La formation professionnelle : une politique publique en mutation. https://artimon.fr/perspectives/la-formation-professionnelle-une-politique-publique-en-mutation/

It is 0.55% of the gross wage bill for companies with fewer than 11 employees, and 1% for companies with 11 or more employees[161] .

Since 2021, training organisations wishing to have their training funded by the CPF, the State, the Regions or skills operators have been required to obtain certification issued by France Compétences[162] .

The training market is worth around €32 billion a year in France[163] and 32% of adults take part in vocational training each year. However, this figure is still below the Organisation for Economic Co-operation and Development (OECD) average of 41%[164] .

However, the number of people taking training courses has been rising since 2019 in France. Under the CPF, 984,000 training courses were taken in 2020, compared with 517,000 in 2019. This increase can be explained in part by the liberalisation of the training market and the introduction of the CPF in 2019, which facilitates access to training[165] .

According to Dares data, "*in 2016, 39% of people aged between 18 and 64, whether self-employed or jobseekers, declared that they had taken a training course for professional purposes during the year. Since 2015, working people have been able to use their personal training account (CPF) on their own initiative: in 2018, 380,000 private-sector employees, or 1.7%, were able to take part in training in this way. Access to training for jobseekers and low-skilled young people is receiving particular attention from the public authorities, notably with the introduction of the Skills Investment Plan (PIC) since 2018. In 2019, around 930,000 jobseekers were able to benefit from the status of vocational training trainee, enabling them to be paid or to benefit from social cover to follow a training course* "[166] .

INSEE's 2018 "Training and Jobs" report shows that managers are the ones who take the most training, ahead of blue-collar workers (66% of managers have taken a training course during the year, compared with 35% of blue-collar workers), and that it is the youngest and most highly qualified workers who make the most use of vocational training. This raises the question of the contribution of vocational training to reducing inequalities[167] .

According to some of the players interviewed as part of this study, most in-company training time in the construction sector is taken up by compulsory "safety" training.

Companies are also trained by their suppliers in the use of their products. It should be noted that some manufacturers only guarantee their products to companies trained in their installation or use. In return, some manufacturers accompany contractors on site to ensure that their products are properly installed and used.

It is generally difficult for companies to find time for technical training, for a number of reasons:

- The training "culture" is underdeveloped among employees, who feel that they are sufficiently competent and that "on-the-job training is enough";
- Lack of availability and costs incurred by the time spent on training - this is exacerbated when the training is at a distance. Craftsmen and small businesses find it difficult to measure the return on their investment in training. Time spent on training is often seen as time wasted that could have been spent on the site;
- Difficulty in identifying the obligations to be fulfilled on site, and consequently the training they need;
- A negative assessment of the training offered and/or the trainers:
- Training courses are often ill-suited to the needs and constraints of companies and their employees - because they are too long or too theoretical.

6.1.2 Initial training for the construction sector.

[161] URSSAF, The vocational training contribution (CFP). https://www.urssaf.fr/portail/home/espaces-dedies/contributions-de-formation-profe/la-contribution-a-la-formation-p.html
[162] J. Atoui (2018), Training reform: what will change by 2022. https://www.digiformag.com/actualite-formation/reforme-de-la-formation-ce-qui-va-changer-dici-2022/
[163] CPFormation, The evolution of the training market. https://cpformation.com/evolution-du-marche-de-la-formation/
[164] OECD (2019), Is vocational training in France ready for the future?
[165] Dares, (2021) Le compte personnel de formation en 2020. https://dares.travail-emploi.gouv.fr/sites/default/files/73f4ad7a502801600d1d2f258aff2212/Dares%20Resultats_compte%20personnel%20de%20formation_%202020.pdf
[166] Dares, Vocational training. https://dares.travail-emploi.gouv.fr/politiques-de-lemploi-et-formation-professionnelle/formation-professionnelle
[167] Artimons (2019). https://artimon.fr/perspectives/la-formation-professionnelle-une-politique-publique-en-mutation/

In France, there are around 70 national education diplomas, 75 qualifications from the Ministry of Employment and 34 specialised certificates of professional qualification (CQP) that provide training for building and civil engineering trades[168] .

Building and public works training courses, from secondary school to BTS, are relatively well distributed throughout the country, whereas the distribution is much less even for apprenticeships in secondary school and higher education[169] . To complete their training, most students in the building and civil engineering sector are required to complete a work placement or an apprenticeship.

6.1.2.1 Diplomas from existing initial training courses

In secondary education[170] :

- Certificat d'Aptitude Professionnelle (CAP) prepares you for more than 20 construction specialities (bricklaying, roofing, electricity, etc.)[171] via nearly 40 diploma courses[172] ;
- Brevet d'Études Professionnelles (BEP), which covers a family of trades (wood and associated materials, etc.);
- Vocational baccalaureate (Bac Pro), after a conventional school curriculum or a CAP/BEP ;
- Technological baccalaureate (Bac Techno).

In higher education (from Bac+2 to Bac+5) :

- BAC+2
  - Brevet de Technicien Supérieur (BTS) - Building, public works, surveyor, fluids, energy, etc.
  - Diplôme Universitaire de Technologie (DUT) - Building and Public Works.
- BAC+3
  - Bachelor Universitaire Technologique (BUT) - Civil engineering sustainable construction and its 4 courses: building works, public works, rehabilitation and improvement of the environmental performance of buildings, design consultancies.
  - Bachelor Universitaire Technologique (BUT) - Métiers de la transition et de l'efficacité énergétiques (Energy transition and efficiency professions) and its 4 pathways: energy optimisation for buildings and industry, construction of energy installations for buildings and industry, energy management for buildings and industry, operation of energy installations for buildings and industry.
  - Professional degrees - Building and public works with 4 specialities: building and construction, civil engineering and construction, public works, energy and environmental performance of buildings.
- BAC+5
  - Masters in building or public works
  - Specialised Masters in Building and Public Works
  - Engineering diplomas
  - Architecture diplomas

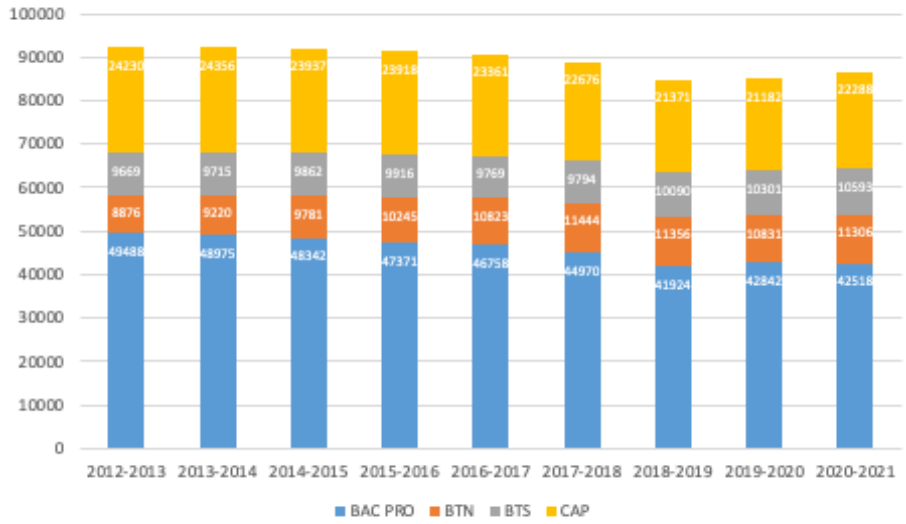
6.1.2.2 Initial training by school

[168] Pôle Emploi, Se formation dans les métiers du BTP. https://www.pole-emploi.fr/actualites/le-dossier/batiment---travaux-publics/se-former-dans-les-metiers-du-bt.html#:~:text=Pr%C3%A8s%20de%2070%20dipl%C3%B4mes%20de.(voie%20scolaire%20ou%20universitaire
[169] Céreq (2020), Construire les compétences de demain dans le BTP, BREF 289. https://www.cereq.fr/sites/default/files/2020-03/Bref%20389-web_1_0.pdf
[170] HUPSO (2023), Building and public works training. https://www.hupso.co/formation-metier-conducteur-travaux/article/formations-batiment-btp
[171] ONISEP (2022), training courses for the construction industry. https://www.onisep.fr/metier/decouvrir-le-monde-professionnel/batiment-et-travaux-publics-btp/les-formations-pour-exercer-dans-le-btp#:~:text=De%20nombreuses%20formations%2C%20de%20bac%20%2B%202%20%C3%A0%20bac%20%2B%205&text=La%20licence%20pro%20mention%20m%C3%A9tiers,forment%20aux%20m%C3%A9tiers%20du%20secteur
[172] Data.Gouv (2023), List of national education vocational diplomas. https://www.data.gouv.fr/fr/datasets/liste-des-diplomes-professionnels-de-leducation-nationale/

Numbers in secondary education

The trend in the number of secondary school pupils in building and civil engineering courses has been declining since 2012, with a slight improvement since 2018/2019[173] . There were 92,263 in 2012, compared with 84,741 in 2018 and 86,705 in 2021, representing a decline of 8.2% between 2012 and 2021. This graph, based on data from the Observatoire du BTP, includes all secondary education courses run by the French national education system (Bac Pro, BTn, CAP), including BTS.

Figure 6-11 : Trend in the number of students in initial training in secondary education



Source: Observatoire du BTP

This downward trend can be explained by the fall in the number of baccalaureate holders and the increase in apprenticeship training (see below).

Of the 87,000 secondary school students in the building and civil engineering sector, almost half are studying for a Bac Pro. These accounted for 53% in 2010, but their share has fallen in favour of the Bac Technologique (BTn), which now accounts for 13% compared with 10% in 2010.

Focus on BTS

Although BTS courses are open to students with a baccalaureate, they are taught in secondary schools and are part of the French national education system. Of all the students enrolled in equivalent courses (BTS, Diplôme National des Métiers d'Art et du Design - DN MADE, Diplôme des Métiers d'Art - DMA) grouped together under the heading "Section de Techniciens Supérieurs - STS", less than 6% are in construction-related courses[174] . Almost all of the STS courses will see a decline in their numbers from 2020 (-5.7% in 2021), after remaining relatively stable or increasing slightly over the last 10 years. In specialisms linked to the building and public works sector, this decline is sometimes even more marked:

- The Construction and Roofing stream will have 371 students in 2021, 15% of whom will be women, with an annual decline of 8.2%;
- The Finishes stream has 931 students, 55% of whom are women, and is down 1.9%;
- The Civil Engineering and Wood Construction Multi-Technology Specialities stream has 3,505 students, 17.3% of whom are women, and has seen a drop of 8.1%;
- The Mining and Quarrying, Civil Engineering and Surveying stream has 1,835 students, 10% of whom are women, an increase of 1.9%;
- The Electricity and Electronics stream has 9,343 students, 14.8% of whom are women, and is down by 6.9%.

As the Ministry's report does not specify the evolution of the workforce by sector of activity, it is possible that other branches leading to building trades are not taken into account here.

[173] Observatoire du BTP, Dataviz. https://dataviz.metiers-btp.fr/formationinitiale
[174] Ministry of National Education (2022), Repères et références statistiques. https://www.education.gouv.fr/reperes-et-references-statistiques-2022-326939

A total of 0.5% of students enrolled in higher technician sections (BTS, DN MADE, DMA) are studying courses related to the construction sector. This drop is linked to the fall in the number of baccalaureate holders in the 2022 session and the increase in apprenticeship training, with the number of new entrants to these courses falling by 8.4%.

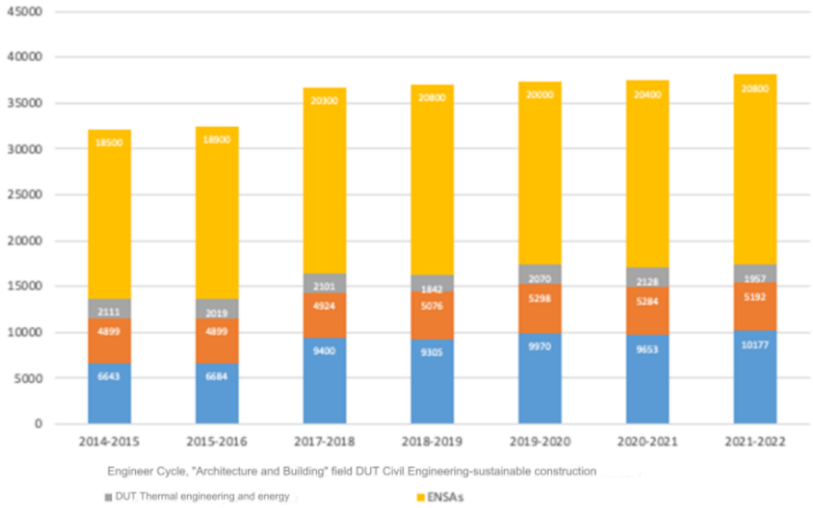
Enrolment in higher education

The graph below shows enrolments in the main higher education qualifications in the building and civil engineering sector. Any masters or bachelor's degrees that could lead to work in the building and civil engineering sector are not included. These figures therefore offer only a partial picture of the courses leading to careers in the building and public works sector, and a fortiori in construction.

It should also be noted that these figures correspond to the number of students taking these courses, and not to the number of graduates per year. The fact that there are so many architecture students is partly explained by the fact that the courses last at least 5 years, whereas the DUT/BUT and engineering courses last only 2 to 3 years.

While enrolments have increased significantly since 2014-2015, particularly for engineering students, they have been fairly stable for a number of years.

Figure 6-12 Trend in the number of students in higher education in the building and civil engineering sector



Source: MESRI

According to a study carried out in 2023 by the Observatoire du BTP among more than 900 companies, 14% of all employees recruited over the last 3 years have higher education qualifications, i.e. 1,310 employees in the sample studied[175] . Companies with more than 50 employees, and especially those with more than 300, recruit the most young people with higher education qualifications.

Half of the young people recruited come from a BTS or DUT (2-year higher education qualification) and a third from an engineering or masters school. It is also interesting to note that the higher the level of study at the time of recruitment, the higher the proportion of women. For example, women account for only 33% of those recruited at BTS or DUT level, but 47% at Master's level. Overall, women accounted for 38% of new hires from higher education.

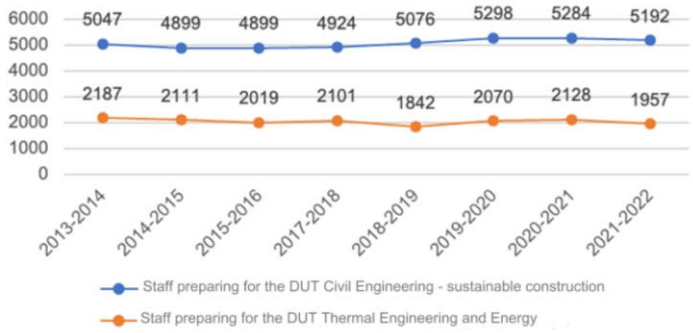
Finally, young people with a higher education qualification have a higher retention rate in the sector than apprentices (see below), and companies are also more inclined to retain them, since 60% of them recruited in the last 3 years are still in post at the time of the survey. This is particularly true for medium-sized companies with between 20 and 50 employees.

Focus on DUTs

The Diplôme Universitaire de Technologie (DUT) is a two-year university degree that will be gradually replaced from 2021 by the Bachelor Universitaire de Technologie (BUT), a 3-year degree.

[175] Observatoire du BTP (2023), Le recrutement des jeunes issus de l'enseignement supérieur (Recruitment of young people from higher education)

Figure 6-13 Enrolment trends for DUTs in the building and public works sector



Source: MESRI SIES/SISE

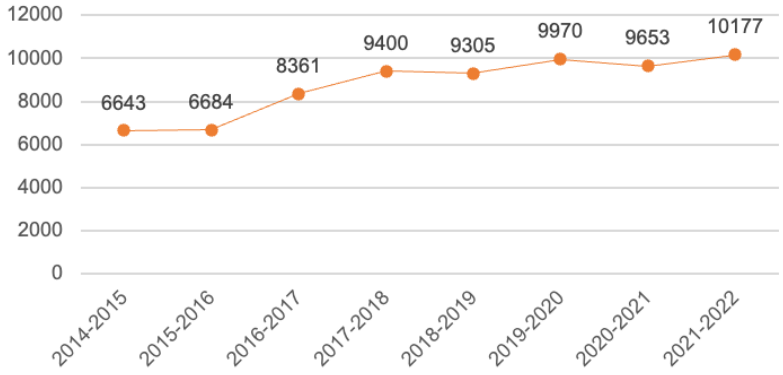
Enrolment in DUT/BUT will fall by 4.9% in 2021. This decline can also be seen in construction-related courses, but unlike the BTS, in proportions similar to the other courses. The overall trend has been stable over the past 10 years.

In civil engineering and thermal engineering, women will account for only 18% and 10% of the workforce respectively in 2021.

Focus on architecture schools

The number of students on the engineering cycle in the 'Architecture and Building' field rose sharply between 2014 and 2018, but has been levelling off for several years. It accounts for 6% of all engineering students, all fields combined, and has remained stable since 2014. Enrolments in this 'architecture and building' field are increasing at the same rate as for all engineering students.

Figure 6-14 Trend in engineering students in the "Architecture and Building" field



Source: MESRI SIES/SISE

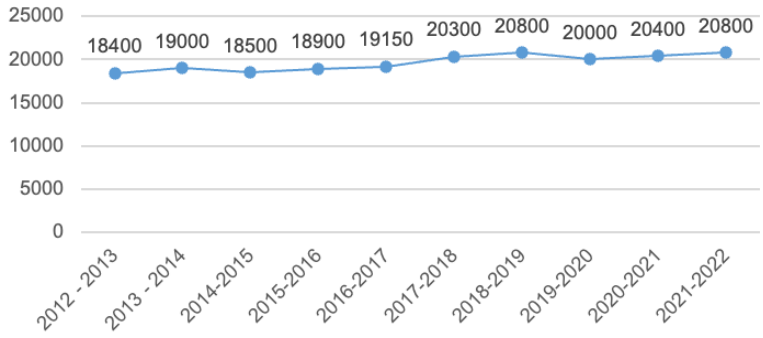
The proportion of female engineering students in the Architecture and Building programme has risen slightly in recent years, passing the 30% mark in the 2020-2021 academic year. It is very slightly above the average for all engineering students, which was 29.1% in the 2021-2022 academic year.

It is important to note that the Ministry of Higher Education, Research and Innovation classifies engineering students into eleven fairly generic areas of training. Other students, who are not listed in the "Architecture and Buildings" category, in particular those in the "Engineering and related techniques", "Mechanical engineering", "Processing and production industry", but also "Computing and computer sciences" and "Other" categories, may be required to work in the building and public works sector, particularly in relation to the new challenges facing the sector (production of renewable energy, re-use, digital technology, carbon footprint, etc.). These

numbers include students enrolled in private engineering schools, who account for around 30% of all engineering students[176] .

In 2021, the Observatoire des Métiers du BTP estimates that almost 10% of professionals in the sector will be engineers and related managers, compared with 30% employees and technicians and 67% manual workers[177] .

Figure 6-15 Trend in enrolment at architecture schools



Source: MESRI SIES/SISE

Finally, enrolment at the twenty Écoles Nationales Supérieures d'Architecture (ENSA) has remained stable at around 20,000 students for several years. These schools award the Diplôme d'État d'Architecture (DEA), which confers a Master's degree. Following this second cycle, students can continue their studies to obtain the Habilitation à l'exercice de la Maîtrise d'œuvre en son Nom Propre (HMONP), by following additional professional training.

Young graduates mainly work in the fields of architectural design (84.5%) and building renovation and maintenance (47.6%)[178] . However, 40% of graduates do not work in architectural agencies or as self-employed architects, but for local authorities, CAUEs, town halls, project owners, social landlords or developers[179] .

6.1.2.3 Apprenticeship as the main route to training for construction trades

Apprenticeships offer the opportunity to acquire hands-on training by working in a company while preparing for the desired qualification. After a period of very sharp contraction in apprenticeship offers (-27% between 2009 and 2014 according to Dares), the number of apprentices is rising again and the Ministry of Education expects to have 629,635 apprentices in 2021, across all fields and levels.

Companies in the construction sector are also involved in the increase in apprenticeships. The "Civil engineering, construction, wood" speciality accounts for around 10% of the total, with 62,695 apprentices.

However, it is not the only form of training leading to a career in the building and public works sector. According to Constructys, by 2021 the building and civil engineering sector will have 79,729 apprentices at all levels, 88% of them in the building sector and 12% in public works. This represents an increase of 41% in one year. The regions with the most apprentices in the building and civil engineering sector are Auvergne-Rhône-Alpes, Île-de-France and Nouvelle-Aquitaine[180] .

For the 2022-2023 school year, the CCCA-BTP, whose scope of study appears to be broader than that of Constructys, estimates that there will be nearly 103,000 apprentices training for a BTP trade[181] . This increase, of more than 50% compared with the 2016-2017 school year, and 5% in one year, can be explained in particular by the financial aid linked to the recruitment of apprentices.

Of these 103,000 apprentices, 57% are on level 3 courses (including 92.7% CAPs and 5.2% qualifications), 24% on level 4 courses (including 58.7% Brevets Professionnels and 36% Bac Professionnels), and 19% on

[176] Ministère de l'enseignement supérieur et de la recherche (2022), Les effectifs inscrits en cycle ingénieur en 2021-2022. https://www.enseignementsup-recherche.gouv.fr/sites/default/files/2022-06/nf-sies-2022-15-18596.pdf
[177] Observatoire des Métiers du BTP. https://dataviz.metiers-btp.fr/salaries
[178] Conseil national de l'ordre des architectes (2022), Archigraphie. https://www.architectes.org/publications/archigraphie-2022
[179] Senate (2023), Proceedings of the Committee on Culture, Education and Communication
[180] Constructys (2022), Activity Report 2021. https://rapport-activite-2021.constructys.fr/flipbook/index.html#page/30-31
[181] CCA-BTP (2023), Start of the 2022-2023 academic year: almost 103,000 apprentices training for a building and civil engineering trade. https://www.ccca-btp.fr/wp-content/uploads/2017/10/CP_effectis_apprentis_BTP_09.03.2023.pdf

higher education courses (including 47.5% BTSs, 21.5% engineering degrees and 15.8% bachelor's degrees). Higher education will see the biggest increases, accounting for almost one in five apprentices in 2022.

The tables below show the breakdown of apprenticeship and school-based training by construction and civil engineering qualification. The school-based/apprenticeship ratio is therefore set to change in favour of apprenticeships.

Figure 6-16 Building and civil engineering training courses in 2018/2019

Level	Diploma	Apprenticeship (%)	School Pathway (%)	Total
5	CAP	66%	34%	63,753
5	MC	93%	7%	813
5	Others (BCP, CTM,TH, TITRE)	100%	0%	493
4	BAC PRO	12%	88%	47,896
4	BTN	0%	100%	11,356
4	MC	60%	40%	567
4	Others (BP, BP DEP, BTM, TH, TITRE)	100%	0%	11,368
3	BTS	38%	62%	16,26
3	Others (BM, TH, TITRE)	100%	0%	435
	Total	44%	56%	152,9

Source: CCCA-BTP

The trades that make the most use of apprenticeships are the finishing trades. According to the CCCA-BTP, these are also the trades that will see the biggest increase in the number of apprentices in 2021 (+16.6%). In 2022, the biggest increase will be in studies and management (+12%).

Figure 6-17 Breakdown of trainees by trade group for 2018/2019

Occupational Groups	Apprenticeship (%)	School Path (%)	Total
Tiling	73%	27%	2,327
Carpentry	47%	53%	6,203
Heating	37%	63%	22,984
Roofing	85%	15%	4,845
Electricity	49%	51%	17,653
Masonry	62%	38%	14,752
Carpentry (Woodwork)	40%	60%	19,67
Metalwork	37%	63%	9,358
Painting, Glazing, Coatings	52%	48%	11,925
Plastering	81%	19%	2,913
Plumbing	71%	29%	6,672
Public Works	82%	18%	1,962
Driving and Mechanics	41%	59%	4,744
Studies, Supervision	17%	83%	26,81
Total	**42%**	**58%**	**152,818**

Source: CCCA-BTP

According to the CAPEB, apprenticeships are heavily concentrated in small businesses: 77% of construction apprentices were trained in businesses with fewer than 20 employees in 2020[182] .

In terms of disability, the trend is continuing: the threshold of 10,000 disabled work-study students has been passed in 2022, representing an increase of 21% compared to 2021[183] .

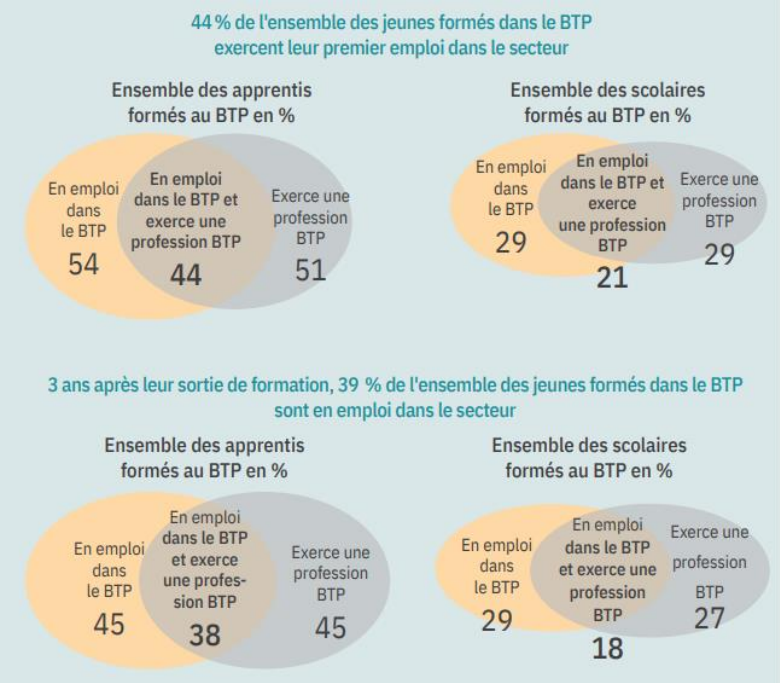
[182] CCCA-BTP (2018/2019), CAPEB key figures for 2020
[183] Batiactu (2023), Apprenticeships: the number of young graduates entering the construction industry is rising. https://www.batiactu.com/edito/apprentissage-insertion-jeunes-diplomes-progresse-dans-65821.php

On the other hand, a significant number of apprentices or young people trained in the building and civil engineering sector stop their studies before obtaining their diploma: the rate of leavers without a diploma was 27% in 2016 (compared with 13% for other sectors)[184] and apprentices account for 60% of these leavers without a diploma.

Several factors could explain these premature terminations: the high proportion of apprentices under the age of 18 (38% of apprenticeship contracts), and the fact that the majority of apprentices work in SMEs or VSEs, where contract terminations are more frequent. In addition, the lack of attractiveness of the sector is compounded by the above two factors.

In 2016, only 44% of young people trained in the building and civil engineering sector had their first job in the sector (54% of apprentices and only 29% of school leavers). After three years, this figure has fallen to 39%. In response, those involved in the sector have tried to make apprenticeships more secure and prevent them from being broken, by making the rights and duties of each party clearer when the contract is signed, with the apprentice, the company and the apprentice training centre present, as well as the support solutions available in the event of difficulties. Problems of access to housing, family or health are also more frequently identified by players such as the CCCA-BTP or the OPPBTP[185] .

Figure 6-18 Weight of target trades in the integration of young people trained in the building and civil engineering sector



Source: Céreq-Génération, 2016 survey of the 2013 generation[186]

More recently, in 2023, the CCCA-BTP published a joint version of two barometers on apprenticeship, one surveying the level of satisfaction of apprentices and the other that of companies[187] . The two surveys, conducted with the CAPEB, the FFB, the Fédération Nationale des Travaux Publics (FNTP) and the Fédération des SCOP du BTP, received responses from more than a hundred CFAs (representing more than half of all apprentices) and 38,000 companies.

The results illustrate the strengths of the apprenticeship system, and highlight the positive changes in training and reception conditions for apprentices. As far as apprentices are concerned, 89% of young people say that apprenticeship has met their expectations, and over 80% are satisfied with their establishment and 90% with their company. 55% explained that they had chosen their speciality out of personal taste, with the desire to

[184] Céreq (2020), Construire les compétences de demain dans le BTP, BREF 289. https://www.cereq.fr/sites/default/files/2020-03/Bref%20389-web_1_0.pdf
[185] *Ibid.*
[186] *Ibid.*
[187] Batiactu (2023), Training: what do young people and construction companies think of apprenticeships? https://www.batiactu.com/edito/formation-professionnelle-ce-qu-il-faut-retenir-apprentissage-66192.php?MD5email=45440780a5befc259d2e4a5df7116df7&utm_source=news_actu&utm_medium=edito&utm_content=article

"do something with their hands" and to "move around". However, a third of them say that they found their host establishment on their own.

On the company side, they stress the equal importance of behavioural qualities (respect, motivation, team spirit) and technical skills.

Apprentices seem to have woken up to the urgent need to protect the climate, with 52% saying they are concerned about environmental protection. This is a trend that the older generation seems to be relying on, since 75% of companies say that it is up to the younger generation to drive innovation in the construction sector. This last point confirms one of the obstacles to the sector's attractiveness to the younger generation: the sector's lack of integration of environmental and climate issues, and the low level of recognition of its role in achieving national objectives.

ADEME Webseries[188]

In October 2022, ADEME and CCCA-BTP launched the "T'es refait!" web series. The aim is to promote training and careers in energy renovation, particularly among young people aged 15 to 24. A budget of two million euros has been earmarked for the project. The 30 episodes of the series feature two fictional characters as well as "ambassadors", apprentices and training centre managers. A quirky tone has been chosen to appeal to young people, but is also aimed at parents and people undergoing retraining. The videos redirect interested parties to a platform that puts them in direct contact with training organisations throughout France.

6.1.2.4 Perception of initial training courses not very qualitative

The sector is therefore facing a number of obstacles that are compounding the problems of recruitment and labour.

The main problem mentioned by those involved in the sector is the lack of appeal of the building and public works sector from the initial training stage onwards. Often perceived as a failure at school by students and those around them, fewer and fewer students are opting for the building and civil engineering sector. The working conditions are perceived as too difficult and the pay as too low[189] . This feeling is linked to the effects of the health crisis, but also to the feeling of having been badly guided during their school career. This feeling of poor guidance helps to devalue the usefulness of studies in the eyes of young people, especially those with a low level of education. Lastly, the study we quote considers that this feeling can constitute an obstacle to lifelong learning policies and to attempts to reintegrate the most disadvantaged young people via the school system.

However, the survey tempers the image of suffering linked to the many consequences of the Covid-19 crisis, by describing a generally happy youth whose well-being depends on the quality of social relations and the meaning given to work. This could therefore be a way of encouraging recruitment in the building energy performance sector. It does not reveal a generational divide and radical divergences from previous generations, nor does it describe a generation that is extremely sensitive to issues of gender and race. There are, of course, significant differences depending on the socio-economic background of the respondents: affluent, precarious, urban, rural, etc.

Industry players mention other problems, including a problem of prerequisites on leaving school, which has an impact on safety on building sites. In addition, the virtual absence of training in environmental issues means that the sector is unable to keep pace with developments. In fact, according to the players interviewed for this study, the standards do not currently incorporate the elements of the RE2020. Unfortunately, it can take up to 20 years to modify a standard.

Training courses from the baccalauréat upwards are just beginning to incorporate the challenges of the energy transition. Changes in the names of courses are incorporating the fields of renewable energy, energy efficiency and sustainable development. On the other hand, these themes are not, or not sufficiently, reflected in vocational training certificates (CAPs) or in training for the most operational occupations.

[188] https://www.youtube.com/watch?v=fKVD9CeVpCo
[189] Institut Montaigne (2022), Une jeunesse plurielle, Survey of 18-24 year olds

A recent survey was carried out in 2023 by the training organisation Envergure, in which 88% of respondents felt that there would be a need for training over the next 5 years, particularly in several sectors[190] :

- Thermal envelope of buildings and thermal renovation
- Insulation and cladding
- Circular economy and waste recovery
- Low consumption
- Occupant comfort
- Air quality
- Biosourced materials
- New regulations

Training in these new sectors is therefore a crucial and immediate requirement if we are to meet tomorrow's recruitment needs.

6.1.3 Further training specific to the building sector

Continuing education is open to all professional certifications (diplomas, professional titles, certificates of professional qualification and private titles registered with the RNCP, as well as certifications and authorisations registered in the specific repertoire. It is also open to non-certifying courses that enable people in working life to specialise or acquire new skills.

6.1.3.1 Vocational qualifications from the Ministry of Employment

Professional qualifications can be acquired through vocational training (apprenticeship or continuing education) or through validation of prior experience. It generally concerns[191] :

- People who have left the school system and wish to acquire a qualification in a specific sector, in particular under a professionalisation or apprenticeship contract;
- Experienced people wishing to have the skills they have acquired validated with a view to social advancement by obtaining a recognised qualification;
- People wishing to retrain, whether they are looking for a job or already have one;
- Young people who already hold a level 3 diploma as part of their initial training and wish to specialise in a vocational qualification through an apprenticeship.

In 2021, there were 246 professional qualifications, **81** of which were **in the construction sector**[192] , representing almost a third of all professional qualifications. In the same year, 17,873 people obtained a construction-related qualification, an average of 221 per qualification. This figure was 55 the previous year, mainly due to the Covid-19 pandemic. Eighty per cent of those awarded qualifications in the construction sector were level 3 qualifications, and only 13% of these people (around 900) prepared for a qualification under an apprenticeship contract.

Figure 6-19 Top 5 construction titles in 2021

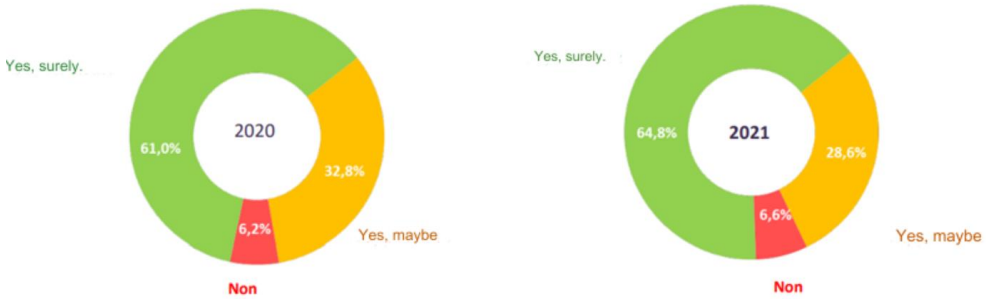
	2021	Evol. 2021/20
Building equipment electrician	2,107	51%
Building maintenance worker	1,689	35%
Heating and plumbing installer	1,536	46%
Drywall installer/ Plasterer	903	37%
Building painter	832	26%

Sources: Ministry of Labour; AFPA

[190] ADEME (2023), État des lieux des formations et métiers du secteur de la rénovation énergétique des bâtiments (State of training and jobs in the building energy renovation sector).
[191] Ministère du Travail, du Plein emploi et de l'Insertion (2023), Professional qualifications. https://travail-emploi.gouv.fr/formation-professionnelle/certification-competences-pro/titres-professionnels-373014
[192] Ministère du Travail, du Plein emploi et de l'Insertion (2022), Bilan des titres professionnels en 2021. https://travail-emploi.gouv.fr/IMG/pdf/bilan_des_titres_professionnels_2021.pdf

According to the "Companies and professional qualifications 2019-2020" survey, companies are increasingly in favour of recruiting holders of professional qualifications. The number of companies that are unsure (yes, maybe) is now lower in 2021. On the other hand, the proportion of companies opposed to recruitment has not decreased, and has even increased.

Figure 6-20 Professional qualifications and future recruitment 2020-2021: response to the question of the value of recruiting someone with a professional qualification



Sources: Ministry of Labour; AFPA (2020), Survey of companies and professional qualifications 2019

Professional qualifications in Building Information Modeling (BIM)

The professional titles are updated every year and new titles are created. In 2019, for example, the Ministry of Labour has created two new professional titles relating to building data modelling: BIM modeller for the building industry and BIM coordinator for the building industry.

BIM managers create 3D models and manage all the data involved in a building project. The CSTB created BIM manager training courses in 2014. The ESTP and ENPC also offer specialised masters degrees in BIM. The Onisep defines the "BIM manager" profession as one that is "conquering the building and public works sector".

The BIM 2022 Plan follows on from the Digital Transition Plan for the Building Industry (PTNB) of 2015 and aims to generalise the use of digital technology in the building industry by 2022[193] . It has 2 main strands:

- Generalise BIM control throughout the building industry by making practices more reliable and providing security for all those involved, thanks to clear and balanced definitions of the expectations and responsibilities of each party;
- Deploy BIM in all regions and for all, using the right tools.

6.1.3.2 Certificates of professional qualification

The vocational qualification certificate *"provides recognition of the skills and know-how required to practise a trade".* It is issued and created by the national joint employment committees (CPNE) of the professional sector. It is available to employees, jobseekers and young people wishing to complete their initial training.

The CQPs registered in the National Register of Professional Certifications (RNCP) must be sent to France Compétences[194] . There will be 75 CQPs linked to the building and public works sector by 2022, including 18 in the RNCP. In the list provided by the Observatoire du BTP, 39 relate more specifically to the building industry.

