# BUILD UP Skills – SPAIN

## Analysis of the national Status Quo

**August 2012**




**Further information**

More details on BUILD UP Skills can be found at www.buildupskills.eu

More details on the IEE programme can be found at http://ec.europa.eu/intelligentenergy

This report was prepared by the following team:

**Fundación Laboral de la Construcción:**

- Ana González Martín
- Elena Novillo Ruiz
- Javier González López
- Puy Jiménez Fernández-Sesma
- Raúl Flores Martos

**Subdirección General de Innovación y Calidad de la Edificación del Ministerio de Fomento:**

**Instituto Nacional de las Cualificaciones del Ministerio de Educación:**

**Instituto Tecnológico de la Construcción-AIDICO**

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## 1. Introduction

### Status quo in Europe


**20/20/20 sustainability objectives**

* Reduce emissions of greenhouse gases by 20%
* Save 20% on energy consumption through better energy efficiency
* Develop renewable energy sources up to 20%

### Status quo in Spain

The **2010/31/EU Directive** together with the Spanish legal regulations will have direct consequences on building legislation since it must be reviewed in terms of energy consumption in buildings whose energy efficiency requirements will be strengthened.

### BUILD UP SKILLS SPAIN


There are five key stages predicted for the **BUILD UP SKILLS SPAIN** project.

## 2. Objectives and methodology

### Objectives

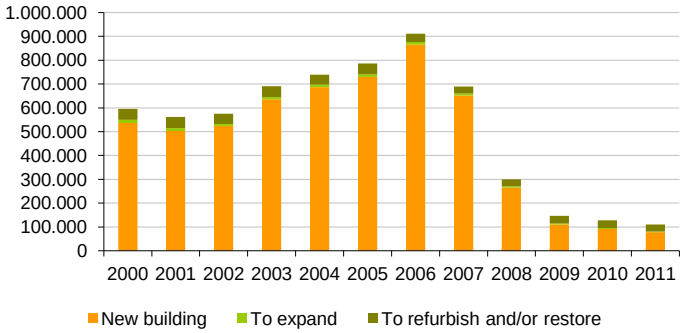
| | | |
|---|---|---|
| Determine current building sector characteristics | Analyse national plans and strategies in order to reach the objectives proposed by the EU as regards energy for 2020 | Gather relevant data about building and energy sectors |
| Examine the current National System of Professional Qualifications and Training, as well as the training programmes for continuous training | Define any competence or training gaps that exist between the current situation and the predicted needs for 2020 | Identify the existing barriers that prevent builders or constructors from achieving adequate training |

### Methodology

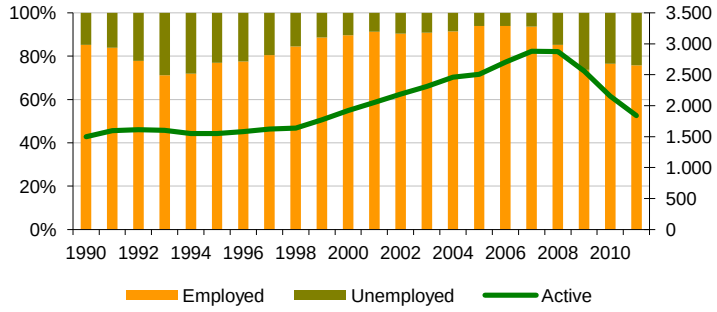

The planned methodology will combine the consultation of **primary and secondary** sources.

## 3. Description of the construction sector

### Historical training[1]



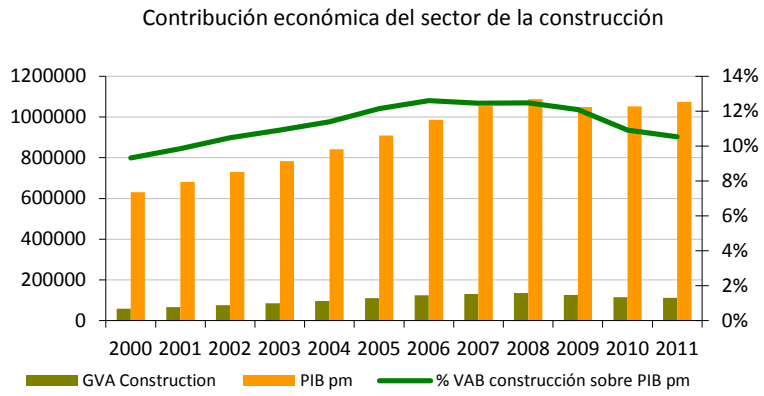

The number of **project permits** has fallen drastically since 2006.




The number of **employees** in the sector has not stopped falling since the year 2007. This reduction together with an increase in the number of unemployed leaves the current number of working employees in the construction sector in 2011 at 1,393,000 people, **15.62% lower** than the year before.

Some sectors are gambling on **energy efficiency (EE) and renewable energies (RE)**, especially the industrial sector, hotels and the food industry.

### Economic contribution to the GDP




The contribution of the construction sector to the **national GDP** throughout this time has gone from 9.31% in the year 2000 to 10.53% in 2011. This value peaked in 2006, contributing 12.60% of the Spanish GDP.

[1] The green boxes hold training coming from secondary sources. The blue boxes hold training coming from primary sources.

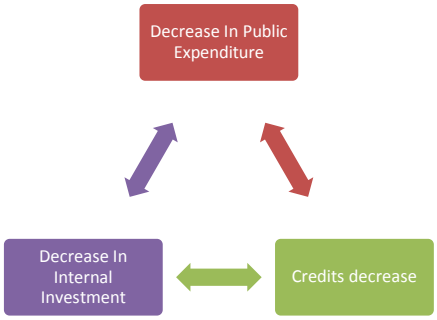
### Supply chain

In terms of production of materials, a major qualitative leap has been observed: **R&D** has been greatly improved and **new materials** adapted to energy efficiency are in development, although the supplier has included renewable products within their catalogue of products. As such, they have had to renew all of their technical knowledge and, in many cases, employ an **energy maintenance manager or technician.**

### Market trends and predictions

The elevated **housing stock** existing in residential buildings remains and makes both the construction of more buildings as well as renovation more difficult.

### Main changes which affect the sector




The appearance of certain factors commonly called **demand factors** is negatively influencing the building sector.

It is hoped that the negative trend which the construction sector in Europe showed in the second half of 2011 will stop in 2013 and 2014, with **growth rates** being estimated at around 2%.
In Spain, the forecasts point to the situation in the Spanish economy in the construction sector as being "delicate" and "critical".

### Immigration and emigration

The qualification of the **immigrant workforce** is the same as the national one: there is a clear need for training in the sector, independently of where the worker comes from.

Some highly-qualified worker, such as engineers or architects, are **emigrating** in search of opportunities, especially to countries where construction is an emergent sector.

### Grey economy

It is estimated that in 2009 **29.3% of the GDP** generated by the construction sector corresponds to activities **completed outside** of regulations.