[193] Ministry of Ecological Transition (2022), Building and digital. https://www.ecologie.gouv.fr/batiment-et-numerique
[194] Ministère du travail, du plein emploi et de l'insertion (2017), Certificat de Qualification Professionnelle (CQP). https://travail-emploi.gouv.fr/formation-professionnelle/certification-competences-pro/article/certificat-de-qualification-professionnelle-cqp

Figure 6-21 List of professional qualifications in the building and civil engineering sector (updated on 16/01/2023)

CPNE NO.	TITLE	Sector	CCN classification	Deadline CPNE
002-1997 11 25	SCAFFOLDING ERECTOR	BTP	N.II CCN CONSTRUCTION WORKERS N. II - P.1 CCN CONSTRUCTION WORKERS	DECEMBER 2026
009-2000 09 30	DECONSTRUCTION PREPARATOR *(formerly demolition preparator)*	BTP	N. II CCN OUVRIER DU BÂTIMENT and N. II P.1 CCN OUVRIER DES TP	DECEMBER 2026
010-1998 09 25	CONFIRMED APPRENTICE MASTER	BTP	Not concerned	Not concerned
019-2001 04 04	UNDERWATER INSPECTION OFFICER - INSPECTING A STRUCTURE IN THE ENVIRONMENT SUBAQUATICS	PUBLIC WORKS	N. II- P.2 CCN WORKERS	DECEMBER 2027
020-2001 04 04	DIVING INSPECTOR	PUBLIC WORKS	N. IV CCN WORKERS	DECEMBER 2027
023-2001 10 15	BUILDER OF URBAN ROADS AND NETWORKS	PUBLIC WORKS	N. II- P.2 CCN WORKERS	DECEMBER 2027
024-2001 10 15	DESIGN AND SITE TECHNICIAN	BUILDING	N. E CCN ETAM	DECEMBER 2026
026-2002 09 24	SMOKE EXTRACTION SYSTEM INSTALLER-MAINTAINER	BUILDING	N. II CCN WORKERS	DECEMBER 2027
027-2002 12 17	PROJECT MANAGER *(formerly assistant project manager)*	BUILDING	N E CCN ETAM	MARCH 2026
029-2002 09 24	DRILLER (DESTRUCTIVE DRILLING OPTION)	PUBLIC WORKS	N. II- P.2 CCN WORKERS	DECEMBER 2026
035-2002 09 24	*CORDIST - See No. 133-2002 09 24*	*BTP*	*N. II CCN BUILDING WORKERS* *N. II- P 1 CCN CONSTRUCTION WORKERS*	*JUNE 2024*
036-2002 09 24	*ROPEWORKER TECHNICIAN (formerly rope worker level 2) - See No. 134-2002 09 24*	*BTP*	*N. III - P.1 CCN CONSTRUCTION WORKER* *and N. III - P.1 CCN OUVRIER DES TP*	*JUNE 2024*
038-2003 07 07	SUSPENDED PLATFORM ERECTOR	BTP	N. II CCN BUILDING WORKERS N. II P.1 CCN CONSTRUCTION WORKERS	DECEMBER 2027
039-2003 07 07	FACADE PLASTERER	BUILDING	N. II CCN WORKERS	DECEMBER 2027
041-2003 09 23	JOURNEYMAN PIPE FITTER IN DRINKING WATER SUPPLY	PUBLIC WORKS	N. III- P. 1 CCN WORKERS	DECEMBER 2026
042-2003 09 23	JOURNEYMAN SEWER FITTER	PUBLIC WORKS	N. III- P.1 CCN WORKERS	DECEMBER 2026
044-2004 03 23	HTB OVERHEAD LINE INSTALLER	PUBLIC WORKS	N. II- P.1 CCN WORKERS	DECEMBER 2027
046-2004 09 21	INDUSTRIAL THERMAL INSULATION FITTER *(formerly industrial insulation fitter)* *insulation industrial thermal insulation)*	BUILDING	N.II CCN WORKERS	DECEMBER 2027
049-2005 03 13	ANTI-CORROSION PAINTER	BUILDING	N.II CCN WORKERS	DECEMBER 2025
050-2005 09 29	JOURNEYMAN HERITAGE MASON	BUILDING	N.III- P.1 CCN WORKERS	DECEMBER 2026
051-2005 12 30	INDUSTRIAL THERMAL INSULATION TEAM LEADER	BUILDING	N.IV- P.1 CCN WORKERS	DECEMBER 2026
055-2005 12 20	BARDEUR	BUILDING	N.II CCN WORKERS	DECEMBER 2027
057-2005 12 20	SEALANT ON CONCRETE WITH BITUMINOUS COATING	BUILDING	N.II- CCN WORKERS	DECEMBER 2026
062-2006 03 15	INSTALLER-MAINTAINER OF SOLAR THERMAL AND HEATING SYSTEMS PHOTOVOLTAICS	BUILDING	N.IV- P.1 CCN WORKERS	DECEMBER 2026
066-2007 04 03	CATENARY LINEMAN	PUBLIC WORKS	N.II- P.1 CCN WORKERS	DECEMBER 2026
067-2007 11 29	ANTI-CORROSION TEAM LEADER	BUILDING	N IV P1 CCN WORKERS	DECEMBER 2026
072-2008 12 05	TRACK LAYER	PUBLIC WORKS	N.II- P.1 CCN WORKERS	DECEMBER 2026
074-2010 03 04	ASSISTANT SITE TECHNICIAN	BUILDING	N.D CCN ETAM	DECEMBER 2026
075-2010 03 04	PROFESSIONAL DRY STONE WORKER	BUILDING	N.II- CCN WORKERS	DECEMBER 2025
076-2010 06 03	BUILDING AND CIVIL ENGINEERING ASSISTANT *(formerly BUILDING AND CIVIL ENGINEERING ADMINISTRATIVE ASSISTANT)*	BTP	N.E CCN ETAM	DECEMBER 2026
077-2010 12 15	INSTALLER OF THERMAL AND PHOTOVOLTAIC SOLAR PANELS IN COVER	BUILDING	N.II CCN WORKERS	DECEMBER 2027
079-2011 04 28	BOUTEFEU	PUBLIC WORKS	N.III- P.1 CCN WORKERS	DECEMBER 2026
080-2011 04 28	MASTER BLASTER	PUBLIC WORKS	N.E CCN ETAM	DECEMBER 2026
081-2011 04 28	PROFESSIONAL ROOFING THATCHER	BUILDING	N.II- CCN WORKERS	DECEMBER 2026
082-2011 06 28	SITE SUPERVISOR, BUILDING JOINERY AND FITTINGS	BUILDING	N.E CCN ETAM	DECEMBER 2021
084-2011 11 22	DRINKING WATER SUPPLY PIPE-LAYER	PUBLIC WORKS	N.II- P.1 CCN WORKERS	DECEMBER 2026
085-2011 11 22	SEWER PIPE FITTER	PUBLIC WORKS	N.II- P.1 CCN WORKERS	DECEMBER 2026
086-2012 03 03	RAILWAY SIGNALLING FITTER	PUBLIC WORKS	N.II- P.1 CCN WORKERS	DECEMBER 2026
087-2012 07 04	CONCRETE CORE SAW	BUILDING	N.II- CCN WORKERS	JUNE 2029
088-2012 11 06	HEAT PUMP SYSTEM INSTALLER AND MAINTAINER	BUILDING	N.III- P.1 CCN WORKERS	DECEMBER 2027
089-2012 11 06	INSTALLER-MAINTAINER OF VENTILATION AND AIR CONDITIONING MANAGEMENT SYSTEMS INDOOR AIR QUALITY	BUILDING	N.III- P.1 CCN WORKERS	DECEMBER 2024
090-2012 11 06	OPTICAL FIBRE CONNECTOR *(formerly FTTH Connector)*	PUBLIC WORKS	N.II-P2 CCN WORKERS	DECEMBER 2026
092-2014 03 20	NATURAL HAZARDS PROTECTION TECHNICIAN *(formerly Natural Hazards Protection Worker - N II P 2)*	PUBLIC WORKS	N.IV CCN WORKERS	JUNE 2029
093-2014 10 07	PROFESSIONAL DRY STONE WORKER	BUILDING	N.III-P2 CCN WORKERS	DECEMBER 2026
094-2014 12 04	SITE MANAGER, HVAC ENGINEERING	BUILDING	N.E CCN ETAM	DECEMBER 2026
095-2015 10 06	RESEARCH PROJECT MANAGER	BTP	N.G CCN ETAM	DECEMBER 2026
096-2015 12 16	ASBESTOS REMOVAL OPERATOR	BUILDING	N.II CCN WORKERS	DECEMBER 2026
097-2015 12 16	MANUFACTURER-INSTALLER OF METAL BUILDING STRUCTURES	BUILDING	N.II CCN WORKERS	DECEMBER 2024
098-2015 12 16	SLIPFORM PAVER DRIVER	PUBLIC WORKS	N.III- P.1 CCN WORKERS	DECEMBER 2026
099-2016 02 16	INSTALLER OF DOORS, GATES AND AUTOMATIC PEDESTRIAN DOORS	BUILDING	N.III P 1 CCN WORKERS	DECEMBER 2024
100-2017 03 23	CITY LOCKSMITH	BUILDING	N.II- CCN WORKERS	DECEMBER 2024

CPNE NO.	TITLE	Sector	CCN classification	Deadline CPNE
102-2017 03 23	ORGANISER LES TRAVAUX SUR CORDES *(ex Technician in the organisation of work on ropes)* *strings)* - See 138-2017 03 23	BTP	N.B CCN CADRE	DECEMBER 2025
103-2017 07 04	TRAINING OCCASIONALLY IN YOUR COMPANY *(e.g. occasional trainer)* *in the company)*	BTP	Not concerned	Not concerned
104-2017 07 04	PLANER OPERATOR	PUBLIC WORKS	N.II-P2 CCN WORKERS	DECEMBER 2026
105-2018 03 06	COLD ROOM AND CLEAN ROOM ENVELOPE FITTER	BUILDING	N.II- CCN WORKERS	DECEMBER 2025
111-2019 01 15	TEAM LEADER, REINFORCED CONCRETE BUILDER	BUILDING	N.IV P1- CCN WORKERS	DECEMBER 2024
112-2019 03 21	MAINTAINER OF DOORS, GATES AND AUTOMATIC PEDESTRIAN DOORS	BUILDING	N.III P 1 CCN WORKERS	DECEMBER 2024
113-2019 03 21	BLIND AND SHUTTER INSTALLER	BUILDING	N.III P1 CCN WORKERS	DECEMBER 2024
115-2019 03 21	TECHNCIEN D'ETUDES ET CHANTIERS EN REHABILITATION DURABLE *(ex Technicien* *for the improvement of sustainable housing)*	BUILDING	N.E CCN ETAM	DECEMBER 2024
116-2020 01 22	POLYURETHANE DESIGNER FOR THE BUILDING INDUSTRY	BUILDING	N.II- CCN WORKERS	DECEMBER 2025
117-2021 09 13	RAILWAY SIGNALLING DESIGN ENGINEER	PUBLIC WORKS	N. E CCN ETAM	DECEMBER 2025
118-2021 10 05	FIBRE OPTIC SUBSCRIBER CONNECTOR	PUBLIC WORKS	N II P2 CCN WORKERS	DECEMBER 2025
119-2021 10 05	LAUZIER CALCAIRE ROOFER	BUILDING	N.II- CCN WORKERS	DECEMBER 2026
120-2021 10 05	LAUZIER SCHISTE ROOFER	BUILDING	N.II- CCN WORKERS	DECEMBER 2026
121-2021 12 21	TEMPORARY TRAFFIC SIGNALLER ON DUAL CARRIAGEWAYS	PUBLIC WORKS	N.II- P.1 CCN WORKERS	DECEMBER 2026
122-2021 12 21	CHIEF TEMPORARY SIGNALLER ON DUAL CARRIAGEWAYS	PUBLIC WORKS	N.III- P.1 CCN WORKERS	DECEMBER 2026
123-2005 12 20 *(ex* *053-2005 12 20)*	ROAD SURFACE DRESSING APPLICATOR	PUBLIC WORKS	N.II- P.1 CCN WORKERS	DECEMBER 2026
124-2005 12 20 *(ex 053-2005 12 20)*	ASPHALT ROAD SURFACING APPLICATOR	PUBLIC WORKS	N.II- P.1 CCN WORKERS	DECEMBER 2026
125-2007 11 29 *(ex 068-2007 11 29)*	URBAN APPLICATOR FOR ROAD MARKING SERVICES	PUBLIC WORKS	N.II- P.1 CCN WORKERS	DECEMBER 2026
126-2007 11 29 *(ex 068-2007 11 29)*	ROAD/MOTORWAY SIGNAGE APPLICATOR HORIZONTAL ROAD	PUBLIC WORKS	N.II- P.1 CCN WORKERS	DECEMBER 2026
127-2007 11 29 *(ex 069-2007 11 29)*	CHIEF URBAN APPLICATOR FOR ROAD MARKING SERVICES	PUBLIC WORKS	N.III- P.1 CCN WORKERS	DECEMBER 2026
128-2007 11 29 *(ex 069-2007 11 29)*	CHIEF ROAD/MOTORWAY APPLICATOR FOR ROAD MARKING SERVICES	PUBLIC WORKS	N.III- P.1 CCN WORKERS	DECEMBER 2026
129-2021 12 21	CHAPISTE TEAM LEADER	BUILDING	N.IV P1- CCN WORKERS	DECEMBER 2026
130-2022 01 25	LAYING CONCRETE TRACK	PUBLIC WORKS	N. II - P1 CCN WORKERS	DECEMBER 2026
131-2022 12 21	WORKING ON A DRY STONE CONSTRUCTION SITE	BTP	Not concerned	DECEMBER 2027
132-2023 03 30	OPERATOR IN TRENCHLESS PIPELINE REHABILITATION	PUBLIC WORKS	N. II - P2 CCN WORKERS	MARCH 2028
133-2002 09 24	ROPE WORKING - INITIAL LEVEL (former rope access technician)	BTP	N. II CCN BUILDING WORKERS N. II- P 1 CCN CONSTRUCTION WORKERS	JULY 2028
134-2002 09 24	ROPE WORKING - ADVANCED LEVEL (former rope access technician)	BTP	N. III - P.1 CCN CONSTRUCTION WORKERS N. III - P.1 CCN CONSTRUCTION WORKERS	JULY 2028
135-2023 07 10	SUPERVISE ROPE ACCESS WORK ON SITE	BTP	N. F CCN ETAM du Bâtiment and CCN ETAM Public Works	JULY 2028
136-2014 12 04	BUILDING SITE MANAGER	BUILDING	N.E CCN ETAM	JULY 2028
137-2018 10 18	BUILDING WORKSHOP MANAGER	BUILDING	N.E CCN ETAM	JULY 2028
138-2017 03 23	ORGANISING WORK ON ROPES (ex 102-2017 03 23)	BTP	N. B CCN cadres du Bâtiment and CCN cadres des Travaux Publics	JULY 2028
139-2010 12 15	METAL PROFILE BEATER	PUBLIC WORKS	N.II-P1 CCN WORKERS	DECEMBER 2028
140-2018 10 18	METALWORK DESIGN DRAUGHTSMAN	BUILDING	N.E CCN ETAM	DECEMBER 2028
141-2018 12 19	THRESHING TEAM MANAGER	PUBLIC WORKS	N.III- P.2 CCN WORKERS	DECEMBER 2028
142-2018 12 19	ROAD RESTRAINT FITTER	PUBLIC WORKS	N.II-P1 CCN WORKERS	DECEMBER 2028
143-2018 12 19	CHIEF ROAD RESTRAINT FITTER	PUBLIC WORKS	N.III- P.1 CCN WORKERS	DECEMBER 2028
144-2023 12 12	INSTALLER OF TEMPORARY SIGNS ON TWO-WAY AND DUAL CARRIAGEWAYS URBAN ROADS	PUBLIC WORKS	N.II- P.1 CCN WORKERS	DECEMBER 2028
145-2023 12 12	CHIEF FITTER OF TEMPORARY SIGNAGE ON TWO-WAY AND DUAL CARRIAGEWAYS URBAN ROADS	PUBLIC WORKS	N.III- P.1 CCN WORKERS	DECEMBER 2028
146-2023 12 12	POELIER-CONSTRUCTEUR MAINTENEUR DE POELE MACONNE ARTISANAL	BUILDING	N. III - P2 CCN WORKERS	DECEMBER 2028
147-2023 12 12	ASSISTANT DRILLER IN SURFACE GEOTHERMAL ENERGY AND WATER DRILLING	PUBLIC WORKS	N.II- P.1 CCN WORKERS	DECEMBER 2028
148-2024 06 17	SUPPORTING WORK-STUDY STUDENTS ON THE JOB	BUILDING	Not concerned	JUNE 2029

Source: Observatoire du BTP

Focus on certification for the Senior Apprenticeship Master

The apprenticeship master certification was created following the apprenticeship transformation plan of 9 February 2018 aims to massify and develop apprenticeship in France. According to INSEE data, in 2019 France will still have around 1.5 million young people aged 15 to 29 who are neither in employment, education or training. This figure corresponds to 12.9% of the total for this age group[195] .

The plan provides for the creation of a specific certification for apprenticeship masters, to enable them to demonstrate their skills. To qualify, apprentices must have already supervised at least one apprentice in the course of their career, or have received training. The title of Confirmed Apprentice Master (MAC) is awarded following a certification test.

9 skills classified into 3 areas of expertise:

Figure 6-22 Areas of competence of the apprentice master

Areas of Expertise	Professional Skills
1. Welcome and facilitate the integration of the apprentice/trainee	1. Prepare the arrival of the apprentice/trainee in the company 2. Welcome the apprentice/trainee upon their arrival in the company 3. Facilitate the integration of the apprentice/trainee during the trial period
2. Support the development of learning and professional autonomy.	4. Follow the progress with the training center 5. Organize the training path within the company 6. Support the apprentice/trainee in their learning path
3. Participate in the transmission of know-how and the evaluation of learning.	7. Rely on work situations to develop learning 8. Guide the apprentice/trainee's reflection on their professional and learning activities 9. Evaluate the learning outcomes in a work situation

Source: Ministère du Travail, du Plein Emploi et de l'Insertion (2023), Certification relative aux compétences de maître d'apprentissage/tuteur.[196]

6.1.3.3 Continuing training workforce in the construction industry

A company's propensity to train its employees depends on a large number of factors: its size, its market segment, the surrounding offer, etc. The rate of access to training, which corresponds to the number of employees who have undergone vocational training over the year as a proportion of the total workforce, was 37.5 in 2015 in the construction sector, 10 points below the average for all sectors of activity.

The increase in the number of micro-businesses and the rise of self-employment are making it more difficult to access channels for renewing skills through training. It has also been observed that a period of economic contraction discourages players from mobilising training, for fear of losing the employee they have trained, whether an experienced worker or an apprentice[197] .

The following people are eligible for continuing vocational training:

- Working people, which includes employees and jobseekers. Jobseekers who have the status of trainees in continuing vocational training as long as they are in training;
- Young people under the age of 30 who are taking part in work placements that involve support, professional integration, guidance or other types of training. These actions must be carried out within the framework of calls for projects: "100% inclusion", "Prépa apprentissage", "insertion professionnelle des réfugiés" or schemes: "Prépa-compétences", "Promo 16-18";
- Anyone wishing to undertake self-funded training.

[195] INSEE (2021), Les jeunes ni en emploi, ni en études, ni en formation : jusqu'à 21 ans, moins nombreux parmi les femmes que parmi les hommes, Focus 229. https://www.insee.fr/fr/statistiques/5346969
[196] https://travail-emploi.gouv.fr/formation-professionnelle/certification-competences-pro/certification-matu
[197] Céreq (2020), Construire les compétences de demain dans le BTP, BREF 289. https://www.cereq.fr/sites/default/files/2020-03/Bref%20389-web_1_0.pdf

Since 2012, there has been a downward trend in the number of continuing training trainees in the building and civil engineering sector, from 319,000 to almost 255,000 in 2021. The data comes from the Observatoire du BTP, and the scope of trainees considered is not explained. The decline observed in 2019 can be explained by a significant drop in training related to prevention that year (-19%), the leading area of training for building and civil engineering tradespeople, as well as training related to management (-16%)[198] . Training related to physical constraints or the use of dangerous products, on the other hand, increased that year.

It is also interesting to note that some trades are training more than others, such as roofers, plumbers/heaters and electricians. Conversely, the stone and landscape trades will see the biggest drop in training in 2019[199] .

The challenge is to attract self-employed tradespeople to take part in training, as they account for 40% of the construction industry workforce but only 5% of trainees. In fact, the vast majority of trainees are employees who have training obligations. Similarly, few women are taking training, accounting for 3% of trainees in 2019, whereas they already represented 13% of employees that year.

Figure 6-23 Number of trainees in continuing training in the building and public works sector

Source: Observatoire du BTP

6.1.4 Jobseeker integration schemes

The rate of access to training for jobseekers has been rising overall since 2017, with the rate of people entering training within a year of registering with Pole Emploi at 10.7% in 2019. People with few or no qualifications have less access to training than those with a bachelor's degree, although the gaps are narrowing. The access rate also varies greatly from one region to another, from very low in Île-de-France to the highest in Occitanie, Brittany and Centre-Val de Loire.

Alongside these training courses, there are schemes to facilitate the recruitment of jobseekers, which also enable them to be integrated and trained.

Every year, Pôle emploi sends out a questionnaire to establishments to find out their recruitment needs by sector of activity and by employment area[200] . 424,000 responses were collected in 2023. Construction and public works accounted for 8.6% of recruitment projects. They do not appear to be the most sought-after occupations, but some of them do appear in the 10 occupations where the rate of difficulty in recruiting is highest: qualified roofers and zinc workers, plumbers and heating engineers.

A number of measures are in place to help jobseekers find work, including a large number of subsidised contracts. Here is an overview of the latest data available on the number of people benefiting from these schemes, including, where possible, the proportion of beneficiaries linked to the construction sector.

Contrat de professionnalisation: for jobseekers aged 26 or over. The contract combines periods of in-company training with periods of in-company training. The contract leads to the award of a professional qualification certificate (CQP), a professional title or a diploma registered in the national register of professional certifications[201] or a qualification recognised in the classifications of a national collective agreement.

[198] Batiactu (2021), Prevention: building and civil engineering professionals trained less in 2019. https://www.batiactu.com/edito/prevention-professionnels-btp-se-sont-moins-formes-62242.php
[199] *Ibid.*
[200] Pôle Emploi (2023), "Besoins en Main-d'œuvre 2023" survey. https://statistiques.pole-emploi.org/bmo
[201] FFB, Training. https://www.lebatiment.fr/se-former/demandeur-demploi

According to data from the French Ministry of Labour, professionalisation contracts in the construction sector have been falling since 2018, after increasing since 2015. While a similar decline has been observed for all professionalisation contracts across all sectors since 2018, the increase had been continuous since 2010.

Figure 6-24 Trend in the number of professionalisation contracts signed in the construction sector, including the building industry

Sources: Dares; Ministry of Labour, Employment and Integration

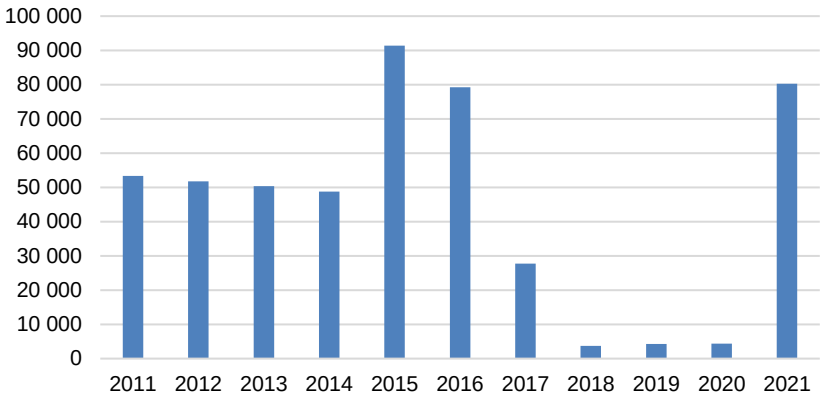
The sharp fall in contracts in 2020 and 2021 is explained by the Covid-19 pandemic and the subsequent drop in business.

CUI-CIE **contracts** (**Contrats Uniques d'Insertion - Contrats Initiative Emploi**) are designed to facilitate the professional integration of unemployed people experiencing social and professional difficulties in accessing employment. These are private law contracts, either fixed-term or open-ended, lasting between 6 and 24 months. Under this scheme, employers can receive monthly assistance of up to 47% of the gross hourly minimum wage, which can be adjusted according to the situation of the beneficiary and the employer[202] . The employer is obliged to support the employee on the CUI scheme in order to encourage long-term integration into employment through support, training and periods of work experience with another employer.

Hirings in the commercial sector via this type of contract (CUI-CIE) barely increased in 2019, after a fall of 24,000 hirings in 2018 compared with 2017. However, they took off in 2021 under the "1 young person, 1 solution" plan, reaching 80,200 new hires across all sectors. In fact, young people will account for 94% of new recruits on subsidised contracts in the commercial sector in 2021. Unlike in the non-profit sector, subsidised contracts are more often open-ended and full-time, and the people on them are less likely to be unemployed[203] . CUI-CIE contracts have gradually taken over from the "jobs for the future" scheme[204] , which ended in 2018[205].

[202] Agence de services et de paiement (2021), Contrat unique d'insertion. https://www.asp-public.fr/aides/contrat-unique-dinsertion
[203] Dares (2022), En 2021, davantage de contrats aidés, notamment pour les jeunes dans le secteur marchand. https://dares.travail-emploi.gouv.fr/publication/en-2021-davantage-de-contrats-aides-notamment-pour-les-jeunes-dans-le-secteur-marchand
[204] The aim of the "jobs for the future" scheme was to give young people with few qualifications their first work experience between November 2012 and December 2020. These contracts took the form of CUI. Since 2018, it has no longer been possible to enter into future employment contracts.
[205] INSEE (2020), Emploi, chômage, revenus du travail. https://www.insee.fr/fr/statistiques/4501574?sommaire=4504425

Figure 6-25 Trend in the number of single integration contracts - employment initiative contracts (CUI-CIE) in all market sectors combined



Sources: Dares; Ministry of Labour, Employment and Integration

Operational Employment Preparation (POE) is a training programme designed to enable jobseekers to acquire the professional skills needed to meet a recruitment requirement identified in advance, either by Pôle emploi (in which case it is referred to as individual POE), or by a professional sector or its affiliated OPCO. This preparation, which is co-constructed by Pôle emploi and the company or industry concerned, takes the form of a grant dedicated to the training of the jobseeker. Training may not exceed 400 hours[206] .

Constructys, the skills operator for the construction industry, reports that 1,763 trainees will be trained in 2020 under collective POEs, thanks to co-funding of the PIC in partnership with Pôle emploi[207] . Largely due to the health crisis, this figure is down on 2019, when 2,164 trainees were trained through Collective Operational Employment Preparations (POEC) with €6.5 million in co-funding from the CIP[208] .

Training for foreign workers in shortage occupations

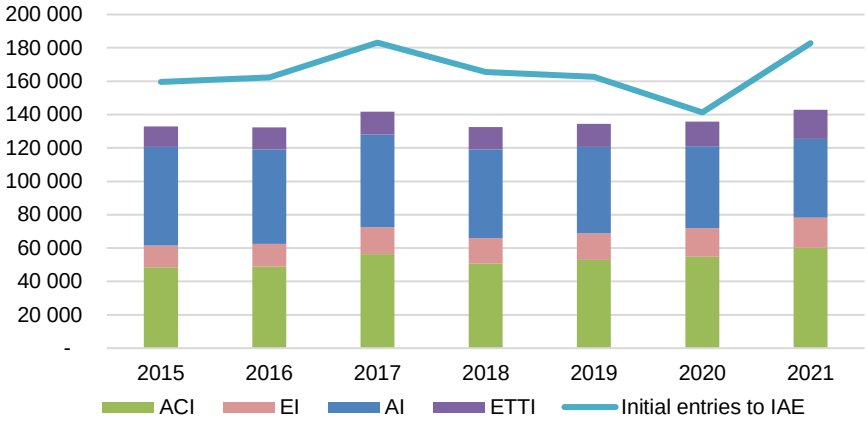
Constructys finances training in shortage occupations, under an agreement with Pôle emploi and as part of the "Hébergement, Orientation et Parcours vers l'Emploi - HOPE" programme. These courses are designed to help people with refugee or subsidiary protection status find employment. They include 400 hours of POEC and 450 hours of professional training. These sessions can be organised by AFPA or CFA des Compagnons du devoir, for example, depending on the region.

Integration through Economic Activity (IAE). The IAE pathways take place within dedicated structures: Ateliers et Chantiers d'Insertion (ACI), Entreprises d'Insertion (EI), Associations Intermédiaires (AI) and Entreprises de Travail Temporaire d'Insertion (ETTI). These programmes last around a year in the ACI and EI schemes, and 6 to 8 months in the AI and ETTI schemes.

In 2021, 142,900 people were working in a social integration structure, a 5% increase on 2020. With the exception of the drop in 2020 due to the health crisis, the number of employees has been stable overall since 2015. The employees concerned are mainly young men, half of whom had been jobseekers for at least a year when they were hired[209] .

[206] Observatoire des métiers du BTP, Les dispositifs de formation. https://www.metiers-btp.fr/entrant-btp/entrant-btp/les-dispositifs-de-formation/ ; Pole Emploi, La Préparation Opérationnelle à l'Emploi individuelle (POE I). https://www.pole-emploi.fr/employeur/aides-aux-recrutements/les-aides-a-la-formation/la-preparation-operationnelle-a.html
[207] Constructys (2021), Rapport d'activité 2020. https://rapport-activite-2020.constructys.fr/flipbook/index.html
[208] Constructys (2020), Activity Report 2019. https://rapport-activite.constructys.fr/wp-content/uploads/2020/09/constructys-ra2019-web-integral.pdf
[209] Dares (2021), L'insertion par l'activité économique en 2021. https://dares.travail-emploi.gouv.fr/publication/linsertion-par-lactivite-economique-en-2021

Figure 6-26 Initial entries into IAE and number of employees on integration schemes at the end of the year



Sources: Dares; Services and Payment Agency (ASP)

Few of the new IAE contracts are linked to the construction sector, around 18,000 in total, except in ETTIs where they represent 33% of new contracts in 2021, i.e. around 11,800 contracts.

Table 6-1 Occupations held by employees newly recruited in 2021

	ACI	EI	AI	ETTI
Construction, building and public works	**7**	**4**	**2**	**33**
Secondary works	2	2	1	8
Building work and shell	5	1	1	22

Sources: Dares; Services and Payment Agency (ASP)

Aid to encourage the recruitment of long-term jobseekers[210] has been introduced for 2021 and 2022 as part of the "Plan to Reduce Recruitment Tensions". Contracts signed between 1er November 2021 and 30 June 2022 must :

- Be at least 30 years old;
- Be registered as a jobseeker required to carry out positive job-seeking acts (for at least 12 of the last 15 months);
- You must not have worked more than 78 hours a month recently;
- The person hired must also sign a professionalisation contract.

The aid has been extended to other beneficiaries for contracts signed between 1er July and 31 December 2022. However, this aid has not been extended to 2023[211] .

Free jobs: tested from 1er April 2018 and then extended to the whole of France from 1er January 2020, it is due to end at the end of 2023. The "emplois francs" scheme enables employers to receive aid when they take on an employee living in a Priority Urban Neighbourhood (QPV) on a permanent or fixed-term contract of at least 6 months. The amount of aid is €5,000 per year over three years for permanent contracts and €2,500 per year over two years for fixed-term contracts. As part of the "1 young person, 1 solution" plan, the amount of aid has been re-evaluated for young people under the age of 26 from 15 October 2020. As a result, the number of people taking up "emplois francs" will increase by 15% in 2021, following a phase of generalisation of the scheme that began in 2020. In 2022, 26,400 new applications for emplois francs will have been accepted, compared with 27,300 in 2021[212] . However, the number of people currently benefiting is on the rise, with 49,200 people in all sectors combined in 2022. The data available from DARES does not allow us to distinguish between the "emplois francs" created in the construction sector.

[210] Constructys (2021), Les nouvelles aides exceptionnelles à l'embauche de demandeurs d'emploi de longue durée. https://www.constructys.fr/les-nouvelles-aides-exceptionnelles-a-lembauche-de-demandeurs-demploi-de-longue-duree/#:~:text=Pour%20les%20contrats%20de%20professionnalisation,de%20cat%C3%A9gorie%20A%20et%20B*
[211] Public service (2023), Aid for the recruitment of long-term jobseekers. https://www.service-public.fr/particuliers/actualites/A15297#:~:text=Un%20d%C3%A9cret%20du%2029%20juin,plus%20b%C3%A9n%C3%A9ficier%20de%20cette%20ai
[212] Employment policies (2023), Free jobs. https://poem.travail-emploi.gouv.fr/synthese/emplois-francs

Local financial support schemes for training

In the Nouvelle-Aquitaine region, for example, local aid has been introduced to reduce jobseekers' exposure to price rises. It entitles you to :

- A training start-up bonus of €1,000 for those enrolled in a regional training course lasting at least 3 months and whose contract start date is between 1er November 2022 and 30 June 2023;
- A 4% increase in regional pay for vocational training trainees. This increase will apply to around 22,000 trainees and will also apply to trainees in training since July 2022[213] .

CAPEB Auvergne Rhône-Alpes and Pôle emploi are committed to promoting the value of craft businesses in the building and public works sector. The two parties signed a partnership agreement on 26 July 2022, focusing on 3 areas[214] :

- Develop mutual knowledge between the 2 networks and share information on the sector and its recruitment and training needs;
- Help promote the sector, make it more attractive and meet recruitment needs;
- Supporting business start-up or takeover projects in the construction sector.

Despite all these measures, the integration of jobseekers is still underdeveloped and cannot meet the growing need for recruitment. A number of reasons were cited by industry players:

- The distance between the jobseeker's place of residence and the training venue ;
- Reluctance to retrain: this means investing in new training, which can seem long, restrictive and expensive;
- Preconceived ideas about the lack of training in the construction industry ;
- The industry's poor image.

Ecological Transition Schools (ETRE)

ETRE schools have been expanding throughout France since 2019, and now number 11. They are positioning themselves as an innovative educational solution, offering free training courses, for young people aged 16 to 25 as a priority, around jobs in the ecological transition, particularly on subjects of eco-construction, energy renovation or reuse. The courses last from 1 week to 1 year, and focus mainly on practical work. There are three types of training: "re-mobilisation" training, which involves hands-on experience and professional encounters; pre-qualification training, which involves trying out different trades; and qualification training, which can be in-house or external. The conditions for taking part in these courses vary from school to school.

6.1.5 Changes in skills and professions

As part of an ADEME study entitled "Overview of training and careers in the building energy renovation sector", a telephone survey was carried out among a dozen building energy renovation professionals (companies, associations, training bodies) on the quality of the training available.

On a scale of 0 to 10, respondents rated the current level of training and qualifications specific to renovation with an average of 6.3, and the current level of skills of professionals with an average of 5.9. There is still a great deal of training needed to make the ecological transition in the building sector a reality, both in the primary and secondary trades, and in management and design. Of course, this development must lead to changes in the existing skills of these trades, but it may also lead to the creation of new skills, or even new trades.

The CARIF-OREF network[215] wanted to gain a better understanding of how different trades in the building and public works sector would be affected and how they would evolve. To this end, it carried out a study aimed at observing how the ecological transition is reflected in companies in the region and characterising the evolution, emergence or absence of transformations in trades and skills.

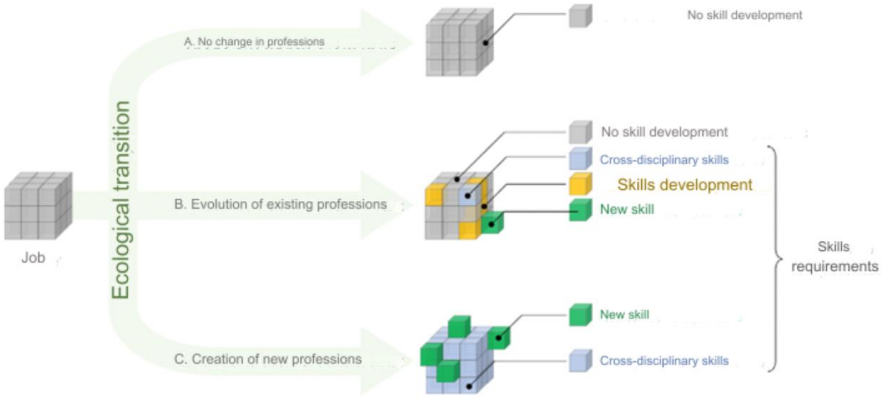
[213] Régions de France (2023), Nouvelle-Aquitaine: new support for jobseekers undergoing vocational training. https://regions-france.org/actualites/en-direct-des-regions/nouvelle-aquitaine-nouvelles-aides-demandeurs-demploi-formation-professionnelle/

[214] Pôle emploi (2022), The CAPEB and Pôle emploi are committed to promoting employment in the building and public works sector. ttps://www.pole-emploi.org/regions/auvergne-rhone-alpes/communiques-de-presse/2022t1/la-capeb-et-pole-emploi-sengagent-pour-favoriser-lemploi-dans-les-entreprises-artisanales-du-btp.html?type=article

[215] CARIF-OREF: Centre d'Animation et de Ressources de l'Information sur la Formation - Observatoire Régional Emploi Formation. Source: Réseau des CARIF-OREF (2023), Quels besoins en compétences et en formations en lien avec les métiers de la transition écologique?

The study characterises the skills-related issues as follows: certain occupations with no changes in skills, existing occupations with the integration of cross-disciplinary skills, new skills and changes in existing skills, and new occupations involving new skills and cross-disciplinary skills.

Figure 6-27 Hypothesis of the effects of the ecological transition on jobs



Source: CARIF-OREF Network Association (2023)

This experiment looked at the building and civil engineering trades in the Normandy and Pays de la Loire regions, and concluded that regulations are the main lever for integrating the transition into skills and training requirements, followed by public support policies (financial aid, MaPrimeRénov', tax deductions), which have a strong influence on building and civil engineering companies, and the expectations of society and consumers to reduce consumption.

In these two regions, the study looked at changes in skills, or new skills in demand, in 23 different construction trades, as well as the availability of training in the region. The findings are as follows:

- The players interviewed in the two regions do not systematically observe the same needs (changing or new skills) for each profession;
- Very few professions involve no change in skills or no new skills. This is the case for the building painter, the project designer, the project calculator and the public works supervisor;
- Overall, the emergence of new professions is not significant;
- Across all professions, the study found a need for additional knowledge, not necessarily linked to mastery of a new skill;
- Finally, it has been observed that most of these skills can be acquired via dedicated training in the region, or via modules within existing training courses. However, there is a lack of key training courses, such as those on thermal insulation from the outside or on roofs, using innovative materials such as cellulose wadding, in the Pays de la Loire region, and on the maintenance of photovoltaic (PV) solar panels and EMSP diagnostics in Normandy.

According to the players interviewed as part of this study, the new skills to be developed relate both to technical subjects, linked to energy efficiency, new materials and new challenges (summer comfort, water management, preservation of biodiversity, reuse), and also to more cross-disciplinary skills, in particular the ability to work in a team with other trades, and to think globally about the work. To a lesser extent, skills enabling the mastery of new digital tools are mentioned as skills to be developed in the future. Finally, the study does not allow us to identify any real needs that differ from one region to another.

Chantiers participatifs, a popular education approach

Participative building sites have been developing for a number of years, particularly for eco-construction projects. The Botmobil association was set up in the 2000s, at a time when straw construction was gaining ground. The aim of this association is to offer training in earth and straw construction, through participative workcamps supervised by competent professionals. The association was also involved in setting up the French Straw Construction Network. The workcamps are open to everyone, including people planning to retrain for a new career or to build and renovate their own homes.

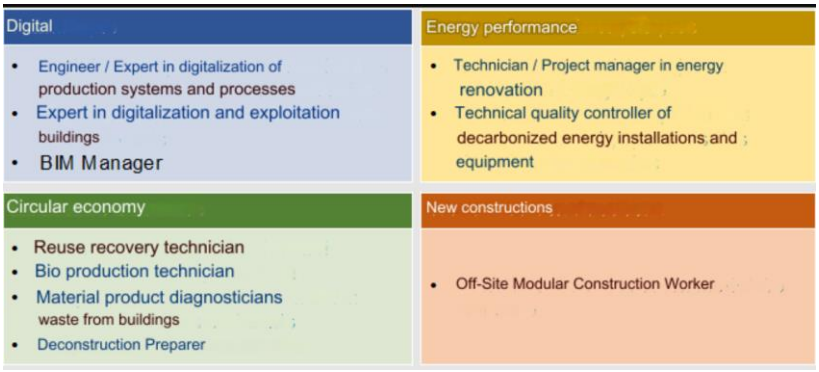
However, France Compétences would like to highlight the emergence of functions that can be likened to new professions. Titles relating to emerging professions should benefit from an exceptional procedure for their registration on the RNCP. To this end, as part of the France 2030 investment plan, the organisation is launching a call for contributions to identify emerging professions that will be subject to a special RNCP registration procedure in order to respond rapidly to changes in the labour market.

By 2023, France Compétences has identified 7 emerging trades, 4 of which correspond to the new challenges facing the construction industry[216] :

- Off-site modular construction worker
- Expert in digitisation and building operation
- Recycling technician
- Technical quality controller for carbon-free energy installations and equipment

A number of building and civil engineering trades have also been added in recent years:

Figure 6-28 New professions that have emerged in recent years, by type of expertise



Source: France Compétences

6.1.5.1 Focus on support for project owners

In the interviews conducted as part of BUS2, many of the players interviewed spoke of a missing link in many cases, that of the project manager or AMO, which would make it possible to guarantee the quality of the renovations. This support is one of the main obstacles to the widespread adoption of comprehensive renovations that achieve BBC levels.

The skills and fields of action of these professions are also set to evolve. The Observatoire Paritaire des métiers du Numérique, de l'Ingénierie, du Conseil et de l'Événement (OPIIEC) in 2022 has identified 5 trends that will mainly determine the development of support professions in the construction sector and the evolution of their skills[217] :

- **Regional governance:** the need for support will make up for local authorities' lack of in-house skills to deal with the new challenges. However, they will be constrained by the reduction in State funding. AMO service providers will also have to adapt to the new sub-national governance of public players and the way in which this system of players now approaches planning.
- **Project and building life cycle:** both generalist and specialist AMO service providers will need to master the analysis of the life cycle and its costs, to be able to provide the project owner with relevant scenarios, and to have greater mastery of the Operation-Maintenance Management (OMM) phase. This requires technical skills (calculation of economic and energy costs) as well as organisational skills to support the project owner's decision-making process.
- **Climate change:** the climate issue is making the decision-making process more complex, which could see the share of intellectual services in construction and development projects rise from 17% to 35% in

[216] Centre Inffo (2023), France Compétences identifies seven new emerging professions for 2023. https://www.centre-inffo.fr/site-centre-inffo/actualites-centre-inffo/le-quotidien-de-la-formation-actualite-formation-professionnelle-apprentissage/articles-2023/france-competences-retient-sept-nouveaux-metiers-emergents-pour-2023
[217] OPIIEC (2022), AMO professions in construction, infrastructure and environmental engineering

10 years. These issues need to be taken into account right from the opportunity or feasibility study stage and throughout the project. Technical and financial prediction models must take into account changes in rainfall, the risk of flooding and the accelerated ageing of infrastructure. Environmental project management is an area of expertise that should become more widespread across all services.

- **Digital:** BIM (Building Information Modeling) and CIM (City Information Modeling) will grow rapidly, and the amount of data required for decision-making is set to increase dramatically. Data of a demographic, sociological or geographical nature will be particularly required for long-term decisions and to determine operating costs.
- **Financial and insurance risks**: construction costs are likely to continue to rise, including for project management services. This budgetary constraint is likely to be exacerbated by increased difficulties in accessing finance. Against this backdrop, project management consultants need to develop their skills in global risk analysis.

In the end, the study highlights the following paradox: two-thirds of both customers and service providers believe that the activity of support service providers will increase, or even rise sharply, over the next 5 years, largely due to structural constraints (regulations, climate change, digital technology) and the increased use of intellectual services. This growth in activity could lead to an 8-10% increase in the number of staff required. However, this increase in project management needs could be limited by the budgetary constraints of project owners.

6.1.5.2 Focus on the carpentry trade

According to a study carried out by the Compagnons du Devoir et du Tour de France and Junior ESSEC[218] Conseil, the constant and rapid rise in demand for timber construction and external thermal insulation is exacerbating the difficulties in recruiting carpenters throughout France[219] . This demand is likely to increase even further with the entry into force of the RE2020 and the place given to wood in it. More than 80% of companies are finding it difficult to recruit, particularly apprentice carpenters, and are having to turn down orders for lack of manpower.

Carpentry work in 2019 employed 17,800 carpenters, and the industry currently trains 2,872 apprentices and 3,371 students each year. But fewer and fewer young people are training to become carpenters, and companies are seeing a mismatch in the profiles of applicants. The wood industry is a good example of the problem of attractiveness suffered by the construction sector, with some of the lowest salaries and a higher incidence of accidents. The proportion of under-25s in the workforce fell from 24% to 18% between 2005 and 2015.

In 2020, the AFPA, in collaboration with Pôle Emploi, recently improved its training offer, and the carpenters trained that year all found jobs. A further 8 people benefited from this training in 2021. As part of this improved training, Pôle Emploi is responsible for ensuring that training sites are welcoming and that trainees are motivated, while the AFPA assesses trainees, provides a covered technical platform and helps trainees find a host company.

The Observatoire du BTP distinguishes 3 categories of skills that are essential for carpenters:

- **Strategic**: these skills are vital to the company. They include defining a commercial policy, product and material traceability processes, project design, and safe assembly/lifting.
- **Penuric**: these are skills that are difficult to generate because of a lack of training. These are cross-disciplinary skills, such as managing the work and steering (technically and financially) a site.
- **Emerging**: these skills are under development. They involve using digital tools such as BIM, implementing a continuous improvement approach, adopting behaviours appropriate to the situation, and anticipating occupational risks.

[218] ESSEC: École Supérieure des Sciences Économiques et Commerciales (Higher School of Economics and Business)
[219] Les Compagnons du Devoir et du Tour de France, Junior ESSEC Conseil (2022), Study on training for the carpentry trade

6.2 TRAINING ORGANISATIONS IN THE BUILDING SECTOR

In 2021, a total of €28.3 billion was earmarked nationally for continuing vocational training and apprenticeships, excluding direct expenditure by companies [220] . The number of private and public continuing education organisations is rising sharply, with 87,000 organisations declaring activity in 2022, corresponding to sales of 15 billion euros[221] . However, the market is highly concentrated, with only 5% of them generating 70% of this revenue.

Training organisations are classified according to the type of training:

Initial training :

- Under school status: Éducation Nationale ;
- By apprenticeship: CCCA-BTP networks (Comité de Concertation et de Coordination de l'Apprentissage du Bâtiment et des Travaux Publics); AOCDTF (Association Ouvrière des Compagnons du Devoir du Tour de France); UNMFREO (Union Nationale des Maisons Familiales Rurales d'Éducation et d'Orientation).

Continuing education :

- AFPA (Agences nationales pour la Formation Professionnelle des Adultes) ; GRETA (Groupement d'Établissements) ; FNCMB (Fédération Nationale Compagnonnique des Métiers du Bâtiment) ;
- Independent training organisations (voluntary or private).

6.2.1 Initial training organisations

6.2.1.1 Public bodies

Public training bodies are under the authority of several ministries.

First of all, the French education system, up to level 4, is managed by the Éducation Nationale. This body is responsible for defining teaching programmes and educational guidelines. Ministerial decisions are implemented by the rector, who is responsible for the rectorate. The rectorate is the headquarters of the Académie, where the academic departments are located.

Missions

The French education system is organised around a number of administrative entities:

- Academic regions: there are 18 of these, each comprising up to 3 academies. Established by the law of 16 January 2015, they are headed by a rector of the academic region, who ensures *"the unity and coherence of the State's message".* They are responsible for implementing regional policies relating to education, training, higher education, etc.
- Academies: France has 30 academies, including 25 in mainland France and 5 in the French overseas territories. The academy is the administrative district of reference for the French education system.
- The Directions des Services Départementaux de l'Éducation Nationale (DSDEN) are responsible for implementing education initiatives at departmental level, as well as managing staff and schools.

Higher education courses are offered in establishments that are mainly under the authority of the Ministry of Higher Education and Research, including IUTs, universities and most engineering schools. However, some engineering schools are under the authority of other ministries, and the ENSA (Écoles Nationales Supérieures d'Architecture) are under the authority of the Ministry of Culture.

It is also important to remember that some private organisations play an important role in initial training, particularly in the engineering cycle. In fact, around 30% of engineering students are enrolled in a private institution. French private engineering schools are recognised by the State.

[220] Dares (2022), Expenditure on continuing vocational training and apprenticeships. https://www.insee.fr/fr/statistiques/2388091
[221] Digiforma (2023), The guide for training organisations. https://www.digiforma.com/guide-of/

Campus des métiers et des qualifications" label

The "Campus des métiers et des qualifications" label is designed to transform the vocational pathway and make it more attractive. There are campuses for a number of industries, including "Infrastructure, building and eco-construction". For example, in the Grand-Est region, the Campus des métiers et des qualifications Éco-construction et Efficacité Énergétique (Campus 3E) was set up in 2015 as a joint initiative of the Alsace region and the Strasbourg education authority to promote careers and training in the building industry through a strong commitment to sustainable construction and close collaboration with higher education and economic players. These campuses can have slightly different objectives: focusing on professional integration, playing a networking role on the subject of sustainable building, giving rise to new projects, or increasing the attractiveness of the sector.

6.2.1.2 CCCA-BTP ~ Comité de Concertation et de Coordination de l'Apprentissage du Bâtiment et des Travaux Publics (Consultation and Coordination Committee for Apprenticeships in the Building and Public Works Sector)

The CCCA-BTP is an association with joint governance, managed by the professional employers' federations and the trade unions of the building and public works branches[222] . The CCCA-BTP is financed by professionals in the construction sector and is made up of 20 full members from employers' professional federations and employees' trade union organisations.

The CCCA-BTP develops vocational training in the building and public works sector, particularly apprenticeships. In 2021, the CCCA-BTP supported 170 training organisations in the building and civil engineering trades. It provides a range of vocational training services for construction trades, designs teaching guidelines, carries out awareness-raising initiatives, responds to calls for European projects, and proposes innovations relating to training and construction trades.

CCCA-BTP resources

Building and public works companies pay an annual contribution based on their workforce. Half of this amount is earmarked for the CCCA-BTP.

Table 6-2: Contribution rates by workforce and business activity

Average headcount	Building	Public works
Less than eleven employees	0,30 %	0,22 %
More than eleven employees	0,30 %	0,22 %

Source: CCCA-BTP, 2021-2022 Activity Report

Regional coverage

The CCCA-BTP is divided into 18 training bodies, i.e. 61 training establishments, each body being able to have several establishments.

6.2.1.3 AOCDTF ~ Association Ouvrière des Compagnons du Devoir et du Tour de France

L'Association ouvrière des Compagnons du Devoir[223] et du Tour de France is a non-profit association under the 1901 law, with thousands of members and 1,350 employees. It is a nationwide organisation recognised as being in the public interest. The aim of the association's funding is to *"guarantee young people free training and independence of action"*.

Its mission is to welcome young people into the Compagnonnage, to help them find a trade and to integrate them into the world of work. It also supports its members in vocational training through apprenticeships. It organises information campaigns to pass on the values of the association and also carries out research into trades and training.

[222] https://www.ccca-btp.fr
[223] https://www.compagnons-du-devoir.com/

Resources

The association's resources come from its training activities and from welcoming young people:

- Apprenticeship tax: the Association is authorised to collect this (OCTA) and to benefit from it as a training organisation.
- Regional and State subsidies for apprenticeship training
- The payment of training hours given to mobile workers by the companies that hire them, as part of the compulsory contribution to be paid for vocational training.
- European funding
- Payment for continuing training hours provided to company employees
- Resources from hotel and restaurant services for young people
- Donations and legacies, which the Association is authorised to receive
- Sponsorship
- Association membership fees

6.2.1.4 FNCMB ~ Fédération Nationale Compagnonnique des Métiers du Bâtiment and other activities

The FNCMB[224] was founded in 1952 by a group of former Compagnons who had inherited the Compagnon tradition. It is an association under the 1901 law and has been recognised as a public utility since 2002. It is one of the three Compagnonnage institutions in France, along with the AOCDTF mentioned above.

Each companion in the Federation belongs to a Society that is a member of the Federation. 7 societies are members of the Federation:

- The Compagnons Charpentiers des Devoirs du Tour de France Company
- The Compagnons Maçons Tailleurs de Pierre des Devoirs du Tour de France society
- La Société des Compagnons Passants Bon Drilles Couvreurs Plombiers Zingueurs et Plâtriers du Devoir
- La Société des Peintres Vitraillistes du Devoir du Tour de France (The Tour de France Society of Stained Glass Painters)
- La Société des Compagnons Boulangers & Pâtissiers Restés au Devoir

6.2.1.5 CFA ~ Apprentice Training Centres

Apprentice training centres (CFAs) enable you to obtain a diploma while working as a salaried professional in a company. They provide theoretical training, supplemented by practical experience within the company. The aim is to obtain a recognised professional qualification in a specific sector of activity. The CFA is responsible for providing apprentices with technical and general knowledge to complement the vocational training they receive in the company.

The French Ministry of Education estimates that there will be 3,123 CFAs in 2022 in all sectors, 332 more than the previous year. A CFA trains an average of 300 young people, through an average of 10 courses. This increase, observed since 2019, is mainly due to the reform of training in 2018 and the opening up of training to the market.

[224] https://compagnonsdutourdefrance.org/pages/notre-federation

6.2.2 Continuing education training organisations

6.2.2.1 AFPA ~ National Agency for Adult Vocational Training

The AFPA [225] was founded in 1949 and is France's leading provider of vocational training leading to qualifications. Its mission is to train people for employment and help them enter the labour market. The AFPA was initially an association (Association pour la Formation Professionnelle des Adultes). It was transformed into an Établissement Public Industriel et Commercial (EPIC) on 1er January 2017 to become the Agence nationale pour la Formation Professionnelle des Adultes. It is now under the supervision of the Ministry of Labour and the Ministry responsible for the budget.

Regional **coverage**

In France, the AFPA has 116 training centres, 13 regional offices and 1 head office in Seine-Saint-Denis.

Courses for adults

The AFPA provides training for 235 professions in a variety of fields (construction, industry, public works, hospitality). According to the AFPA's activity report for 2020, 113,500 people were trained, including 72,000 jobseekers and 41,500 employees. The AFPA also trains 3,000 people with disabilities to facilitate their integration into the world of work. In fact, 1 in 8 working people have received training at the AFPA. The AFPA also advises more than 6,000 companies on their training initiatives.

6.2.2.2 GRETA ~ Groupement d'Établissements

GRETAs are "National Education structures that organise training for adults in most trades. These structures enable students to prepare for a diploma from the CAP to the BTS, as well as to follow training modules. For other levels of training, the continuing education departments of universities or the CNAM[226] are responsible. [...] It draws on the equipment and staff resources of these establishments to build a training offer tailored to the local economy"[227] .

There are 137 GRETAs, at least one in each département. As GRETAs are groupings of establishments, there are more than 4,750 locations where services can be provided.

GRETAs are organised at national, regional and local levels to meet demand.

- **At local level,** GRETAs adapt to local demand to programme continuing training courses by responding to calls for tender.
- **At regional level**, the GRETAs are organised into networks coordinated by a technical adviser to the rector, who *"facilitates relations between the GRETA network and the region's public-sector partners, approved joint collection bodies and major regional companies. He or she encourages the pooling of resources, innovations and technological advances".*
- **At national level**: the Directorate General for Education is responsible for steering the network.

GRETAs also offer online training courses that can be accessed from home.

6.2.2.3 OPCO Constructys

On 1er April 2019, eleven skills operators (OPCO), responsible for supporting vocational training, were approved. They replace the former Organismes Paritaires Collecteurs Agréés (OPCA). The role of these skills operators is to finance apprenticeships, help branches to develop vocational qualifications and assist very small, small and medium-sized enterprises to define their training needs.

OPCO Constructys is the skills operator dedicated to the building and public works sector. Its aim is to advise and inform them on the choice of training courses to consolidate the skills of their employees. It is managed on a joint basis by representatives of various professional organisations representing employees and employers. In 2021, Constructys trained 367,984 trainees, 89% of whom were in the building industry, 8% in public works and 3% in the building materials trade.

[225] https://www.afpa.fr/
[226] CNAM: Conservatoire National des Arts et des Métiers (National Conservatory of Arts and Crafts)
[227] Ministère de l'Éducation Nationale et de la Jeunesse, La formation continue des adultes à l'Éducation nationale. https://www.education.gouv.fr/la-formation-continue-des-adultes-l-education-nationale-3035

6.3 RGE: LABEL RECOGNISING THE QUALITY OF WORK AND SKILLS, ISSUED BY QUALIFICATION

6.3.1 Acknowledged as an environmental guarantor

6.3.1.1 General

The RGE label guarantees the quality of energy renovation work. As described in the RGE charter, it "makes it easier for contracting authorities to identify competent professionals involved in the energy performance of buildings and renewable energy installations"[228] .

To qualify for financial support for energy renovation work, the companies carrying out the work must be RGE-qualified. The eco-conditionality of grants (MaPrimeRénov', the zero-rate eco-loan, energy-saving certificates and the tax credit for energy renovation for very small businesses) ensures that they are directed towards work that will genuinely improve the energy efficiency of the building, carried out by qualified professionals.

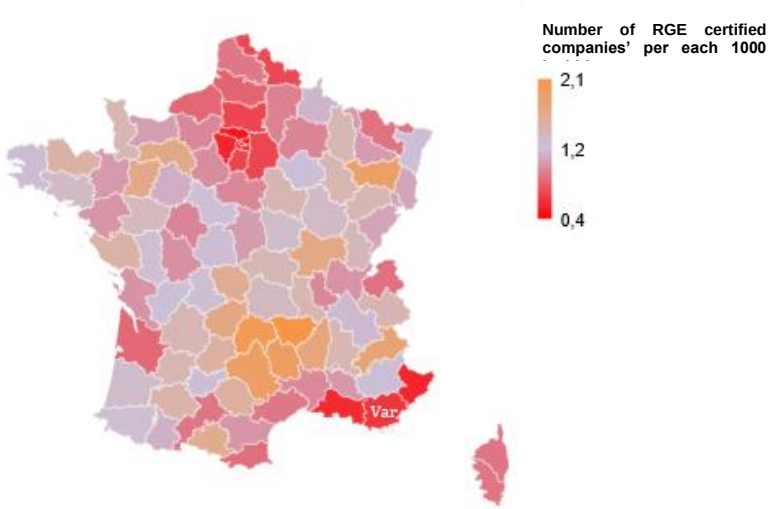
To obtain this qualification, the company must pass an examination demonstrating its compliance with a set of requirements in terms of resources and skills. The RGE label is issued by qualification or certification bodies (Qualibat, Qualit'EnR and Qualifelec, Certibat and Cerqual, OPQIBI[229]) that have signed an agreement with the government and are accredited by the French Accreditation Committee (COFRAC).

The RGE label also enables tradespeople to upgrade their skills. Professionals can go through training organisations offering ongoing training modules. These training bodies are supervised by approved training control bodies such as Certibal, Icert and Qualit'EnR.

The qualification is issued for a period of 4 years, with annual monitoring of the company's legal, administrative, legal and financial criteria. RGE companies are also monitored through audits of the work they carry out. ADEME and the public authorities have also developed an RGE Études quality mark, which includes energy audits.

According to ADEME data, there will be 62,535 RGE companies in 2023, with 188,559 RGE labels held, broken down as follows[230] :

Figure 6-29 Number of RGE companies per 1 000 inhabitants in mainland France in 2022

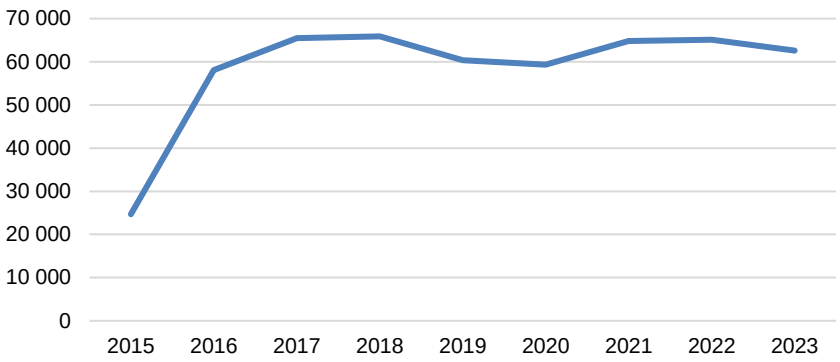


Source: ADEME (2022), List of RGE companies [231]

[228] ADEME, Charte d'engagement relative à l'obtention de la mention RGE (French Environment and Energy Management Agency)
[229] OPQIBI: Organisme Professionnel de Qualification de l'Ingénierie Bâtiment Industrie (Professional body for building industry engineering qualifications)
[230] ADEME (2022), List of RGE companies. https://data.ademe.fr/datasets/liste-des-entreprises-rge-2
[231] *Ibid.*

On average in France, there is one RGE company for every 1,000 inhabitants. However, this figure varies widely from one département to another. However, it's not necessarily a local company that contractors turn to. A study carried out by the Cellule Économique Régionale de la Construction (CERC) in Pays de la Loire shows that the rate of local companies (understood here as belonging to the department studied) mobilised differs greatly between departments: it is 75% in Loire-Atlantique, but 60% in Mayenne or Sarthe[232] . A significant number of companies from the Paris region are also involved.

Figure 6-30 Trend in the number of RGE companies in France



Source: ADEME (2022), List of RGE companies

In 2018, there was a decline. In fact, Qualibat noted a 9% drop in the number of RGE-qualified companies in 2018 compared with the previous year. Several factors are responsible for this drop:

- The qualification was introduced in 2014 for a period of 4 years. Some companies have therefore decided not to renew their qualification. Éric Jost, General Delegate of Qualibat, has also observed a phenomenon of voluntary departures in 2018;
- The RGE reform in 2018, explained below;
- An increase in non-conformities during audits ;
- The removal of certain equipment from the scope of eligibility for the CITE (such as windows)[233] .

6.3.1.2 Reform

In 2018, the desire to consolidate the RGE qualification is leading to a reform to increase household confidence in RGE companies. More stringent controls on the quality of the work and the detection of fraudulent companies are being introduced.

Checks are being stepped up: they are being carried out more randomly and more frequently, with harmonised audit grids and strengthened qualification criteria. The first measures under this reform came into force on 1er January 2021.

6.3.1.3 RGE "site by site"

The RGE "worksite by worksite" scheme is also being introduced. It is being tested from January 2021 to December 2023. It allows companies that are not RGE-qualified but have been in business for at least 2 years to carry out energy renovation work or install equipment eligible for grants. According to the French Ministry for Ecological Transition and Territorial Cohesion: *"Site-by-site qualification increases the supply of tradespeople when this is in short supply. Its aim is therefore to increase the volume of energy renovation work. It enables companies wishing to obtain the RGE label to carry out subsidised work, thereby building up a reference list of projects"*[234] .

[232] CERC PDL (2022), Sustainable building and energy transition. https://www.pays-de-la-loire.developpement-durable.gouv.fr/renovation-energetique-et-evaluation-de-l-a6242.html
[233] Le Moniteur des artisans (2019), Decline in the number of RGE companies in 2018. https://www.lemoniteur.fr/article/baisse-du-nombre-d-entreprises-rge-en-2018.2018600
[234] Ministère de la Transition Écologique et de la Cohésion des Territoires (2022), RGE experimentation site by site

To achieve this, companies must apply to a government-approved qualification body. This body will check the company's files prior to the worksite and then inspect the worksite once the work has been completed. However, the same company cannot be awarded this qualification more than 3 times.

On the other hand, this measure does not seem to have had the success expected by the players in the sector: Daniel Jacquemot, Director of Technical Policy at Qualibat, says that he was "expecting at least 10 times as many applications"[235] .

6.3.1.4 A label that sparks debate

In 2020, 85.8% of control audits carried out by Qualibat were deviation-free. However, many companies are still not sufficiently qualified. The RGE label has therefore been strengthened by the reform, and controls have been tightened. The "site by site" scheme will make it simpler to obtain the label. In 2018, nearly 7,000 companies were deregistered because, for the majority of them, quality discrepancies were observed during on-site inspections[236] .

However, the interviews conducted as part of this study highlighted the divergent opinions on this qualification. It is seen as both a necessity and a handicap for tradespeople, or as a major obstacle to self-renovation. It is sometimes seen as being too easy to obtain, with no guarantee that skills have been acquired. On the other hand, the administrative procedures are cumbersome for SMEs, so they do not apply for the label even though they are competent and capable of carrying out high-quality energy efficiency work. According to the players interviewed, RGE and non-RGE companies are sometimes in competition with each other. Non-labelled companies sometimes offer low prices, which motivates project owners to work with them, even if this means having to forego financial assistance from the State.

According to the CAPEB, only 30% of companies qualified to carry out energy efficiency work on buildings have the RGE label. Described as too complicated, the RGE label is set to evolve. In an open letter to Elisabeth Borne, the French Prime Minister, the CAPEB called for the label to be simplified by 2022, to make it more accessible to qualified craftsmen[237] .

The players interviewed mentioned the problem of the governance of the qualification, but also the quality of the work carried out. Certification is seen as a good way of preventing eco-crime, bringing companies up to standard and achieving quality work in a secure environment. However, some members of the profession see the label as a test to pass, and therefore as a constraint rather than an added value. Despite the divergences, the players agree that the RGE label needs to be questioned and improved, if only in terms of the quality of the work, which is not yet fully compliant with national objectives (even though 85.8% of the control audits carried out by Qualibat were without deviation), or in terms of simplifying the process of obtaining it.

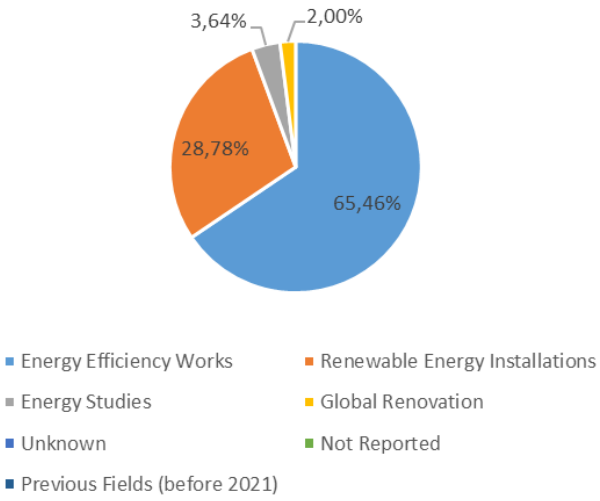
Another issue raised was the lack of a global approach to the RGE label, which is awarded by speciality. According to ADEME data, only 3,838 companies are RGE "Global Renovation" companies, i.e. 2% of RGE companies (see figure below).

Michel Jarleton, training delegate for the Union Nationale des Syndicats Français d'Architectes (UNSFA) and in charge of issues relating to the energy transition, also supports this last point: "*The RGE label gives craftsmen and works companies a slightly more global vision than before, but everyone remains within their own speciality. Architects are de facto RGE. He could therefore intervene with some of his specificities, such as the overall diagnosis, which enables us to know where we're starting from, where we're going and to define how to go about it to obtain the best possible results in terms of energy and environmental performance"*[238] .

Changes to the scheme are discussed within the RGE partnership body, which brings together the Ministry for Ecological and Solidarity Transition (MTES), ADEME, professional organisations, qualification bodies and consumer associations.

[235] Le Moniteur (2022), Qualibat reports positively on the reformed RGE. https://www.lemoniteur.fr/article/qualibat-dresse-un-bilan-positif-du-rge-reforme.2186832
[236] Batiactu (2019), Thousands of companies have been struck off the RGE label. https://www.batiactu.com/edito/milliers-entreprises-ont-ete-sorties-label-rge-55257.php
[237] Batiactu (2022), Craftsmen ask the Prime Minister to simplify the RGE. https://www.batiactu.com/edito/atisans-demandent-simplification-rge-a-premiere-ministre-65253.php
[238] Energy balance, RGE Label: fiasco or breakthrough? https://www.equilibredesenergies.org/13-03-2017-label-rge-fiasco-ou-avancee/

Figure 6-31 Breakdown of RGE companies in France by sector (%)



Source: ADEME (2022), List of RGE companies[239]

6.3.2 Qualification bodies RGE

A qualification is different from a certification. A qualification is recognised only by the collective bargaining agreements of an industry and provides proof of a particular skill. A training course leading to a qualification does not lead to the award of a title of any kind, but enables you to develop new skills as part of a career change or to maintain your employability in the sector concerned.

A certification is directly linked to a specific profession and not an area of skills. Certification is recognised by a professional branch. It is issued by the Ministry of Labour in the case of a vocational qualification, or by the Commission paritaire nationale de l'emploi (CPNE) in the case of a vocational qualification certificate.

Qualification bodies are accredited by COFRAC. In France, there are 3 main RGE qualification bodies: Qualibat, Qualit'EnR and Qualifelec.

6.3.2.1 Qualibat

Qualibat is a non-profit-making association set up in 1949 by the public authorities to help rebuild France's housing stock after the war. Qualibat issues qualification and certification labels for the building sector. It is the only generalist body in the building sector and covers all work relating to energy efficiency and renewable energies.

With 170 employees, 35 regional branches and 3,000 volunteers, Qualibat is present throughout mainland France and Réunion.

Since its creation, Qualibat has certified and qualified up to 90,000 companies and craftsmen in the sector.

Qualibat offers professional qualifications, trade certifications and management system certifications.

6.3.2.2 Qualit'EnR

Qualit'EnR is an association set up in 2006 to help people in the renewable energy sector (solar thermal, photovoltaic, wood energy, heat pumps and geothermal drilling, installation of condensing boilers or micro-cogenerations) to improve their skills, and more specifically for the installation of renewable energy production equipment.

Qualit'EnR represents more than 18,000 qualified companies, more than 30,000 active qualifications and more than 67,000 inspections carried out since 2007.

Qualit'EnR issues 7 RGE quality labels: Qualisol, Qualibois, QualiPV, QualiPAC, Qualiforage, Chauffage +, Ventilation +.

[239] https://data.ademe.fr/datasets/liste-des-entreprises-rge-2

6.3.2.3 Qualifelec

Qualifelec is designed for electrical professionals working in the fields of energy efficiency and the installation of equipment using renewable energies. The qualifications cover 5 main areas: high voltage, low voltage, electrical equipment, renewable energy and infrastructure.

Qualifelec currently has 1,167 RGE companies throughout France. The areas of qualification with the most RGE companies are as follows:

- Electrical installations for housing, small commercial premises: 914
- Electric vehicle recharging infrastructure: 518
- Solar photovoltaic: 403
- Electric heating: 341
- Electrical installations for medium to large tertiary industry: 251

6.4 CURRENT SKILLS-BUILDING SCHEMES FOR IMPLEMENTING ENERGY EFFICIENCY AND RENEWABLE ENERGY MEASURES IN BUILDINGS

6.4.1 FEEBAT Programme ~ Training in Energy Saving in the Building Sector

6.4.1.1 Presentation of the programme

The FEEBAT (Formation aux Économies d'Énergie dans le Bâtiment) programme is designed to support professionals and future professionals in the building and architecture sector in their training and skills development in the field of energy-efficient building renovation. The programme is financed by the Energy Savings Certificates (CEE) scheme and by continuing training funds collected from companies. It comprises around thirty training courses and various modules.

Its educational content is also accessible to teachers and trainers at CFAs in the sector, so that they can train future graduates in the sector.

The programme was launched in 2007 with the initial aim of training 50,000 building professionals. Today, since its launch, more than 200,000 professionals have received training through the programme's various modules. *In fact, there are 4 times as many people trained as there are people whose training is paid for by FEEBAT.*

In 2018, an agreement signed on 4 September marked a major change in the programme by broadening the targets to include initial training: pupils, apprentices, students from secondary schools, CFAs, schools of architecture and their teachers and trainers. The agreement also placed the emphasis on *"innovative teaching methods, so as to be able to offer each professional, whether a trainee or a practising professional, a personalised skills development programme aimed at acquiring the skills needed to meet the major challenge of the energy transition in the building sector"*[240] .

In 2023, the programme won a "Digital Learning Trophy" in the "Blended Learning and Support" category.

The programme is organised around 3 main themes:

- **Area 1: Initial training**

The aim of this area is to train teachers and trainers, particularly from the French national education system, apprenticeships and architecture schools, to incorporate training modules on energy renovation into initial training courses in the various building sectors. Higher education courses (DUT or engineering courses, for example) are not covered by the scheme.

The first two modules will be available from the start of the 2023 academic year.

- **Area 2: Continuing training**

This priority will enable us to continue our support for training building professionals and project managers in the field of energy-efficient renovation of buildings.

[240] FEEBAT (2022), Implementation agreement for the FEEBAT Programme

- **Area 3: In-depth integration of the programme internally and within the national ecosystem**

The objectives of these 3 areas are reviewed and updated for the coming years. The agreement signed on 6 April 2022 covers the objectives to be achieved by 31 December 2025.

6.4.1.2 Organisation of the system

The Association Technique Énergie-Environnement (ATEE) is the lead sponsor of the programme, chairing the committees.

The **Steering Committee is** made up of :

- The State
- ADEME
- ATEE
- THE AQC
- Professional building organisations (CAPEB, FFB, FEDERATION SCOP BTP)
- Professional organisations for architects (Conseil National de l'Ordre des Architectes - CNOA)
- CCCA-BTP
- Funding bodies: DYSTRIDYN, EDF and SIPLEC
- Guests

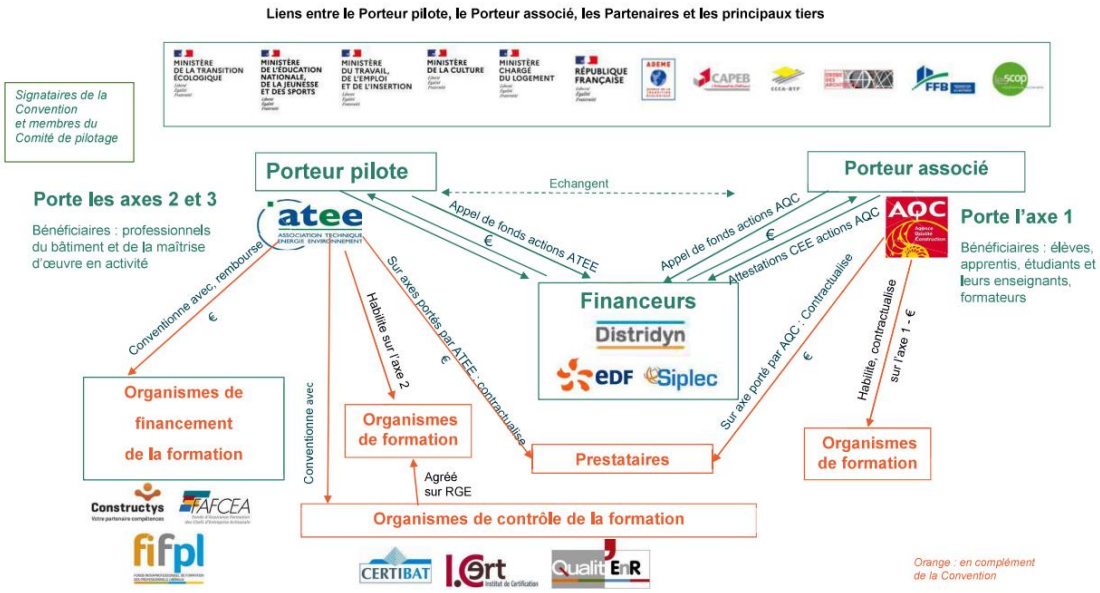
This committee monitors the implementation of the system. It ensures that deadlines are met, and decides what action needs to be taken.

A **technical committee** has also been set up to ensure operational implementation.

- The State
- ADEME
- ATEE
- THE AQC
- Professional building organisations (CAPEB, FFB)
- Professional organisations for project management (CNOA)
- CCCA-BTP
- Voluntary funders

The Operational Committees are mandated by the Technical Committee. They are responsible for the operational implementation of an action or set of actions. They are made up of representatives of organisations or structures whose expertise is relevant to the theme covered by the action. Other relevant guests may take part in these operational committees without being members of the steering committee or technical committee.

Figure 6-32 Organisation of the FEEBAT programme



Source: FEEBAT (2022), FEEBAT Programme Implementation Agreement

6.4.1.3 Financing of training

The programme is eligible for the CEE scheme. Contributions to the programme funds are paid by the funding bodies (EDF, DYSTRIDYN and SIPLEC) following calls for funds.

The maximum budget allocated for the entire duration of the programme is €42,000,000, divided between the funders and the programme priorities.

Figure 6-33 Breakdown of total funding for the FEEBAT programme by priority area

Action	Deliverables	Maximum amount financed by the EEC (k€ excluding VAT or net)
Axis 1 - Initial training	Design, deployment, quality and life of training courses, provision of resources. Resources Associated Carrier	19,191
Axis 2 - Continuing education	Design, deployment, quality and life of training courses. Pilot Carrier Resources	19,865
Axis 3 - Deep integration of the program internally and in the national ecosystem	Coherence and pooling, communication, external synergies, program evaluation, resources Pilot and Associate Carriers	2,336
Program management	Pilot Carrier and Associate Carrier	608
TOTAL		42

Source: FEEBAT (2022), FEEBAT Programme Implementation Agreement

The roll-out of training courses under axis 2 is co-financed by the OPCOs, FAF Constructys, FAFCEA and FIF PL (partners in the FEEBAT programme)[241] .

[241] FAF(CEA): Fonds d'Assurance Formation des Chefs d'Entreprise Artisanale (training insurance fund for heads of craft businesses); FIF PL: Fonds Interprofessionnel de Formation des Professionnels Libéraux (inter-professional training fund for self-employed professionals).

6.4.1.4 National roll-out

The FEEBAT programme is available throughout France. The modules are also adapted for overseas territories. Axis 1 - Initial training - is deployed by teams within the Academies.

In 2020, a new website, www.feebat.org, went online, giving a new impetus to communication about the scheme. The site now allows different entries depending on the category concerned (architects, teachers or building professionals).

In 2022, a Linkedin FEEBAT account has been set up, making the FEEBAT programme's activities even more visible to an even wider audience: https://www.linkedin.com/company/feebat.

The outlook for 2022-2025 *"includes a focus on greater integration of the programme internally and within the national ecosystem, reflecting the importance of synergy and pooling with other players and programmes that are linked to or can usefully provide training in energy renovation".*

6.4.1.5 training

The FEEBAT[242] training courses are aimed at the programme's 3 target groups:

- **Building professionals, craftsmen, company directors, journeymen, the programme's historical targets**

FEEBAT offers training courses for building professionals to obtain the RGE label in various areas of energy efficiency work: excluding renewable energies with the RENOVE module and thermal renewable energies in partnership with Qualit'EnR.

Reno AUDIT: to become an energy auditor, this 17.5-hour course teaches the skills needed by building professionals.

The FEEBAT programme also offers a range of modules on energy renovation[243] .

- **Architects and project managers, the historic 2nd target group for the FEEBAT programme**

FEEBAT is now offering 2 training courses for this target group, all designed by the programme:

- **DynaMOE 1**: a course focusing on energy-efficient renovation of existing single-family homes and energy audits in this market segment. It is aimed at architects, project managers and design offices. The 8-week course includes 35 hours of training each in "*designing and implementing an energy renovation project", as well as "coordinating the various trades involved in the project*". This training is compulsory for architectural firms wishing to carry out an energy audit eligible for MaPrimeRénov' and CEE financial aid.

- **DynaMOE COPRO**: training course launched in May 2023, focusing on energy-efficient renovation of condominiums and energy audits in this market segment. It is aimed at architects, project managers and design offices. The 8-week course includes 5.5 days of training in "*designing and implementing an energy renovation project for condominiums*", "*coordinating the various trades involved in the project*" and "*convincing the players involved in energy renovation for condominiums*". This training course is compulsory for architectural firms wishing to carry out an energy audit in a condominium eligible for MaPrimeRénov' Copropriété[244] .

[242] https://www.feebat.org/
[243] https://www.feebat.org/formations/modules-de-formation-batiment-feebat/
[244] See testimonials from architects who have tried this course: https://www.youtube.com/watch?v=Xh-xYQC0jLM

- **Future professionals (pupils, apprentices, students in secondary schools, CFAs and ENSAPs) and their teachers and trainers: the final target group for the FEEBAT programme.**

The modules for initial training are currently being developed and should be available in 2023. The training courses will be divided into three categories: those aimed at secondary schools, those aimed at architects and those aimed at CFA instructors. The aim of these courses is to accelerate the uptake of these subjects in the classroom, so that they can be taught quickly and on a massive scale. Teachers can make direct use of the course materials offered by FEEBAT[245] , which they will have been trained to use. Eventually, this training could be incorporated into initial teacher training.

It is important to note that FEEBAT's initial training courses are not intended for courses run by the Ministry of Research and Higher Education (DUT/BUT, bachelor's degrees, master's degrees, engineering schools). The targeted training courses, from CAP to BTS, have been divided into five streams by FEEBAT: electrical, energy, building, economics and finishing.

5 modules are currently being designed for lycée teachers (CAP to BTS) and CFA teachers. Two familiarisation sessions were held in Dijon and Besançon on 12 and 13 December 2022. The first two modules, M0 and M1, were presented to 27 CFA teachers and trainers. The first modules will be deployed from the start of the school year in September 2023. Ultimately, the aim is for these teaching elements to be included in the examinations used to obtain diplomas.

Figure 6-34 FEEBAT modules in initial training for lycée teachers from CAP to BTS or CFA teachers

5 modules for 3 Diploma levels

Module 0 - The challenges of energy renovation **Module 1 -** The principles of energy performance	→ **Level 3** Certificate of Professional Aptitude (CAP), Level 3 supplementary mention (MC3) and professional titles (TP3)
Module 2 - The diagnosis of energy renovation **Module 3 -** The design of renovation work programs **Module 4 -** The implementation of renovation work programs	→ **Level 4** Professional Certificate (BP), Professional Baccalaureate (Bac Pro) and technological STI2D (Bac Techno), Level 4 supplementary mention (MC4), professional titles (TP4) and Technical Brevets of Trades (BTM)
	→ **Level 5** Higher Technician Certificate (BTS), professional titles (TP5) and Master's degrees (BM)

The FEEBAT programme has two distinct strands to address this 3ème target group:

- A section aimed at the French education system and the apprenticeship network,
- A section for the 20 Écoles Nationales Supérieures d'Architectures et de Paysages (ENSAP), entitled Métamorphoses.

Courses run by the Ministry of Higher Education and Research (DUT/BUT, bachelor's degrees, master's degrees, engineering schools) are not included in the target.

1) Section for national education and the apprenticeship network

This section concerns two audiences:

- Pupils, apprentices and students enrolled in courses leading to building industry diplomas who are concerned by renovation issues, so that they can take on board the challenges of energy efficiency as future professionals. This represents a target of 100,000 people trained each year, spread across around a hundred qualifications and diplomas.
- Teachers in the French national education system and instructors in apprenticeship training bodies (CFA) of all types, to strengthen their skills base in improving the energy efficiency of existing buildings and help them incorporate the resources created by FEEBAT into their training courses. That's over 10,000 people to be trained by June 2024.

[245] Videos presenting the FEEBAT programme for students and apprentices (https://www.youtube.com/watch?v=gEKsrfaUZOk) and for teachers and trainers (https://www.youtube.com/watch?v=0rw_7Gq0G8c)

The training courses offered by the FEEBAT programme are divided into five areas of expertise:

- Electrical energy systems professions (electrical engineering, building electronics)
- Non-electrical energy systems (fluid installations, air conditioning, energy management)
- Building shell trades (concrete structures, wood, metal, roofing, external joinery, ITE, cladding, masonry, etc.)
- Prescription and economic professions (project owners and contractors, 3D modelling, construction economics, etc.)
- Trades in interior finishing and fittings (lining, partitions, ceilings, interior joinery, fittings, finishing, etc.)

For each business line, 3 levels of qualification are concerned:

- Level 3: Certificat d'Aptitude Professionnelle (CAP), Mention Complémentaire niveau 3 (MC3) and Titres Professionnels (TP3)
- Level 4: Brevet Professionnel (BP), Baccalauréat Professionnel (Bac Pro) and Technological Baccalauréat STI2D[246] (Bac Techno), Mention Complémentaire niveau 4 (MC4), Titres Professionnels (TP4) and Brevets Techniques des Métiers (BTM)
- Level 5: Brevet de Technicien Supérieur (BTS), Titres Pro (TP5) and Brevet de Maîtrise (BM)

Figure 6-35 FEEBAT modules in initial training for levels from CAP to BTS or trainers

Module 0 - The challenges of energy renovation **Module 1 -** The principles of energy performance **Module 2 -** The diagnosis of energy renovation **Module 3 -** The design of renovation work programs **Module 4 -** The implementation of renovation work programs	→ **Level 3** Certificate of Professional Aptitude (CAP), Level 3 supplementary mention (MC3) and professional titles (TP3) → **Level 4** Professional Certificate (BP), Professional Baccalaureate (Bac Pro) and technological STI2D (Bac Techno), Level 4 supplementary mention (MC4), professional titles (TP4) and Technical Brevets of Trades (BTM) → **Level 5** Higher Technician Certificate (BTS), professional titles (TP5) and Master's degrees (BM)

Five modules have been specifically designed for the National Education and Apprenticeship Network section:

- M0 - The challenges of energy renovation
- M1 - The principles of energy performance
- M2 - Energy renovation diagnosis
- M3 - Designing renovation programmes
- M4 - Carrying out renovation programmes

The design of M0 and M1 has been completed[247] . These two modules are being rolled out to national education teachers and apprentice training centre instructors, with deployment to students and apprentices scheduled for the start of the 2023 academic year. The roll-out of the training is particularly ambitious, with a target of over 10,000 teachers and trainers trained by June 2024, working in more than 2,000 public and private establishments.

The other modules are currently being designed. M2 and M3 test sessions were successfully organised in February 2023 at the Lycée Cantau in Anglet (64).

2) Metamorphoses" section for ENSAPs

"Métamorphoses" comprises two installations that are currently being designed.

- **System 1: Library of teaching tools made available to teachers free of charge**

[246] STI2D: Science and Technology for Industry and Sustainable Development
[247] Two examples of videos produced for the module: one on thermal bridges https://vimeo.com/827178626/a06183eb2e?share=copy and on natural ventilation https://vimeo.com/827256557/e77c527b74?share=copy, and one on an immersive model to develop skills in the field https://vimeo.com/827256728/0801a01185?share=copy

These resources include teaching aids that can be used directly or freely adjusted by teachers. They can be used to run teaching sessions of varying length for students on a range of specific subjects. This collection also includes resources that teachers can distribute directly to students, for example to help them explore a subject in greater depth on their own.

- **Scheme 2: Multimodal in-service training scheme for ENSAP teachers**

8 training themes have been identified to cover all the issues involved in energy renovation:

- 6 technical themes
- 1 theme dedicated to the appropriation of teaching tools
- 1 theme to encourage cross-disciplinary teaching on energy renovation

Table 6-2 FEEBAT modules in initial training for teachers in schools of architecture

Eight themes of *Metamorphoses*
(T1) A stock in need of renovation
(T2) The thermal behaviour of a building
(T3) Designing a renovation strategy
(T4) Solutions for the envelope
(T5) Equipment
(T6) The players and the life of the project
(T7) Appropriation of teaching tools
(T8) "Building the collective" workshops

6.4.1.6 Figures

From 2018 to May 2023, FEEBAT provided training for thousands of trainees in the building, project management and renewable energy sectors.

- Building: over 14,000 trainees and 42,000 training days
- Renewable energies: 8,000 trainees and 34,000 training days
- MOE: 2,400 trainees and 7,000 training days

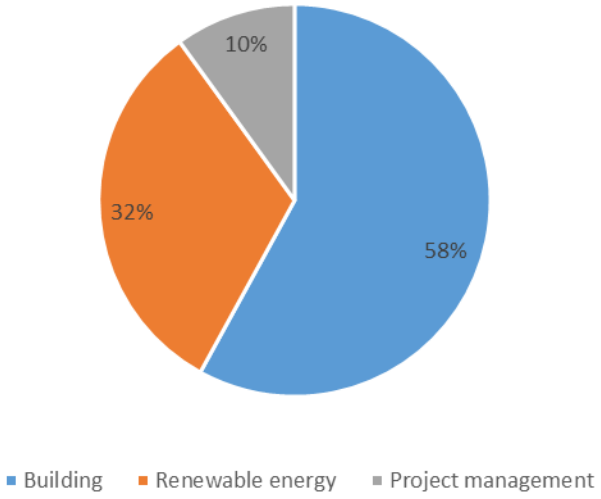
A total of nearly 24,800 trainees were taken on during this period.

Figure 6-36 Number of trainees supported by FEEBAT between 2018 and May 2023

	2018	2019	2020	2021	2022	2023	Total
Building	2585	2626	2406	3413	2923	418	14381
Renewable energy			1485	2765	3359	399	
Project management	376	889	415	383	284	73	2405
Total	**2971**	**3514**	**4306**	**6537**	**6576**	**890**	**24794**

Source : FEEBAT

Figure 6-37 Breakdown of the number of FEEBAT trainees (%)



Source : FEEBAT

98% of the modules taken are still those linked to the RGE: RENOVE (60%), Thermal Renewable Energies (36%) and audits of individual homes (3%). The latter was launched in mid-2020.

6.4.1.7 Outlook for the programme

The FEEBAT Overview presents the outlook for the coming years:

- Finalise the design of initial training programmes and roll them out to teachers and trainers
- Designing new training modules for practising professionals to support new regulations, as well as continuing to roll out existing modules.

The extension of the programme until 2025 means that the FEEBAT programme can be integrated into the current energy context, with the aim of increasing the number of training courses for its target groups and improving the skills of those involved.

According to the players interviewed, the FEEBAT programme is a recognised programme that provides national consistency in terms of knowledge and skills in energy renovation. The FEEBAT programme plays an important role in adapting teaching to the new energy challenges. The content of FEEBAT is described as relevant and qualitative. Some even mention producing the programme in several languages. However, two weak points are highlighted by certain players: the integration of the ability to work together and the management of interfaces.

On the other hand, only a small proportion of small businesses use the programme's training courses.

6.4.2 OSCAR Programme ~ Optimisation and Simplification of CEE for Renovation Craftsmen

The OSCAR programme[248] is run by ATEE in partnership with ADEME, MTE, CAPEB, FFB and the federations of building equipment and materials distributors (Fédération des Distributeurs de Matériaux de Construction - FMDC; Fédération des Distributeurs de Matériel Électrique et de génie climatique - FDME; Fédération des Négociants en Appareils Sanitaires, chauffage, climatisation et canalisations - FNAS). It is financed by AIDEE (Association Interprofessionnelle pour le Développement de l'Efficacité Énergétique), DYSTRIDYN, EDF, ESSO, SIPLEC and Total Énergies Marketing France as part of the CEE scheme.

The aim of the programme is to help tradesmen and companies in the building sector to incorporate public (Anah) and private (CEE) support into their energy renovation packages, so that they can talk more easily to householders about the benefits. To achieve this, the programme aims to set up a network of 6,000 Energy

[248] https://programme-oscar-cee.fr/

Renovation Advisers (RARs) in mainland France and Corsica, simplify the administrative procedures for obtaining EWCs, in particular by going paperless, and create a website for craftsmen and building firms.

The first training session took place on 23 November 2022 in Metz. The aim of these sessions is to train the players present so that they are subsequently able to support craftsmen and craft businesses. After the training session, the participants will be asked to carry out an awareness-raising campaign in the field. This session will be monitored and validated by a trainer. As of 14 April 2023, 17 training organisations and 55 trainers have trained 647 trainees, and 343 have been accredited after completing an initial course.

Following these two sessions, the actor obtains his "RAR" certificate.

6.4.3 On-site training programmes

6.4.3.1 PRAXIBAT

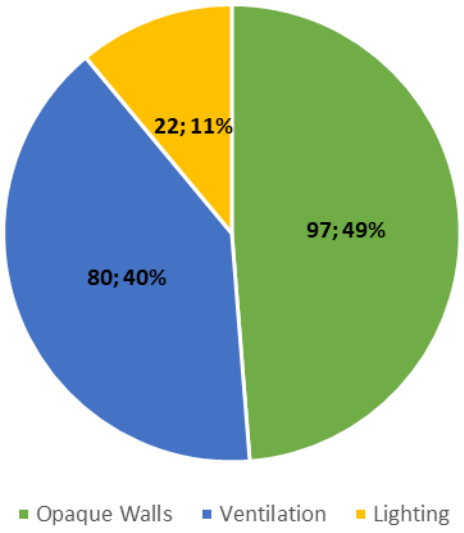
Launched in 2008, PRAXIBAT provides training in energy-efficient building techniques. The programme targets both young people in initial training and adults in vocational training (employees, tradespeople, jobseekers, architects).

PRAXIBAT bases its training on a large proportion of practical work (60% of training). To achieve this, educational work sites or "technical platforms" enable trainees to work in real-life conditions. There are currently around 200 technical training sites throughout France. They reproduce real-life site conditions, giving trainees the chance to experiment through "hands-on teaching".