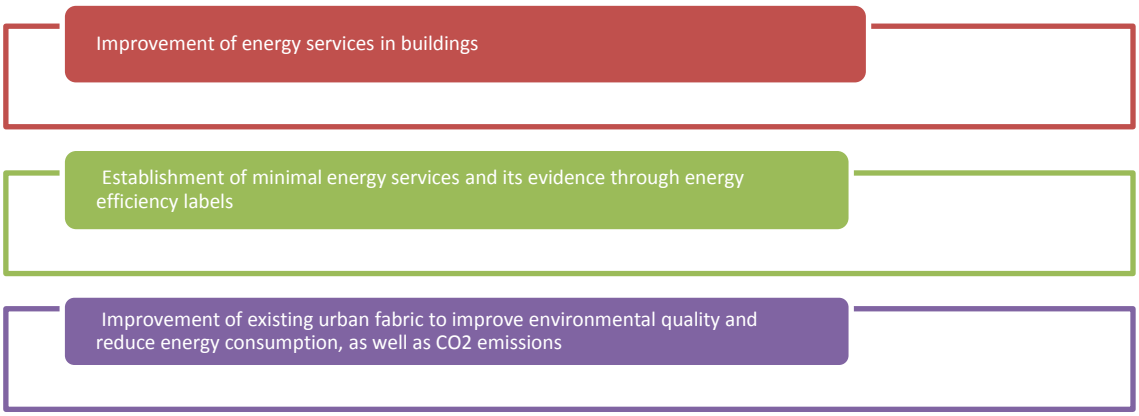
**There is a grey economy** in the sector which is found mainly in the renovation subsector since this does not require the activities carried out to be declared.

### Profiles of professionals involved

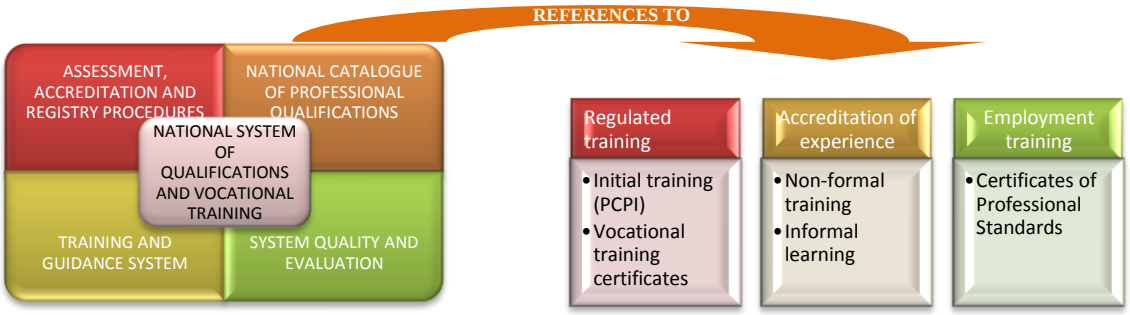
The change in legislation will require an improvement in the qualifications of employees in the sector since there will be greater **demand for a specialised workforce**, even though, these days, this confers no competitive advantage to companies. It will, however, if EE and the use of RE are enforced.

## 4. National policies and strategies for contributing to EU building objectives for 2020

### In the field of energy




### In the field of vocational education and training

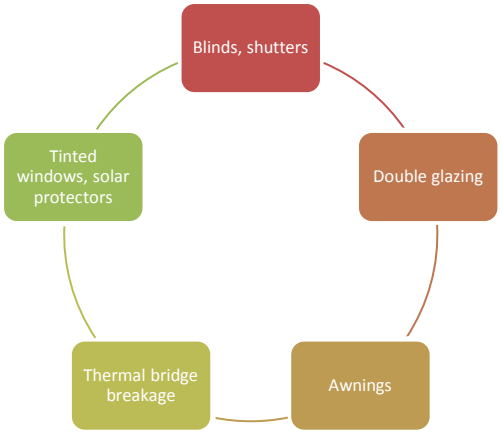



## 5. Statistics on the energy and building sectors

### Statistics on the building sector

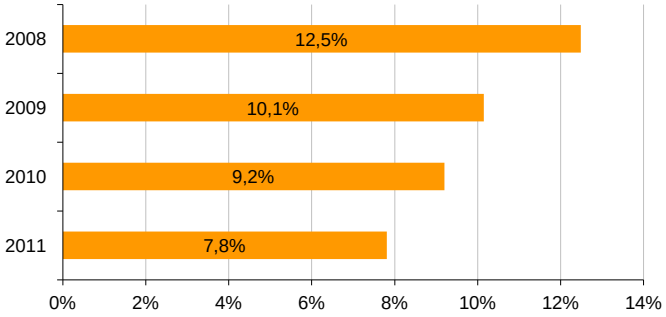
It can be estimated that the total number of buildings in Spain designed for residential use currently stands at **9.64 million buildings**.
Predictably, this number **will not significantly increase** in the next few years given the current economic crisis and the limited population growth predicted in Spain.

Buildings constructed **as from 2007 have better investments** in terms of their energy efficiency, however they make up a very small percentage since the building sector suffered an unprecedented slowdown in its activities as from that year.




The principal **means of thermal insulation** which were adopted in Spanish homes were the installation of blinds or shutters (94.0% of homes), double-glazing (39.3%), awnings (23.0), thermal bridge breakers (11.4%), and installing tinted windows or solar protectors (4.1%).

The **absence of incentives**, **failures** in administrative management, the **lack of control** in ensuring the following of legislation or the **lack of training** to the users and owners of buildings are some of the barriers which make energy installations harder to install.

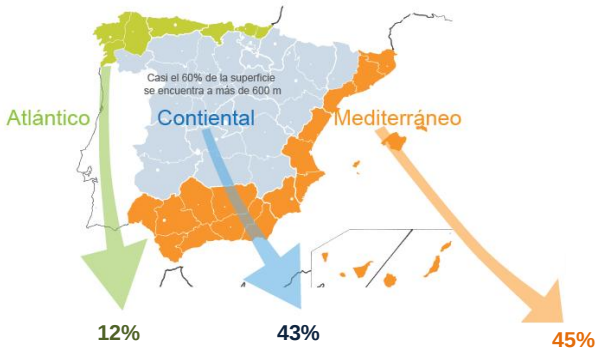



The proportion of **employees** in the building sector **fell** gradually between 2008, in which it represented 12.5%, to the 7.8% it held in 2011, a total **loss of over 1,100,000** workers.

***Statistics on energy consumption and renewable energy in buildings***

In terms of energy, the residential sector makes up **17% of the final total consumption** and 25% of the demand for electricity.

The **average consumption** of a Spanish home is 10.521 kWh per year (0,038 TJ), chiefly, in terms of final energy, the consumption of fuel: 1.8 times greater than the use of electric.




The total consumption of homes located in the **Mediterranean area** is, approximately, the same as the total consumption of those located in the continental climate zone.

Single-family homes consume more energy given that they usually have a much higher percentage of surfaces (walls and roofs) directly exposed to the open air or in contact with the ground.

## Atlantic

Family homes consume 5 times more than families in tower blocks

Energy source:
*Block: Electricity (46,1%)
*Houses: Oil (32%) and renewable energy (32%)

## Continental

Family homes consume 3 times more than families in tower blocks

Energy source:
*Block: natural gas (40,7%)
*Houses: Renewable energy (37%)

## Mediterráneo

Family homes consume 6 times more than families in block

Energy source:
*Bloque: electricity (54,9%)
*Unifamiliar: Renewable energy (40%)

**Heating**
*82% individual
*Electricity (46%) y natural gas (32%)

**Hot water**
*Individual boiler
*Natural gas (40%), butane (26%) y electricity (22%)

**Refrigeration**
*Reversible heat pump (78%)
*Electricity (100%)

**Kitchens**
*Gas cookers (31%) and gas ceramics (30%)
*Electricity, natural gas or LPG

**Illumination**
*Average no of lightbulbs per household = 23
*8.3 conventional compared to 7 low-consumption

**Appliance**
*The most common energy class is A (40%)
*La Standby option is present in most households

**Consumption in the residential sector** is two-thirds based on fuels, mostly oil products, natural gas and renewable energy.
**Renewable energy sources** are being more and more important, providing approximately as much energy as oil products.