3 training modules are available:

- Creating a high-performance building envelope (opaque walls)
- Installing an efficient ventilation system (ventilation)
- Designing and installing efficient lighting (lighting)

Figure 6-38 Distribution of PRAXIBAT technical centres



Source: ADEME (2020), Le programme PRAXIBAT [249]

6.4.3.2 AFEST ~ Action de Formation en Situation de Travail (On-the-job training action)

The experiment conducted in 2015 and initiated by the DGEFP aimed to define the conditions under which on-the-job training would be synonymous with skills enhancement and, above all, recognised as such and therefore eligible for training funding[250].

[249] https://data.ademe.fr/datasets/praxibat
[250] Lefebvre Dalloz Compétences (2022), AFEST: what assessment and what prospects for 2023? https://formation.lefebvre-dalloz.fr/actualite/decodeur-afest-quel-bilan-et-quelles-perspectives-pour-2023

The AFEST is being developed from 2019 and allows "learners" to alternate periods of practice, during which they apply gestures and other skills that will later be recognised, with periods of taking a step back. A trainer, from within or outside the company, accompanies the learner and repeats as many times as necessary the role-playing and the taking a step back, to assess and validate the training. The trainer must be able to conduct these debriefs in such a way as to comply with the legal criteria of the scheme. However, no certification is currently required.

The AFEST referent, often the company's training managers, are responsible for coordinating and implementing the scheme. The health crisis has put a major brake on its development, but AFEST continues to grow, particularly through hybrid formats, and to be integrated into training schemes. The OPCOs are including AFESTs in their skills development plans, and some are planning to finance them.[251]

6.4.3.3 FIT ~ Work Integrated Training

This system enables employees to receive training directly on site. A container is used to provide the theoretical part of the training, and employees are then invited to put the content into practice directly in the workplace. The cohorts of trainees bring together different trades to make it easier to learn how to co-ordinate the various gestures, and to meet air-tightness requirements as effectively as possible. Unlike AFEST, FIT is not on-the-job training, but enables the theoretical skills acquired to be applied quickly.

The scheme has been trialled in the Hauts-de-France region by Constructys, with four volunteer employment centres, the Centre de Développement des Éco-Entreprises (CD2E) and Alliance Villes Emploi. By 2020, 29 sites had benefited from the FIT, and 150 public and private project managers had been trained in energy-efficient renovation[252] .

6.5 EUROPEAN INITIATIVES AND PROJECTS RELEVANT TO SKILLS DEVELOPMENT IN THE BUILDING SECTOR

6.5.1 European initiatives

Pact for Skills

Launched on 10 November 2020, the Skills Pact is the first flagship initiative of the European Skills Agenda. Through this Pact, the Commission is encouraging public and private organisations to work together to support the upskilling and re-skilling of individuals, in order to underpin a fair recovery as well as the green and digital transformations envisaged by the Green Pact for Europe. To join the Pact, organisations must adhere to key principles: i) promoting a culture of lifelong learning for all; ii) building strong skills partnerships; iii) monitoring skills supply and demand and anticipating skills needs; and iv) combating discrimination while promoting gender equality and equal opportunities. Pact members have access to information on skills upgrading and retraining needs, advice on relevant funding instruments to improve adult skills in their regions and countries, and partnership opportunities within a growing community. The Pact follows on from a communication published in the summer of 2020, which emphasised its cross-sectoral nature and the intention to prioritise support for the industrial ecosystems most affected by the crisis, requiring ambitious strategies for upskilling and retraining. One of the ecosystems identified is the construction industry. The European executive highlights the difficulty of attracting young, skilled workers to the sector and recommends filling the skills gaps - among a workforce of 12 million - by focusing on upskilling in the areas of energy and resource efficiency, decentralised energy solutions and the renovation of existing buildings, among others.

A Pact for Skills in Construction by the EU sectoral social partners, EFBWW and FIEC in cooperation with EBC

The Pact was initiated by the European Commission as part of the Pact for Skills, and developed by FIEC, EFBWW and EBC to mobilise concerted efforts between private and public partners in favour of quality investment in vocational training and knowledge, skills and abilities. The initiative benefits the European construction industry, and all people of working age in the EU's single market, with a full commitment to respect and uphold the following key principles:

- Establish solid partnerships, including with vocational training institutions

[251] CEGOS, 10 questions about AFEST. https://www.cegos.fr/ressources/faq-reglementation-formation-professionnelle/10-questions-sur-l-afest
[252] C-Campus Le Blog (May 2020), Work-Integrated Training (WIT). Online: https://www.blog-formation-entreprise.fr/interview-constructys-formation-integree-au-travail-fit/

- Monitor professional supply and demand and anticipate needs in terms of knowledge, skills and abilities
- Combating discrimination
- Attracting more young people and women to the sector
- Promote a culture of lifelong learning for all, supported by appropriate incentives

Construction Skills Observatory

The Construction Skills Observatory, part of the Blueprint Construction project, is designed to observe and monitor the skills needs of construction companies in various EU countries. It helps to anticipate skills needs at national and European level. The Observatory complements the data provided by the European Construction Observatory (ECSO).

Its main objective is to facilitate the transnational sharing of knowledge and sectoral enrichment, by offering valuable information to all players in the construction sector, particularly vocational training providers. They can access up-to-date information on current and future skills needs to better align their training programmes. The Observatory includes statistical data, reports, articles and links relating to skills and training in the construction sector.

BUILD UP Skills

BUILD UP Skills is a European Union initiative launched in 2011. It has been funded successively under the Intelligent Energy Europe programme, Horizon 2020 and currently under the LIFE programme for the transition to clean energy. It is currently managed by the Climate, Infrastructure and Environment Executive Agency (CINEA).

It directly supports the EU Skills Pact, in particular the pact linked to the construction sector, signed by the social partners in 2022, which aims to "retrain and upskill at least 25% of all workers in the construction industry over the next 5 years, to reach the target of 3 million workers".

The initiative concerns all professionals involved in the building value chain, as well as the companies that employ them, public authorities, building owners and tenants.

The main areas of intervention include

- Intelligent skills for the green transition in the built environment ;
- Skills development, by supporting new training and qualification schemes covering all aspects of the decarbonisation of buildings;
- The adoption of skills, by developing measures to increase demand for skills and qualified professionals.

Over the years, the projects supported have made it possible to test and validate a complete toolbox of approaches, including :

- National skills strategies, including assessment of skills gaps and roadmaps for action supported by key stakeholders;
- Qualification and training programmes in various thematic areas (deep renovation, near-zero energy buildings, heat pumps, building information modelling, circular construction, etc.);
- Innovative tools and methods for training the workforce, e.g. training provided directly on the renovation site or via digital means;
- Pilot training courses for professionals and/or trainers, although the main focus of BUILD UP Skills is on engineering new skills and implementing innovative methods, rather than organising large-scale training courses;
- Mechanisms to stimulate demand for skills, for example through awareness-raising campaigns, the development of skills passports and registers of trained professionals, or exploring ways of including skills or qualifications requirements in procurement procedures.

These tools and approaches are now available to be reproduced and scaled up at national or regional level.

As of June 2024, 94 projects have been funded, representing an EU contribution of €58 million since 2011.

This project is part of the BUILD UP SKILLS initiative.

6.5.2 European projects

** The following is a summary of the various EU-funded projects that have helped to advance the BUILD UP Skills initiative, with a focus on projects implemented in France.

BUILD UP Skills France (IEE-Pillar 1):

The BUILD UP Skills project addressed the barriers to achieving energy efficiency targets in the French building sector. It carried out an in-depth assessment of training needs and current initiatives, and developed a roadmap in consultation with stakeholders for improving skills acquisition in the sector.

- For more information: BUILD UP Skills France I - roadmap & link to project page

BIMEET project

The BIMEET project aimed to improve the uptake of ICT and BIM by significantly enhancing the skills and capabilities of the EU construction workforce. This coordinating and supporting action project was supported by a strong consortium including education and research expertise, accreditation bodies and industry participation through an EU-wide expert panel. Its objectives included promoting energy-efficient buildings in a systematic, measurable and effective way through BIM training to meet European energy and carbon reduction targets. The project aimed to cultivate a well-trained and competent generation in BIM for energy efficiency, while establishing a leading training platform supported by a community of interest.

Key outputs included a harmonised BIM and energy efficiency skills matrix aligned with the EQF framework, and a training platform to widely disseminate the BIMEET EQF. These results, combined with a labelling scheme, aimed to ensure the sustainability of the project beyond its lifetime. BIMEET involved universities and technological institutes from five EU countries (Finland, France, Greece, Luxembourg and the UK), gathering perspectives on market needs and developing innovative training schemes.

The project's specific methodology identified roles, skills and training needs in BIM for energy efficiency, using a repository of data sources and a training portal. This portal served as a comprehensive resource for BIM-related information and customised training recommendations for construction professionals and trainers. E-learning played a central role in enabling effective training sessions, particularly benefiting manual workers less inclined to attend physical training.

BIMEET concluded its activities in February 2020, publishing new training and e-learning schemes under its brand. Discussions were underway to further exploit the platform and its tools, potentially recognising it as a centralised repository for BIM training recognised by training institutes and standards bodies.

Partners: Finland, France, Greece, Luxembourg, United Kingdom.

- For more information https://cordis.europa.eu/project/id/753994/fr

BIMplement

Operational from September 2017 to August 2020, BIMplement focused on establishing a large-scale, comprehensive qualification methodology, integrating technical, interdisciplinary and BIM-related skills. The project aimed to equip trainers and learners with the essential tools to develop a competent workforce. The main objective was to improve the quality of ultra-low energy construction and renovation (NZEB) through in-depth training, continuing professional development (CPD) and qualification programmes. These initiatives took a multi-disciplinary approach covering different trades and skill levels, using practical learning tools enhanced by BIM in the workplace. Specific objectives included:

- Improve overall quality through on-the-job learning facilitated by BIM across project phases and trades. - Cultivate a new generation of BIM-qualified professionals and tradespeople to raise standards in construction and renovation. - Facilitate collaboration between different trades with adaptable qualification, certification and

accreditation methodologies for BIM learning in the workplace. - Develop and validate a strategy for replicating and enhancing qualification and training programmes.

By the end of the project in August 2020, BIMplement had developed a transferable methodology based on lessons learned from previous BUILD UP SKILLS and H2020 skills projects in the construction sector, as well as practical experiments involving craftsmen and small businesses in various regions.

- For more information: www.bimplement-project.eu

CEN-CE project:

The CEN-CE project, funded by the EU's H2020 initiative, aimed to improve the skills of professionals in the construction sector to reduce energy consumption and carbon emissions, in line with the EU's climate commitments and legislation.

CEN-CE, which stands for Certified Experts to CEN Standards, focused on establishing a comprehensive Europe-wide training and qualification scheme for HVAC (Heating, Ventilation, Air Conditioning) professionals specialising in water-based heating and cooling systems. These professionals were essential if the performance levels of Near Zero Energy Buildings (NZEBs) were to be achieved, as current assessments of technical systems often ignore critical factors, leading to inaccurate assessments of energy performance.

The project used European standards (CEN) to train professionals, promoting a holistic approach to building energy assessments. Benefits included innovative consideration of systems, accurate calculations incorporating actual energy use, and the creation of a level playing field across Europe. CEN-CE aimed to equip middle and senior level professionals with the skills to assess the impacts of energy efficiency using the new CEN standards, recognised through a qualification scheme. Standardised methods have also facilitated the creation of shared industrial databases.

Following its operational period from June 2018 to November 2020, the CEN-CE project has developed into a sustainable business model, continuing its training and qualification efforts in collaboration with other organisations, and promoting mutual recognition across participating countries such as Belgium, Croatia, France, Italy and Slovakia.

- For more information: https://www.cen-ce.eu/

BUSLeague project:

The BUSLeague project aimed to address the challenges of stimulating demand for an energy-skilled workforce and building practical capacity throughout the lifecycle of buildings. It did this by implementing transnational recognition of energy skills and adapting successful training methods from previous EU and national initiatives such as BUILD UP Skills and Construction Skills. BUSLeague focused on mutual recognition of skills, awareness raising, capacity building and legislative change.

The project was implemented at national level in Austria, Bulgaria, France, Ireland, the Netherlands and Spain. It drew on the expertise of researchers in anthropology and educational technology to optimise the transfer of learning and its impact. The main results are documented on the project website and the Zenodo community, covering mutual recognition, awareness raising, capacity building, skills development, legislative change, ethnographic insights and educational technology research.

- For more information: www.busleague.eu

INSTRUCT project:

The INSTRUCT project aimed to strengthen energy efficiency skills in the European construction sector in response to growing challenges. The project established an operational framework for workers, facilitating the recognition of energy efficiency skills and qualifications, while ensuring new legislative frameworks. Seven European countries took part in the project, helping to encourage a new generation of qualified and certified workers, and paving the way for legislative changes in the sector. The aim of INSTRUCT was to address the challenges faced by the European construction sector in meeting energy efficiency targets. It aimed to stimulate demand for energy efficiency skills through training initiatives and policy instruments. The project

focused on developing a framework and services for a new generation of skilled workers and on legislative changes to increase energy skills across the lifecycle and supply chains.

Key achievements included: (a) Evidence reinforcing the link between skills/education and energy performance/quality. (b) Tools for the mutual recognition of energy efficiency skills and qualifications. (c) Concrete demonstrations in five European regions. (d) Dissemination and awareness-raising actions across Europe. (e) New legislative frameworks for relying on skilled workers in public procurement.

The consortium drew on industry best practice, educational excellence and the experience of accreditation bodies, ensuring Europe-wide coverage with the participation of seven countries and five clusters. Supported by a network of stakeholders and Build Up Skills chapters across Europe, the project involved over 200 members in its community of interest. The aim was to implement evidence-based market and policy instruments across the EU to increase the demand for energy skills in the construction sector.

- For more information: www.instructproject.eu

TRAIN4SUSTAIN project:

The EU-funded TRAIN4SUSTAIN project aimed to establish innovative training and qualification standards to improve sustainable energy skills in the European construction sector. It focused on mutual recognition to ensure that training courses certified in one country would be recognised in all others. Building on the recent European framework for energy and resource efficient buildings, the project has extended energy skills qualifications across borders, promoting a skills quality standard, a European register and a skills passport.

Running from May 2020 to October 2022, the project has mobilised France, Germany, Hungary, Italy and Spain to make energy efficiency more attractive to professionals in the sector by increasing the number of skilled workers capable of carrying out effective energy renovations.

- For more information: www.train4sustain.eu

*** Other European projects focused on upskilling:

Construction Blueprint

Construction Blueprint is a project funded by the 2018 call for projects of the European Union's Erasmus+ programme, part of the Sectoral Alliances for Skills Key Action 2 (Lot 3), responsible for the implementation of a new strategic approach (Blueprint) to sectoral cooperation on skills. The main aim of the Construction Blueprint project is to develop a new strategic sectoral approach to collaboration on skills in the construction sector and to develop a better match between the skills needs of companies and the skills taught in training centres. To achieve this goal, the project brings together 3 European sectoral organisations, 9 national sectoral representatives and 12 vocational training centres and higher education institutions from 12 European countries.

The main advantage and benefit of the roll-out of this project was that it brought together players from the construction industry as well as vocational education and training (VET) organisations. It sought to establish a strategic approach for the next few years to meet the challenges caused by skills mismatches among construction workers, and aimed to match their skills with the needs and requirements of the labour market. This new strategy was clearly linked to the general strategy for the growth of the European construction industry and complemented other initiatives and measures implemented for the sector.

Project results :

- **PESTLE analysis -** The project has produced a report on the political, economic, social, technological, legal and environmental factors likely to impact on the construction industry and affect skills shortages, gaps and mismatches.
- **Sectoral skills report** - The project provided a report on the current "state of the art" of sectoral skills in the construction sector, showing the gap between current and future skills. This report identified the training needs of workers in the sector in the short and medium term, estimated the number of workers

to be trained and the occupational profiles concerned, and defined the measures, recommendations and actions for the deployment of Blueprint.

- **Skills needs analysis -** The project has produced a report on the skills needs identified in the consortium countries, particularly in the fields of energy efficiency, the circular economy and digitisation.

- **Roadmap and action plan -** The project developed a roadmap outlining the strategies, measures, activities, outcomes and action plan to be implemented in order to adapt the supply of skills to the expectations and needs of the sector. This roadmap was in line with the sector skills strategy and was a fundamental part of the roll-out of the Construction Blueprint.
- **Interactive map -** A digital resource was created to collect good practice and innovative initiatives seeking to address skills gaps and mismatches. This interactive map also showcased best practice in leveraging EU funding to best support different career paths, mobility projects, entrepreneurial opportunities, etc.
- **Online courses -** A series of online courses dealing with energy efficiency, the circular economy and digitisation has been launched, accessible to all interested parties (students, workers, trainers, vocational training managers, etc.).
- **New training programmes** - New training programmes have been designed to update the vocational education and training (VET) offer for pupils/students and workers in the construction sector in the fields of energy efficiency, digital technology and the circular economy.
- **Skills required in European companies -** The project has produced the results of the first edition of a survey of almost 2,000 European companies in the construction sector on the skills most in demand.
- **Observatory -** An online tool was set up to anticipate skills needs at European and national level, combining information from primary (survey) and secondary sources. This tool helped the partners to make decisions about training provision.
- **Report on professions and qualifications subject to modernisation -** The project produced a benchmarking report including the relationships between know-how and skills (particularly in relation to energy efficiency, digital and the circular economy) that were to be included in the process of upgrading the skills of the relevant professional profiles.
- **National reports on the modernisation of professional profiles -** Final national reports have been produced on the professional profiles to be updated at national level, including a classification of the need for updating for a relevant qualification process.
- **Promotional material** - Promotional material has been developed to reinforce and increase the appeal of the construction sector.
- **Final dissemination day -** A closing event was organised in Brussels on 22 February 2023 to present all the results and good practices of the project.

BUStoB in the Netherlands

The BUStoB (BUILD UP Skills to Business) project aimed to close the skills gap in the Netherlands by developing a comprehensive range of training modules focusing on green skills for construction and installation workers. As well as designing courses, the project aimed to stimulate demand for these skills. This included creating rapid skills assessments to raise awareness, identify gaps and encourage participation in training.

The project resulted in the development of 65 new e-learning modules covering 79 thematic areas, including Near Zero Energy Building (NZEB) technologies and interdisciplinary skills. These modules, accessible via the BUILD UP Skills Advisor application, provided easy access to training resources. The application not only provided learning materials, but also served as an assessment tool and offered job-specific information on training opportunities.

BUStoB has been successful in promoting partnerships between the construction industry, vocational training institutes and government bodies, leading to an increase in demand for green skills training. The project's initiatives are central to the Dutch National Energy Agreement, contributing to the country's human capital agenda.

Following the close of the project, the BUILD UP Skills Advisor app has been widely adopted, with over 2,500 downloads and around 550 fully trained trainers and ambassadors. The project methodology continues to influence efforts to address the skills needed for circular construction and digitisation within the construction sector.

Train-to-NZEB

The Train-to-NZEB project has established Building Knowledge Hubs (BKHs) in Central and Eastern European countries to promote Near Zero Energy Buildings (NZEBs). These hubs offer practical training, demonstrations and consultancy services aimed at improving the skills of building professionals and raising awareness among decision-makers. By integrating practical training with theoretical learning, the project meets national NZEB standards and aims to respond to growing market demand for energy-efficient buildings. Over three years, the project has successfully trained 90 trainers, 2,400 construction workers and 614 professionals such as designers and engineers. The network continues to grow, fostering a culture of knowledge exchange and supporting the transition to sustainable building practices.

Fit-to-nZEB

The Fit-to- nZEB project has successfully met the challenge of preparing the construction sector to meet the energy and climate targets for 2020 and 2030, with a particular focus on Near Zero Energy Buildings (NZEBs). Key achievements include the development of educational programmes in 8 European countries: Czech Republic, Romania, Bulgaria, Italy, Croatia, Ireland, Austria and Greece. These programmes targeted various levels of education, from higher education institutions to vocational training centres, with the aim of increasing skills in the renovation of energy-efficient buildings. The project developed technical skills and new training curricula and integrated them into national education plans. It has also set up training facilities and certified numerous trainers, facilitating the implementation of more than 20 pilot courses. Thanks to broad stakeholder involvement and a systematic communication campaign, FIT-TO-NZEB has helped to shape national policies and educational standards, ensuring lasting impacts beyond its initial duration.

PROF / TRAC

PROF/TRAC, a 3-year EU-funded project launched in March 2015, involved 15 partners from eight different countries. Initiated by a collaborative team representing various stakeholders involved in the construction and renovation of Near Zero Energy Buildings (nZEBs), including universities, European engineering associations, architects and social housing organisations.

The project aimed to bridge the skills gap among professionals involved in the design, construction, management and refurbishment of nZEBs. Key objectives included:

- Skills mapping: Identification of the skills required for nZEBs and assessment of existing gaps among professionals.
- Training platform: Development of an open and constantly updated training platform to ensure sustainable access to knowledge. This platform includes a system of training and qualifications at EU level, adaptable to national needs.
- Training the trainers: Creation of a programme to train educators who would then disseminate the curriculum developed nationally and internationally. This included training sessions and webinars.
- Directory of training materials: Creation of a directory of training materials for continuing education and professional development.

PROF/TRAC successfully trained 128 certified nZEB trainers from 23 countries, who then trained over 1,300 architects, engineers and building managers. The project's efforts were aimed at encouraging the interdisciplinary collaboration essential for the effective design and implementation of nZEBs.

Looking ahead, PROF/TRAC's legacy includes the continuation of courses and training sessions to further enhance the skills of professionals and promote sustainable construction practices across Europe.

WE Qualify project - Improve Skills and Qualifications in the Building Workforce (Cyprus)

WE-Qualify aimed to fill the skills gap in the construction sector in Cyprus, in particular the shortage of skilled workers for the construction of energy-efficient buildings equipped with renewable energy installations. Initially funded as part of the Intelligent Energy Europe programme, and then as part of the Build Up Skills Initiative, the project focused on promoting vocational training for technical trades in construction and related sectors involved in the installation and maintenance of energy-saving and renewable energy systems.

The results of the project included the development of three training modules: installation of thermal insulation, installation of double glazing and external sun screens, and installation of biomass boilers and stoves. These modules were designed to enhance the skills and knowledge of workers in order to meet European standards for the energy performance of buildings. WE-Qualify succeeded in training 92 installers and certifying 76, thereby contributing to the qualification framework and promoting professional advancement in the sector.

The initiative has highlighted the importance of tailor-made training based on gap analyses to identify and address deficiencies in energy-related skills. The success of the project in Cyprus serves as a model for other European regions seeking to promote skills for the energy transition and support employment in sustainable construction practices.

7 JOBS, PROFESSIONS, SKILLS: GAPS BETWEEN THE CURRENT SITUATION AND NEEDS IN 2030

7.1 BUILD UP SKILLS MODELLING PUT INTO PERSPECTIVE WITH THE WORK OF FRANCE STRATÉGIE AND NÉGAWATT

Various estimates of job requirements between now and 2030 have been produced[253] :

- négaWatt in 2022 on the basis of the négaWatt 2022 scenario[254] ;
- France Stratégie in 2023 with an estimate based on the low-carbon Scenario Métiers 2030 produced in 2022 (France Stratégie and Dares)[255] ;
- Build Up Skills 2 detailed in this section.

Coordination work was carried out from January to July 2023 in order to compare the results and integrate the ranges obtained into the continuation of the work carried out in BUS2 and into the Roadmap proposal that will follow.

The France Stratégie, BUS2 and négaWatt scenarios are relatively convergent for energy renovation, with an estimated additional need for between 170,000 and 250,000 jobs compared with today. The energy renovation of housing is the building segment that would provide the most direct jobs between now and 2030 (more than the construction and renovation of the tertiary sector).

The BUS2 scenario estimates this additional need at 197,000 FTEs for the energy renovation of buildings, including an average of almost 1,181,000 homes per year between 2022 and 2030. Almost non-existent between 2012 and 2021, low-energy building (BBC) renovations will represent the bulk of the renovations to be carried out from 2022 onwards (911,000 renovations). At the same time, almost 270,000 non-BBC energy renovations will be carried out.

The various scenarios anticipating the need for jobs between now and 2030 (France Stratégie, BUS2, negaWatt) differ in their assumptions about the pace of new construction and the corresponding jobs, ranging from virtual stability (France Stratégie) to a sharp fall (BUS2, negaWatt) in order to reduce emissions from new buildings and the artificialisation of land, and in line with demographic trends (up to 70%). The initial trajectories proposed by the SGPE[256] forecast a more moderate fall in new housing construction (between 2 and 18%). Despite these differing assumptions, it is accepted that the entire sector will have to undergo considerable change if it is to adapt to the environmental challenges of the next decade.

The BUS2 scenario, based on ADEME's scenario 2, projects a significant reduction in new construction from 2023, in favour of exploiting the existing stock, in particular by focusing on the rehabilitation of vacant dwellings and second homes. Investment in new housing construction would fall considerably, from an average of €35 billion a year between 2012 and 2021 to €10.6 billion a year between 2021 and 2030, accompanied by an overall reduction of 182,200 direct full-time equivalents (FTEs) on average between 2022 and 2030, compared with an average of 259,200 FTEs over the 2012-2021 period. If new construction methods are taken into account (leading to more expensive and labour-intensive projects), the reduction in employment requirements over the forecast period (2022-2030) would be 179,700 FTEs.

7.2 BUILD UP SKILLS" TARGET SCENARIO FOR THE ECOLOGICAL TRANSITION OF THE BUILDING INDUSTRY

The study is based on a target scenario, which represents the indicative path to be followed in order to meet the non-negotiable national and European targets for 2030 and 2050.

[253] France Stratégie and Dares presented a comparison of the 3 exercises at the Annual Conference on Professions and Skills (4/7/2023): results of the mission entrusted to France Stratégie on the energy renovation of buildings. https://www.strategie.gouv.fr/actualites/conference-annuelle-metiers-competences-resultats-de-mission-confiee-france-strategie. See also the publication France Stratégie, Dares (2023), Rénovation énergétique des bâtiments : quels besoins de main d'œuvre en 2030 ? Analysis note no. 126

[254] Quirion P. (2022), TETE, un outil en libre accès pour estimer les emplois générés par la transition écologique - Présentation et application au scénario négaWatt 2022, OFCE Review 176

[255] France Stratégie and Dares (2023), Rénovation énergétique des bâtiments : quels besoins de main d'œuvre en 2030 ? Analysis Note No. 126

[256] SGPE (2023) : Green planning in buildings

To speed up the fight against climate change :

- France has set itself the target of carbon neutrality by 2050.
- Against the backdrop of the war in Ukraine and the associated energy crisis, the European institutions have recently raised their sights;
- In energy terms, the Energy Efficiency Directive, which was revised in 2023, reinforces the ambitions in terms of energy savings by 2030;
- In terms of the fight against climate change, the European objective is climate neutrality by 2050 and a 55% reduction in greenhouse gas emissions by 2030 compared to 1990 (Fit for 55).

As the decision to raise ambitions at European level was taken after the publication of the 2ème National Low-Carbon Strategy (SNBC2), this more ambitious approach will have to be taken into account in the future SNBC3.

To establish the costing in terms of markets and FTEs, it is necessary to use an ecological transition scenario as a basis. There are several scenarios:

- France's "official" scenario is that of the SBNC. The current SNBC (SNBC2) dates from 2019. It is currently being revised and does not reflect the Fit for 55 objective, which was adopted after its publication. As the SNBC3 is currently being drawn up, it was not possible to use this scenario as a basis for BUS2.
- Other forward-looking scenarios were drawn up and published in 2021: ADEME (Transition(s) 2050), RTE, The Shift Project and négaWatt. For buildings, all of these scenarios explore, to varying degrees, action levers such as: renovation, decarbonisation of heating, limiting new construction and changing behaviour.

For reasons of ease of access to the modelling data, it was decided to choose the target scenario from among the ADEME scenarios. Not all of the ADEME scenarios are compatible with achieving the Fit for 55 objective in 2030 (this objective was adopted after the scenarios were published): only the S1 "Frugal Generation" and S2 "Territorial Cooperation" scenarios are compatible with achieving the Fit for 55 objective in 2030 (subject to the final translation of the objective for each sector).

This choice was made in consultation with the DGEC, which is leading the preparation of the SNBC3, on the basis of the trends emerging in the SNBC at the time the scenario was chosen, i.e. in spring 2023.

Scenario 2, "Territorial cooperation" (S2), was **chosen as it would** enable the Fit for 55 to be achieved, and would also be the scenario closest to the SNBC3 guidelines. This scenario has guidelines that are compatible with the current state of discussions on the SNBC3 for the renovation of the tertiary sector, and changes of a similar order of magnitude for the reduction in new construction. However, it is less ambitious in terms of the rate at which the building stock is phased out of fossil fuels, and more ambitious in terms of the performance of housing renovations.

In addition, the Transition(s) 2050 scenarios include a Trend scenario, which allows a comparison between the Target scenario and a more "run-of-the-mill" scenario.

More details on the Transition(s) 2050 scenarios are available at: https://www.ademe.fr/les-futurs-en-transition/les-scenarios/

Figure 7-1 Scenario 2 ADEME: Overview of the residential sector

ENERGY RENOVATION	DECARBONIZATION OF HEATING	AIR CONDITIONING	VOLUME OF NEW CONSTRUCTION
An ambitious renovation policy, focused on climate urgency, is implemented. High-performance, step-by-step energy renovations (achieving at least the BBC Rénovation 2009 label criteria) become the majority. One-off renovations not aligned with a performance trajectory disappear. By 2050, the housing stock is renovated to a high level of energy performance, with 80% of dwellings achieving the BBC-renovation performance level.	The energy transition accelerates due to the high rate of renovations, coupled with the replacement of end-of-life equipment. Oil is phased out by 2040. Gas continues to be used, notably with condensing boilers installed during renovations. Heating networks expand significantly, as does wood heating and electric heat pumps.	The rate of air conditioning increases to manage heatwaves, but not all dwellings are equipped by 2050.	The annual number of new dwellings built decreases significantly. The need for housing decreases due to slower population growth and changes in cohabitation practices among elderly people. The population increase is mainly absorbed by optimizing the existing building stock (converting secondary residences into primary ones, reducing vacancies). Secondary residences are shared.

Source : ADEME[257]

Figure 7-2 ADEME Scenario 2: Overview of the tertiary sector

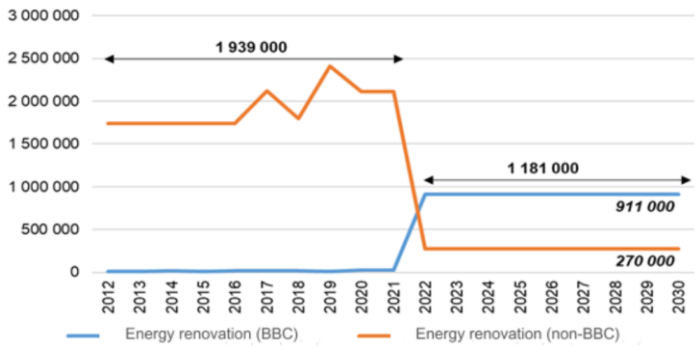
ENERGY RENOVATION	DECARBONIZATION OF HEATING	AIR CONDITIONING	VOLUME OF NEW CONSTRUCTION
An ambitious renovation policy, focused on climate urgency, is implemented. High-performance, step-by-step energy renovations (achieving at least the BBC Rénovation 2009 label criteria) become the majority. One-off renovations not aligned with a performance trajectory disappear. By 2050, the housing stock is renovated to a high level of energy performance, with 80% of dwellings achieving the BBC-renovation performance level.	The energy transition accelerates due to the high rate of renovations, coupled with the replacement of end-of-life equipment. Oil is phased out by 2040. Gas continues to be used, notably with condensing boilers installed during renovations. Heating networks expand significantly, as does wood heating and electric heat pumps.	The rate of air conditioning increases to manage heatwaves, but not all dwellings are equipped by 2050.	The annual number of new dwellings built decreases significantly. The need for housing decreases due to slower population growth and changes in cohabitation practices among elderly people. The population increase is mainly absorbed by optimizing the existing building stock (converting secondary residences into primary ones, reducing vacancies). Secondary residences are shared.

Source : ADEME[258]

[257] https://www.gouvernement.fr/upload/media/content/0001/06/5c69b301c13d5d591078031ffbde23156227028c.pdf
[258] *Ibid.*

7.2.1 Physical data - Energy renovation in the residential sector

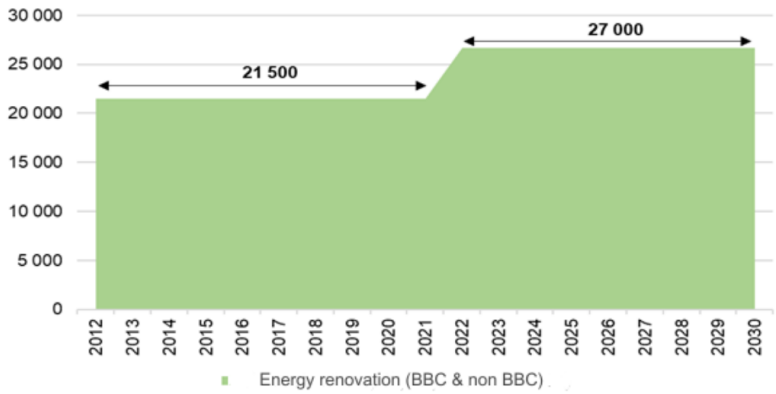
Figure 7-3 Target scenario: Energy renovation targets (BBC and non-BBC) for the residential sector between 2012 and 2030 (number of homes)



Sources: Average 2012-2021 (observed data) - BBC Effinergie Observatory; National Observatory for Energy Renovation (ONRE). Average 2022-2030 (forward-looking data) - ADEME (2021), Prospective - Transition(s) 2050

7.2.2 Physical data - Energy renovation in the tertiary sector

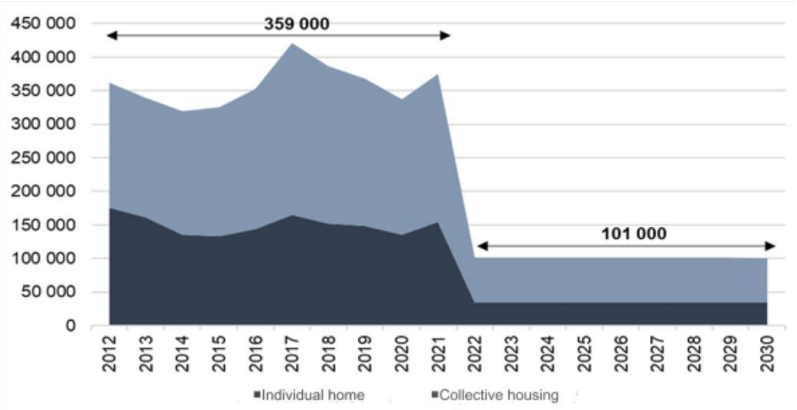
Figure 7-4Target Scenario: Energy renovation targets (BBC and non-BBC) for the tertiary sector between 2012 and 2030 (thousands of m²)



Sources: Average 2012-2021 (observed data) - CODA Stratégies (2015 and 2016), Les marchés de la rénovation énergétique dans le secteur tertiaire, Technical report. Average 2022-2030 (prospective data) - ADEME (2021), Prospective - Transition(s) 2050

7.2.3 Physical data - New residential construction

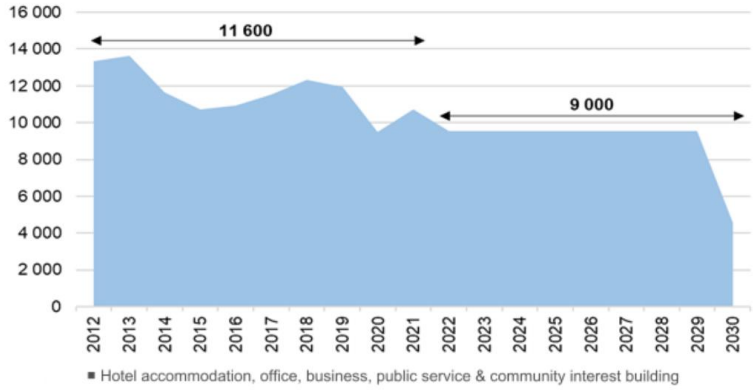
Figure 7-5 New construction targets for the residential sector between 2012 and 2030 (number of dwellings)



Sources: Average 2012-2021 (observed data) - SDES, Housing construction, Sit@del2 database. Average 2022-2030 (prospective data) - ADEME (2021), Prospective - Transition(s) 2050

7.2.4 Physical data - New construction in the tertiary sector (RE2020)

Figure 7-6 Target scenario: New construction targets for the tertiary sector (covered by the RE2020) between 2012 and 2030 (thousands of m²)

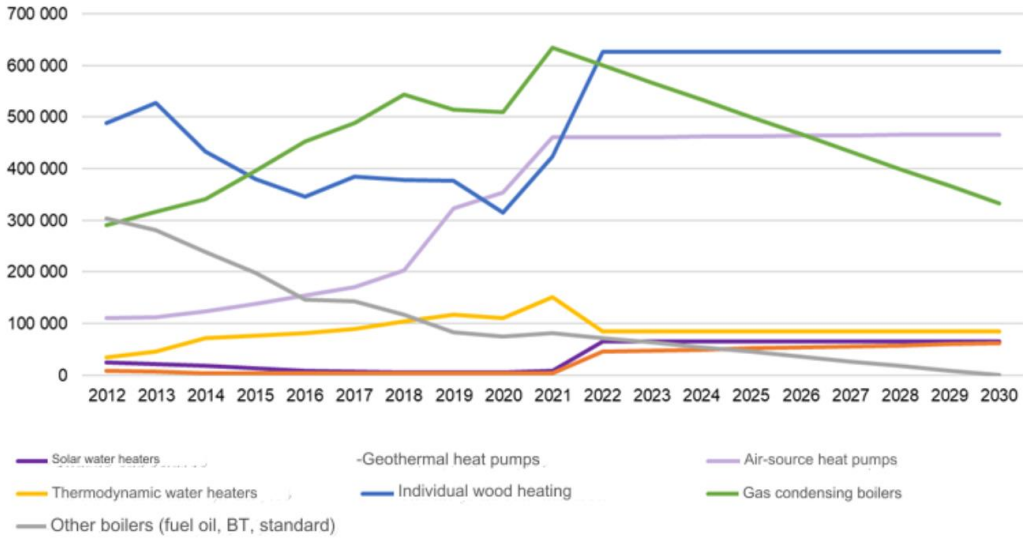


Sources: Average 2012-2021 (observed data) - INSEE, Floor area under construction, Results as of the date taken into account. Average 2022-2030 (prospective data) - ADEME (2021), Prospective - Transition(s) 2050

7.2.4.1 Physical data - Focus on the deployment of heating and domestic hot water equipment in new-build and renovation projects

From 2022 onwards, the annual installation rate for heat pumps will be very high, particularly for geothermal heat pumps. From just over 3,500 units in 2021, geothermal heat pumps will be installed at an average rate of almost 53,700 units a year. Installation of air-source heat pumps is expected to remain virtually unchanged in 2021, at more than 460,000 units installed per year. Thermal solar panel installations are expected to increase 8-fold between 2021 (8,700 installations) and 2030 (66,000 installations). Individual wood-burning appliances are expected to rise from 423,000 units installed in 2021 to 627,000 in 2030 (+48%).

Figure 7-7 Target Scenario: Annual installation targets for heating and domestic hot water equipment in the residential sector (renovation and new construction) between 2012 and 2030 (number of units)



Sources : From 2012-2021 (observed data) - Observ'ER (2022), Suivi du marché français des applications solaires thermiques ; Uniclima (2022), Bilan 2021 et perspectives 2022 des industries thermiques, aérauliques et frigorifiques ; Observ'ER (2022), Suivi du marché des pompes à chaleur individuelles ; AFPAC (2022), Le poids de la filière PAC en France, Chiffres année 2021 ; AFPG (2021), La géothermie en France, Étude de filière ; SDES (2022), Tableau de bord des énergies renouvelables (bilan des EnR) ; Observ'ER (2022), Suivi du marché des appareils domestiques de chauffage au bois ; ADEME (2013 et 2018), Étude sur le chauffage domestique au bois, Marchés et approvisionnement ; CEREN (communication interne). From 2022-2030 (prospective data) - ADEME (2021), Prospective - Transition(s) 2050

The number of gas-fired condensing boilers will fall from 2022. From 634,000 gas-fired CCs installed in 2021, they will fall to around 333,000 units in 2030. In fact, under the RE2020, 2022 marks the end of gas-only heating - even for Very High Energy Performance (VHEP) boilers - in new-build properties. Initially, this ban will only apply to new single-family homes. Collective housing, such as condominiums, will be affected in 2025 by the application of the new RE2020 climate impact thresholds, which will be progressively lowered.

As for other non-efficient equipment and boilers (oil-fired, low-temperature - LV, standard), their installation has been banned since 1er July 2022 in new homes. This equipment must be replaced by more efficient equipment (pellet boiler, heat pump) when old appliances are replaced. This measure applies to both residential and commercial buildings. Replacement is not compulsory, and it will still be possible to repair the appliance. Nevertheless, this measure should consolidate the position of efficient heating and DHW equipment using renewable energy in homes and businesses. As a result, the Target scenario aims for the definitive phase-out of these appliances and the replacement of the entire stock of equipment by 2030.

7.2.5 Summary of physical data for Target and Trend scenarios

The physical data for energy renovation and new construction in the two scenarios are summarised below:

Table 7-1 Energy renovation and new build targets for the Trend and Target scenarios

			Trend scenario	Target scenario
Segment	**Sector**	**Average 2012-2021**	**Average 2022-2030**	
Energy renovation (BBC & non-BBC)	Residential	1,939,000 homes : 14,000 BBC and 1,925,000 non-BBC	2 197 000 homes : 85,000 BBC and 2,112,000 non-BBC	1,181,000 homes: 911,000 BBC and 270,000 non-BBC
	Tertiary	21 500 000 m²	22 800 000 m²	27 000 000 m²
New build	Residential	359,000 homes	287,000 homes	101,000 homes
	Tertiary	11 600 000 m²	16 800 000 m²	9 000 000 m²

Sources: Average 2012-2021 (observed data) - Observatoire BBC Effinergie; Observatoire national de la rénovation énergétique (ONRE); CODA Stratégies (2015 and 2016), Les marchés de la rénovation énergétique dans le secteur tertiaire, Rapport technique; SDES, Construction de logements, Base Sit@del2; INSEE, Surface de plancher commencée, Résultats en date de prise en compte. Average 2022-2030 (prospective data) - ADEME (2021), Prospective - Transition(s) 2050

As mentioned above, the most important points to remember are :

- **Energy renovation:** massive shift from non-BBC to BBC energy renovation of housing in the Target scenario ;
- **New construction:** fall in the rate of housebuilding in both scenarios, but greater in the Target scenario.

7.3 MODELLING SCOPE

The results presented in the following section concern :

- Two segments: energy renovation (BBC and non-BBC) and new construction
- Two sectors: residential (single-family homes, collective housing) and non-residential (tertiary)

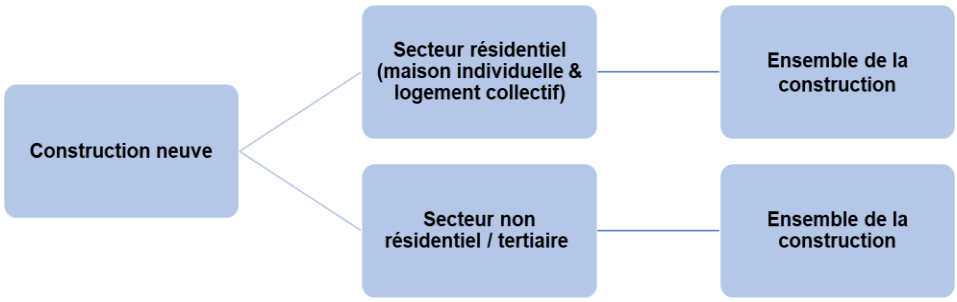
For new construction of tertiary premises, the scope is limited to premises covered by the RE2020. This means that only hotel accommodation, shops, offices and public service buildings are included.

It should also be remembered that in the case of renovation, only energy renovation work, as well as work inseparably linked to energy renovation, is taken into account in the scope of the BUS2 study. This excludes non-energy and related renovation work. There is, however, a box dedicated to estimating the expenditure and employment requirements associated with related work carried out during the renovation of vacant dwellings and second homes (see box in section 7.4.3.1).

Activities linked to real estate services are also excluded from the figures in this study, even though they are essential to the sector's transition.

The two diagrams below summarise the entire scope of this report. The figures are shown in the blue boxes. For new housing construction, new RE2020 tertiary premises construction and tertiary premises renovation, the results are presented in aggregate. Due to a lack of information and available detailed data, these results could not be broken down by action taken. For example, for the new construction of commercial premises, only the results specific to the construction sites, the installation of openings and the installation and maintenance of rare equipment (geothermal heat pumps, connection to biomass boilers, photovoltaic solar panels; boxes in orange in the diagram below) can be measured separately and extracted from the total results. The same principle is used in the case of new-build housing and the energy renovation of commercial premises.

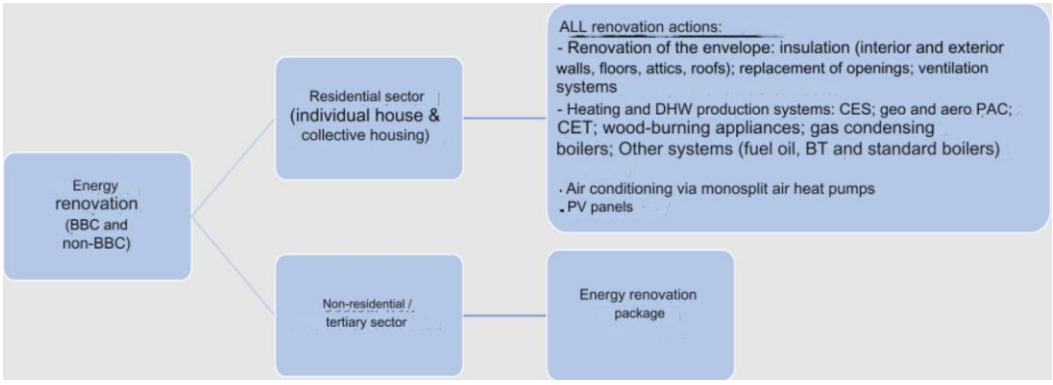
Figure 7-8 Diagram showing the perimeter taken into account in the new-build segment.*



(*) CES: solar water heater; PAC: heat pump; CET: thermodynamic water heater; PV: photovoltaic.

The only segment for which it has been possible to identify and quantify all of the measures is home energy renovation - whether it involves one or several measures. Thus, the results in terms of expenditure and jobs for residential energy renovation represent the sum of expenditure and jobs for each action.

*Figure 7-9 Diagram showing the scope of the energy renovation segment (BBC and non-BBC) *.*



(*) BBC: bâtiment basse consommation (low consumption building); ECS: eau chaude sanitaire (domestic hot water); CES: chauffe-eau solaire (solar water heater); PAC: pompe à chaleur (heat pump); CET: chauffe-eau thermodynamique (thermodynamic water heater); BT: basse température (low temperature); PV: photovoltaic.

The results presented concern the assessment of needs in terms of :

- Total investment and maintenance expenditure to be carried out (in euros - €) ;
- Direct and indirect employment across all industries (in full-time equivalents - FTE) ;
- Direct jobs only in the building industry (NAF 41 Building construction and NAF 43 Specialised construction work) and technical support (NAF 71 Architectural and engineering activities, technical testing and analysis).

The methodology used to evaluate the TETE tool, the modifications and additions made to the tool and its limitations, as well as all the assumptions made, are presented in Appendix 1.

Impacts "direct and indirect jobs; all sectors of activity combined".

In terms of employment, it is estimated that :

- **Direct jobs:** jobs directly attributable to energy transition measures in the building sector:
  - Jobs associated with investment: manufacture and sale of equipment and materials, civil engineering, construction, insulation work, assembly and installation of equipment, connection, preliminary studies, engineering and project management;
  - Jobs associated with the upkeep and maintenance of all the equipment used.
- **Indirect jobs: jobs with suppliers of direct activities, suppliers of suppliers, etc**.

Impacts "direct jobs; construction and technical support sectors".

Only direct jobs associated with the construction and technical support sectors are included in the transition from jobs to professions:

- **Branch 41: Building construction**

  This division covers the general construction of buildings of all kinds. It includes new construction, repairs, extensions and alterations, the erection of prefabricated buildings or structures on site, and temporary construction. It includes the entire construction of dwellings, offices, shops and other public, utility, agricultural and other buildings.

- **Branch 43: Specialist construction work**

  This division includes specialised construction activities (special works), i.e. the construction of parts of buildings and civil engineering structures or the preparation for this purpose. These are usually specialised activities concerning an aspect common to different structures, requiring particular know-how or equipment, such as masonry, paving, scaffolding, roofing, etc. The erection of steel structures is included. The erection of steel structures is included. Specialist construction work is generally subcontracted but, particularly in the case of repair work, it is also carried out directly for the owner of the structure.

  Completion and finishing work are also covered.

  This division includes the installation of all kinds of amenities that make the building functional. These activities are generally carried out on the construction site, although parts of the work may be carried out in a specialist workshop. This includes activities such as plumbing, the installation of heating and air-conditioning systems, aerials, alarm systems and other electrical work, automatic fire extinguishing systems, lifts and escalators, etc. Insulation work (water, heat, sound), sheet metal work, commercial refrigeration, installation of lighting systems, etc. are also included. Repair and maintenance activities similar to those described above are included.

  Building completion activities include activities that contribute to the completion or finishing of a building, such as glazing, plastering, painting, tiling or covering floors and walls with other materials such as parquet, carpets, wallpaper, etc., sanding floors, finishing carpentry, acoustic work, cleaning exteriors, etc., as well as repair activities similar to those described above. Repair activities similar to those described above are also included.

  The rental of equipment with operator falls into the class corresponding to the specific construction activity carried out with this equipment.

- **Branch 71: Architectural and engineering activities, technical control and analysis activities**

  This division includes the provision of architectural, engineering, planning, building inspection, surveying and mapping services. It also includes the provision of physical, chemical and other analysis services.

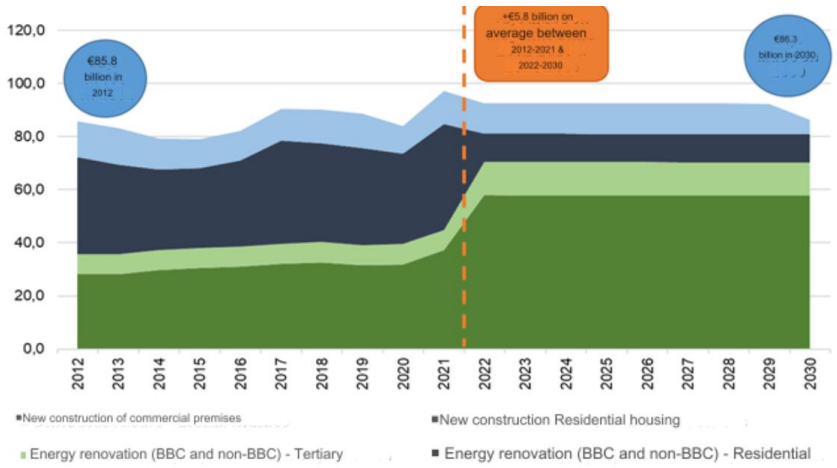
7.4 MODELLING RESULTS - TARGET SCENARIO AND COMPARISON WITH HISTORICAL DATA

These results are first presented for the Target scenario. At each stage, the difference in results between the average over the observed period (2012-2021) and the average over the prospective period (2022-2030) is also presented. These results concern the different segments (energy renovation / new construction) and sectors (residential / tertiary).

7.4.1 Target scenario - Investment and maintenance expenditure results

Between 2012 and 2021, all the work carried out (energy renovation and new construction) in the residential and tertiary sectors generated an average annual expenditure of €85.9 billion (in investment and maintenance). To achieve the objectives of the Target scenario, this spending would have to increase to an average of €91.7 billion per year from 2022 until 2030 (almost €6 billion more each year, i.e. an increase of 7%).

Figure 7-10 Target scenario: Total expenditure between 2012 and 2030 (€bn)



As shown in the figure below, a large proportion of the expenditure in the Target scenario decreases for new construction and increases for energy renovation.

- New construction: from an average of €47bn/year between 2012 and 2021 to an average of €21.4bn/year between 2022 and 2030, i.e. €25.6bn less each year (-54%).

- Energy renovation (BBC and non-BBC): from an average of €38.9bn/year between 2012 and 2021 to an average of €70.3bn/year between 2022 and 2030, i.e. an additional €31.4bn each year (+81%).

Figure 7-11 Target scenario: Total expenditure on new construction and energy renovation between 2012 and 2030 (€bn)

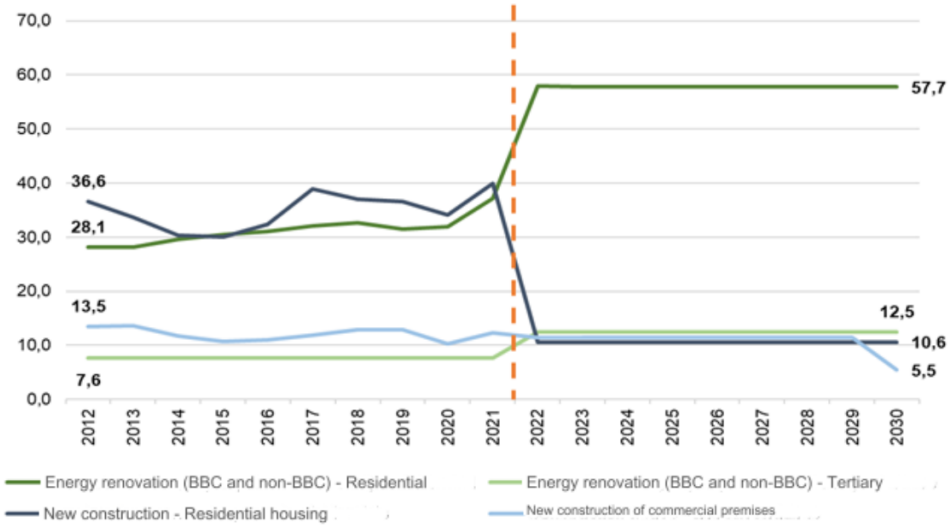


Table 7-2 Target scenario: Total expenditure on energy renovation (BBC and non-BBC) and new construction between 2012 and 2030 (€bn)

Segment	Sector	2012	2021	2022	2030	Average 2012-2021	Average 2022-2030	Δ of averages
Energy renovation	Residential	28,1	37,2	57,9	57,7	31,3	57,8	+26,5 (x1,8)
	Tertiary	7,6[259]	7,6	12,5	12,5	7,6	12,5	+4,9 (x1,6)
New build	Residential	36,6	40,0	10,6	10,6	35,0	10,6	-24,4 (÷3,3)
	Tertiary	13,5	12,2	11,5	5,5	12,1	10,8	-1,3 (÷1,1)
Total		**85,8**	**97,0**	**92,5**	**86,3**	**85,9**	**91,7**	**+5,8 (x1,1)**

The results presented here are based on the application of unit investment and maintenance costs to physical flows (cost of installing a heat pump, external insulation, maintenance of wood boilers, etc.). They make it possible to identify in detail the FTE requirements associated with each type of work and maintenance using existing [€/FTE] ratios, in particular those derived from the ESANE system or from INSEE's National Accounts (NA). They lead to higher estimates in terms of expenditure than those documented in the literature, in particular the figures produced by I4CE for the Panorama des financements Climat (see Appendix 1).

NB: To this expenditure on energy renovation must be added the expenditure required to renovate vacant dwellings and second homes, which makes it possible to optimise the use of the existing stock, as well as the expenditure required to carry out the work associated with energy renovation, which is often included in the project and can represent around half of the renovation expenditure[260] . There is, however, a box dedicated to estimating the additional expenditure and employment requirements linked to the related work carried out during the renovation of vacant dwellings and second homes (see box in section 7.4.3.1).

7.4.2 Target scenario - Results in direct and indirect jobs (all industries combined)

The various energy renovation and new construction projects carried out between 2012 and 2021 required an average of 974,000 direct and indirect FTE/year across all sectors of activity. This requirement increases slightly in the Target scenario, with an average of 998,000 direct and indirect FTE/year between 2022 and 2030 (+2%). This trend covers two very different dynamics between new construction and energy renovation:

- New construction: the need for FTEs will fall significantly, from an average of 544,000 direct and indirect FTEs/year between 2012 and 2021 to an average of 243,000 direct and indirect FTEs/year between 2022 and 2030, i.e. 301,000 fewer direct and indirect FTEs each year (a 2.2-fold reduction).

- Energy renovation (BBC and non-BBC): the need for FTEs increases sharply, from an average of 429,000 direct and indirect FTEs/year between 2012 and 2021 to an average of 754,000 direct and indirect FTEs/year between 2022 and 2030, i.e. 325,000 additional direct and indirect FTEs each year (multiplied by 1.8).

[259] The level of investment in energy renovation in the tertiary sector is based on the work of CODA Stratégies. Sources: CODA Stratégies (2015), Les marchés et de la rénovation énergétique dans le secteur tertiaire, Technical report; CODA Stratégies (2016), Le marché des équipements et systèmes thermiques, Résidentiel et tertiaire, Technical report.
[260] BBC Effinergie Observatory

Figure 7-12 Target scenario: Direct and indirect job requirements between 2012 and 2030 - All industries combined (FTE)

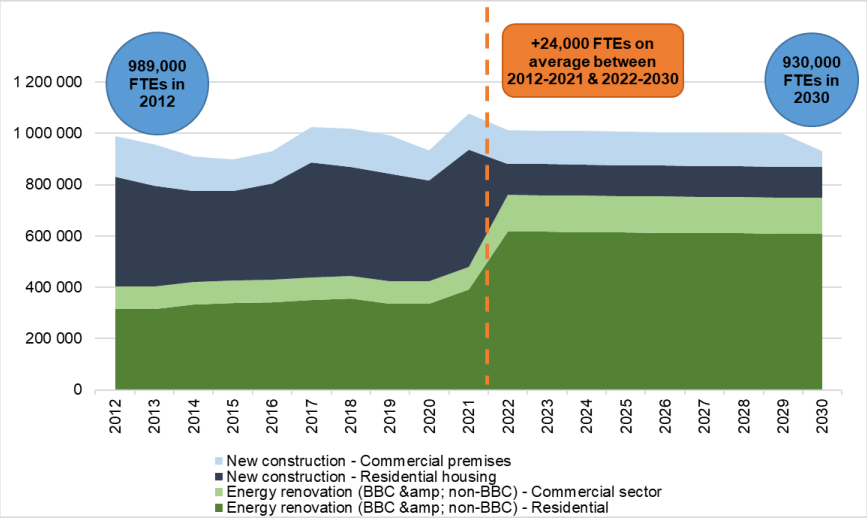


Table 7-3 Target scenario: Direct and indirect jobs (all branches of activity combined) in energy renovation (BBC and non-BBC) and new construction between 2012 and 2030 (FTE)

Segment	Sector	2012	2021	2022	2030	Average 2012-2021	Average 2022-2030	Δ of averages
Energy renovation	Residential	315 000	392 000	617 000	608 000	341 000	612 000	+271 000 (x1,8)
	Tertiary	89 000	87 000	143 000	141 000	88 000	142 000	+54 000 (x1,6)
New build	Residential	427 000	459 000	121 000	119 000	405 000	120 000	-285 000 (÷3,4)
	Tertiary	158 000	140 000	131 000	62 000	140 000	123 000	-17 000 (÷1,1)
Total		**989 000**	**1 078 000**	**1 013 000**	**930 000**	**974 000**	**998 000**	**+24 000 (x1,02)**

7.4.3 Target scenario - Results in direct jobs (construction and technical support sectors)

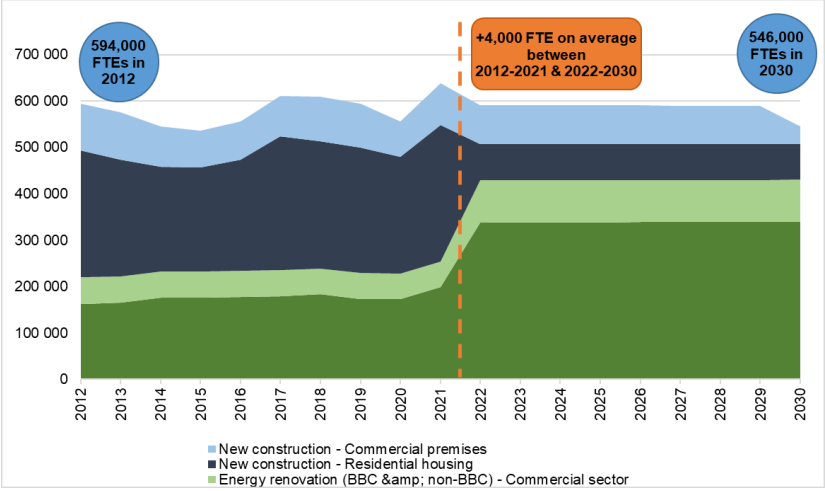
Direct jobs in the building (NAF 41 and NAF 43) and technical support (NAF 71) sectors alone represented an average of 582,000 FTE/year between 2012 and 2021. In the Target scenario, these direct jobs would increase slightly, to an average of 586,000 FTE/year between 2022 and 2030, representing an additional need of 4,000 FTE over ten years. As mentioned above, this overall trend covers two very contrasting dynamics between new construction and energy renovation.

- New construction: from an average of 349,000 direct FTE/year between 2012 and 2021 to an average of 156,000 direct FTE/year between 2022 and 2030, i.e. 193,000 fewer direct FTE each year (division by 2.2).

- Energy renovation (BBC and non-BBC): from an average of 233,000 direct FTE/year between 2012 and 2021 to an average of 430,000 direct FTE/year between 2022 and 2030, i.e. 197,000 additional direct FTE each year (multiplied by 1.8).

Of these direct jobs, only those related to technical support (NAF 71) are expected to fall from an average of 19,200 FTE/year between 2012-2021 to an average of 16,800 FTE/year between 2022-2030. The additional need for technical support in energy renovation, particularly for installing efficient equipment and coordinating the various works, does not offset the decline observed in the new construction segment.

Figure 7-13 Target scenario: Direct job requirements in the building (NAF 41 and 43) and technical support (NAF 71) sectors between 2012 and 2030 (FTEs)



According to the Target scenario, the most buoyant segment in terms of direct employment (construction and technical support sectors) in 2030 is that of energy-efficient home renovation, whereas new home construction was at the top of the ranking from 2012 to 2021. From 2022 to 2029, new construction will be the segment that provides the fewest direct jobs.

Figure 7-14 Target Scenario: Direct job requirements in the building (NAF 41 and 43) and technical support (NAF 71) sectors by segment in 2012 and 2030

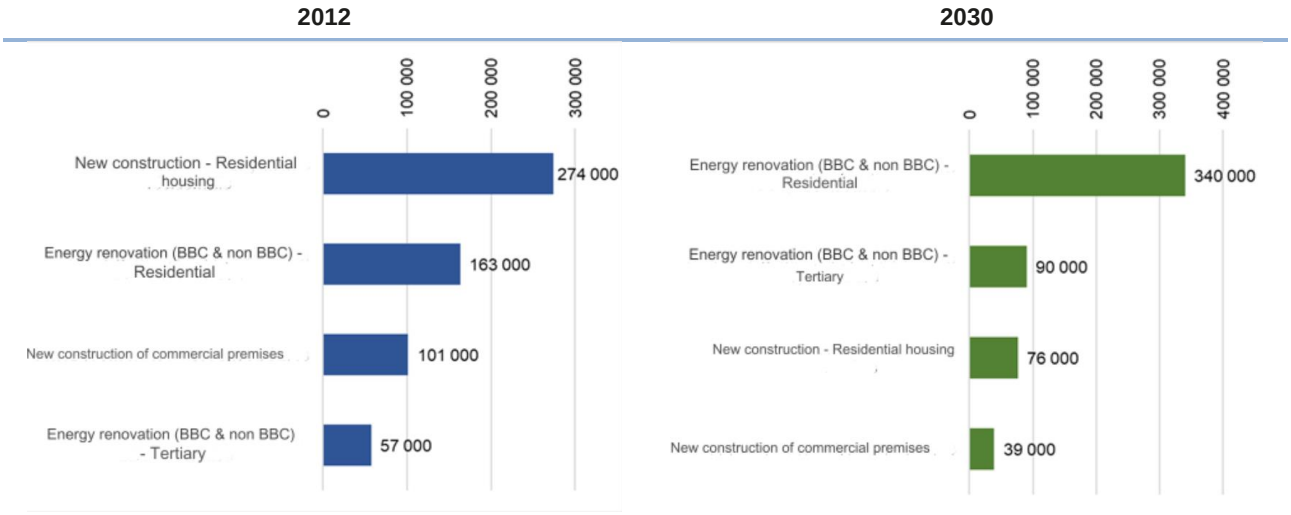


Table 7-4 Target scenario: Direct jobs (building and technical support sectors) in energy renovation (BBC and non-BBC) and new construction between 2012 and 2030 (FTEs)

Segment	Sector	2012	2021	2022	2030	Average 2012-2021	Average 2022-2030	Δ of averages
Energy renovation	Residential	163 000	199 000	338 000	340 000	176 000	339 000	+162 000 (x1,9)
	Tertiary	57 000	56 000	92 000	90 000	56 000	91 000	+35 000 (x1,6)
New build	Residential	274 000	294 000	78 000	76 000	259 000	77 000	-182 000 (÷3,4)
	Tertiary	101 000	90 000	84 000	39 000	89 000	79 000	-11 000 (÷1,1)
Total		**594 000**	**639 000**	**592 000**	**546 000**	**582 000**	**586 000**	**4,000 (Stable)**

7.4.3.1 Target scenario - Energy renovation in the residential sector - Results in direct jobs (building and technical support sectors)

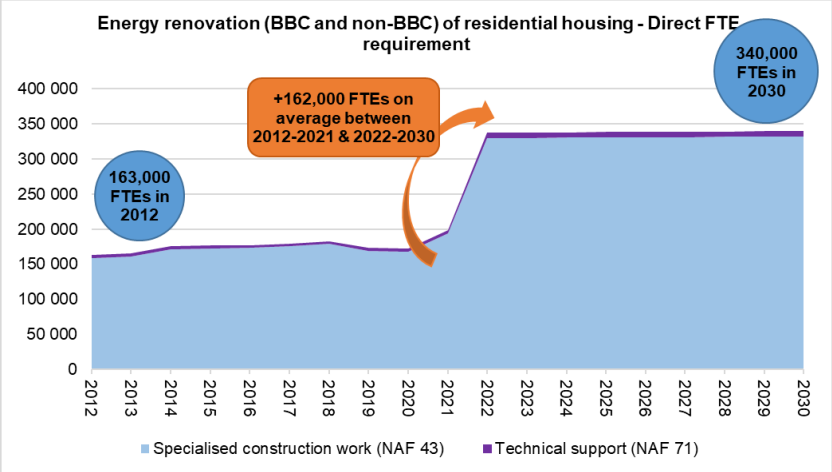
Turning now to the energy renovation of homes alone, the Target scenario calls for the energy renovation - BBC and non-BBC - of almost 1,181 thousand homes on average per year between 2022 and 2030, including 793,200 single-family homes and 387,300 multi-family homes. Almost non-existent between 2012 and 2021, BBC energy renovations would represent the bulk of the renovations to be carried out from 2022 onwards (more than ¾ of renovations).

All energy renovations (BBC and non-BBC) include one or more of the following measures:

- Energy renovation of the building envelope through insulation work (internal walls, external walls, floors, attics, roofs) and/or replacement of openings;
- Installation and maintenance :
  - A range of heating and domestic hot water systems: solar water heaters (SWH), aerothermal and geothermal heat pumps (AHPs), thermodynamic water heaters, wood-burning appliances, gas-fired condensing boilers, other low-efficiency systems (oil-fired condensing boilers, standard boilers, low-temperature boilers),
  - Monosplit air-to-air heat pump air conditioning systems;
  - Photovoltaic panels on small and medium-sized roofs;
  - Ventilation systems.

Carrying out all these renovation measures required an average of 176,000 direct FTE/year in the building and technical support sectors between 2012 and 2021. To achieve the targets set by the Target scenario, an average of 339,000 direct FTE/year would need to be employed from 2022 onwards, i.e. almost twice as many as over the observed period. This represents 162,000 additional direct FTEs to be employed over ten years.

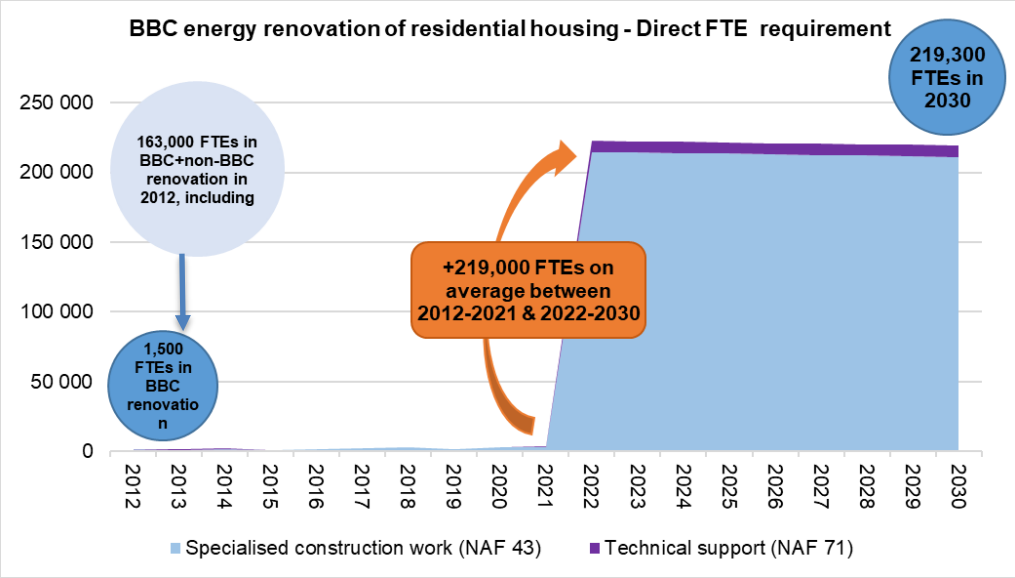
Figure 7-15 Target Scenario - Energy renovation in the residential sector: Direct job requirements in the building (NAF 43) and technical support (NAF 71) sectors between 2012 and 2030



Direct jobs related to technical support alone (NAF 71) would rise from an average of 4,300 FTE/year between 2012-2021 to an average of 7,700 FTE/year between 2022-2030, representing an additional requirement of 3,400 FTE.

As mentioned above, non-EBC energy renovations are set to decline massively in favour of BBC energy renovations. The latter are more costly and more employment-intensive. As a result, the reduction in the number of jobs needed to carry out non-BC renovation work would be more than offset by the increase in the number of jobs needed for BBC renovations. In fact, the need for direct jobs (in the construction and technical support sectors) to carry out low-energy renovation would rise from an average of 2,000 direct FTE/year between 2012-2021 to 221,000 direct FTE/year between 2022-2030, i.e. more than 219,000 additional FTE in 10 years.

Figure 7-16 Target Scenario - BBC energy renovation in the residential sector: Direct job requirements in the building (NAF 43) and technical support (NAF 71) sectors between 2012 and 2030



Estimated expenditure and employment requirements linked to work carried out during the renovation of vacant dwellings and second homes
(related work made necessary by energy renovation)

The so-called energy-related work is accounted for and detailed in this section 7. However, it is interesting to note that other work is required, whether related to energy renovation or not. As a result, the expenditure and FTEs required for these other works are added to the expenditure and FTEs devoted to energy renovation. To illustrate this, we looked specifically at vacant dwellings and second homes.

In this box, we estimate the expenditure to be made and the direct jobs to be employed for the renovation of second homes and vacant dwellings according to the targets set in the Target scenario. This scenario envisages the renovation of almost 695,000 second homes and 121,740 vacant homes over ten years, in order to convert them into primary residences. These renovations represent an important lever for making better use of the existing housing stock and building only when necessary. They involve major restructuring operations that radically transform the homes concerned[1] , combined with ambitious energy renovation work (BBC equivalent).

(1) Work that only preserves the building envelope, adding a lift, modifying stairwells, reconfiguring/modifying housing types, improving accessibility, etc.

- **Second homes:** According to our estimates, almost €43 billion will need to be invested in renovating the 695,000 second homes between 2022 and 2030, or €4.8 billion for 77,200 homes per year. This renovation work will require 34,600 direct FTEs (in the construction and technical support sectors) each year, the equivalent of more than 311,000 direct FTEs over the period 2022-2030. The support jobs alone represent 1,300 FTE/year, or 11,400 FTE over the period in question.

- **Vacant housing:** Expenditure on rehabilitating the 121,740 vacant homes amounts to €3.3 billion over the period 2022-2030, i.e. more than €364 million for 13,530 homes per year. To carry out this work, 23,860 direct FTEs are needed (including 870 FTEs for technical support). This represents 2,650 direct FTE/year, including around a hundred in technical support.

Table 7-5 Rehabilitation of second homes and vacant dwellings according to the Target scenario: Summary of results in terms of expenditure (€bn) and direct jobs in the construction and technical support sectors (FTEs)

2022-2030 period	Number to be rehabilitated	Expenditure (€bn)	Direct FTEs (construction and technical support)
Second homes	694 785 (77,200/year)	42.8 bn (€4.8bn/year)	311,440 FTES (34,600 FTE/year)
Energy renovation		*28.5 bn (€3.2bn/year)*	*207,630 FTES (23,070 FTE/year)*
Related work		*14.3 bn (€1.6bn/year)*	*103,810 FTES (11,530 FTE/year)*
Vacant dwellings	121 740 (13 530/year)	3.3 billion (€364m/year)	23,860 FTES (2,650 FTE/year)
Energy renovation		*2.2 billion (€243m/year)*	*15,910 FTES (1,770 FTE/year)*
Related work		*1.1 billion (€121m/year)*	*7,950 FTES (880 FTE/year)*
Total	**816 525 (90 725/year)**	**46.1 bn (€5.1bn/year)**	**335,300 FTES (37,260 FTE/year)**
Energy renovation		***30.7 bn (€3.4bn/year)***	***223,530 FTES (24,840 FTE/year)***
Related work		***15.4 bn (€1.7bn/year)***	***111,770 FTES (12,420 FTE/year)***

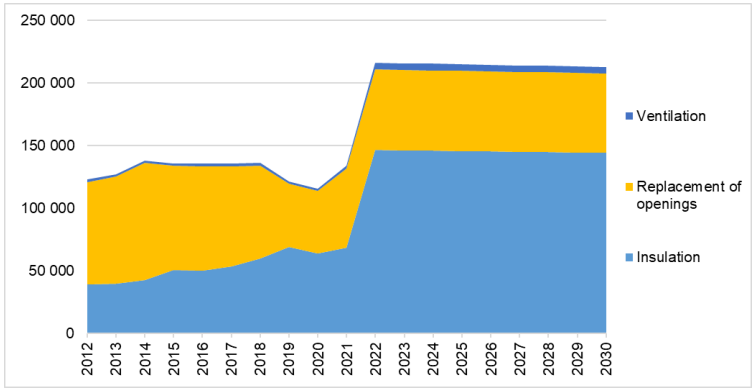
The TETE assessment methodology, its limitations and all the assumptions made are presented in Appendix 1.

7.4.3.2 Target Scenario - Energy renovation in the residential sector - Focus on direct jobs linked to envelope renovation

The transition from non-BBC renovations (by gesture) to BBC renovations (overall) entails much more extensive renovation work on the building envelope. This includes insulation, replacement of windows and doors, and the installation and maintenance of ventilation systems.

As a result, the need for direct FTEs (in the construction and technical support sectors) dedicated to this work on the building envelope is increasing, rising from an average of 133,000 FTEs/year between 2012-2021 to 220,000 FTEs/year between 2022-2030, i.e. more than 86,000 additional FTEs to be employed over ten years. This additional need mainly concerns insulation, ahead of replacement of openings and ventilation. It should be noted, however, that job requirements for ventilation activities are increasing significantly, multiplying by 2.5 over the period.

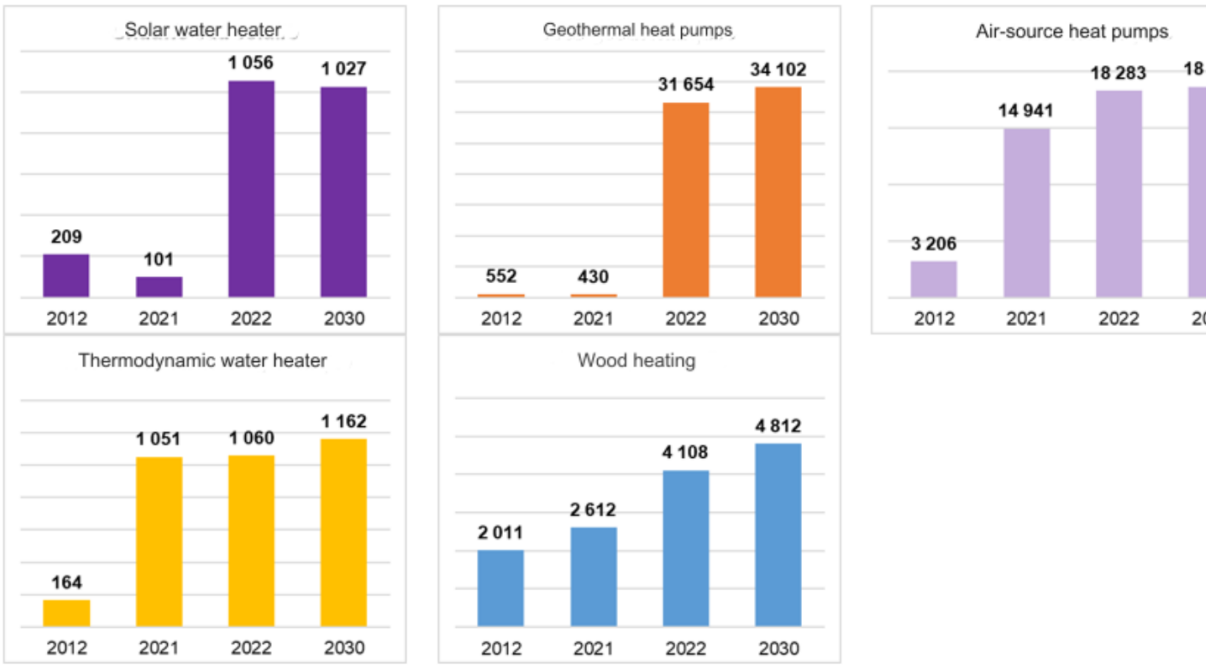
Figure 7-17 Target Scenario - Energy renovation in the residential sector - Focus on direct jobs related to the annual installation of equipment



As mentioned above, the major energy renovations planned for housing in the Target scenario involve, among other things, the massive deployment of efficient equipment for heating and DHW production. The installation of this equipment during renovation concerns new purchases in existing housing (replacement of one type of equipment with another), as well as the replacement of old equipment in existing housing (replacement of one type of equipment with the same type of equipment).

Below are the direct jobs linked to the installation of the various equipment in renovation projects. These results follow the pace of deployment mentioned above (section 7.2.4.1), resulting in: a sharp increase in the number of jobs required to install geothermal heat pumps and solar thermal water heaters between 2021 and 2030, a steady increase compared to 2021 (but slowing down between now and 2030) in the number of jobs required to install aerothermal heat pumps, thermodynamic water heaters and wood-burning appliances.

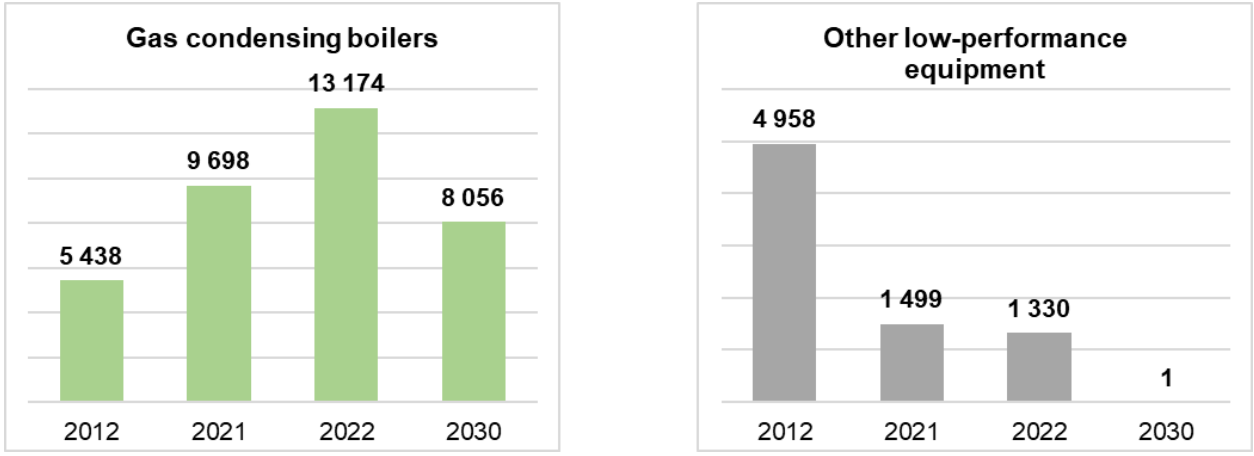
Figure 7-18 Target Scenario - Energy renovation in the residential sector: Focus on direct jobs linked to the annual installation of equipment using renewable energy between 2012 and 2030



The rate of deployment of gas-fired condensing boilers is expected to decline from 2022 onwards. As a result, the number of jobs associated with installing these boilers is expected to fall, from more than 13,000 FTEs per year in 2022 to more than 8,000 FTEs in 2030. Despite a drop in annual installations, this equipment would still play a major role in the heating systems installed in renovation projects, and would still generate a significant proportion of direct jobs.

If oil- and coal-fired appliances are banned from the market from July 2022, their use will gradually decline, until they are completely phased out. By 2030, no jobs would therefore be needed in this segment of the market.

Figure 7-19 Target scenario - Energy renovation in the residential sector: Focus on direct jobs related to the annual installation of heating equipment between 2012 and 2030

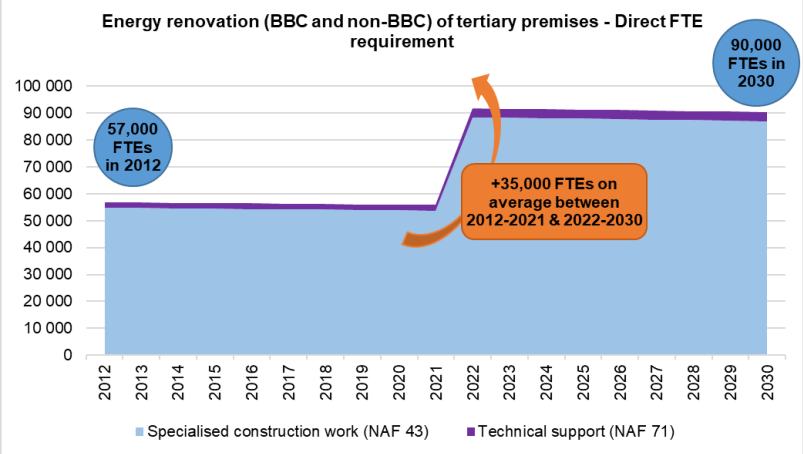


7.4.3.3 Target scenario - Energy renovation in the tertiary sector - Results in direct jobs (building and technical support sectors)

The entry into force of the "Tertiary Eco-Energy" scheme should encourage players to undertake more renovation work on tertiary premises. This incentive is reflected in the targets set in the Target scenario, with a 24% increase in the surface area to be renovated between the observed average (2012-2021) and the forecast average (2022-2030). To achieve these targets, direct employment (in the building and technical

support sectors) would rise from an average of 56,000 FTE/year between 2012-2021 to 91,000 FTE/year between 2022-2030 (+62%), representing an additional need for almost 35,000 direct FTE over ten years.

Figure 7-20 Target Scenario - Energy renovation in the tertiary sector: direct job requirements in the building (NAF 43) and technical support (NAF 71) sectors between 2012 and 2030

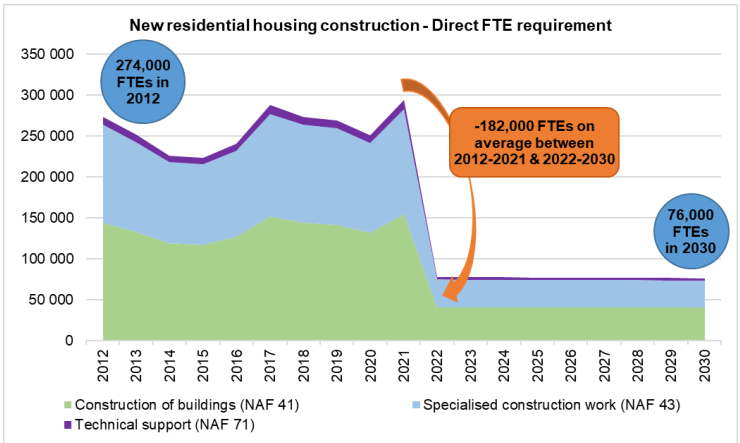


If we isolate the direct jobs linked to technical support (NAF 71), we can see that these would rise from an average of 2,100 FTE/year between 2012-2021 to an average of 3,300 FTE/year between 2022-2030, representing an additional requirement of 1,300 FTE.

7.4.3.4 Target scenario - New construction in the residential sector - Results in direct jobs (building and technical support sectors)

Direct jobs linked to new housing construction will fall sharply from 2022 onwards, as a result of the targets set in the Target scenario. The need for direct jobs would fall from an average of 259,000 FTE/year between 2012-2021 to just 77,000 FTE/year between 2022-2030. This represents 3.4 times fewer direct jobs needed in ten years, the equivalent of 182,000 fewer FTEs to be employed.

Figure 7-21 Target Scenario - New construction in the residential sector: direct job requirements in the building (NAF 41 and 43) and technical support (NAF 71) industries between 2012 and 2030



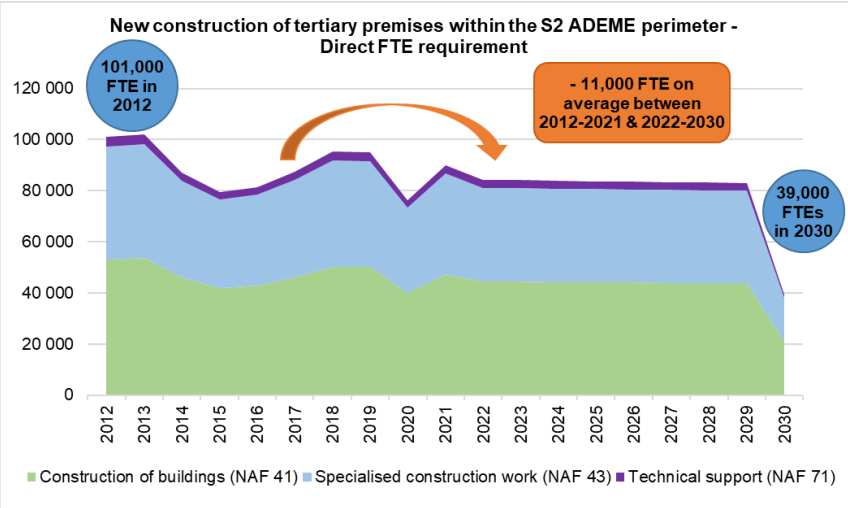
As a reminder, between 2012 and 2021, an average of almost 151,000 single-family homes and 208,000 multi-family homes were built each year (SDES, Construction de logements, Base Sit@del2). In the Target scenario, this rate falls to an average of 34,000 single-family homes (3.1 times less) and 67,000 multi-family homes (4.4 times less) per year between 2022 and 2030.