## 6. Available vocational training and education

### Professional training referred to the National Catalogue of Professional Qualifications

The **National Catalogue of Vocational Training and Qualifications** makes up the base for the elaboration of training for vocational training qualifications, certificates and modular and accumulative training associated with a unit of competence.


* PCPI (Initial Professional Qualification Programmes)
* Certificates of Professional Standards: levels I and II
* Vocational Training Certificates: Medium and Higher Grades

**Current Vocational Training** does not deal with all of the bases required to implement EE and RES, principally because it does not cover all of the related activities in the sector.

**Formal training** in energy efficiency is aimed at high levels, 3 and 4. There is no sufficient training material directed at levels 1 and 2. Although the experts may consider specific technical training unnecessary, it may be convenient to provide a more general vision focused upon the activity being developed.
As such, the possibility of **transversal training on EE and RE** is being considered for some professionals involved in the building trade.

In relation to instruments which allow for the monitoring of requirements in training and competences, there are **professional monitoring organisations** such as the National Institute of Qualifications or the Public Employment Service.

### Vocational training not referred to the National Catalogue of Professional Qualifications

There are no data available on the provision of training on EE or RE in the building sector which is not referred to the CNCP. However, in the opinion of the experts consulted, there is a **wide range of private training available** related with energy efficiency (EE) and renewable energies (RE).

One of the largest sources of this type of training is the **Tripartite Foundation for Employee Training**, which claims to have trained around 14,000 people in the subject of energy efficiency.

The organisation which manages the largest volume of training in the construction sector is the **Construction Labour Foundation (FLC)**.
The analysis of the FLC's databases shows that between 2007 and the present, over **7,500 students have been training in courses** related to energy efficiency in building, al closely related with the saving of energy.

Professional training **not referred to the catalogue** is characterised by:
* Dispersal
* Lack of certification
* Important training in the field of sustainable buildings
* Dynamic training adapted to the needs of the market
* Intensive training for technicians with degrees
* Lack of training courses for technicians without degrees.
* Importance of social agents and training subsidised by companies

Training which is not referred to the CNCPF **does not necessarily include official accreditation**; in fact, the most common situation is that an institution which does not depend on administration will carry out the accreditation, in spite of the fact that accredited training is most in demand

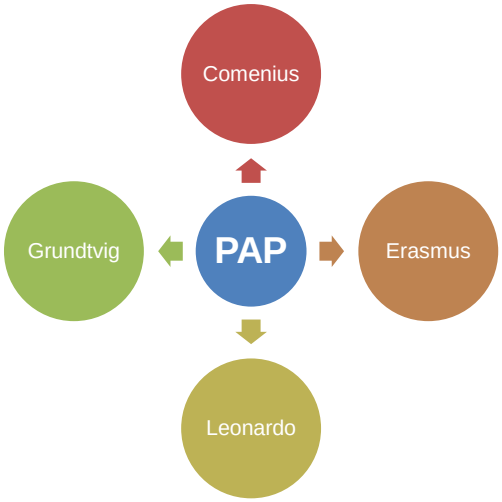
**Accreditation of skills through professional experience** is seen as vital within the construction sector; in other words, recognition of professional experience favours the relocation of untrained workers through a process of verifying their professional skills.

**Obligatory** EE training is seen as desirable, especially to cover lower levels of qualifications since it is difficult for workers to access training courses by themselves.

**Job counselling** gains special relevance, especially within initial vocational training centres.

Within the sector, there is **clear polarisation** of workers: on one hand, there are highly-qualified workers, and on the other, an unqualified mass of salaried workers. Demand for the first type is either non-existent or inadequate. The second type know their needs and where to find more adequate training.
It is necessary to **motivate** level 1 and 2 workers (auxiliary technicians and mid-grade technicians), in other words, those with low qualifications, to stimulate the demand.

**Relevant national and regional training initiatives supported by the EU**



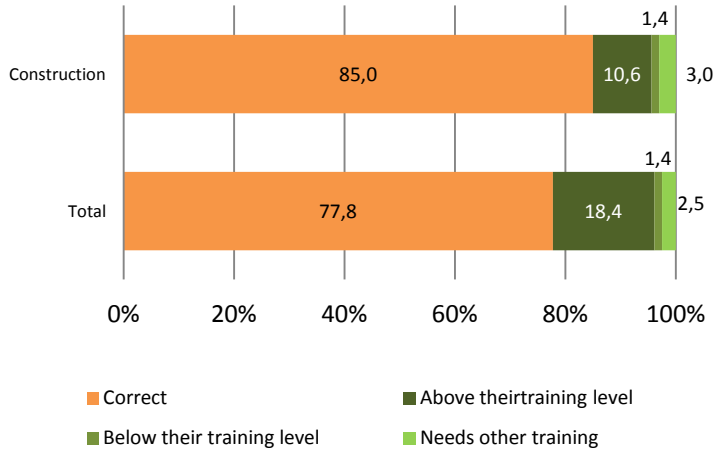

The EU is developing a program in the field of education and training called a **"Programme of permanent learning"** (PAP) which attempts to contribute to the *"creation of a society of advanced knowledge with sustainable economic development, more and better employment opportunities, and greater social cohesion"*.

The **Leonardo da Vinci** programme has been chosen to illustrate EU initiatives on the subject of EE and RE because of the four belonging to the PAP, it is the only one which is clearly sectorial.

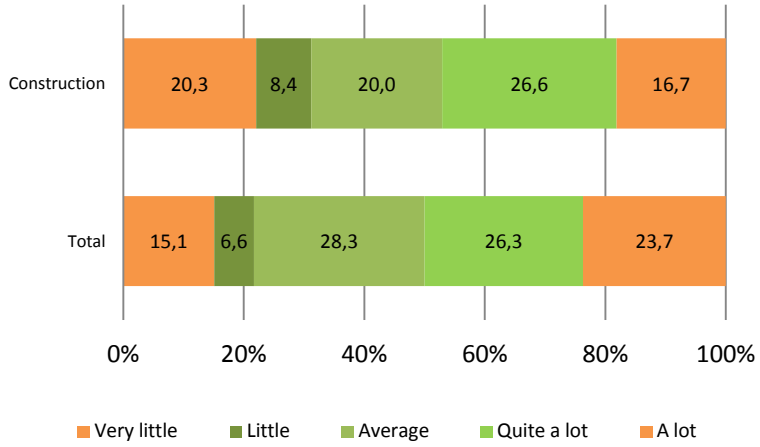
## 7. Current gaps in training and needs for 2020

### Evolution of the workforce

The building sector has seen the size of the **workforce affiliated with Social Security** reduced, especially in the construction of decks and residential buildings with reductions of over 20%. However, installations of facilities (electric, plumbing, heating, air conditioning and carpentry) have seen a small reduction (10%).