This significant drop in the rate of new residential construction would lead to a reduction in the need for technical support. Direct employment in NAF 71 alone would fall from an average of 9,500 FTE/year between 2012-2021 to an average of 2,800 FTE/year between 2022-2030, a reduction of 6,700 FTE.

7.4.3.5 Target Scenario - New construction in the tertiary sector (RE2020) - Results in direct jobs (building and technical support sectors)

The decline in new construction is less marked in the tertiary sector (premises covered by the RE2020[261]). From an average of 11,600 thousand m² built per year between 2012-2021, the average number of premises built per year between 2022-2030 would be 9,000 m² (-23%). This would reduce the need for direct jobs in this segment by 12%. These would fall from 90,000 direct FTE/year between 2012-2021 to 79,000 direct FTE/year between 2022-2030.

Figure 7-22 Target Scenario - New construction in the tertiary sector (AR2020): Direct job requirements in the building (NAF 41 and 43) and technical support (NAF 71) sectors between 2012 and 2030



Direct jobs related to technical support alone (NAF 71) would fall slightly from an average of 3,300 FTE/year between 2012-2021 to an average of 2,900 FTE/year between 2022-2030, i.e. a reduction of 400 FTE.

Table 7-6 Target scenario: Summary of results in terms of investment and maintenance expenditure (€ billion) and direct jobs in the building and technical support industries (FTEs)

Segment	Sector	Average 2012-2021	Average 2022-2030	Changing needs
Energy renovation	Residential	31.3 billion 176,000 FTES	57.8 billion 339,000 FTES	x1,8
	Tertiary	7.6 billion 56,000 FTES	12.5 billion 91,000 FTES	x1,6
New build	Residential	35.0 bn 259,000 FTES	10.6 billion 77,000 FTES	÷3,3
	Tertiary	12.1 billion 89,000 FTES	10.8 billion 79,000 FTES	÷1,1
Total		**85.9 billion 582,000 FTES**	**91.7 billion 586,000 FTES**	**x1.1 in expenditure Stable in FTE**

[261] Hotel accommodation, shops, offices, public service and community interest buildings

Estimated expenditure and job requirements linked to new construction methods

In addition to decarbonising HVAC (heating, ventilation and air-conditioning) equipment, the change in construction methods also involves using wood or concrete construction systems with a reduced environmental impact, as well as selecting finishing products that are bio-sourced or have an optimised production process. It is difficult to estimate how much of this will naturally come from reducing the impact of construction products by optimising processes (recycling steel, reducing transport, integrating bio-sourced materials into products, etc.), but it is certain that current construction methods will have to change by 2028 in order to comply with the regulations.

As part of BUS2, these new construction methods are integrated by making several assumptions* :

- It is assumed that from 2024 onwards, all the housing and commercial premises to be built according to the Target scenario will be constructed using new construction methods (in line with the RE2020 standards).
- Unit costs for new construction will increase by 9% between 2024 and 2027 compared with 2021, and by a further 3% between 2028 and 2030.)

(*) Assumptions by Pouget Consultants and In Numeri

The table below compares the requirements in terms of expenditure and direct employment (in the building and technical support sectors) for new construction that includes new construction methods with the requirements that do not. New construction methods require 3% more expenditure and FTEs.

Table 7-7 Expenditure and direct employment requirements for new construction with and without new construction methods

New build		Without new construction methods	With new construction methods
	Average 2012-2021	**Average 2022-2030**	
Residential	35.0 bn 259,200 FTES	10.6 billion 77,000 FTES	10.9 billion 79,500 FTES
Tertiary	12.1 billion 89,500 FTES	10.8 billion 79,000 FTES	11.2 billion 81,500 FTES
Total	**47 billion 348,700 FTES**	**21.4 billion 156,000 FTES**	**22.1 billion 161,100 FTES**

The TETE assessment methodology, its limitations and all the assumptions made are presented in Appendix 1.

7.5 COMPARISON OF THE MAIN RESULTS OF THE TARGET AND TREND SCENARIOS

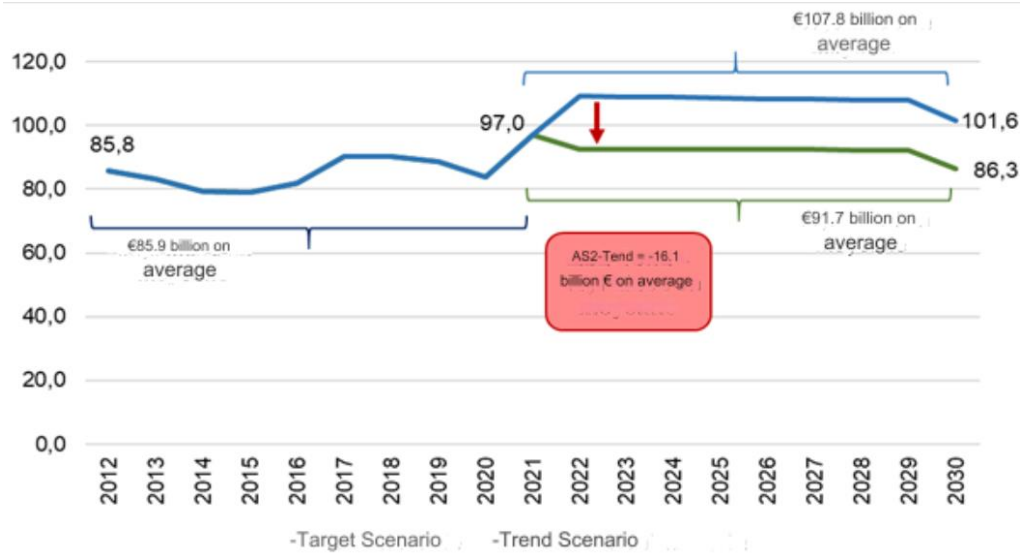
This section compares the main results of the Trend and Target scenarios, highlighting trends over the forecast period (2022-2030). As a reminder, the main differences between the two scenarios are :

- Almost 11 times more homes undergo BBC energy renovation each year in the Target scenario than in the Trend scenario;
- Almost 20% more commercial premises to be renovated each year in the Target scenario than in the Trend scenario;
- The volume of new housing is almost 3 times lower in the Target scenario than in the Trend scenario;
- Almost double the amount of tertiary premises to be built in the Trend scenario compared with the Target scenario.

7.5.1 Comparison of scenarios - Investment and maintenance expenditure results

Extending current trends (2012 to 2021) to 2030 (~ Trend scenario), total expenditure would average €107.8 billion per year between 2022 and 2030. Spending over the forecast period in the Trend scenario is 18% higher than in the Target scenario over the same period (€91.7 billion). The difference between the two scenarios is mainly due to the fall in spending on new construction in the Target scenario, which is not entirely offset by the rise in renovation spending.

Figure 7-23 Comparison of scenarios: Total expenditure between 2012 and 2030 (€bn)

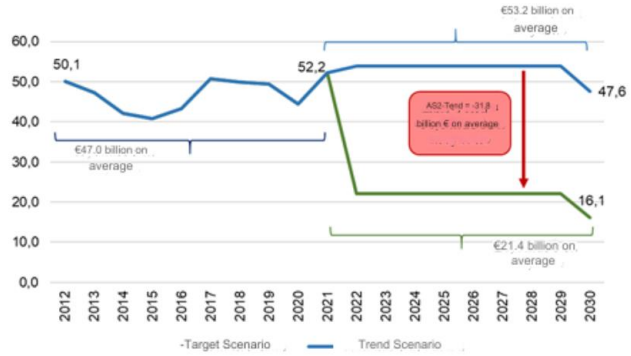


In the Trend scenario, average annual expenditure between 2022 and 2030 would break down as follows :

- 53.2 billion per year for new construction, i.e. 2.5 times more than in the Target scenario (€21.4 billion per year);
- 54.6 billion/year for energy renovation, 0.8 times less than the Target scenario (€70.3 billion/year).

Figure 7-24 Comparison of scenarios: Total expenditure on new construction and energy renovation between 2012 and 2030 (€bn)

New build



Energy renovation

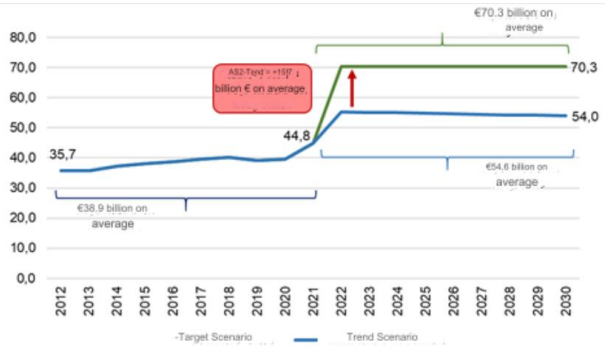


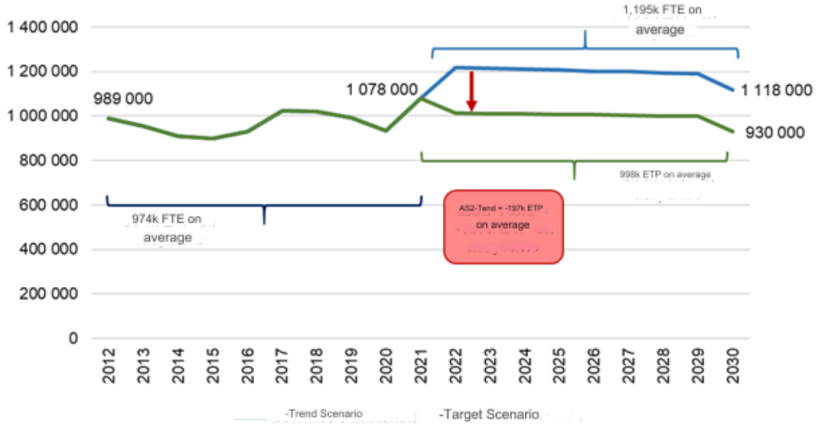
Table 7-8 Comparison of scenarios: Total expenditure between 2012 and 2030 (€bn)

			Trend scenario	Target scenario
Segment	**Sector**	**Average 2012-2021**	**Average 2022-2030**	
Energy renovation	Residential	31,3	44,0	57,8
	Tertiary	7,6	10,7	12,5
New build	Residential	35,0	32,9	10,6
	Tertiary	12,1	20,3	10,8
Total		**85,9**	**107,8**	**91,7**

7.5.2 Comparison of scenarios - Results in direct and indirect jobs (all industries combined)

Direct and indirect employment (all branches of activity combined) follows the same pace as expenditure. Between 2022 and 2030, these jobs are estimated at an average of 1,195 thousand FTE/year for the Trend scenario, compared with 998 thousand FTE/year for the Target scenario (-16%). This represents 197 thousand fewer FTEs in ten years in the Target scenario.

Figure 7-25 Comparison of scenarios: direct and indirect job requirements between 2012 and 2030 - All industries combined (FTE)



This difference mainly concerns the new-build segment. In the Trend scenario, the average direct and indirect jobs between 2022 and 2030 would be distributed between :

- 604,000 direct and indirect FTE/year for new construction, i.e. 2.5 times more than in the Target scenario (243,000 FTE/year);
- 591,000 direct and indirect FTE/year for energy renovation, i.e. 0.8 times less than in the Target scenario (754,000 FTE/year).

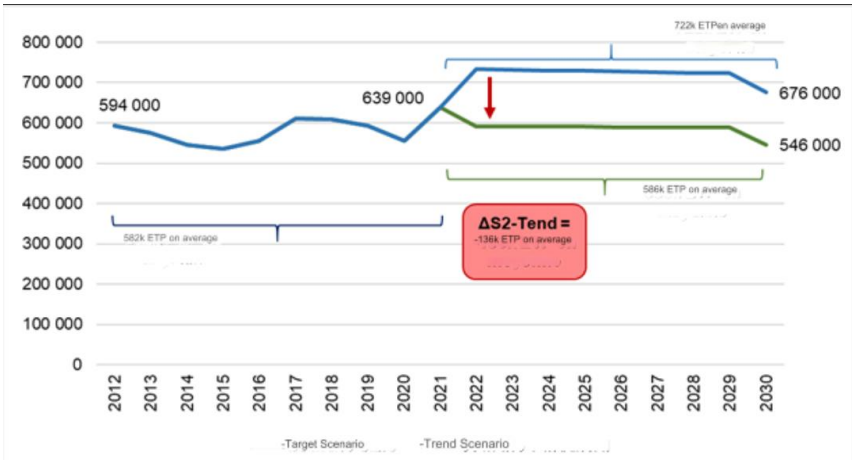
Table 7-9 Comparison of scenarios: Direct and indirect job requirements between 2012 and 2030 - All industries combined (FTE)

			Trend scenario	Target scenario
Segment	**Sector**	**Average 2012-2021**	**Average 2022-2030**	
Energy renovation	Residential	341 000	470 000	612 000
	Tertiary	88 000	121 000	142 000
New build	Residential	405 000	373 000	120 000
	Tertiary	140 000	230 000	123 000
Total		**974 000**	**1 195 000**	**998 000**

7.5.3 Comparison of scenarios - Results in direct jobs (construction and technical support sectors)

Between 2022 and 2030, achieving the Trend scenario would require an average of 722,000 direct FTEs each year in the building (NAF 41 and 43) and technical support (NAF 71) branches, compared with 586,000 direct FTEs for the Target scenario. This would represent a need for 136,000 fewer FTEs over ten years in the Target scenario.

Figure 7-26 Comparison of scenarios: direct job requirements in the building (NAF 41 and 43) and technical support (NAF 71) sectors between 2012 and 2030 (FTEs)



In the Trend scenario, the average number of direct jobs (in the construction and technical support sectors) between 2022 and 2030 would be distributed between :

- 387,000 direct FTE/year for new construction, i.e. 2.5 times more than in the Target scenario (156,000 FTE/year);
- 335,000 direct FTEs/year for energy renovation, i.e. 0.8 times less than in the Target scenario (430,000 FTEs/year).

Figure 7-27 Comparison of scenarios: direct job requirements (building and technical support sectors) in the new-build and energy renovation segments between 2012 and 2030 (FTE)

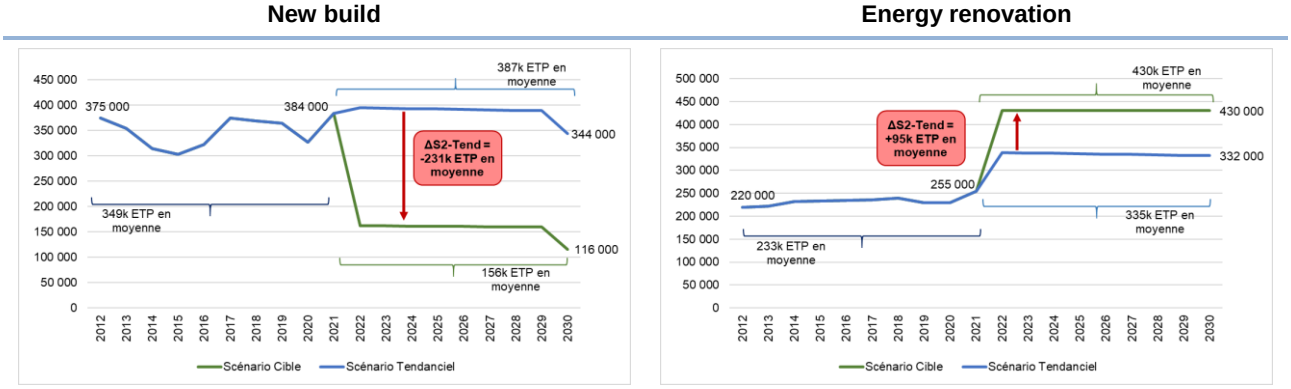


Table 7-10 Comparison of scenarios: Direct job requirements - Building and technical support sectors (FTE)

			Trend scenario	Target scenario
Segment	**Sector**	**Average 2012-2021**	**Average 2022-2030**	
Energy renovation	Residential	176 000	258 000	339 000
	Tertiary	56 000	78 000	91 000
New build	Residential	259 000	239 000	77 000
	Tertiary	90 000	148 000	79 000
Total		**582 000**	**722 000**	**586 000**

7.6 TRANSITION FROM DIRECT JOBS TO JOBS

This section presents the conversion of direct job requirements (FTEs in the building and technical support industries) into building trades. The need for trades is compared between the observed period (2012-2021) and the prospective period (2022-2030). To do this, two sources of information and data are used:

- **The Dares nomenclature of occupational families (FAP) -** The FAP is one of the main nomenclatures of occupations. FAPs group together professionals who use common skills based on similar "professional gestures". In this way, the PAFs make it possible to study employment and the supply and demand for jobs using the same job reference framework. With the help of the PAFs, it is possible, for example, to identify jobs that are likely to offer job opportunities, to analyse tensions between job supply and demand, and to inform training decisions. For the purposes of this study, we are focusing on occupations in the "Building and public works" sector. It is based on the breakdown of the workforce in this field by trade category (FAP). This breakdown is available in 2012 and 2019 (based on the results of the Employment survey; processed by Dares[262]). We extrapolate between these two years to reconstitute the 2012-2019 series. The series is extended to 2030 by making assumptions about changes in the weight of each trade as a function of the targets set in terms of energy renovation and new construction (see Appendix 3). For example, it is assumed that the technical support professions will account for a greater proportion of the energy renovation work to be carried out by 2030 (or even double this proportion). This exercise is carried out separately for the residential and tertiary sectors.

[262] https://dares.travail-emploi.gouv.fr/enquete-source/enquete-emploi

- **Expert opinion on the trades to be employed by segment and by sector -** This involves identifying the trades to be employed by segment of activity (energy renovation/new construction) and by sector (residential/tertiary). This makes it possible to distinguish the specific features of each segment and each sector, depending on the work to be carried out. For example, the installation of heating equipment does not require the same trades if it is carried out in a single-family home or in a block of flats or a school (see Appendix 4). So, gesture by gesture, we base ourselves on feedback from experts in terms of the trades required to carry out the gesture in question.

Once the trades have been identified, the data communicated by DARES is extrapolated to break down the direct FTEs into the trades concerned. In the case of energy-efficient renovation of housing, given that all of the tasks have been identified and quantified, we can distinguish between the trades involved in the installation of the equipment and those involved in the upkeep and maintenance of the equipment. This exercise is not carried out in the case of energy-efficient renovation of tertiary premises and all new construction, as the results are presented at an aggregate level.

In the following, we have chosen to present the results in terms of trades separately for the renovation segment and the construction segment, in order to better understand the specific characteristics of each segment. As presented above, depending on the targets set for the Target scenario, the need for FTEs, and therefore trades, is likely to increase in the renovation segment and decrease in the new construction segment. In absolute terms, one might assume a systematic transition of trades from new construction to energy renovation. In reality, however, this transition is not so obvious, depending on the trade concerned. Recruitment conditions, skills upgrading, working conditions, project procurement, etc. differ between these two segments.

The trades required are then presented by segment (energy renovation/new construction) and by sector (residential/tertiary). All the trades involved in energy renovation and new construction (all sectors combined) are presented in Appendix 2.

7.6.1 Careers - Residential energy renovation

The massive development of energy-efficient home renovation is having a major impact on the professions in the sector.

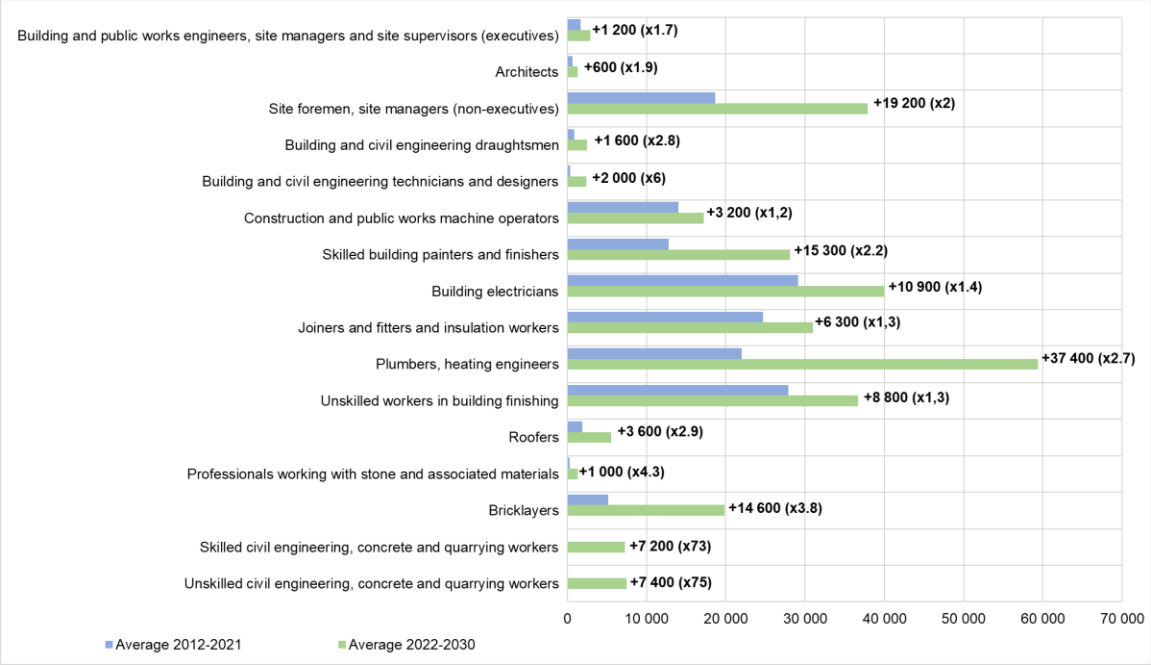
On the investment side (energy-efficient renovation of the building envelope, fitting and installation of various equipment), bricklayers, roofers, skilled painters and finishers and professionals working with stone and associated materials will be more involved in work to renovate the building envelope (insulation, replacement of joinery), while plumbers, heating engineers and electricians will be involved in the mass deployment of various heating, DHW, ventilation and air-conditioning equipment in detached and multi-family homes.

As the following graph shows, among the FTEs for investment, those working as bricklayers would be multiplied by 3.8 between 2012-2021 and 2022-2030, representing 14,600 additional FTEs to be mobilised in bricklaying over the next ten years. In order to respond to the large-scale deployment of efficient equipment, the job requirements for plumbers and heating engineers - needed to install the various pieces of equipment - would increase by 37,400 FTEs between 2012-2021 and 2022-2030 (i.e. a 2.7-fold increase) and for electricians by 10,900 FTEs (i.e. a 1.4-fold increase over the same period).

The most significant increase would be in the need for skilled and unskilled extraction workers, with a need multiplied by 73 and 75 respectively over the next ten years (7,200 additional FTEs of skilled workers and 7,400 additional FTEs of unskilled workers). The development of these trades, which are essentially required for the installation and connection of geothermal heat pumps in collective housing, reflects the very ambitious objectives of the Target scenario in terms of the development of the sector over the next decade. According to the Target scenario, there will be more than 367,000 geothermal heat pumps in collective housing by 2030, whereas only 1% of geothermal heat pumps are currently installed in collective housing, i.e. almost 5,000 heat pumps (AFPG). [263]

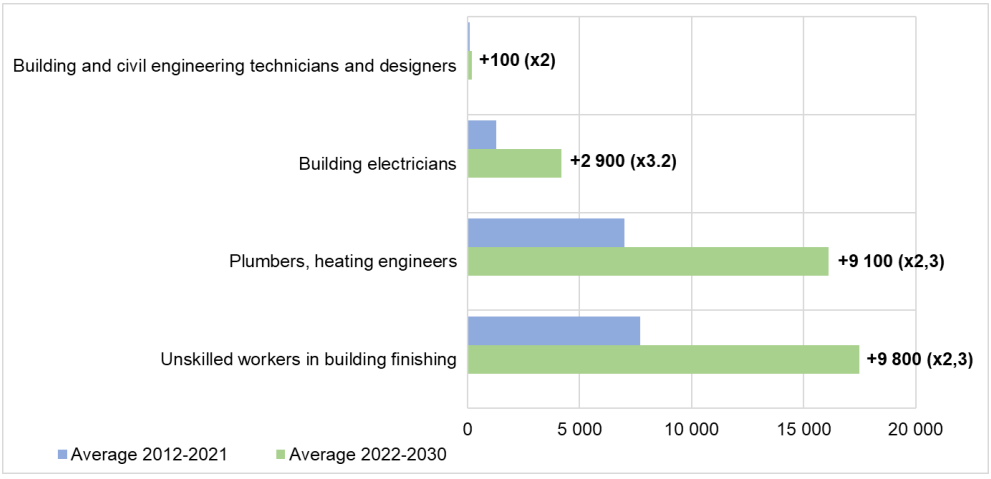
[263] AFPG (2021), Geothermal energy in France, Sector study

Figure 7-28 Investment activities - Trades to be mobilised for energy renovation in the residential sector (single-family homes and multi-family housing) over the observed period (2012-2021) and the prospective period (2022-2030) (FTEs)



When it comes to the upkeep and maintenance of the equipment installed base, the permanent trades to be mobilised would mainly involve unskilled workers in the finishing trades, plumbers, heating engineers, electricians and building technicians. Unsurprisingly, as the building stock grows and is renewed, the need for permanent trades will increase. As the diagram below shows, the number of FTEs occupying one of the above-mentioned positions will increase between 2 and 3 times over the next few years.

Figure 7-29 Maintenance activities - Trades to be mobilised for energy renovation in the residential sector (single-family homes and multi-family housing) over the observed period (2012-2021) and the prospective period (2022-2030) (FTEs)

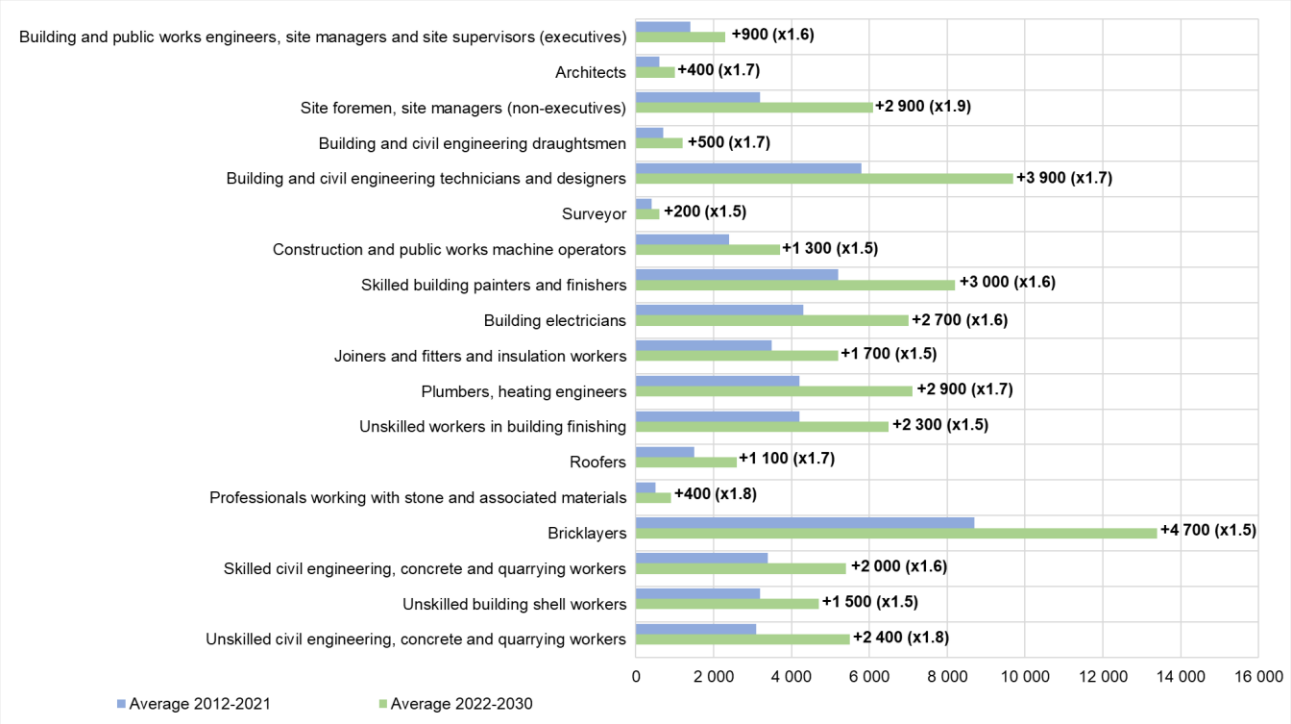


7.6.2 Professions - Energy renovation in the tertiary sector

As we were unable to break down the energy renovation of tertiary sector premises step by step (as is the case for the renovation of housing), the breakdown of the trades required in this segment is presented for all activities, without distinguishing between investment and maintenance.

The targets for energy renovation in the tertiary sector are less ambitious than in the residential sector. As a result, the need for FTEs will increase between 1.5 and 2 times over the next ten years. The biggest increase would be in the number of bricklayers (4,700 additional FTEs in this role in ten years' time), technicians (+3,900 FTEs) and design engineers, and skilled painters and finishers (+3,000 FTEs).

Figure 7-30 Occupations to be mobilised for energy renovation in the tertiary sector over the observed period (2012-2021) and the prospective period (2022-2030) (FTEs)

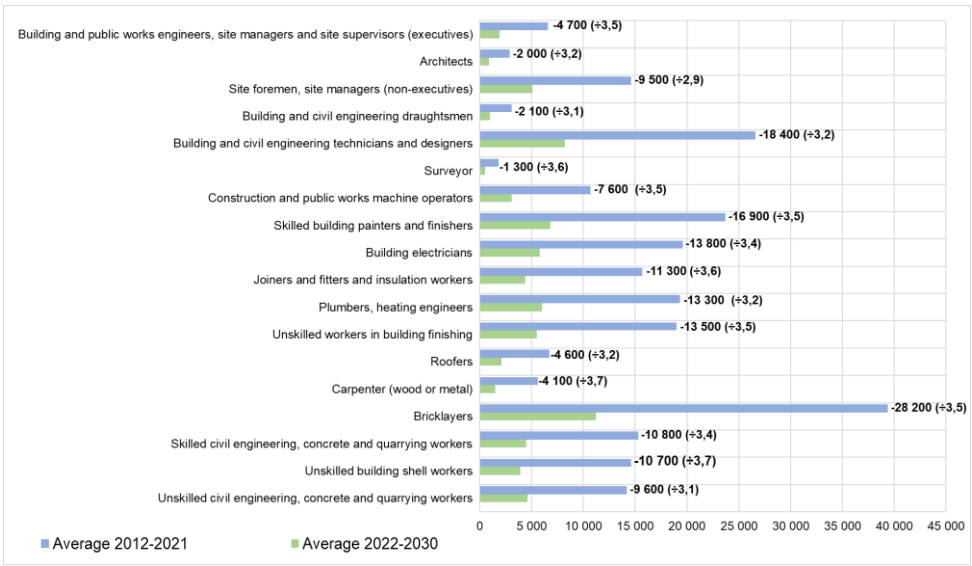


7.6.3 Professions - New construction

As with energy renovation in the tertiary sector, the transition from FTEs to trades in the new-build segment is based on aggregated results.

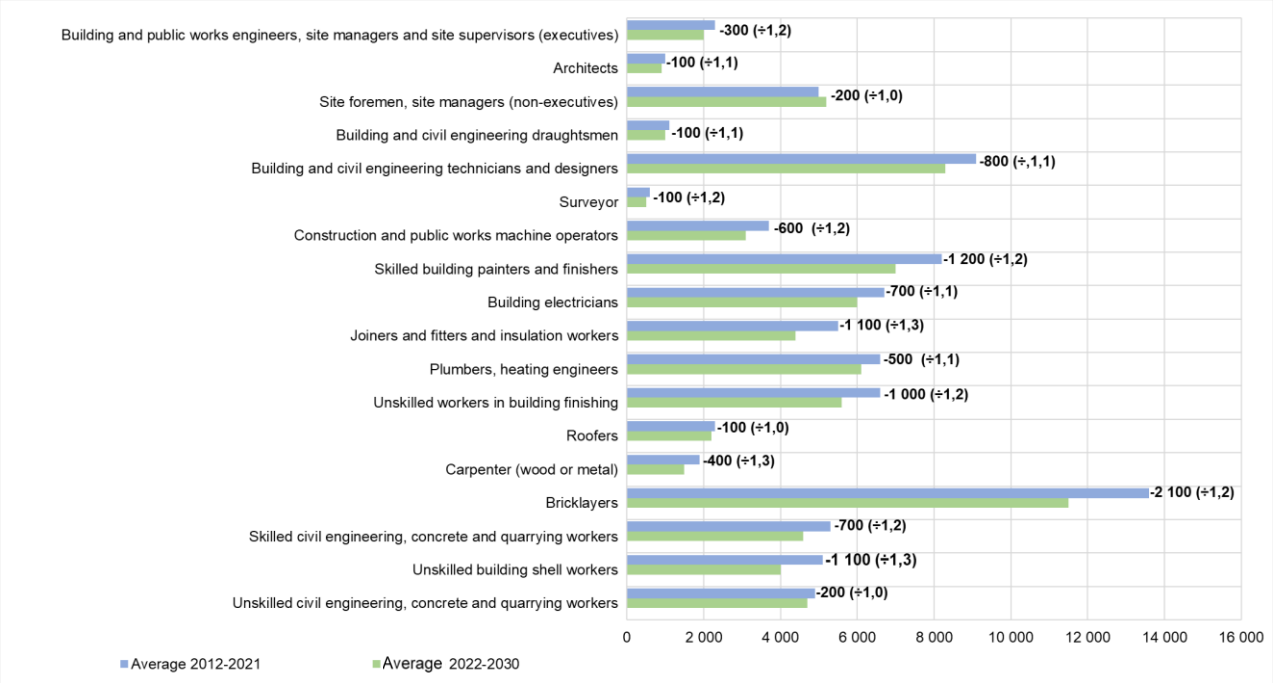
- New housing construction : Faced with the significant drop in new housing construction in the Target scenario, the need for trades would fall sharply. The biggest declines would be in the number of bricklayers (down 28,200 FTEs over ten years), building technicians and designers (down 18,400 FTEs) and skilled painters and finishers (down 16,900 FTEs). There has also been a decline in the number of technical support staff: down 4,700 FTEs for building engineers, site managers and site supervisors (managers) and down 2,000 FTEs for architects.

Figure 7-31 Trades required for new housing construction over the observed period (2012-2021) and the forecast period (2022-2030) (FTEs)



- New tertiary construction RE2020 : The decline in jobs in the tertiary sector is less significant than in the residential sector. These declines would mainly concern bricklayers (down 2,100 FTEs in this function over ten years), skilled painters and finishers (down 1,200 FTEs), as well as unskilled carpenters and joiners, and fitters and insulators (down 1,100 FTEs each). Technical support activities will also require fewer construction engineers, site managers and site supervisors (-300 FTEs) and architects (-100 FTEs).

Figure 7-32 Trades to be mobilised for new construction of RE2020 tertiary premises over the observed period (2012-2021) and the prospective period (2022-2030) (FTE)



7.7 AN ADDITIONAL STUDY TO ANALYSE THE SKILLS/QUALIFICATIONS GAP BETWEEN THE CURRENT SITUATION AND THE NEEDS IN 2030 (YEAR BY YEAR): INTEGRATION OF THE SDP TOOL INTO THE MODELLING TO SUPPORT PHASE 1 OF BUS2.

The BUS2 model lacked a key to interact more directly with the world of producers of skills upgrading, i.e. initial and continuing training.

The study "Integration of the SDP tool in the modelling supporting phase 1 of BUS2" specifies the 6 skill levels for each profession,

- Contractor
  - level 1: neither trained nor aware of energy efficiency
  - level 2: Sensitised
  - level 3: Trained

- Manager
  - level 1: neither trained nor aware of energy efficiency
  - level 2: Sensitised
  - level 3: trained

The advantage of modelling is that it covers a wider area than just energy-efficient home renovation, taking into account trades that go beyond the 'blue-collar' building trade, and it has also enabled us to take a closer look at the observed data from official statistics.

The table below shows the breakdown, according to SDP, of trades by level of training for renovation. As the following figures show, the level of training required varies from one trade to another.

*Figure 7-3: Breakdown of direct building FTEs required for residential renovation, excluding maintenance, by trade: SDP tool - Target **2023***

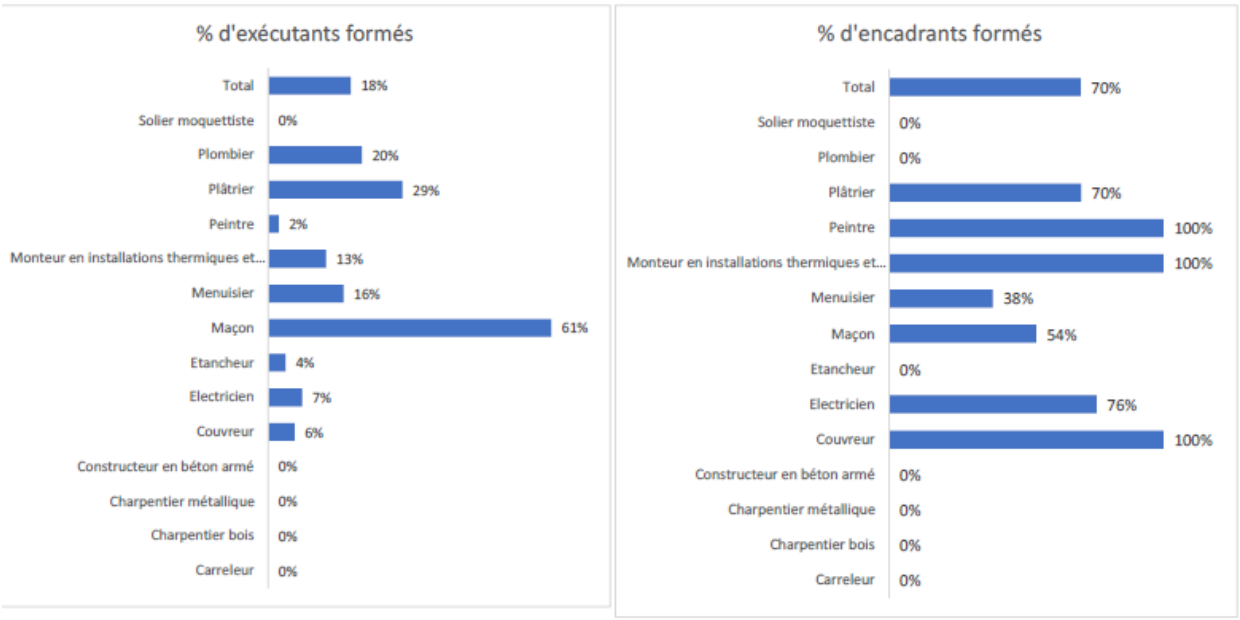
SDP Trade	Non-executives - Non EE/EnR	Non-executives - Sensitized	Non-executives - Trained	Managers - Non EE/EnR	Managers - Sensitized	Managers - Trained	Total
Tiler	3323	1009	0	0	0	0	4331
Carpenter wood	7899	0	0	0	19	0	7918
Carpenter metal	1563	0	0	0	19	0	1582
Concrete builder	2971	0	0	0	0	0	2971
Roofer	9305	5709	909	0	0	862	16784
Machine operator	305	5709	909	0	0	862	16784
Heavy goods vehicle driver	0						0
Electrician	5179	12512	1403	300	870	3622	23885
Roofer	421	0	212	0	659	0	6292
Crane operator	0						0
Mason	104	671	12251	0	926	10704	39966
Joiner	2776	392	1305	0	654	397	9052
Installer in thermal and climate installations	0	392	1305	0	654	397	9052
Painter	1795	24953	622	0	0	968	28337
Plasterer	0	26817	10986	0	307	7154	48027
Plumber	4121	210	1101	0	0	0	5432
Locksmith-Metalworker	0	0	0	0	0	0	0
Floor and carpet layer	993	0	0	0	0	0	993
Stone cutter							
Driller							
Total	46384	94604	3062	300	14551	34261	22072

Source (ADEME)

The table above shows the breakdown, according to SDP, of trades by level of training for renovation. The level of training required varies from trade to trade.

As far as operatives are concerned, it is the bricklayers for whom there is a strong need for training, according to the SDP tools. For supervisors, training is almost always considered necessary, whatever the trade (there are not supervisors in all trades). Only carpenter supervisors need less training than other occupations (see table 7.33).

Figure 33.33: Rate of training in energy renovation deemed necessary, by trade, for



Source ADEME

For each of the trades, the FTEs can be broken down by type of site. Table 7.34 shows the number of FTEs allocated to each type of site for all bricklayers (SDP nomenclature with the six skill levels). This analysis exists for each of the following trades:

- Mason (contractor)
- Stonemason
- Wood carpenter + Metal carpenter (contractor)
- Roofer (contractor)
- Plumber + fitter in heating and air-conditioning installations (contractor)
- Joiner + Plasterer + Waterproofing contractor
- Electrician (contractor)
- Painter + Tiler + Floor layer (contractor)
- Machine Operator + HGV Operator + Crane Operator (operator)
- Manager

Figure 7.35: Example: Breakdown of FTE masons needed for renovation - if the 2023 target is to be met

Construction Site	Worker Level 1 - Non-REE/EnR	Worker Level 2 - Sensitized	Worker Level 3 - Trained	Supervisor Level 1 - Non-REE/EnR	Supervisor Level 2 - Sensitized	Supervisor Level 3 - Trained	Total
High-performance boiler in single-family home	0	0	0	0	0	0	0
High-performance boiler in multi-family building	0	0	0	0	0	0	0
Individual wood heating/DHW	0	0	0	0	0	0	0
Collective wood heating/DHW	0	0	0	0	0	0	0
Electric heating/DHW	0	0	0	0	0	0	0
Solar heating/DHW	0	0	0	0	0	0	0
Geothermal drilling	0	0	0	0	0	0	0
Window insulation	0	2,699	0	0	0	0	2,699
Wall insulation from the inside	1,03	0	0	0	0	0	1,03
Wall insulation from the outside in single-family home	0	2,561	11,203	0	8,002	10,242	32,008
Wall insulation from the outside in multi-family building	0	1,582	1,163	0	1,396	512	4,654
Roof insulation	0	0	0	0	0	0	0
Photovoltaic	0	0	0	0	0	0	0
Heat pump	0	0	0	0	0	0	0
Ventilation	0	0	0	0	0	0	0
Total	1,03	6,842	12,366	0	9,398	10,754	40,39

8 DIAGNOSIS IN 4 LOCAL AREAS FOCUS

In order to compare our observations at national level and the method for quantifying job requirements in order to achieve national objectives with the realities on the ground, a diagnosis of job requirements at regional level was carried out with four Maisons de l'Emploi (MDEs), which were responsible for coordinating the players in their area.

8.1 AIX-MARSEILLE-PROVENCE METROPOLITAN AREA

8.1.1 Context

The area covered by the Maison de l'Emploi Ouest-Provence is that of the Aix-Marseille-Provence Metropolitan Area, which has 1,840,000 inhabitants and 92 municipalities. The Maison de l'Emploi Ouest-Provence, created in 2007, is a non-profit association under the 1901 law, which relies on a basic partnership base consisting of the Aix-Marseille-Provence Metropolitan Area, the DREETS and Pôle Emploi.