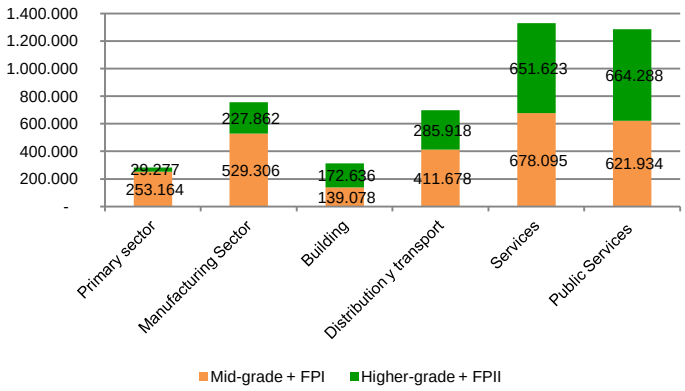



**85%** of workers consider that the relationship between an employee's job post and the training they have received is suitable.




**28.7%** of employees state that academic training is of little or very little use for the job they are carrying out, a higher proportion that employees throughout the entire activity (21,7%).

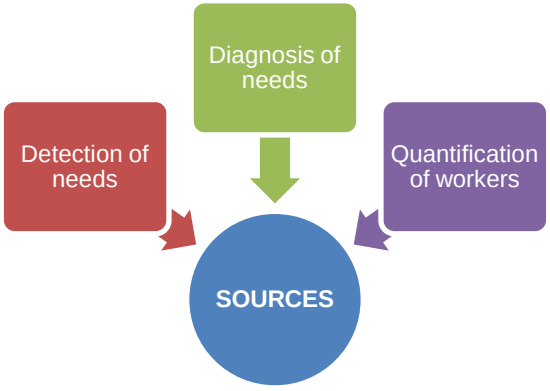
**64.8%** of students who finish their obligatory education choose to study for a Baccalaureate compared to 35.2% who choose Vocational Training (58% in the EU).




The number of professionals trained with certificates in the construction sector is **311,714**, which is 6.7% of the total number of certificate holders in Spain. Of these, 45% are mid-grade and 55% are from higher education.
5.3% of the Mid-Grade certificate holders

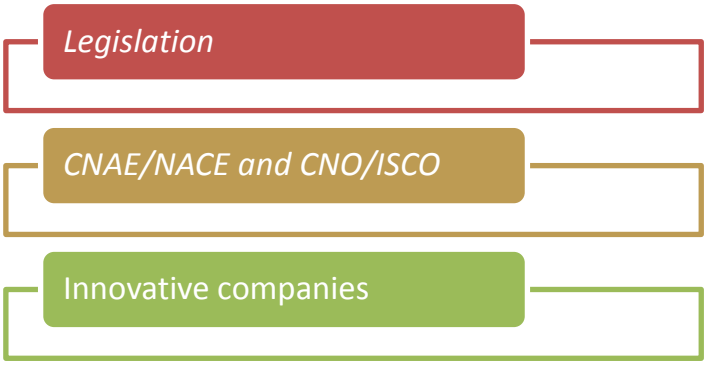
According to the Spanish National Accounts Base, the weight of employment in the construction sector is over 9%, and as such, there is a **large training deficit** compared to other sectors.

Therefore, the **numbers are low** since it is predicted that by the year 2020, there will be a workforce of around 20,309,000 people in Spain, and around 50% of those will have a mid-level qualification.



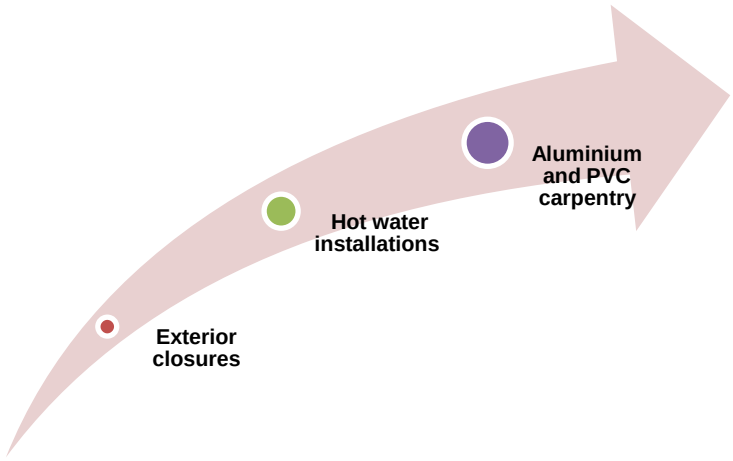

For the **detection and identification of skills** required for each job and level of competence, it is necessary to observe and analyse various sources of training.

## A. DETECTION OF NECESSARY SKILLS

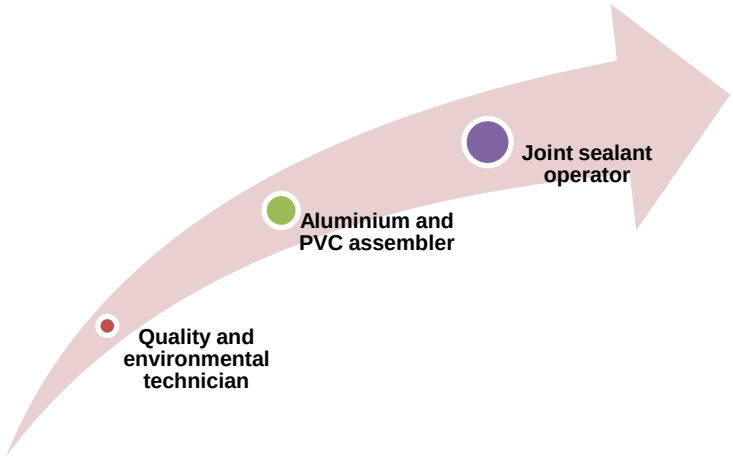



There are three main points to be observed to **detect new skills**: legislation, the classification of economic and occupational activities, and innovative businesses.

## B. ASSESSMENT OF NECESSARY SKILLS[2]

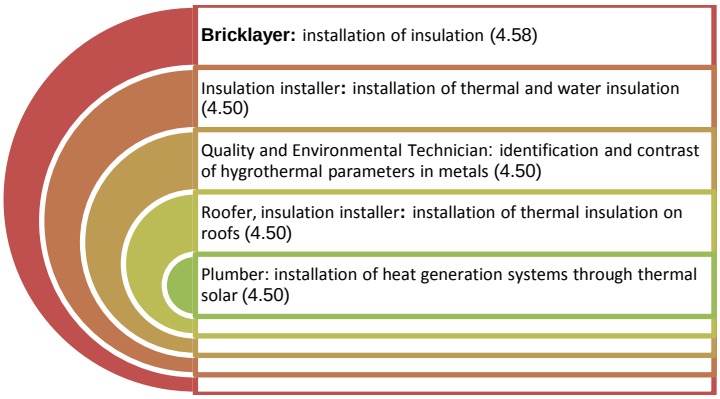



The most important **stages of completing** work related to energy efficiency and the use of renewable energy are: **working with PVC and aluminium (4,31), hot water facilities (4,13)** and **external closures (4,12)**




The most important **job roles** in work related to energy efficiency and the use of renewable energy are: **joint sealant operator (4,36), aluminium y PVC assembler (4,26)** and **quality and environmental technician (4,26)**

[2] The scale used is from 1 to 5, with 1 being "skill is not at all important for carrying out energy sustainability objectives" and 5 being "skill is very important for carrying out energy sustainability objectives".