In this area, the BUS2 project is led by the Maison de l'Emploi Ouest Provence. It brings together around thirty partners and players who have been working on the diagnosis since March 2023, including representatives of the metropolis and territorial departments of the State, numerous associations and training structures in the area, as well as companies and certain representatives of professional federations.

8.1.2 Key figures

The survey was carried out in the Aix-Marseille-Provence metropolitan area. The residential housing stock comprises 933,958 dwellings covering 72 million m², representing a total energy consumption of more than 7.8 TWh/year. More than 187,700 of these homes are classified E-F-G. There are also 60,724 vacant homes, 22,000 of which have been vacant for more than 2 years.

Table 8-1 Aix-Marseille-Provence Metropolitan Area: Housing stock by type of dwelling and energy class (number of dwellings)

	No. of homes	Of which A+B	Of which C+D	Of which E+F+G
Housing stock	**933 958**	**47 641**	**637 814**	**187 781**
Main residence	292 603	26 383	198 364	67 856
Main residence flats	403 814	12 596	290 154	101 064
Social housing (HLM)	140 080	6 852	123 559	9 669
Secondary or occasional residences	36 737	1 810	25 735	9 192
Vacant dwellings	60 724	Nearly 22,000 of them for more than 2 years		

Source: CERC PACA

The Aix-Marseille-Provence Metropolitan Area is characterised by a high proportion of substandard housing, with an estimated 60,000 potentially substandard private housing units (categories 6 to 8 in the General Tax Directorate database), of which 40,000 are concentrated in the city of Marseille.

Buildings subject to the tertiary sector eco-energy scheme (DEET) account for 5,592 premises, or 4,650 buildings with a surface area of more than 19 million m². These buildings consume more than 4.6 TWh/year. Of these commercial premises, almost 520 are rated G, 540 F, 1,350 E and 2,770 C-D.

Table 8-2 Aix-Marseille-Provence Metropolitan Area: tertiary sector stock subject to the tertiary sector eco-energy scheme by energy class (number of premises)

Commercial property	
5,592 premises ~ 4,650 buildings ~ Over 19 M² in size	
B label	411
C label	1 478
D label	1 292
E label	1 348
F label	540
G label	519

Source: CERC PACA

8.1.3 Energy renovation and new construction targets

1. Renovation

There are more than 8,060 G-rated homes, 16,780 F-rated homes and 62,960 E-rated homes in the rental stock, making a total of 87,800 homes, equivalent to 22% of the rental stock. According to the French Climate and Resilience Act[264] , these homes will - without renovation - be excluded from rental from 2025 (for those classified as G), 2028 (for those classified as F) and 2034 (for those classified as E) respectively. It should be noted that this percentage is low compared to the national level due to the milder climate in winter.

The scenario envisaged by BUS2 is to follow that of the city's PLH until 2028, giving priority to renovating the 87,800 rental homes classified E-F-G between 2023 and 2033, i.e. almost 8,000 high-performance renovations (BBC equivalent) per year. These renovations will be supplemented by BBC renovations of 90,780 non-rented homes classified E-F-G, i.e. more than 10,000 homes per year between 2025 and 2030.

Table 8-3 Aix-Marseille-Provence Metropolitan Area: Residential rental stock by type of dwelling and energy class E-F-G (number of dwellings)

Residential rental stock (no. of units)	**386 687**
Of which : Label G (to be renovated by 2025)	8 062
Houses	*1 437*
Flats	*6 412*
HLM	*213*
Of which : Label F (to be renovated by 2028)	16 779
Houses	*4 615*
Flats	*10 953*
HLM	*1 211*
Of which : E label (to be renovated by 2034)	62 964
Houses	*6 474*
Flats	*49 265*
HLM	*7 225*

Source: CERC PACA

Over the same period (2025-2030), we are also adding the BBC renovation of 9,190 secondary or occasional homes classified E-F-G, i.e. more than 1,020 homes per year.

In the end, we are also taking into account the renovation of all C and D homes (over 637,800 homes), which will only require 1 or 2 acts of renovation, i.e. almost 58,000 homes per year between 2023 and 2033.

[264] Act no. 2021-1104 of 22 August 2021 on combating climate change and building resilience to its effects

Premises subject to DEET will be subject to the same housing renovation timetable, with priority given to renovating premises classified G-F-E between 2023 and 2033, with all G-rated premises to be renovated by 2025, F-rated premises by 2028 and E-rated premises by 2034. From 2025 onwards, the renovation of premises classified C and D will also be required.

2. New build

In order to come close to the national scenario in terms of a decline in new construction, it is proposed to respond to this decline by renovating 22,000 vacant homes over two years old between 2029 and 2033. In addition, the Metropole's Local Housing Programme (PLH 2023[265]) provides for the delivery of 10,000 homes per year until 2028. This target is maintained in the scenario envisaged by BUS2 via new construction. Beyond that, the national S2 scenario is applied, gradually reducing the number of new homes built until, in 2033, fewer than 3,000 new homes are built. The shortfall in new construction is therefore offset by the rehabilitation of vacant homes in the area.

For the tertiary sector, the national target is a 23% reduction in new tertiary buildings. This same objective is maintained for the Metropolitan Region up to 2033. As a result, the number of new premises built will fall from over 568,000 in 2022 to over 438,500 in 2033.

3. Summary of the selected scenario

In the end, the BUS2 scenario for the Aix-Marseille metropolitan area has the following objectives:

- Housing renovation :
  - Priority to be given to rental properties rated E to G to be renovated (BBC equivalent) from 2023 to 2033
    - 8,062 G-rated homes in two years (by 2025)
    - 16,779 F-rated homes in five years (by 2028)
    - 62,964 E-rated homes in eleven years (by 2033)
  - Non-rental housing classified E to G to be renovated between 2025 and 2033
    - 99,976 homes (including second or occasional homes) in nine years (BBC equivalent)
  - All homes classified C-D to be renovated over time (non-BBC) between 2023 and 2033
    - 637,814 homes in eleven years
  - Renovation of over 21,000 vacant homes between 2029 and 2033 (in response to the fall in new construction)

- Renovation of commercial premises :
  - Priority to premises classified E to G to be renovated between 2023 and 2033
    - 519 G-rated premises in two years (by 2025)
    - 540 F-rated premises in five years (by 2028)
    - 1,348 E-rated premises in eleven years (by 2033)
  - All premises classified C-D to be renovated between 2025 and 2033
    - 2,770 premises in nine years

- New housing construction :
  - Delivery of 10,000 homes per year until 2028 (target set out in the PLH)[266]
  - A gradual fall in the rate of new housing construction from 2029 onwards, in line with the national Target scenario: -70% between 2028 and 2033 for Metropolitan France, resulting in almost 3,000 new homes delivered in 2033.

- New construction of commercial premises :
  - A gradual fall in the rate of new construction from 2023, in line with the national target: -23% between 2023 and 2033 for metropolitan France, resulting in more than 438,500 m² delivered in 2033 (compared with 568,100 m² in 2022)

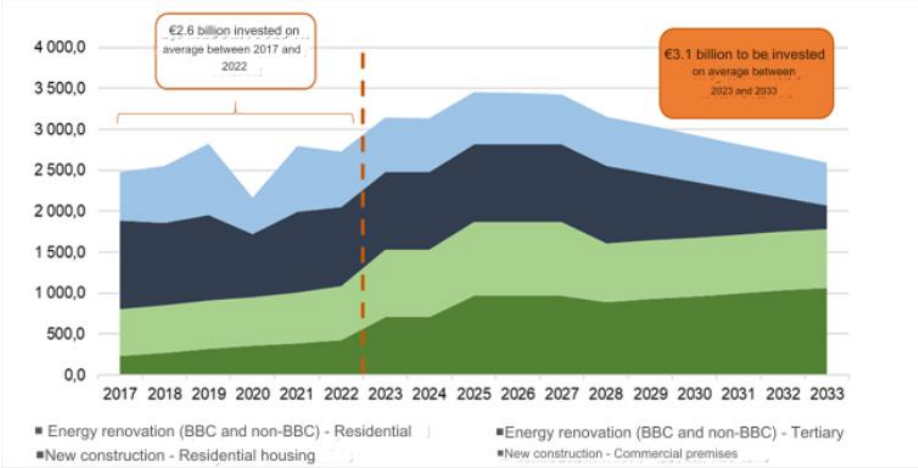
[265] The Metropolis of Aix-Marseille-Provence (2023), Local Housing Programme 2023-2028
[266] *Ibid.*

8.1.4 Diagnosis of job requirements

Based on the data observed in terms of energy renovation and new construction from 2017 to 2022[267] , it is estimated that €2.6 billion will be spent on investment and maintenance each year in the Aix-Marseille-Provence metropolitan area.

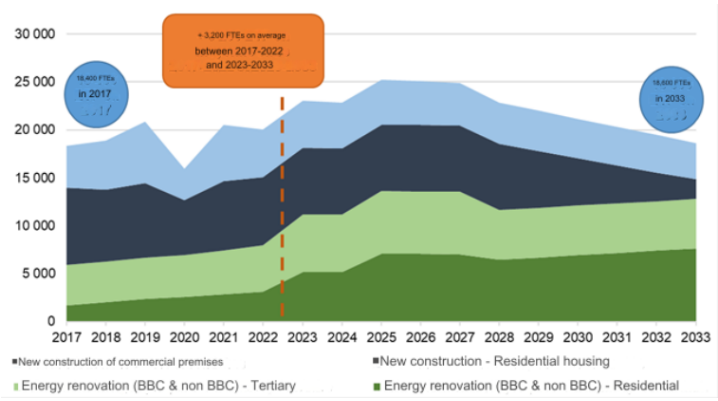
In order to achieve the objectives set for the Metropolitan Area under BUS2, this expenditure would have to increase to €3.1 billion per year from 2023 until 2033. In fact, the fall in activity in the new-build sector (from €1.7 billion in 2012 to €812 million in 2033) would be offset by the increase in activity in the energy renovation sector, particularly via the policy of rehabilitating vacant housing (from €800 million in 2012 to €1.8 billion in 2033).

Figure 8-1 Aix-Marseille-Provence Metropolis: Total expenditure between 2017 and 2033 (€M)



Direct jobs in the building (NAF 41 and NAF 43) and technical support (NAF 71) sectors alone represent an average of 19,100 FTE/year between 2017 and 2022. These direct jobs would increase to an average of 22,300 FTE/year between 2023 and 2033 depending on the scenario adopted, representing an additional requirement of 3,200 FTE over ten years. Overall, therefore, and without prejudging the capacity for a direct transfer of FTEs between major sectors of activity, the increase in direct jobs needed to achieve the energy renovation targets would offset the drop in direct jobs in the new construction segment.

Figure 8-2 Aix-Marseille-Provence Metropolitan Area: Direct job requirements in the building (NAF 41 and 43) and technical support (NAF 71) sectors between 2017 and 2033 (FTE)



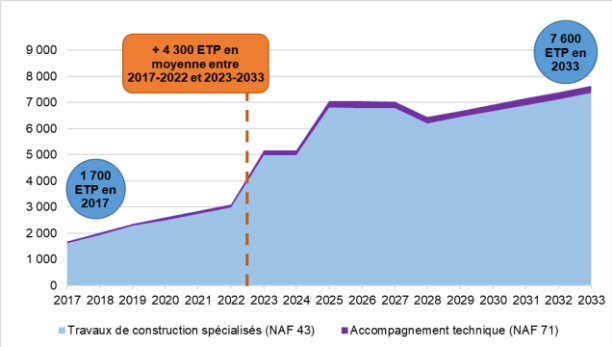
- New construction: from an average of 12,200 direct FTE/year between 2017 and 2022 to an average of 9,900 direct FTE/year between 2023 and 2033, i.e. 2,400 direct FTE less each year (division by 1.2).
- Energy renovation (BBC and non-BBC): from an average of 6,900 direct FTE/year between 2017 and 2022 to an average of 12,400 direct FTE/year between 2023 and 2033, i.e. an additional 5,600 direct FTE each year (multiplied by 1.8).

[267] La Métropole d'Aix-Marseille-Provence (2023), Programme local de l'habitat 2023-2028 ; CERC PACA ; Hypothèse In Numeri

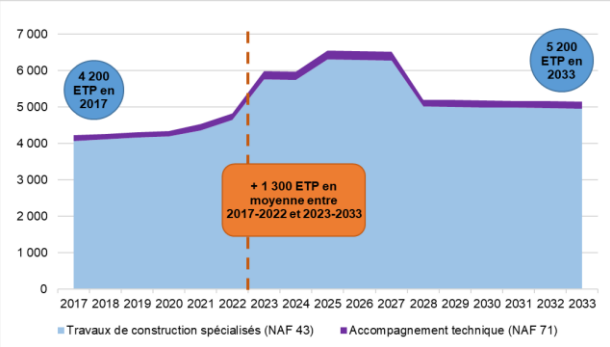
Below are the results in terms of direct jobs per segment (energy renovation / new construction) and per sector (residential / tertiary).

Figure 8-3 Aix-Marseille-Provence Metropolitan Area: Direct job requirements (building and technical support sectors) by segment (new construction and energy renovation) and by sector (residential and tertiary) between 2017 and 2033 (FTE)

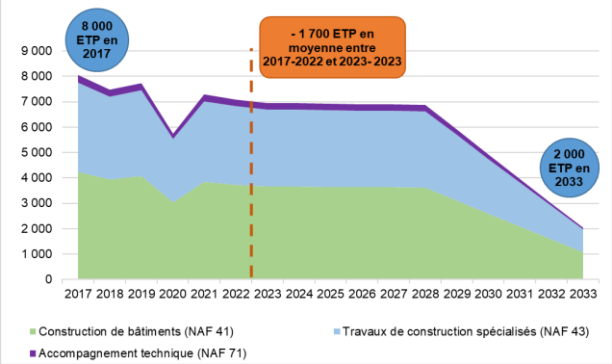
Energy renovation - Residential



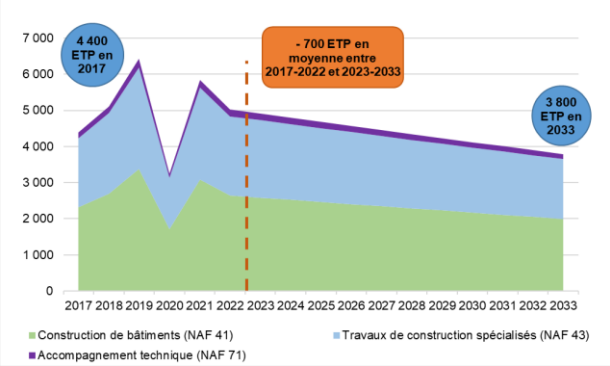
Energy renovation - Commercial sector



New build - Residential



New construction - Commercial



The table below summarises all the results for the Aix-Marseille-Provence Metropolitan Area in terms of total expenditure and direct employment (building sector and technical support).

Table 8-4 Aix-Marseille-Provence Metropolitan Area: Summary of results in terms of investment and operation-maintenance expenditure (€bn) and direct employment in the building and technical support sectors (FTE)

Segment	Sector	2017	2023	2028	2033	Average for 2017-2022	Average 2023-2033	Δ of averages
Energy renovation	Residential	1,700 FTES 227 M€	5,200 FTES 707 M€	6,200 FTES 888 M€	7,600 FTES 1 064 M€	2,400 FTES 331 M€	6,700 FTES 925 M€	**+4 300 (x2,8)**
	Tertiary	4,200 FTES 570 M€	6,000 FTES 817 M€	5,200 FTES 718 M€	5,200 FTES 718 M€	4,400 FTES 600 M€	5,700 FTES 785 M€	**+1 300 (x1,3)**
New build	Residential	8,000 FTES 1 088 M€	6,900 FTES 949 M€	6,900 FTES 949 M€	2,000 FTES 283 M€	7,200 FTES 980 M€	5,600 FTES 768 M€	**-1 600 (÷1,3)**
	Tertiary	4,400 FTES 592 M€	4,900 FTES 670 M€	4,300 FTES 599 M€	3,800 FTES 528 M€	5,000 FTES 679 M€	4,300 FTES 599 M€	**-700 (÷1,2)**
Total		**18,400 FTES 2 480 M€**	**23,000 FTES 3 144 M€**	**22,600 FTES 3 155 M€**	**18,600 FTES 2 594 M€**	**19,100 FTES 2 590 M€**	**22,300 FTES 3 077 M€**	**+3 200 (x1,2)**

8.1.5 Main issues identified

Market support

- Optimising the organisation of players and their service offerings in the area of "support for individuals" across the metropolitan area;
- Support for landlords of 87,800 E-F-G homes and analysis of the 60,724 vacant homes;
- Awareness-raising and training for local councillors and technicians, and support for the renovation of public service buildings.

Jobs and skills

- Support for the integration of new groups, particularly women, on worksites: implementation of the MDE plan for industry in the form of awareness-raising initiatives for managers and middle managers;
- Implementation of training methods adapted to professionals (Distantiel, FIT, AFEST, PRAXIBAT);
- Training building professionals in charge of renovation projects in summer comfort, co-activity and airtightness.

A number of good practices have been identified in the region, and these need to be publicised and extended:

- Training for those involved in property transactions (estate agents, property managers, bank advisers and notaries);
- Experimenting with architect-craftsman groupings;
- Helping to increase the number of women in the workforce.

8.2 GREATER LYON AREA

8.2.1 Context

The area covered by the Maison Métropolitaine d'Insertion pour l'Emploi (MMIE) is that of Greater Lyon. This area comprises 59 municipalities and has a population of 1.350 million, of which Lyon and Villeurbanne account for more than half.

In this area, the BUS2 project is steered by the MMIE, a Public Interest Grouping (GIP) with 47 members, the majority of whom are the Greater Lyon Metropolitan Authority, the City of Lyon, the State and Pôle Emploi.

In the Lyon metropolitan area, and more widely in the Rhône and Isère regions, there are a large number of professional associations and training bodies promoting sustainable construction and working to disseminate best practice. Similarly, the Lyon and Grenoble metropolitan areas have strong policies in this area. As a result, it was very difficult to position the BUS2 approach locally, as it appeared to be an addition to those already underway, and thus risked complicating everyone's actions and existing interfaces.

Under these conditions, it was very difficult for the MMIE to mobilise local partners to roll out BUS2 in its area.

8.2.2 Key figures

The survey was carried out in the Lyon metropolitan area, with the help of research consultancies commissioned to work on the project at national level.

81% of the housing stock in the Lyon metropolitan area is made up of multi-family dwellings. It is estimated that, of the 900,000 homes, 120,000 have a DPE rating of F or G, and are therefore considered to be "thermal flats" that should be renovated by 2028[268] .

The tertiary sector covers 35 million m², 78% of which is subject to the tertiary eco-energy decree (28 Mm²). Three quarters of these premises are in the private sector, and the remainder (7 million m²) are in the public sector. 50% of tertiary sector premises have a DPE class D, E, F or G.

In this region, the number of VSEs and auto-entrepreneurs has increased by 68% since 2012. This range of companies accounts for 18,900 of the 19,700 construction companies. Of these companies, 1,191 have an RGE "energy efficiency work" qualification and 134 an RGE "overall renovation" qualification. There is 1 RGE company for every 1,000 inhabitants.

The number of employees, including temporary workers, has risen since 2015, from 45,000 to 52,000 in 2021.

As is the case at national level, there is a major shortage of both skilled companies and labour to meet the challenges of high-performance renovation of the residential and tertiary sectors.

[268] Act no. 2021-1104 of 22 August 2021 on combating climate change and building resilience to its effects

8.2.3 Main issues identified

The MMIE's mission within BUS2 will focus on aggregating and making visible the results and good practices of existing initiatives. In addition, a mapping of the players and their precise roles will be carried out. The aim is to give these players visibility of their actions at national level.

8.3 COMMUNAUTÉ D'AGGLOMÉRATION DU COTENTIN

8.3.1 Context

The Cotentin conurbation, located at the end of the peninsula of the same name, has a population of 182,000. The BUS2 survey of this area was led by the Maison de l'Emploi et de la Formation (MEF) in conjunction with the Communauté d'agglomération, and with the participation of public and private players.

The MEF is an association chaired by Catherine BIHEL, elected member and mayor of Les Pieux. The MEF works in the fields of employment, training and integration. It runs the local Maison de l'Emploi (employment centre), which has been involved in forward-looking management of jobs and skills for over ten years. The Communauté d'agglomération du Cotentin brings together 132 municipalities. One of its areas of responsibility is housing, and as such it runs a housing renovation scheme called "Je Rénov' en Cotentin".

The players involved in BUS2 include representatives of the conurbation, the Normandy Region, the State (DREETS and Rectorat), vocational training providers (Constructys, CFA de Coutances, AFPA) and Pôle Emploi.

The work on the inventory was informed by data supplied by the consortium of consultancy firms, and by discussions organised during two plenary sessions and working groups.

8.3.2 Energy renovation and new construction targets

To ensure that the region meets the target scenario for renovation and new construction, as well as the objectives set by the French government, we need to consider the analyses carried out by the consortium of consultancy firms and the figures that emerge from them. The national targets are applied to the Cotentin conurbation by applying ratios for the Cotentin region or, where applicable, for Normandy as a whole (e.g.: number of energy-efficient renovations to be carried out on single-family homes: national target x (number of MI in Cotentin / number of MI at national level). The final targets for the region between 2022 and 2030 are as follows: 21,000 homes classified G or F should be treated as a priority.

- Every year, more than 2,700 homes and 100,000 m² of commercial buildings would have to be renovated to BBC standards (in order to reduce their energy consumption by 40% by 2030).
- The large-scale deployment of efficient heating and domestic hot water production equipment would mainly involve heat pumps (aerothermal and geothermal), solar heating and individual wood-burning appliances.
- The rate of new housing construction is set to fall sharply from 2022, with the aim of reducing it by a factor of 3 by 2030. This would mean a reduction from 56,000 m² in 2021 to almost 19,000 m² in 2030.

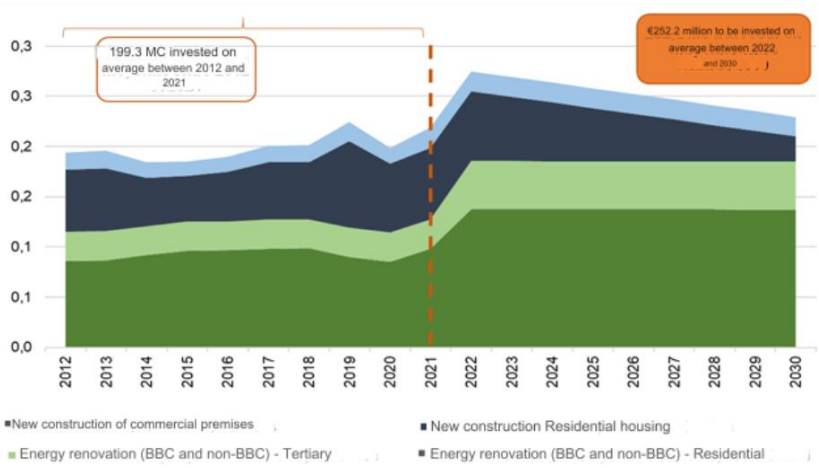
8.3.3 Diagnosis of job requirements

Based on data observed in terms of energy renovation and new construction from 2012 to 2021[269], it is estimated that more than €199 million will be spent on investment and maintenance each year in the Cotentin conurbation.

In order to achieve the objectives set for this area under BUS2, this expenditure would have to increase to €252.2m/year from 2022 until 2030.

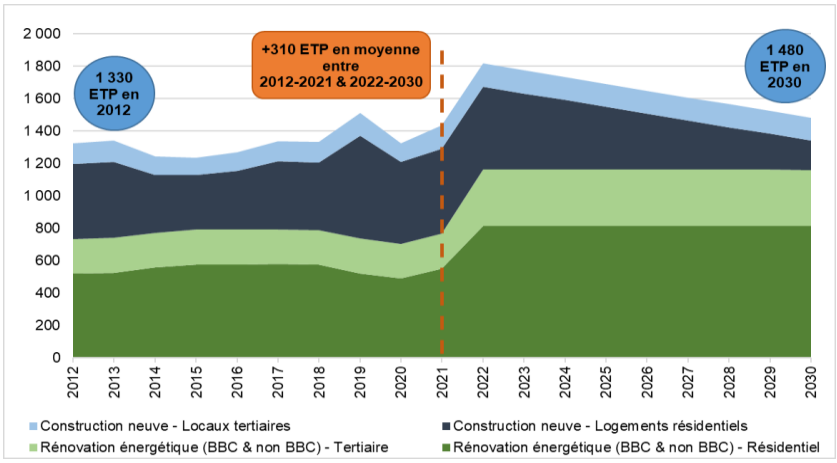
[269] SDES, Sitadel; BBC Effinergie Observatory; National Energy Renovation Observatory (ONRE); Hypothèse In Numeri

Figure 8-4 Communauté d'agglomération du Cotentin: Total expenditure between 2012 and 2030 (€M)



Direct jobs in the building (NAF 41 and NAF 43) and technical support (NAF 71) sectors alone represent an average of 1,340 FTE/year between 2012 and 2021. These direct jobs would increase to an average of 1,650 FTE/year between 2022 and 2030 according to the scenario adopted, representing an additional requirement of 310 FTE over ten years. It can therefore be seen that the increase in direct jobs needed to achieve the energy renovation targets would offset the fall in direct jobs in the new-build segment.

Figure 8-5 Communauté d'agglomération du Cotentin: Direct job requirements in the construction (NAF 41 and 43) and technical support (NAF 71) sectors between 2012 and 2030 (FTE)



- New construction: from 570 direct FTE/year on average between 2012 and 2021 to 490 direct FTE/year on average between 2022 and 2030, i.e. 90 direct FTE less each year (division by 1.2).
- Energy renovation (BBC and non-BBC): from an average of 760 direct FTE/year between 2012 and 2021 to an average of 1,160 direct FTE/year between 2022 and 2030, i.e. 400 additional direct FTE each year (multiplied by 1.5).

8.3.4 Main issues identified

The first observation is that there is an abysmal gap between the scenario adopted for BUS2, the current rate of construction and the renovation programme currently underway.

The attractiveness of the building trades is a major problem, which has consequences for demand for training (with sessions cancelled, for example) and for recruitment.

The overloading of contractors is resulting in increasingly long lead times for work.

Finally, "best practices" are likely to be developed in the region:

- BBC renovators (scheme run by the Normandy Region);
- The "BTP" scheme to help develop an interest in the building trades (to be implemented in 2024);
- The "ecoconstruction worker" diploma course to be set up in Cherbourg in 2024;
- Recruitment and training methods such as those used by the Coutances CFA or Bouygues ;
- Actions taken by the conurbation to promote recruitment.

8.4 CAMBRÉSIS REGION

8.4.1 Context

The semi-rural area of Cambrésis, in the Hauts-de-France region, has a population of 162,000. The BUS2 assessment was led by Cambrésis Emploi, with the active support of the Syndicat mixte du Pays du Cambrésis and the participation of a wide range of stakeholders. Cambrésis Emploi is a local association chaired by an elected representative appointed by his or her peers. It works in the fields of professional integration, training and employment. It runs an Employment Centre.

The Syndicat mixte du Pays de Cambrésis is a public body run by a board representing the three intercommunal bodies (2 agglomeration communities and 1 community of communes). A technical team carries out missions in the following areas: town planning, housing, local development, environment, climate and energy.

The stakeholders involved included elected representatives (including mayors of small towns), business leaders, representatives of the Public Employment Service and Constructys, etc. These different players had taken part in the development of the "Support for Prospective Dialogues - SDP", co-piloted by ADEME and the Maison de l'Emploi in 2021/2022. This resulted in an action plan that is currently being implemented.

8.4.2 Energy renovation and new construction targets

To ensure that the region meets the target scenario for renovation and new construction, as well as the objectives set by the French government, we need to consider the analyses carried out by the consortium of consultancy firms and the figures that emerge from them. The national targets are applied to the Cotentin conurbation by applying ratios for the Cambrésis region or, where applicable, the Hauts-de-France region (e.g.: number of energy-efficient renovations to be carried out on single-family homes: national target x (number of MI in the Cambrésis region/number of MI at national level). In the end, the objectives for the region between 2022 and 2030 are as follows:

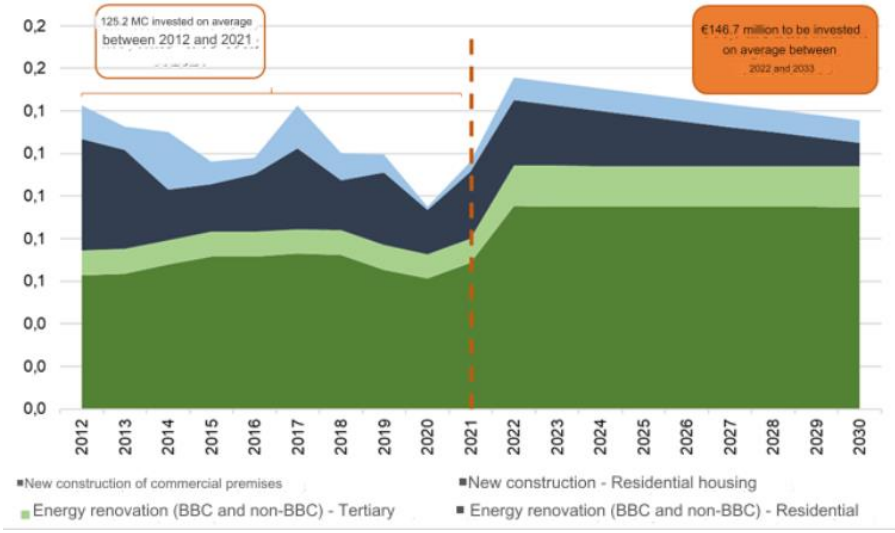
- Each year, renovation of 2,100 homes to BBC standards and 41,000 m² of commercial buildings;
- The large-scale deployment of efficient heating and domestic hot water production equipment would mainly involve heat pumps (aerothermal and geothermal), solar heating and individual wood-burning appliances.
- The rate of new housing construction is set to fall sharply from 2022, with the aim of reducing it by a factor of 3 by 2030. This would mean a reduction from more than 24,000 m² in 2021 to 8,000 m² in 2030.

8.4.3 Diagnosis of job requirements

Based on the data observed in terms of energy renovation and new construction from 2012 to 2021[270] , it is estimated that more than €125 million will be spent on investment and maintenance each year in the Cotentin conurbation.

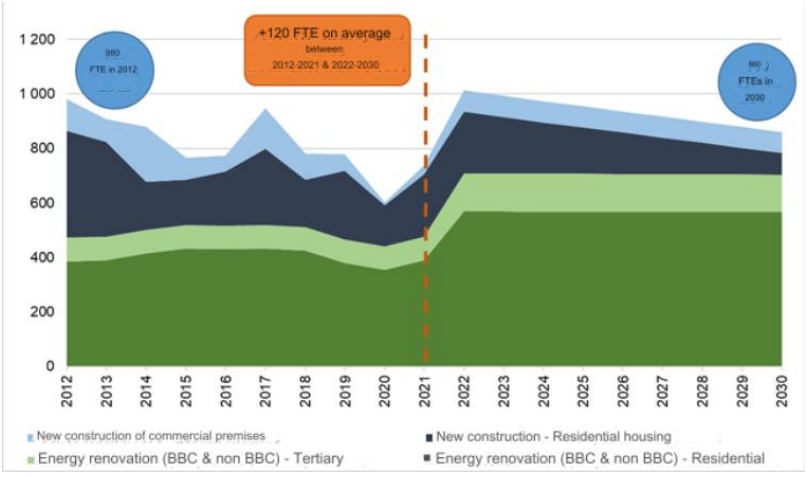
In order to achieve the objectives set for this area under BUS2, this expenditure would have to increase to €146.7m/year from 2022 until 2030.

Figure 8-6 Cambrésis region: Total expenditure between 2012 and 2030 (€M)



Direct jobs in the building (NAF 41 and NAF 43) and technical support (NAF 71) sectors alone represent an average of 820 FTE/year between 2012 and 2021. These direct jobs would increase to an average of 940 FTE/year between 2022 and 2030 depending on the scenario adopted, representing an additional requirement of 120 FTE over ten years. It can therefore be seen that the increase in direct jobs needed to achieve the energy renovation targets would offset the fall in direct jobs in the new-build segment.

Figure 8-7 Cambrésis region: Direct job requirements in the building (NAF 41 and 43) and technical support (NAF 71) sectors between 2012 and 2030 (FTE)



[270] SDES, Sitadel; BBC Effinergie Observatory; National Energy Renovation Observatory (ONRE); Hypothèse In Numeri

- New construction: from an average of 330 direct FTE/year between 2012 and 2021 to an average of 230 direct FTE/year between 2022 and 2030, i.e. around 100 fewer direct FTE each year (1.4-fold reduction).
- Energy renovation (BBC and non-BBC): from 490 direct FTE/year on average between 2012 and 2021 to 710 direct FTE/year on average between 2022 and 2030, i.e. 220 additional direct FTE each year (multiplied by 1.4).

8.4.4 Main issues identified

During the working groups, the various discussions focused mainly on the following points:

- Some local councillors are unfamiliar with the renovation of municipal services and the public support schemes available (CEE; ACTEE +; Green Fund);
- The trial of 5 GMF-type house renovations (5,500 built) and the action undertaken by the Pays ;
- Issues of trust and communication;
- Optimising the "Pass Rénovation" scheme and the work of the Régie du Service Public de l'Efficacité Énergétique (SPEE);
- Increasing the skills of companies and the "training charter" project;
- Collection and treatment of site waste;

The roadmap and action plan for the Cambrésis region will be drawn up in September. The key points discussed will be taken into account.

9 BRAKES TO BE LIFTED

The study shows that to ensure a good match between the market and employment in the building sector for issues relating to environmental performance, it will be necessary to remove certain obstacles linked to the development of demand for renovation performance, recruitment, the retention or retraining of workers and skills upgrading.

9.1 OBSTACLES TO THE DEVELOPMENT OF DEMAND FOR RENOVATION PERFORMANCE

Renovation is an efficient process (achieving DPE class A or B) under certain conditions. It requires a detailed study of the work to be carried out, as well as the skills and coordination of the various professionals involved and the work to be carried out. However, high-performance renovation is not currently a priority for private individuals, and there are a number of obstacles to the development of demand.

In private homes :

- The higher cost compared with conventional work is a disincentive and is not necessarily offset by the grants, which are perceived as being too complex to understand and difficult to obtain;
- Energy audits and project management can be difficult to obtain funding for (assistance is available mainly at local level, but only in certain areas), and private individuals do not immediately see these expenses as a cost associated with the work, and therefore do not necessarily wish to pay for them;
- The financial package involving bank loans is complex, and the debt ratio criterion for granting loans does not take into account the savings generated by the work;
- There is still a lack of confidence in support schemes and professionals, particularly as a result of scams and poor workmanship;
- It remains difficult to find qualified companies to carry out all the work;
- The inconvenience and nuisance caused by major work on all the elements of a house and the possible need to relocate discourage private individuals from embarking on a comprehensive renovation project.

In the tertiary sector, the main obstacle is a lack of awareness of the issues among stakeholders, including local councillors and their technical departments in the case of public buildings. In the private sector, players may feel that they have little to do with the issue, particularly if they are not subject to the tertiary sector eco-energy scheme.

9.2 BARRIERS TO RECRUITING AND RETAINING EMPLOYEES IN THE SECTOR

Although none of the building and civil engineering trades has benefited from a DGEFP tension reduction plan, the sector is suffering from recruitment difficulties as perceived by companies. This study highlights several obstacles to resolving these tensions.

The main obstacle to large-scale recruitment, identified by the players involved, is the lack of appeal within the industry. At present, training courses are struggling to attract applicants. Working conditions are also a major factor contributing to this lack of appeal, an aspect that is moreover anticipated by apprentices and students right from the initial training phase. These conditions are described as demanding and physically taxing, often performed outdoors, with working hours that are not conducive to family constraints, which frequently lead to incapacity before the legal retirement age. Pay levels are frequently perceived as inadequate.

In addition to the lack of attractiveness, the difficult working conditions and unfavourable image from which the sector suffers are reinforced throughout training and during the first year of professional practice. Indeed, the rate of students (including apprentices) leaving the education system without obtaining a diploma was 27% in 2016, compared with a rate of 13% for other courses. What's more, only 44% of young people who trained in the building and civil engineering sector began their careers with their first job in the sector, a percentage that falls to 39% after three years. These figures clearly illustrate that the attraction of this sector is not merely an external perception, but is in fact a discouraging professional reality for a significant proportion of students and young workers. Improving working conditions and pay is therefore the key to ensuring that the jobs needed to achieve our objectives are filled on a sustainable basis.

Over and above the material conditions, the construction sector has experienced, and continues to experience, a lack of recognition of its societal and environmental impact. Many stakeholders in secondary schools and higher education establishments have identified a desire among teenagers and young adults to move into meaningful professions in a rapidly changing world. From this perspective, the building industry, particularly through energy renovation, could benefit from a positive and meaningful general perception because of its ability to contribute to the ecological transition, but this is not yet the case.

The demand for labour cannot be met solely by bringing young graduates onto the market, given the considerable amount of time young people spend in training. It is crucial to diversify recruitment sources:

- Cross-industry reconversions: new construction can serve as a pool of experienced and skilled labour to fill certain positions. However, this transition implies a strengthening of skills at both company and employee level, as well as a reorganisation of activity in line with current challenges. With this in mind, it makes sense to identify the trades most affected by the decline in new construction, and to design specific training programmes to facilitate these professional transitions. While foreign workers are heavily involved in new-build projects, they can also play a major role in stepping up renovation projects. It would therefore be appropriate to develop specific programmes aimed at foreign workers, to train them specifically in the challenges of renovation.

- Professional retraining: recruitment can also come from industrial sectors outside the industry, thus attracting professionals undergoing retraining. This type of initiative is still marginal, but a number of initiatives are promoting retraining by emphasising the beneficial role of the building trades and energy renovation in particular. At the crossroads of improving working conditions and the image of a sector perceived as traditional and out of touch with contemporary issues, the building sector also faces difficulties in attracting women. Actively promoting female participation in this field requires a thorough review of the perception of these trades, as well as efforts to provide an inclusive, non-discriminatory and equitable environment.

9.3 BARRIERS TO SKILLS DEVELOPMENT

The need to improve skills involves both initial training, including apprenticeships, for new entrants, and continuing training tailored to the constraints of professionals in the construction and related sectors.

The building trades most affected by the need for energy-efficient renovation work are : Unskilled building finishers, skilled painters and building finishers, as well as bricklayers for the shell, and plumbers, heating engineers and electricians for the installation of equipment.

The propensity of companies to train their employees is variable, unsystematic and uneven. Continuing training schemes need to be adapted to the constraints of companies and professionals.

Existing training courses and schemes are inadequate in size

Training courses and initiatives to prepare professionals to upgrade their skills in the area of ecological transition do not seem to be sufficiently geared to the immediate challenges and are not always adapted to professionals and the diversity of companies.

Initial training

- Baccalaureate courses are just beginning to incorporate the challenges of the energy transition, and changes in the names of courses are incorporating the fields of renewable energy, energy efficiency and sustainable development.
- Vocational courses take little or no account of these issues.
- However, it can take several years for training courses to change.
- Trainers working upstream of young people's initial training (in particular those in charge of SEGPA classes) are not sufficiently recognised (even though they play an essential role in the acquisition of basic skills and guidance).
- Trainers are still too focused on job-specific references, and do not include energy efficiency and co-activity aspects.

Continuing education :

- Very few professions involve a change in skills or an improvement in knowledge.
- Many of these new skills can be acquired via existing training courses in the areas observed, or via additional modules.
- Key training courses are still lacking, such as external thermal insulation and the use of new materials.
- the employment and skills development commitment agreements (EDEC) concluded at national level with the construction industry include very little about the ecological transition.
- However, new professional qualifications linked to the ecological or digital transition have recently appeared, such as the "BIM manager" qualification, and qualifications relating to emerging professions should benefit from an exemption procedure for their registration in the national register of professional qualifications (RNCP).
- Companies have little availability for training other than compulsory training
- Business leaders expect a return on investment from training for an existing, profitable market.
- Training is generally funded, but the time spent on training is not financially compensated
- The training on offer does not always correspond to the needs and constraints of companies.

Although other initiatives are trying to adapt to the constraints of companies and fill the gap in existing training courses

- The RGE "worksite by worksite" scheme,
- Since 2018, AFEST (Action de formation en situation de travail - on-the-job training action) has enabled professionals to enhance their skills on their worksites by enhancing the professional practices of an employee/learner through a trade expert.
- FIT (work-integrated training), which aims to train building professionals by equipping worksites with teaching platforms.
- Several training sites for building with bio-sourced materials
- Training programmes for property professionals and trustees.

A number of obstacles to increasing the skills of industry professionals have been identified:

- The difficulty for small companies or craftsmen to free up time to devote to training in addition to that which is already compulsory;
- Training materials and formats do not match the needs and skills of professionals;
- The budget loss associated with off-site training ;
- Lack of training for trainers;
- The poor reputation and perception of the RGE scheme means that it needs to be consolidated to ensure that the volume of qualified companies is in line with the quality of renovation work.
- Price competition, which can thwart the quest for quality and therefore for skills upgrading
- A shortage of trainers with both site skills and teaching skills.

10 CONCLUSION

This shared diagnosis has made it possible to identify the areas of work that should structure the co-construction of the roadmap:

Priority 1: Support demand for efficient renovation.

- The widespread adoption of high-performance renovation is a necessity, and can only be achieved by mobilising and coordinating all the players in the building sector. We must also continue to convince homeowners and occupants of the importance and benefits of this type of renovation, which is more cumbersome and more restrictive for them.
- In addition to the energy and carbon aspects, which for the moment remain the main legislative issues surrounding renovation, comprehensive, high-performance renovation must take into account adaptation to climate change, the circular economy and the emergence of bio-sourced materials. However, this massive increase in high-performance renovation must not be achieved at the expense of France's rich heritage and architectural heritage. The renovation of buildings must also be able to provide a response to the challenges of bringing homes up to standard and deteriorating, with limited out-of-pocket expenses for households on modest incomes, in the interests of social justice.
- In the residential sector, these aspects can only be addressed by providing owners with technical, financial and human support. Owners of condominiums must have access to specific support schemes.
- In the commercial sector, the recent introduction of obligations to optimise and reduce energy consumption is encouraging building owners to take an interest in energy issues. However, the stakes and resources involved are not the same for small commercial buildings, public service buildings and private property. The human and financial support systems for these different target groups need to be strengthened.

Priority 2: Encourage the recruitment and retention of workers in the sector

- Renovation targets imply a significant need for jobs in the building sector, with almost 200,000 additional FTEs by 2030. In the desired scenario of comprehensive, high-performance housing renovation, 80% of these jobs would involve the renovation of residential buildings.
- However, this sharp rise in demand for labour cannot be met by recent graduates or apprentices alone. So we need to attract new profiles or retrain workers from other sectors and upgrade the skills of professionals in the industry. This is a key challenge, but there are a number of obstacles to overcome if the necessary renovation volumes are to be achieved. The image, attractiveness and working conditions of the sector need to be improved if it is to be seen as a key sector in the energy and environmental transition, and therefore a meaningful one.
- One of the challenges for employment in the sector is the major changes that are taking place, and will continue to take place, in the new-build sector: new environmental requirements, potential reduction in demand for new buildings. These changes need to be anticipated in order to support the career development of new construction professionals.

Priority 3: Developing training

While training in energy-related issues has been structured over the last ten years, particularly through the RGE scheme, training in new environmental issues is still in the early stages of development. Global renovation requires a strengthening of skills in terms of support for project owners and coordination on the building site. The main obstacles identified are the inadequate training of trainers and the diversity of working methods, particularly between new build and renovation, and between large and small companies.