To determine **emergent skills**, experts have been asked to try to identify hierarchically the various skill requirements of existing jobs in various stages of work, based on their opinion and taking into account the criteria in the Technical Building Code (CTE).

### C. QUANTIFYING THE NUMBER OF WORKERS WITH NECESSARY SKILLS

Of all of the employees in the sector, the percentage of workers which experts consider could be linked to energy efficiency and the use of renewable energy varies - in the best of cases - between **25 and 35%,** though this proportion may increase in the future if there is sufficient funding and monitoring to ensure compliance with regulations.

### Qualification needs

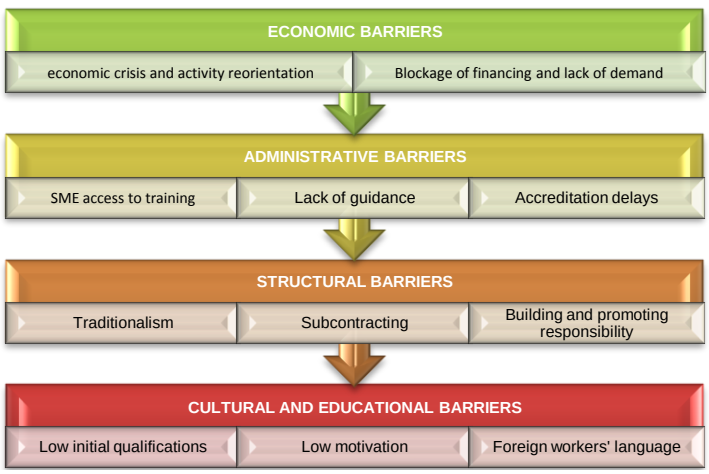
Given that productive processes in the building sector covers a wide variety of stages in which there is a high number of people with different professional profiles, experts consider that there must be some **basic generic subjects** which are taught to all workers in the same way that risk prevention at work materials are taught.

### Monitoring needs

Instruments which allow for the monitoring of skill and training requires are occupational and professional monitoring centres

- ✓ A **national level**: INCUAL's Professional Monitoring Centre and SEPE's Occupational Monitoring Centre
- ✓ A **regional level**: regional monitoring centres.

## 8. Barriers




There are **four** sets of barriers identified to qualification of workers which may make it **difficult to achieve** the 2020 objectives set for the building sector.

## 9. Conclusions

### Conclusions

The collection and analysis of training coming from various **primary and secondary sources** and the contrast between them has meant the creation of 30 key conclusions.

### Validation

As the final stage of the analysis of the situation, validation of the results obtained has been carried out by a **validation panel** in which the main conclusions have been given a value with the aim of seeing if the results gathered throughout the diagnostic process in terms of energy efficiency are corrected in the opinion of experts.

In the panel, experts value key conclusions through a **questionnaire** which, in turn, is debated later as a group.

### Delphi Panel

***Evolution of energy efficiency in the sector***
The possible alternative in the building sector to be able to reach the 2020 objects is to renovate buildings with efficiency criteria.

***Barriers to developing energy efficiency***
The major difficulties to access to training which will continue in the near future are: lack of time, resources, unawareness of training on offer, and the economic situation.

***Measures to surpass these barriers***
To effectively develop energy efficiency, it will be necessary to increase users' awareness through campaigns.

***Innovation, technology and development (R&D)***
Future innovation will require new methods of working and interaction between professionals in the sector.

***Training systems***
Training accreditation adds value to workers' CVs and is a guarantee to the company which hires them.

***Existing training on offer***
The training supply and demand in the sector will rise in the next three years due to changes in legislation and the means of development in construction.

# 1. Introduction

## 1.1. Status quo in Europe

The Europe 2020 Strategy, adopted in the European Council in June 2010, is the new reference point for the coordination of economic and employment policies for member states of the EU.

This strategy presents a vision of a European market social economy in the next decade and is based on three related, high-priority areas which are reciprocally reinforced:


Figure 1. European high-priority areas

- ✓ **Intelligent growth**, developing an economy based on knowledge and innovation.
- ✓ **Sustainable growth**, promoting an economy with low carbon levels, competitive and efficient in terms of resources.
- ✓ **Inclusive growth**, stimulating an economy with a high level of employment which promotes territorial and social cohesion.

Progress towards these objectives will be measured using five principal, representative objectives in the scope of the EU which the member States will have to translate into national objectives which reflect starting points:

1. 75% of the population between 20 and 64 of age must be employed
2. 3% of the EU's GDP must be invested in R&D
3. The 20/20/20 sustainability objectives in the field of climate and energy will be met
4. The rate of early school-leaving must be lower than 10% and at least 40% of young people must have a qualification or diploma
5. There will be 20 million people fewer at risk of poverty.

As such, this strategy gives a strong push to the 20/20/20 plan approved by the European Parliament in December 2008 which, according to the experts, the European Union is placing at the head of the fight against global warming and consolidating the green energy sector. The objectives of sustainability are:


Figure 2. 20/20/20 sustainability objectives

- ✓ Reduce emissions of greenhouse gases by 20%
- ✓ Save 20% on energy consumption through better energy efficiency
- ✓ Develop renewable energy sources up to 20%

Greenhouse gas emissions must be reduced by 20% for 2020 with respect to the levels in 1990. This objective could be changed to 30% if a global agreement on climate change is reached.

Renewable energies (wind, solar, biomass) must represent 20% of the total energy consumption of the EU by 2020.

The EU has also established a specific objective for biofuels which must represent less than 10% of the total consumption of fuel and diesel in transportation.

In terms of energy efficiency, the agreement is to save 20% of total energy consumption by 2020 thanks to better usage of energy in buildings, industry and transportation.

With respect to buildings, the publication of European Directive 2010/31/EU on the 19th of May, 2010, relating to energy efficiency in buildings has determined that member states are to build a Europe which is more ecologically-friendly, greener and less dependent on fossil fuels, as a result of strengthening the requirements that buildings must meet in this respect.

The standard being aimed at is to have "**nearly zero energy buildings**", since it requires that public buildings constructed as from the 31st of December, 2018, must have a total energy consumption of almost nothing. For private buildings, the deadline is the 31st of December, 2020.

The Directive makes no distinction between buildings which consume almost no energy, or those which have very high energy efficiency, meaning that the amount of energy required is very low or almost nothing. This energy should mostly come from renewable energy sources either in situ or nearby.

To achieve this objective, the directive is more specific with regards to lighting or climate control, promoting the use of highly-efficient systems such as decentralised generation of power using renewable energy, CHP, urban heating and cooling networks, heat pumps, monitoring and control, etc.

## 1.2. Status quo in Spain

The 2010/31/EU Directive together with the Spanish legal regulations will have direct consequences on building legislation since it must be reviewed in terms of energy consumption in buildings whose energy efficiency requirements will be strengthened. In addition, the design of nearly zero energy buildings will require a revolution in the design and construction processes, including, amongst others, a greater presence of passive systems (adjustable solar protection systems, natural ventilation...) for which multi-disciplinary teams (town planners, architects, engineers) will be required to work on the project from the beginning.

As such, while strict compliance with the requirements laid down in the Technical Building Code will provide a certain building with a level of energy certification at around a C - according to calculations made with the IT program, Calener, which determines the level of energy efficiency corresponding to a building - with this new directive, it will be necessary to reach an A to comply with the requirements established.