Apprenticeships represent an important training pool for the sector, particularly for small businesses, which are the first to take on apprentices. Ongoing training also varies according to the size of the company, with small companies having less scope to send their employees on training courses. It might therefore be appropriate to devise new incentives for training, some of which could be dedicated specifically to small businesses (covering the costs of training, or even remunerating the company, for example).

In response, local initiatives are emerging to provide support for workers directly on the worksite or in their working environment. One of the challenges is to encourage this kind of approach so that it can be duplicated and then rolled out more widely.

Priority 4: Managing the roadmap

The proliferation of national policies on the energy and environmental transition of buildings, and the accumulation of regulations, creates an impression of instability for players in the sector, preventing them from establishing a long-term vision for their stakeholders, and therefore undermining their investment in the necessary transition process.

On a regional scale, certain initiatives seem to be able to meet local labour needs in line with the specific characteristics of the region. There is a strong need for national policies to support these initiatives so that they can be sustained and transferred to other regions. The added value of these schemes at local level needs to be recognised in national strategies, which could draw more on regional and local knowledge and expertise. However, it will be necessary to overcome the obstacles associated with changes of scale. The assumption of responsibility by local and regional authorities for these training issues will have to be combined with an increase in the skills of elected representatives and local authority technical departments.

The steering of the roadmap must be prepared as soon as it is co-constructed, so that it can be operational from April 2024. Steering will make it technically and financially possible to implement the proposals drawn up in BUS2 for measures to meet the ecological and employment challenges, and in particular to scale up certain measures.

The BUS2 roadmap will have to respect three main principles:

- Take advantage of the opportunities offered by the necessary transition in the building sector to enrich the proposals in terms of jobs;
- Take regional and sub-regional decisions into account when defining national decisions;
- Match concrete and/or field actions to the need for further studies.

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13 LIST OF ACRONYMS

3E	Eco-construction and energy efficiency
ACI	Integration workshop and site
ACTEE	Action by local and regional authorities to promote energy efficiency
LCA	Life cycle analysis
ADEME	Ecological Transition Agency
AFEST	On-the-job training
AFNOR	French Standards Association
AFPA	National Agency for Adult Vocational Training
AFPAC	French Heat Pump Association
AFPG	French association of geothermal energy professionals
AFPOLS	Association pour la formation professionnelle continue des organismes de logement social (Association for continuing vocational training for social housing organisations)
AGEC	Anti-waste for a circular economy
AIDEE	Inter-professional association for the development of energy efficiency
AIJ	Intensive support for young people
AIMCC	French Association of Construction Industries and Products
AIPR	Authorisation to work near networks
AMI	Call for expressions of interest
AMO	Project management assistance
ANAH	National Housing Agency
ANCOLS	National Social Housing Control Agency
ANRU	National Agency for Urban Renewal
AOCDTF	Workers' Association of the Companions of Duty and the Tour de France
APL	Personalised housing assistance
AQC	Quality construction agency
ARA	Assisted self-renovation
AREC	Regional energy-climate agency
ATEE	Energy-Environment Technical Association
AVE	Alliance villes emploi
BACS	Building automation and control systems
BAR TH	Thermal residential building
BBC	Low-energy building
BDNB	National buildings database
BEP	Brevet d'études professionnelles
BIM	Building information *modelling*
BM	Master's degree
BPI	Public investment bank
BRC	Summary of contributions
BT	Low temperature
BTM	Technical trade certificate
BT(n)	Technological baccalaureate
BTP	Building and civil engineering
BTS	Advanced Technician Certificate
BUS	Build up skills
GOAL	University Bachelor of Technology
C2P	Professional prevention account

CACES	Certificate of aptitude for driving machinery safely
CAF	Caisse d'allocation familiale
CAH	Home Improvement Club
CAP	Certificate of vocational aptitude
CAPEB	Confederation of Craft and Small Building Companies
CARIF-OREF	Centre d'animation et de ressources de l'information sur la formation - Regional employment and training observatory
CAUE	Architecture, town planning and environment council
CC	Condensing boiler
CCCA-BTP	Comité de concertation et de coordination de l'apprentissage du bâtiment et des travaux publics (consultation and coordination committee for apprenticeships in the building and public works sector)
CD2E	Eco-enterprise Development Centre
CDC	Caisse des dépôts et consignations
CDD	Fixed-term contract
OPEN-ENDED CONTRACT	Open-ended contract
CEE	Energy savings certificate
EYC	Youth commitment contract
CEP	Shared energy council
CERC	Regional economic unit for the construction industry
CEREMA	Centre d'études et d'expertise sur les risques, l'environnement, la mobilité et l'aménagement (Centre for studies and expertise on risks, the environment, mobility and development)
CEREN	Centre for Economic Studies and Research on Energy
CES	Solar water heaters
CESC	Collective solar water heaters
EESC	Economic, Social and Environmental Council
CESI	Individual solar water heaters
CET	Thermodynamic water heater
CET	Clean energy transition
CFA	Apprentice training centre
CGDD	General Commission for Sustainable Development
CGT	General Confederation of Labour
CIM	City information modeling
CITE	Tax credit for energy transition
CLAP	Local knowledge of the production system
CMA	Chamber of Trades and Crafts
CN	National accounting
CNAM	Conservatoire national des arts et métiers
CNOA	National Association of Architects
COFRAC	French Accreditation Committee
CORIF	Research, engineering and training consultancy (for equality between women and men)
CPE	Energy performance contract
CPF	Personal training account
CPNE	National Joint Employment Committee
CQP	Certificate of professional qualifications
CREBA	Resource centre for the responsible renovation of old buildings
CREP	Lead exposure risk report
CSTB	Scientific and technical centre for the building industry
CUI-CIE	Contrat unique d'insertion - Employment initiative contract
HVAC	Heating, ventilation, air conditioning
DCE	Company consultation file

DDETS	Departmental Directorate of Employment, Labour and Solidarity
DEA	State Diploma in Architecture
WEEE	Waste electrical and electronic equipment
DEET	Decree or tertiary eco-energy scheme
DGALN	Directorate-General for Planning, Housing and Nature
DGCCRF	Directorate-General for Competition, Consumer Affairs and Fraud Control
DGE	Directorate-General for Enterprise
DGEFP	General Delegation for Employment and Vocational Training
DH	Degree Time
DHUP/QC	Direction de l'habitat, de l'urbanisme et des paysages - Quality and sustainable development in construction
DIE	Domestic expenditure on education
DMA	Diplôme des métiers d'art
DN MADE	Diplôme national des métiers d'art et du design (National Diploma in Art and Design)
DNB	Diplôme national du brevet
DOE	File of executed works
ECD	Energy performance diagnostics
DREAL	Direction régionale de l'environnement, de l'aménagement et du logement (Regional directorate for the environment, planning and housing)
DREETS	Regional Department for the Economy, Employment, Labour and Solidarity
DROM	Overseas departments and regions
DSDEN	Departmental Education Services Directorate
DSN	Nominative Social Declaration
DUT	University diploma in technology
DHW	Domestic hot water
ECTS	European credit transfer system
EDEC	Commitment to developing employment and skills
EDF	Électricité de France
EI	Integration company
ELAN	Housing, planning and digital developments
ENIC-NARIC	European network of information centers - National academic recognition information centers
ENPC	École nationale des ponts et chaussées
ENSA	École nationale supérieure d'architecture
ENSAP	National Higher Schools of Architecture and Landscape Design
EPCI	Public institution for inter-municipal cooperation
EPIC	Public industrial and commercial establishment
ERP	Establishments open to the public
ESANE	Production of annual business statistics
ESSEC	École supérieure des sciences économiques et commerciales
ESTP	École spéciale des travaux publics
ETAM	Employees, technicians and supervisors
FTE	Full-time employment
BE	Energy Transition School
ETRIER	Energy, transition, rural, idea, desire, renovation
ETTI	Entreprise de travail temporaire d'insertion
EY	Ernst & Young
FAF(CEA)	Training insurance fund (for heads of craft businesses)
FAP	Professional family
FDME	Federation of distributors of electrical and HVAC equipment
SDS	Safety data sheet

FEEBAT	Training in energy savings in buildings
FFA	French Insurance Federation
FFB	French Building Federation
FIF PL	Interprofessional training fund for liberal professionals
FIT	Work-based training
FLORES	Fichier Localisé des Remunerations et de l'Emploi Salarié (Local remuneration and salaried employment file)
FMDC	Federation of Building Materials Distributors
FNAS	Fédération des négociants en appareils sanitaires, chauffage, climatisation et canalisations (Federation of plumbing, heating, air-conditioning and pipework merchants)
FNCCR	Fédération nationale des collectivités concédantes et régies (National Federation of Local Authorities)
FNCMB	Fédération nationale compagnonnique des métiers du bâtiment
FNSCBA	National Federation of Employees in the Construction, Wood and Furniture Industries
FNTP	National Federation of Public Works
GEIQ	Employers' groups for integration and qualification
GEM	Operations and maintenance management
GHG	Greenhouse gases
GIE	Ecological interest group
GIP	Public interest group
GPEC	Forward-looking management of jobs and skills
GRETA	Group of establishments
GSB	DIY superstores
HLM	Low-rent housing
HMONP	Authorisation to act as project manager in its own name
HOPE	Accommodation, guidance, pathways to employment
HQE(-GBC)	High environmental quality (-Green building challenge)
I4CE	Institute for Climate Economics
IAE	Economic activity integration
IC	Carbon index
ICERT	Certification institute
IDDRI	Institute for Sustainable Development and International Relations
INSEE	French National Institute for Statistics and Economic Studies
LTECV	Energy transition law for green growth
MAC	Senior apprentice master
MADEC	Employment and Skills Anticipation and Development Mission
MAR	My Renovator
MASH	Shared purchasing for housing
MC	Additional qualification
MDE	Job centre
MEF	Employment and training centre
MI	Detached house
MMIE	Metropolitan integration centre for employment
MOA	Project owner
MOOC	Massive open online course
MPR	MaPrimeRénov'
Mt	Million tonnes
MTES	Ministry of Ecological Transition and Solidarity
NAF	Nomenclature of French activity
NOTRe	New territorial organisation of the republic
NZC	Net zero carbon

OECD	Organisation for Economic Co-operation and Development
OMBREE	Overseas for resilient, energy-efficient buildings
ONERC	National observatory on the effects of global warming
NGO	Non-governmental organisation
ONRE	National Energy Renovation Observatory
OPCA	Organisme paritaire collecteur agréé
OPCO	Skills operator
OPERAT	Observation of energy performance, renovation and actions in the tertiary sector
OPIIEC	Joint Observatory for Digital, Engineering, Consultancy and Environmental Professions (Observatoire paritaire des métiers du numérique, de l'ingénierie, du conseil et de l'environnement)
OPPBTP	Professional body for prevention in the building and public works sector
OPQIBI	Professional body for building industry engineering qualifications
OSCAR	Optimising and simplifying EWCs for renovation contractors
PAC	Heat pump
PACA	Provence-Alpes-Côte d'Azur
PACEA	Contractual support pathway to employment and independence
PBD	Green Building Plan
PCAET	Territorial climate-air-energy plan
PCRH	Human resources consultancy services
PDM	Mobility plan
PEC	Employment and skills pathways
PEMD	Products, equipment, materials and waste
GDP	Gross domestic product
PIC	Skills investment plan
PLAI	subsidised integration loan
PLH	Local housing plan
PLI	Intermediate rental loan
PLS	Social rental loan
PLU	Local urban development plan
PLUi	Inter-communal local town planning plan
PLUS	Social rental loan
SMES	Small and medium-sized businesses
NRP	Regional nature park
NRRP	National recovery and resilience plan
POE	Operational preparation for employment
POEC	Collective operational preparation for employment
PPE	Multiannual energy programming
PPT	Multi-year works plan
PREE	Regional energy efficiency plan
PROFEEL	Sector programme for innovation to promote energy savings in buildings and housing
PTNB	Digital transition plan for the building industry
PTZ	Interest-free loan
PV	Photovoltaic
PVC	Polyvinyl chloride
QPV	Priority neighbourhood for urban policy
R&D	Research and development
RAC	Climate Action Network
RAR	Renovation assistance referent
CPR	Representative concentration *pathway*

RE	Energy regulations
RECIF	Renovation of condominium buildings in France
REP	Extended producer responsibility
RGA	Clay shrinkage and swelling
RGE	Recognised as an environmental guarantor
HR	Human resources
RNCP	National Register or Directory of Professional Certifications
RT	Thermal regulations
SARE	Energy renovation support service
SCOT	Territorial coherence plan
SDES	Statistical Data and Studies Department
SDIE	Property energy master plan
SDP	Support for forward-looking dialogues
SERAFIN	Territorial renovation, support and financing service
SEREINE	Solution for assessing the intrinsic energy performance of buildings
SEVS	Green and inclusive economy department
SFEC	French strategy for energy and climate
SGPE	General Secretary for Ecological Planning
SMIC	Minimum growth wage
SNBC	National low-carbon strategy
SPEE	Public service for energy efficiency
SPPEH	Public housing energy performance service
SRADDET	Regional plan for spatial planning, sustainable development and territorial equality
SRCAE	Regional climate-air-energy plan
SSC	Combined solar system
SST	First aid at work
STF	Third-party financing company
STI2D	Sciences and technologies for industry and sustainable development
STS	Higher Technician Section
TD	Tutorial
TE	Energy transition
TEE	Energy efficiency rate
HEAD	Ecological transition, territories, jobs
TFPB	Property tax on built-up properties
THPE	Very high energy performance
TICREF	Conventional reference indoor temperature
TP	Practical work
TP	Professional designation
VSES	Very small company
TREMI	Energy renovation work on single-family homes
VAT	Value added tax
UCF-CIBTP	Union des caisses de France - Temporary sick leave in the building and public works sector
UNMFREO	Union nationale des maisons familiales rurales d'éducation et d'orientation (National Union of Rural Family Homes for Education and Guidance)
UNSFA	National Union of French Architects' Unions
URSSAF	Union de recouvrement des cotisations de sécurité sociale et d'allocations familiales (Union for the collection of social security and family allowance contributions)

USH	Union sociale pour l'habitat
UTCATF	Land use, land-use change and forestry
VAE	Validation of acquired experience
ZAN	Zero net artificial development

14 APPENDICES

APPENDIX 1: OVERALL METHODOLOGY FOR ESTIMATING EXPENDITURE AND JOBS USING THE TETE TOOL

Produced by the Climate Action Network (RAC) and ADEME, the TETE (Transition Écologique - Territoires - Emplois) tool estimates the number of jobs (direct and indirect) created through energy transition policies in a given territory for each year.

The version of the tool used for BUS2 is version 3, which will go online in 2022. This version includes around fifteen sectors in the building sector and efficient heating and DHW equipment using renewable energy. In order to be as exhaustive as possible, other missing sectors are being added to the tool. Where the available data allows, the sectors are broken down as far as possible (single-family homes, multi-family housing, tertiary sector).

As far as equipment is concerned, the initial version of TETE takes account of the entire sector (equipment installed in new buildings and renovation work). Where possible, the sector is split in two, with the part of the equipment installed in new buildings and the part of the equipment installed in renovation projects. This makes it possible to estimate FTEs and then present the trades required by segment (new build/energy renovation).

The table below shows all the sectors studied as part of BUS2. The channels or parts in blue represent the additions and refinements made to the initial version of the TETE tool.

Annex 1.1: Energy renovation

- Energy-efficient (BBC) renovation of single-family homes
- Energy-efficiency (BBC) renovation of collective housing
- Energy renovation (BBC and non-BBC) of tertiary premises covered by the RE2020 (hotel accommodation, offices, shops, public service and general interest buildings)

Annex 1.2: New construction

- New construction of single-family homes
- New-build multi-family housing
- New construction of tertiary premises

Appendix 1.3. Heating, domestic hot water, air conditioning and ventilation equipment

- Photovoltaics on small roofs / Residential sector / New build
- Photovoltaics on small roofs / Residential / Renovation
- Photovoltaics on medium and large roofs / Commercial sector / New build
- Photovoltaics on medium and large roofs / Commercial / Renovation
- Solar water heaters (CESI and SSC) / Single-family homes / New build
- Solar water heaters (CESI and SSC) / Single-family homes / Renovation work
- Solar water heaters (CESC) / Collective housing / New build
- Solar water heaters (CESC) / Collective housing / Renovation
- Geothermal heat pumps / Single-family homes / New build
- Geothermal heat pumps / Single-family homes / Renovation
- Geothermal heat pumps / Collective housing / New build
- Geothermal heat pumps / Collective housing / Renovation
- Geothermal heat pumps / Tertiary sector / New build
- Geothermal heat pumps / Tertiary sector / Renovation
- Air-source heat pumps / Single-family homes / New build
- Air-source heat pumps / Single-family homes / Renovation
- Single-split air-to-air heat pumps for air conditioning / Single-family homes / New build
- Single-split air-to-air heat pumps for air conditioning / Single-family homes / Renovation
- Single-split air-to-air heat pumps for air conditioning / Multi-family housing / New build
- Single-split air-to-air heat pumps for air conditioning / Multi-family housing / Renovation
- Thermodynamic water heaters / Single-family homes / New build
- Thermodynamic water heaters / Single-family homes / Renovation
- Individual wood-burning appliances / Single-family homes / New build
- Individual wood-burning appliances / Single-family homes / Renovation work
- Biomass boilers / Tertiary sector / New build
- Biomass boilers / Tertiary sector / Renovation
- Gas condensing boilers / Single-family homes / New build
- Gas condensing boilers / Single-family homes / Renovation
- Gas condensing boilers / Multi-family housing / New build
- Gas condensing boilers / Multi-family housing / Renovation
- Other low-efficiency equipment * / Single-family homes / Renovation work
- Ventilation / Single-family homes / New build
- Ventilation / Single-family homes / Renovation
- Ventilation / Multi-family housing / New build
- Ventilation / Multi-family housing / Renovation

Appendix 1.4: Insulation

- Internal insulation / Single-family homes
- External insulation / Single-family homes
- Roof insulation / Single-family homes
- Insulation / Multi-family housing

Appendix 1.5. Openings (doors and windows)

- Replacement of openings / Residential sector
- Replacement of openings / Non-residential sector (tertiary)
- Fitting openings in new build / Residential sector
- Installation of openings in the new-build / Non-residential sector (tertiary)

For each of these sectors, a large amount of data is being collected for the 2012-2021 period:

- Physical data: number of m² or dwellings to be renovated; number of m² or dwellings to be built; number of facilities to be installed and number of facilities;
- Unit investment costs and their breakdown by activity (BBC and non-BBC renovation, installation of equipment and joinery, insulation work, studies and technical support) and maintenance costs.

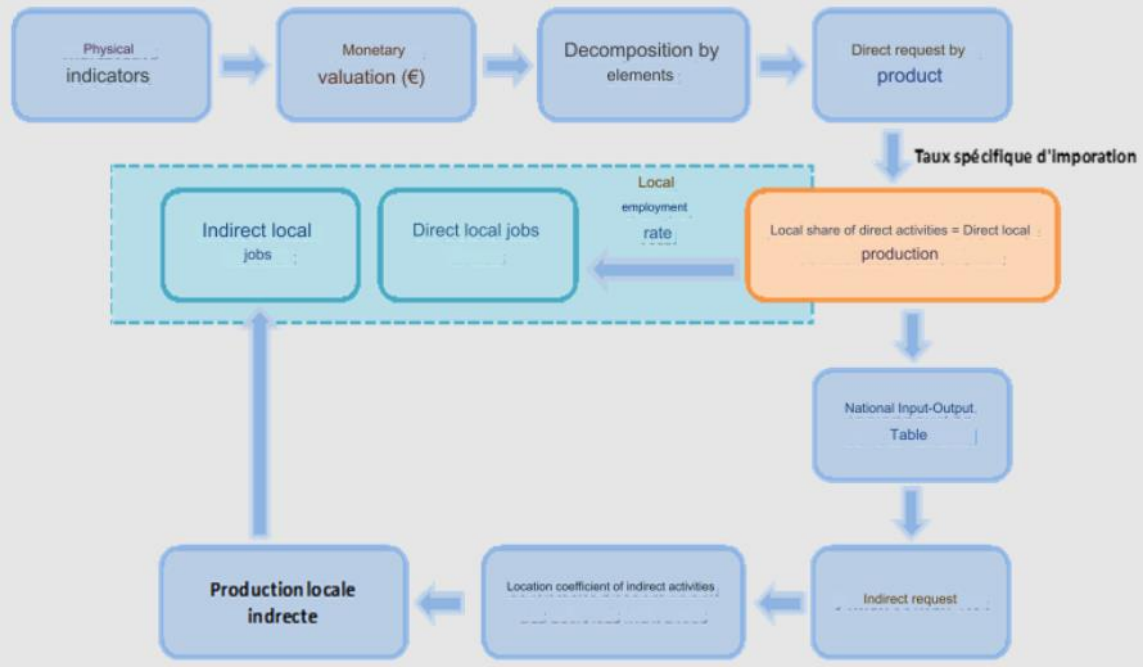
The first step is to use TETE to calculate the **total expenditure** required to carry out each action:

- For the "investment" part, based on annual physical units ~ annual physical data x unit investment cost ;
- For the "maintenance and servicing" section, starting with the number of items of equipment ~ cumulative physical data x unit cost of maintenance and servicing.

These two items of expenditure are broken down by component, corresponding to activities identified in the activity nomenclature. A national production rate is applied to each item of expenditure. This is either the rate calculated on the basis of the national accounts, or a specific rate set according to expert opinion or the results of specific surveys. The result is national output, which corresponds directly to the demand for investment or for the products and services used in maintenance.

The direct and indirect jobs corresponding to this production are then calculated. In the end, we isolate the **direct jobs** by element of the value chain, allowing them to be divided between investment activities and operation-maintenance activities (permanent jobs that cannot be relocated). These direct jobs are then translated into jobs.

Figure 14-1 Diagram showing the quantification of direct and indirect expenditure and employment using the TETE tool



APPENDIX 2: CONVERSION OF DIRECT JOBS INTO TRADES - ENERGY RENOVATION AND NEW CONSTRUCTION AS A WHOLE

Figure 14-2 Trades (investment and maintenance) to be mobilised for energy renovation (residential and tertiary sectors) over the observed period (2012-2021) and the prospective period (2022-2030)

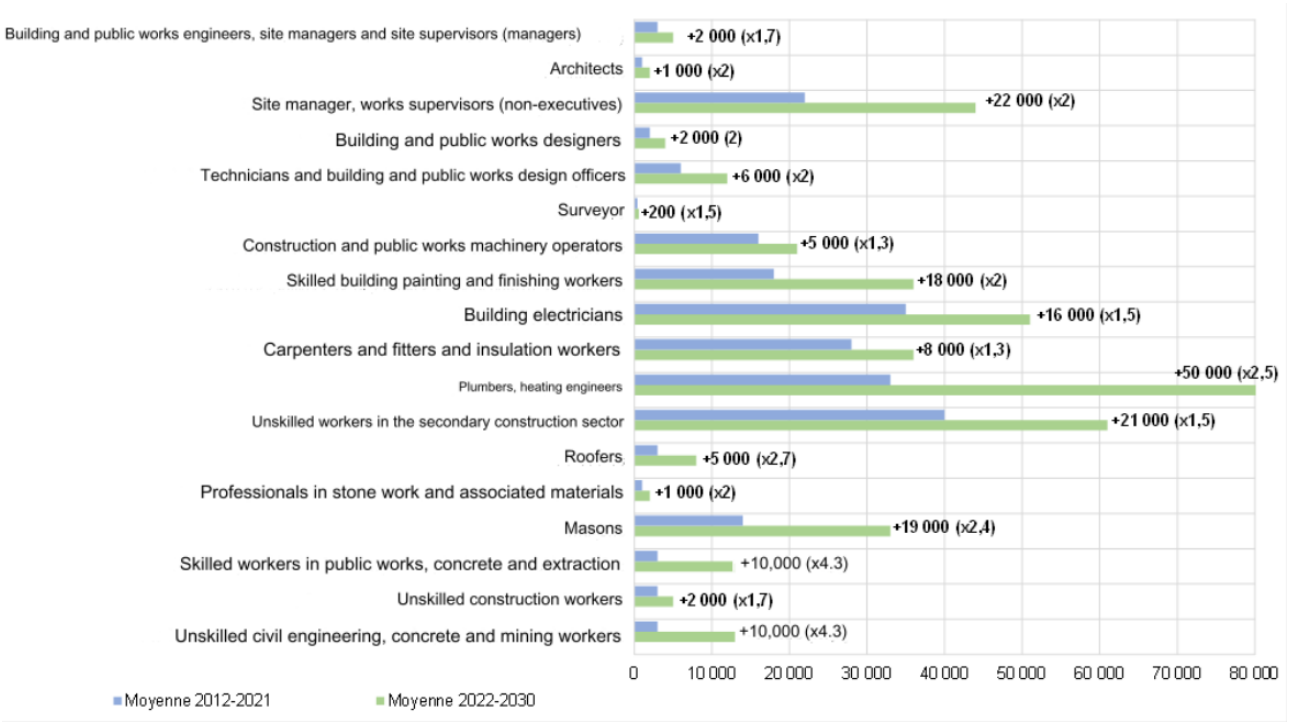
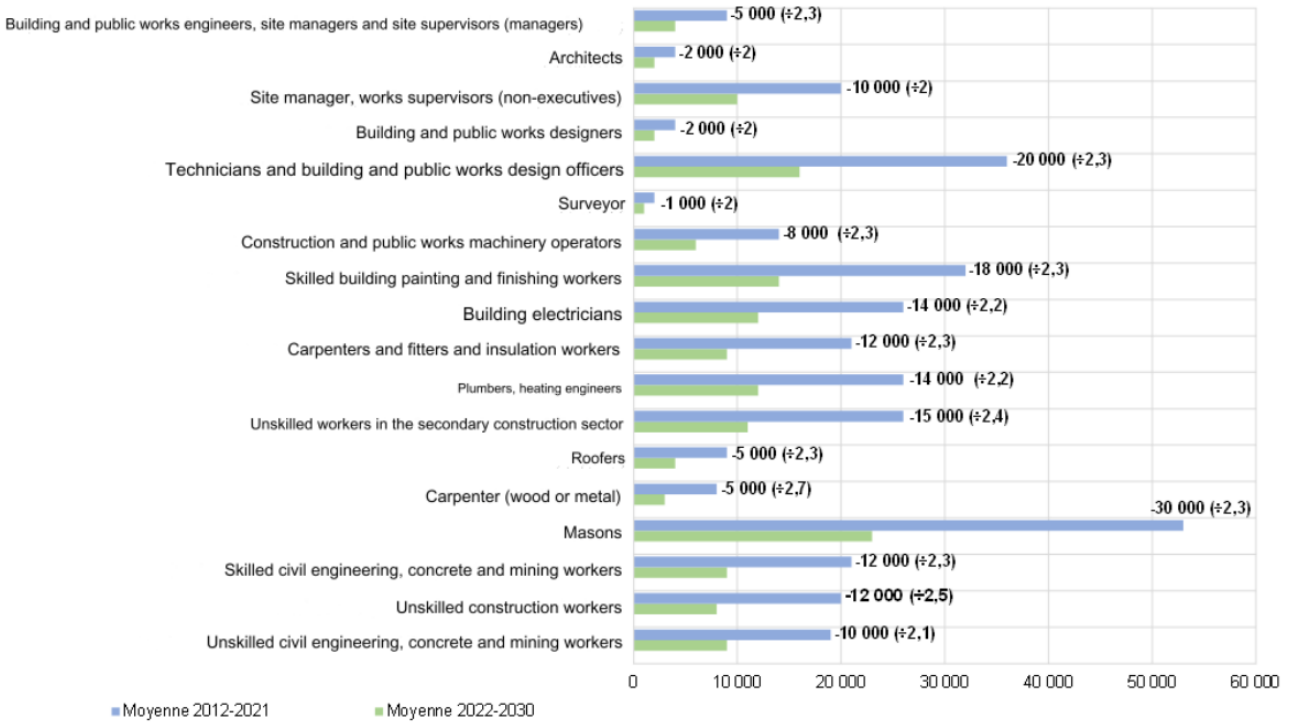


Figure 14-3 Trades to be mobilised for new construction (RE2020 residential and tertiary sectors) over the observed period (2012-2021) and the prospective period (2022-2030)



APPENDIX 3: BREAKDOWN OF HEADCOUNT IN THE "CONSTRUCTION, PUBLIC WORKS" SECTOR BY OCCUPATIONAL FAMILY (FAP) IN 2012 AND 2019 AND ITS EXTENSION TO 2030

Table 14-1 Breakdown of the construction workforce by occupational family in 2012 and 2019 and extension to 2030

			2030		
			Energy renovation		New build
Building and public works occupational group	**2012**	**2019**	**Residential**	**Tertiary**	**Residential and tertiary**
Unskilled civil engineering, concrete and quarrying workers	4 %	5 %	5 %	5 %	5 %
Unskilled building shell workers	6 %	5 %	4 %	4 %	4 %
Skilled civil engineering, concrete and quarrying workers	6 %	5 %	5 %	5 %	5 %
Bricklayers	15 %	13 %	12 %	12 %	13 %
Professionals working with stone and associated materials	1 %	1 %	1 %	1 %	1 %
Carpenter (wood or metal)	2 %	2 %	2 %	2 %	2 %
Roofers	2 %	3 %	2 %	2 %	2 %
Unskilled workers in building finishing	7 %	6 %	6 %	6 %	6 %
Plumbers, heating engineers	7 %	7 %	6 %	7 %	7 %
Joiners and fitters and insulation workers	6 %	5 %	5 %	5 %	5 %
Building electricians	7 %	7 %	6 %	6 %	7 %
Skilled building painters and finishers	9 %	8 %	7 %	8 %	8 %
Construction and public works machine operators	4 %	4 %	3 %	3 %	4 %
Surveyor	1 %	1 %	1 %	1 %	1 %
Building and civil engineering technicians and designers	9 %	10 %	8 %	9 %	9 %
Building and civil engineering draughtsmen	1 %	1 %	1 %	1 %	1 %
Site managers, site supervisors (non-managerial staff)	4 %	6 %	5 %	6 %	6 %
Architects	2 %	4 %	7 %	5 %	4 %
Public works engineers, site managers and site supervisors (executives)	6 %	8 %	15 %	12 %	10 %
Total	**100 %**	**100 %**	**100 %**	**100 %**	**100 %**

Sources: INSEE, Employment Survey, DARES processing of occupational family nomenclature; In Numeri and Pouget Consultants assumptions.

APPENDIX 4: TRADES TO BE MOBILISED BY SEGMENT (ENERGY RENOVATION/NEW CONSTRUCTION) AND BY SECTOR (RESIDENTIAL/TERTIARY)

Appendix 4.1. New build

Table 14-2 Trades to be mobilised in new housing construction (single-family homes and multi-family housing) and commercial premises RE2020 (FTEs)

New build	Detached house	Collective housing	Tertiary premises
Unskilled civil engineering, concrete and quarrying workers	YES	YES	YES
Unskilled building shell workers	YES	YES	YES
Skilled civil engineering, concrete and quarrying workers	YES	YES	YES
Bricklayers	YES	YES	YES
Professionals working with stone and associated materials			
Carpenter (wood or metal)	YES	YES	YES
Roofers	YES	YES	YES
Unskilled workers in building finishing	YES	YES	YES
Plumbers, heating engineers	YES	YES	YES
Joiners and fitters and insulation workers	YES	YES	YES
Building electricians	YES	YES	YES
Skilled building painters and finishers	YES	YES	YES
Construction and public works machine operators		YES	YES
Surveyor	YES	YES	YES
Building and civil engineering technicians and designers	YES	YES	YES
Building and civil engineering draughtsmen	YES	YES	YES
Site foremen, site managers (non-managerial)	YES	YES	YES
Architects		YES	YES
Building and public works engineers, site managers and site supervisors (executives)		YES	YES

Appendix 4.2. Energy renovation of single-family homes

Table 14-3 Trades to be mobilised in the energy renovation of single-family homes - Renovation of the envelope (FTEs)

Energy renovation - Single-family homes	Interior wall insulation	External wall insulation	Loft insulation	Floor insulation	Roof insulation	Replacement joinery
Unskilled civil engineering, concrete and quarrying workers						
Unskilled building shell workers						
Skilled civil engineering, concrete and quarrying workers						
Bricklayers		YES				
Professionals working with stone and associated materials		YES				
Carpenter (wood or metal)						
Roofers					YES	
Unskilled workers in building finishing	YES		YES	YES	YES	YES
Plumbers, heating engineers				YES		
Joiners and fitters and insulation workers	YES	YES	YES	YES	YES	YES
Building electricians				YES		YES
Skilled building painters and finishers	YES	YES	YES	YES	YES	
Construction and public works machine operators						
Surveyor						
Building and civil engineering technicians and designers						
Building and civil engineering draughtsmen						
Site foremen, site managers (non-managerial)	YES	YES	YES	YES	YES	YES
Architects						
Building and public works engineers, site managers and site supervisors (executives)						

Table 14-4 Trades to be mobilised in the energy renovation of single-family homes - Installation of equipment (FTEs)

	Fitting the equipment									
Energy renovation - Single-family homes	**Ventilation**	**PV**	**Solar thermal**	**PAC geo**	**Aero PAC**	**CET**	**Wood-burning appliances**	**CC gas**	**Other boilers**	**Air conditioning**
Unskilled civil engineering, concrete and quarrying workers										
Unskilled building shell workers										
Skilled civil engineering, concrete and quarrying workers										
Bricklayers										
Professionals working with stone and associated materials										
Carpenter (wood or metal)										
Roofers										
Unskilled workers in building finishing										
Plumbers, heating engineers			YES	YES	YES	YES	YES	YES	YES	YES
Joiners and fitters and insulation workers										
Building electricians		YES				YES				YES
Skilled building painters and finishers										
Construction and public works machine operators										
Surveyor										
Building and civil engineering technicians and designers		YES	YES	YES	YES					
Building and civil engineering draughtsmen										
Site foremen, site managers (non-managerial)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Architects										
Construction engineers, site managers and site supervisors (executives)										

Table 14-5 Occupations to be mobilised in the energy renovation of single-family homes - Equipment maintenance (FTEs)

	Upkeep and maintenance of equipment									
Energy renovation - Single-family homes	**Ventilation**	**PV**	**Solar thermal**	**PAC geo**	**Aero PAC**	**CET**	**Wood-burning appliances**	**CC gas**	**Other boilers**	**Air conditioning**
Unskilled civil engineering, concrete and quarrying workers										
Unskilled building shell workers										
Skilled civil engineering, concrete and quarrying workers										
Bricklayers										
Professionals working with stone and associated materials										
Carpenter (wood or metal)										
Roofers										
Unskilled workers in building finishing	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Plumbers, heating engineers			YES	YES	YES	YES	YES	YES	YES	YES
Joiners and fitters and insulation workers										
Building electricians	YES	YES				YES				YES
Skilled building painters and finishers										
Construction and public works machine operators										
Surveyor										
Building and civil engineering technicians and designers										
Building and civil engineering draughtsmen										
Site foremen, site managers (non-managerial)										
Architects										
Construction engineers, site managers and site supervisors (executives)										

Appendix 4.3. Energy renovation of multi-family housing

Table 14-6 Trades to be mobilised in the energy renovation of multi-family housing - Renovation of the envelope (FTEs)

Energy renovation - Collective housing	Interior wall insulation	External wall insulation	Loft insulation	Floor insulation	Roof insulation	Replacement joinery
Unskilled civil engineering, concrete and quarrying workers						
Unskilled building shell workers						
Skilled civil engineering, concrete and quarrying workers						
Bricklayers		YES				
Professionals working with stone and associated materials		YES				
Carpenter (wood or metal)						
Roofers					YES	
Unskilled workers in building finishing	YES		YES	YES	YES	YES
Plumbers, heating engineers				YES		
Joiners and fitters and insulation workers	YES	YES	YES	YES	YES	YES
Building electricians				YES		YES
Skilled building painters and finishers	YES	YES	YES	YES	YES	
Construction and public works machine operators						YES
Surveyor						
Building and civil engineering technicians and designers		YES				
Building and civil engineering draughtsmen						
Site foremen, site managers (non-managerial)	YES	YES	YES	YES	YES	YES
Architects		YES				YES
Building and public works engineers, site managers and site supervisors (executives)		YES		YES	YES	YES

Table 14-7 Trades to be mobilised in the energy renovation of multi-family housing - Installation of equipment and connections (FTEs)

	Installation and connection										
Energy renovation - Collective housing	**Ventilation**	**PV**	**Solar thermal**	**PAC geo**	**Aero PAC**	**CET**	**Wood-burning appliances**	**CC gas**	**Other boilers**	**Air conditioning**	**Connecting biomass boilers**
Unskilled civil engineering, concrete and quarrying workers				YES							YES
Unskilled building shell workers											YES
Skilled civil engineering, concrete and quarrying workers				YES							
Bricklayers											
Professionals working with stone and associated materials											
Carpenter (wood or metal)											
Roofers											
Unskilled workers in building finishing											
Plumbers, heating engineers	YES		YES	YES	YES	YES	YES	YES	YES	YES	YES
Joiners and fitters and insulation workers											
Building electricians		YES				YES				YES	
Skilled building painters and finishers											
Construction and public works machine operators											YES
Surveyor											YES
Building and civil engineering technicians and designers	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Building and civil engineering draughtsmen	YES			YES	YES	YES	YES	YES	YES	YES	YES
Site foremen, site managers (non-managerial)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Architects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Construction engineers, site managers and site supervisors (executives)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 14-8 Occupations to be mobilised in the energy renovation of multi-family housing - Equipment maintenance (FTEs)

	Upkeep and maintenance of equipment									
Energy renovation - Collective housing	**Ventilation**	**PV**	**Solar thermal**	**PAC geo**	**Aero PAC**	**CET**	**Wood-burning appliances**	**CC gas**	**Other boilers**	**Air conditioning**
Unskilled civil engineering, concrete and quarrying workers										
Unskilled building shell workers										
Skilled civil engineering, concrete and quarrying workers										
Bricklayers										
Professionals working with stone and associated materials										
Carpenter (wood or metal)										
Roofers										
Unskilled workers in building finishing	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Plumbers, heating engineers	YES		YES	YES	YES	YES	YES	YES	YES	YES
Joiners and fitters and insulation workers										
Building electricians		YES				YES				YES
Skilled building painters and finishers										
Construction and public works machine operators										
Surveyor										
Building and civil engineering technicians and designers	YES	YES	YES	YES	YES		YES	YES	YES	
Building and civil engineering draughtsmen										
Site foremen, site managers (non-managerial)										
Architects										
Construction engineers, site managers and site supervisors (executives)										

Appendix 4.4. Energy renovation of commercial premises

Table 14-9 Trades to be mobilised in the energy renovation of tertiary premises - Renovation of the envelope (FTEs)

Energy renovation - Commercial premises	Interior wall insulation	External wall insulation	Loft insulation	Floor insulation	Roof insulation	Replacement joinery
Unskilled civil engineering, concrete and quarrying workers						
Unskilled building shell workers						
Skilled civil engineering, concrete and quarrying workers						
Bricklayers		YES				
Professionals working with stone and associated materials		YES				
Carpenter (wood or metal)						
Roofers					YES	
Unskilled workers in building finishing	YES		YES	YES	YES	YES
Plumbers, heating engineers				YES		
Joiners and fitters and insulation workers	YES	YES	YES	YES	YES	YES
Building electricians	YES			YES		YES
Skilled building painters and finishers	YES	YES	YES	YES	YES	
Construction and public works machine operators						YES
Surveyor						
Building and civil engineering technicians and designers		YES				
Building and civil engineering draughtsmen						
Site foremen, site managers (non-managerial)	YES	YES	YES	YES	YES	YES
Architects		YES				YES
Building and public works engineers, site managers and site supervisors (executives)	YES	YES		YES	YES	YES

Table 14-10 Trades to be mobilised in the energy renovation of commercial premises - Installation of equipment and connections (FTEs)

	Installation and connection										
Energy renovation - Commercial premises	**Ventilation**	**PV**	**Solar thermal**	**PAC geo**	**Aero PAC**	**CET**	**Wood-burning appliances**	**CC gas**	**Other boilers**	**Air conditioning**	**Connecting biomass boilers**
Unskilled civil engineering, concrete and quarrying workers				YES							YES
Unskilled building shell workers											YES
Skilled civil engineering, concrete and quarrying workers				YES							
Bricklayers											
Professionals working with stone and associated materials											
Carpenter (wood or metal)											
Roofers											
Unskilled workers in building finishing											
Plumbers, heating engineers	YES		YES	YES	YES	YES	YES	YES	YES	YES	YES
Joiners and fitters and insulation workers											
Building electricians		YES				YES				YES	
Skilled building painters and finishers											
Construction and public works machine operators											YES
Surveyor											YES
Building and civil engineering technicians and designers	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Building and civil engineering draughtsmen	YES			YES	YES	YES	YES	YES	YES	YES	YES
Site foremen, site managers (non-managerial)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Architects	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Construction engineers, site managers and site supervisors (executives)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 14-11 Occupations to be mobilised in the energy renovation of tertiary premises - Equipment maintenance (FTEs)

	Upkeep and maintenance of equipment									
Energy renovation - Commercial premises	**Ventilation**	**PV**	**Solar thermal**	**PAC geo**	**Aero PAC**	**CET**	**Wood-burning appliances**	**CC gas**	**Other boilers**	**Air conditioning**
Unskilled civil engineering, concrete and quarrying workers										
Unskilled building shell workers										
Skilled civil engineering, concrete and quarrying workers										
Bricklayers										
Professionals working with stone and associated materials										
Carpenter (wood or metal)										
Roofers										
Unskilled workers in building finishing	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Plumbers, heating engineers	YES		YES	YES	YES	YES	YES	YES	YES	YES
Joiners and fitters and insulation workers										
Building electricians		YES				YES				YES
Skilled building painters and finishers										
Construction and public works machine operators										
Surveyor										
Building and civil engineering technicians and designers	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Building and civil engineering draughtsmen										
Site managers, site supervisors (non-managerial staff)										
Architects										
Construction engineers, site managers and site supervisors (executives)										

Source: Pouget Consultants assumptions

ADEME IN BRIEF

At ADEME - the French Environment and Energy Management Agency - we are resolutely committed to the fight against global warming and the degradation of resources.

On all fronts, we are mobilising citizens, economic players and regions, giving them the means to move towards a resource-efficient, low-carbon, fairer and more harmonious society.

In all areas - energy, the circular economy, food, mobility, air quality, adapting to climate change, soil - we advise, facilitate and help finance numerous projects, from research to sharing solutions.

At every level, we put our expertise and foresight at the service of public policy.

ADEME is a public body under the authority of the Ministry for Ecological Transition and the Ministry for Higher Education, Research and Innovation.

ALLIANCE VILLES EMPLOI IN BRIEF

Founded in 1993, Alliance Villes Emploi is the national network of local authorities involved in issues of integration, employment and economic development. It brings together more than 200 local councillors of all political hues, united in the conviction that it is at the level of the territory, the living and employment areas, that the relevant level of intervention lies.

To this end, the association federates the tools and mechanisms deployed by its members, in particular the Maisons de l'Emploi (MDEs) and the Plans Locaux pour l'Insertion et l'Emploi (PLIEs), and runs the network of social inclusion clause facilitators.

SUMMARY

This diagnosis sets out the opportunities, obstacles and challenges facing the building sector if it is to achieve the target of reducing France's greenhouse gas emissions by 55% by 2030, compared with 1990 levels (Fit for 55), and move towards carbon neutrality and a building stock renovated to Bâtiment Basse Consommation or equivalent levels by 2050.

It was produced through a process of co-construction in participative working groups, targeted interviews and a literature review. It brings together the current situation based on the 2012-2021 period and provides an estimate of the need in terms of jobs (full-time equivalents) and professions for 2022-2030.

It will serve as a basis for drawing up the roadmap.

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