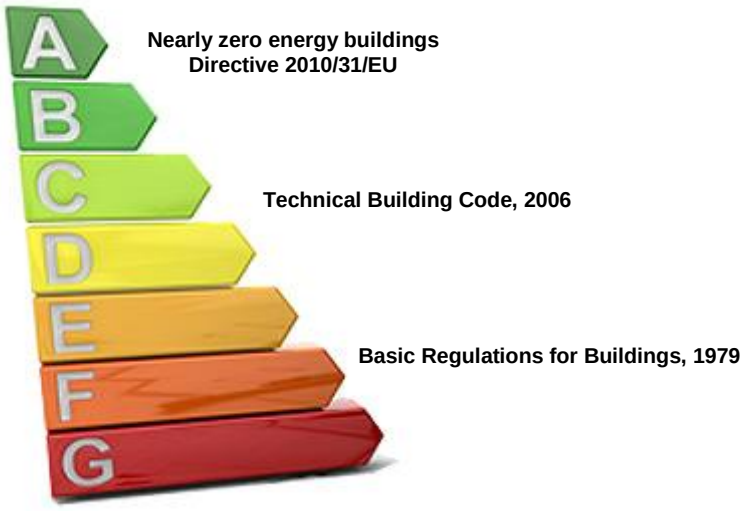



Figure 3. Energy qualifications according to regulations

And what happens with existing buildings which consume large amounts of energy? The 2010/31 Directive focuses more on new buildings than existing ones, only going as far as to say that requirements could be set but without specifying them. It therefore seems that these requirements will be gathered for future legislation. In any event, taking into account that the level of new buildings has dropped considerably and the forecast is that they will not return to the levels before the crisis for a long time, it will be necessary to draw up strategies which promote energy renovation of current buildings - tax deductions, the RENOVE plan, etc. - which will ensure better energy efficiency in existing buildings.

## 1.3. BUILD UP SKILLS SPAIN

The **Build Up Skills Spain** project, managed by the Executive Agency for Competitiveness and Innovation (EACI) and funded by the European Commission, belongs within the program Intelligent Energy Europe (IEE). Its aim is to make a contribution to compliance with the sustainability objectives set by the EU for 2020.


Figure 4. Stages of the BUILD UP SKILLS SPAIN project

To achieve this goal, the project foresees five stages which appear in the figure above, aimed at following objectives:

- ✓ First-hand knowledge of the **status quo** of the building sector within Spain with the aim of answering the energy efficiency and renewable energy training needs of qualified staff.
- ✓ Develop a **national e-community platform** to debate on qualifications, training, energy efficiency and renewable energy.
- ✓ Establish a **roadmap** on professional qualifications in this field which will anticipate demand produced with the aim of meeting sustainability objectives.
- ✓ Promote strong **institutional support**, which contributes to effective implementation of this roadmap.
- ✓ Share knowledge and experience through **exchange activities** with the rest of the EU countries with the final aim of establishing a common European strategy in this respect.

The project is led by the FLC which, together with the three members which form the association, the Ministry of Development's Sub-directorate General for Innovation and Quality in Building Construction, the Ministry of Education's National Institute of Qualifications and Aidico, the Technological Institute of Construction, are those in charge of the various activities which will take place within the project.


Figure 5. Members of the BUILD UP SKILLS SPAIN project

This report attempts to make the results obtained available after carrying out the first stage of the project, i.e. the analysis of the **"STATUS QUO",** and throughout will provide training on the following matters:

- ✓ **Description of the building sector:** relationships with other sectors, supply chain, market trends and forecasts, the principal changes affecting it, immigration and emigration, the grey economy, professional profiles, etc.

- ✓ **National policies and strategies to help reach the EU 2020 objectives on energy in buildings:** in the fields of energy and of vocational education and training.

- ✓ **Statistics on construction and energy:** building sector, workforce, energy consumption and renewable energy in buildings.

- ✓ **Professional training and education available:** vocational education and training available to workers on jobs relating to Energy Efficiency and Renewable Energy, training programs and courses on energy efficiency and renewable energy which don't form part of the "official" training system, and other relevant initiatives both on a national and regional basis which are supported by the EU.

- ✓ **Skill gaps between the current situation and that required in 2020, referring to qualification needs:** workforce evolution, skill needs, identification of new emergent competences, and the number of workers in the construction sector to be trained in each sub-sector/profession for each level of competence in order to reach 2020 energy objectives, qualification and monitoring needs.

- ✓ **Barriers:** analysis of barriers related with construction workers' qualifications which might prevent the country from reaching the 2020 targets within the building sector.

# 2. Objectives and methodology

## 2.1. Objectives

*General objective*

0. The prime objective of this first stage of the BUILD UP SKILLS SPAIN project was to carry out a complete, analytical study of the field and determine the current state of the building sector as regards energy efficiency and renewable energy, as well as analysing the professional qualifications and training available related to this subject.

*Specific objectives*

1. Determine the current characteristics of the building sector, taking into account various indicators such as the labour market, economic contribution to the GDP, supply chain, market trends and forecasts, major changes which affect it, immigration, emigration, grey economy and professional profiles which are involved.
2. Analyse the policies and national strategies available to help reach the European Union's energy objectives for 2020, both from an energy point of view as well as a training and educational one.
3. Compile statistics on the energy sectors and the building sector, determining the stock of buildings and their typology, workforce in the construction and business sector, and statistics relating to energy consumption and renewable energy in buildings.
4. Examine the current Training and Professional Qualifications National System as well as continuous training programs with the aim of knowing the authorities responsible, training providers, accreditation and certification systems, etc., in order to correctly value if the resources available are sufficient to cover training and skills needs on the subject of energy efficiency and renewable energy.
5. Define skills and training gaps between the current situation and those necessary for 2020, determining the need for structural monitoring measures which will allow for early detection of these gaps.
6. Identify existing barriers to reaching a suitable level of qualified building workers which could make achieving objectives in time for 2020 more difficult.

## 2.2. Methodology

The methodology applied for carrying out this study is summarised in the following figure:


Figure 6. Methodology applied in the study

As shown in the previous chart, the study combines the use of documentary and experimental analysis, followed by a validation stage, the objective of which is to ensure the results obtained are validated technically. Finally, a prospective analyst based on carrying out the earlier stages has been developed whose objective was to quantify the future behaviour of the various indicators.

With the aim of making clear to the reader of this report which training comes from primary sources - meaning, from experts - the following key is used:

This icon indicates that the training comes from semi-structured interviews

This icon indicates that the training comes from discussion groups or a panel of experts

***Documentary analysis***

With the aim of setting a base for this "status quo" study, a preliminary search and documentary analysis was carried out in which the secondary sources most relevant to the fields of energy and vocational education and training were consulted. This analysis was used to:

- ✓ Compile statistical data relevant to the analysis' objectives.
- ✓ Serve as a base for the elaboration of the various research tools for the experimental stage.
- ✓ Support and help form the drafting of the various points predicted in the report.

***Experimental analysis***

Once the documentary analysis was complete, an experimental study was developed, something necessary to answer the different variables which, due to their characteristics, it was difficult to answer through secondary sources and which it proved essential to investigate using a primary source. As a result, the following experimental techniques were carried out:

**Semi-structured interviews**

| | | |
|---|---|---|
| **Description** | Qualitative interview carried out by an expert interviewer with a "script" which gathers all of the subjects which must be dealt with throughout the interview. The order in which these subjects are dealt with and the way in which the questions are asked is left up to the interviewer who can make decisions throughout the interview. The interview lasts about an hour. | |
| **Interview group 1** | **Subject** | Description of the construction sector |
| | **No. of interviews** | 6 |
| | **Participants** | 1. AVEN Regional Energy Agency of Valencia<br>2. GRUPO ORTIZ<br>3. AM Architecture and Town Planning<br>4. ANDIMAT. National Association of Isolating Material Manufacturers<br>5. ASPRIMA. Madrid Association of Estate Agents<br>6. IDAE. Institute for the Diversification and Saving of Energy |
| **Interview group 2** | **Subject** | Relevant national and regional initiatives supported by the EU |
| | **No. of interviews** | 4 |
| | **Participants** | 7. Coria City Council<br>8. Spanish Agency Leonardo da Vinci<br>9. Extremeduran Energy Agency Energy saving and efficiency<br>10. Extremeduran Energy Agency International Projects |
| **Interview group 3** | **Subject** | Relevant national and regional initiatives supported by the EU |
| | **No. of interviews** | 9 |

| | | |
|---|---|---|
| | **Participants** | 11. INCUAL. National Institute of Qualifications. Monitoring Centre<br>12. FLCof Navarra<br>13. INCUAL National Institute of Statistics. Water and Energy Professional Family<br>14. WC. Workers Commissions<br>15. CNC. National Construction Confederation<br>16. Usurbil Vocational Training School.<br>17. CEPCO. Spanish Confederation of Building Materials Manufacturers<br>18. A3E. Association of Energy Efficiency Companies.<br>19. EOI. Industrial Organisation School. |

## Focus group

| | | |
|---|---|---|
| **Description** | Qualitative interview carried out by an expert interviewer with a "script" which gathers all of the subjects which must be dealt with throughout the discussion. The group is formed by between 5 to 10 experts on the subject. The interview lasts for approximately one and a half hours. | |
| **Interview group 1** | **Subject** | Available educational and professional development (referred to CNCP), in relation to trades and jobs in building sites and energy efficiency. |
| | **Date and location.** | 25 April 2012. FLC headquarters. Madrid. |
| | **Participants** | 1. European University of Madrid.<br>2. INCUAL. National Institute of Qualifications<br>3. INCUAL. National Institute of Qualifications<br>4. Aragón FLC<br>5. FLCHeadquarters<br>6. FLCHeadquarters<br>7. Spanish Accreditation Association<br>8. Green Building Council<br>9. Virgen de la Paloma Secondary School |
| **Interview group 2** | **Subject** | Available educational and professional development (not referred to CNCP), in relation to trades and jobs in building sites and energy efficiency. |
| | **Date and location.** | 27 April 2012. FLC headquarters. Madrid. |
| | **Participants** | 1. Structuralia<br>2. Tripartite Foundation for Work Training<br>3. Galician Inter-Union Confederation<br>4. ATEDY. Plaster Business and Technical Association<br>5. FLCHeadquarters<br>6. FLCHeadquarters |
| **Interview group 3** | **Subject** | Identification and analysis of barriers |
| | **Date and location.** | 25 May 2012. FLC headquarters. Madrid. |
| | **Participants** | 1. National Construction Confederation<br>2. Spanish Public Employment Service<br>3. FLCHeadquarters<br>4. National Family Reference Centre for Civil and Building Works<br>5. AIDICO. Construction Technological Institute<br>6. FLCHeadquarters<br>7. Spanish Public Employment Service<br>8. MCA-UGT. General Workers' Union - Metal, Construction and Similar<br>9. AIDICO. Construction Technological Institute |

**Expert panel**

| | | |
|---|---|---|
| **Description** | A panel is a meeting between various people on a set subject, focused in advance on the panel's meeting. The members of the panel, who are usually known as "panellists", express their technical and qualified opinion and point of view on the matter. The duration is about 2 hours and is led by a moderator. | |
| **Panel 1** | **Subject** | Skill gaps between the current situation and that required in 2020, referring to energy efficiency and renewable energy qualification needs: |
| | **Date and location.** | 23 May 2012. FLC headquarters. Madrid. |
| | **Participants** | 1. INCUAL. National Institute of Qualifications<br>2. EOI. Industrial Organisation School.<br>3. FTFE. Tripartite Foundation for Work Training<br>4. AM Architecture and Town Planning<br>5. ACCIONA<br>6. GRUPO ORTIZ<br>7. FLCHeadquarters<br>8. Virgen de la Paloma Secondary School<br>9. INCUAL. National Institute of Qualifications |

***Validation***

After having dealt with the various indicators predicted by the documentary and experimental analyses, validation of the results obtained is carried out. The objective is to confirm and support the investigation and, as such, achieve supported, unanimous opinions which reliably show the current reality or "status quo" in this environment. In order to do so, an expert panel is held in which the experts answer a questionnaire showing how much they agree with the conclusions found and. Afterwards, these conclusions are debated within the group:

**Expert panel**

| | | |
|---|---|---|
| **Panel 2** | **Subject** | Technical validation of results Questionnaire followed by debate |
| | **Date and location.** | 12 July 2012. FLC headquarters. Madrid. |
| | **Participants** | 1. AM Architecture and Town Planning<br>2. AIDICO. Construction Technological Institute<br>3. AIDICO. Construction Technological Institute<br>4. EOI. Industrial Organisation School.<br>5. FLCHeadquarters<br>6. INCUAL. National Institute of Qualifications. Water and Energy Professional Family<br>7. ARNAIZ Institute for Study and Research, S.L.<br>8. Grupo Ortiz<br>9. INCUAL. National Institute of Qualifications. Civil and Building Works Professional Family<br>10. INCUAL. National Institute of Qualifications. Coordination<br>11. A3E. Association of Energy Efficiency Companies. |

***Prospective analysis***

With the aim of determining and quantifying how the evolution of energy efficiency and renewable energy will be from various points of view (economic, occupational and training), a complete prospective analysis has been developed, based on the completion of a Delphi technique.

**Delphi Group**

| | | |
|---|---|---|
| **Description** | The Delphi method is a multi-disciplinary research methodology to form predictions and forecasts. Its objective is to reach a consensus based on a discussion between experts. It is a repetitive process. It works based on a questionnaire which must be answered by the experts. In this case, the questionnaire was delivered electronically. | |
| **Panel 1** | **Subject** | Prospective analysis. Application of the Delphi technique |
| | **Participants** | 50 experts from the energy and building sectors. |

## 2.3. Sources

*Primary sources*

- ✓ Acciona
- ✓ Extremeduran Energy Agency
- ✓ Regional Energy Agency of Valencia
- ✓ AM Architecture and Town Planning
- ✓ Association of Energy Efficiency Companies.
- ✓ Madrid Association of Estate Agents
- ✓ National Association of Isolating Material Manufacturers
- ✓ Coria City Council
- ✓ National Professional Family Reference Centre for Civil and Building Works
- ✓ Workers Commissions
- ✓ Spanish Confederation of Building Materials Manufacturers
- ✓ National Construction Confederation
- ✓ Usurbil Vocational Training School.
- ✓ Industrial Organisation School.
- ✓ Construction Labour Centre
- ✓ FLC of Navarra
- ✓ Tripartite Foundation for Work Training
- ✓ Grupo Ortiz
- ✓ Virgen de la Paloma Secondary School
- ✓ National Institute of Qualifications
- ✓ Institute for the Diversification and Saving of Energy
- ✓ Construction Technological Institute
- ✓ General Workers' Union - Metal, Construction and Similar
- ✓ Autonomous Organism of European Educational Programmes Leonardo da Vinci Division
- ✓ Spanish Public Employment Service

*Secondary sources*

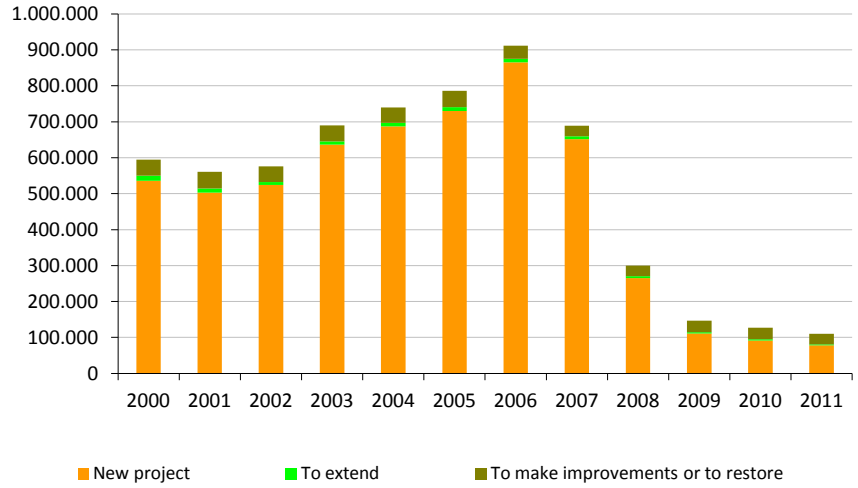
- ✓ Bank of Spain
- ✓ Buildings Performance Institute Europe
- ✓ Vocational Training General Council
- ✓ EUROCONSTRUCT
- ✓ Construction Labour Centre
- ✓ National Institute of Statistics (INE)
- ✓ National Institute of Qualifications
- ✓ Institute for the Diversification and Saving of Energy
- ✓ Ministry of Education, Culture and Sport
- ✓ Ministry of Employment and Social Security
- ✓ Ministry of Development
- ✓ Ministry of Industry, Tourism and Commerce
- ✓ Construction Industrial Monitoring Centre
- ✓ Spanish Electricity Board
- ✓ Spanish Public Employment Service
- ✓ WWF Spain

# 3. Characterisation of the building sector

## 3.1 Historic information

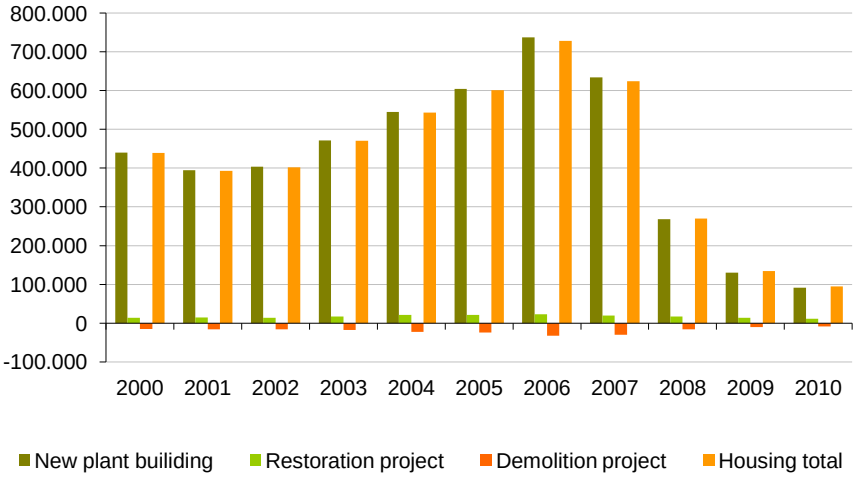
The evolution of the number of project management approvals from the Technical Architect Associations is studied to assess the activity of the building sector during the previous 12 years.

It is observed the drastic fall in the number of new project approvals granted since 2006. It is also observed a growing tendency in the relative weight of restoration project approvals regarding the total of approvals granted since 2006.




Graph 1. Project management approvals: housing number. Source: Ministry of Development.

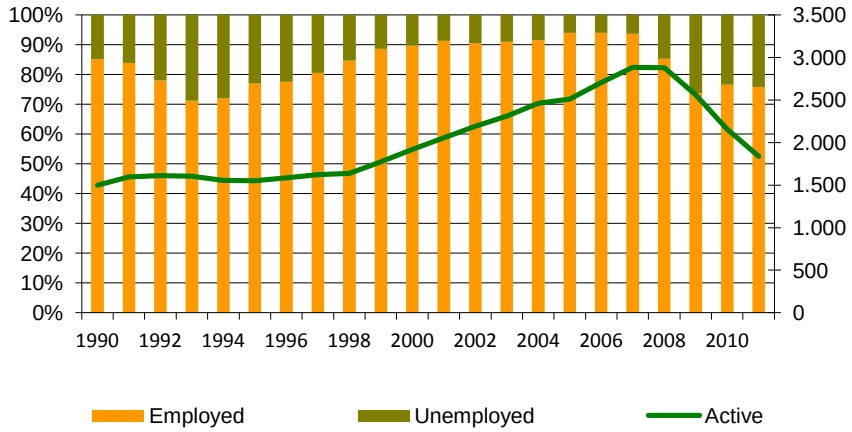
The approval reflects the procedure where the Architect Association gives its consent to the building plans and so it constitutes an advanced indicator of the start of the building productive process. However, not all the approved projects end with the execution of the housing, since that requires a local project permit. In the analysis, the number of local permits could be taken into account as an indicator in the short term of the activity.




Graph 2. Local project permits: number of housing according to type of project. Source: Ministry of Development.

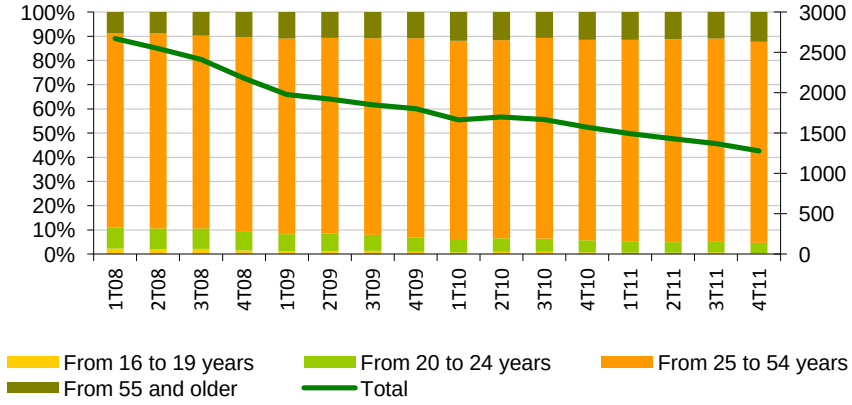
### *3.1.1 Labour market*

At the building sector work market, it is observed that the number of active people at the sector has not stopped decreasing since 2007. This fall together with the increase in the number of unemployed people, leaves the number of employed people at the building sector in 2011 at 1,393,000 people, a 15.62% less than the previous year.




Graph 3. Active, employed and unemployed people at the building sector (thousand of people). Source: Spanish Statistics Institute

According to age, the employment at the building sector has predominantly correspond to ages from 25 to 54, with more than an 80% of total employment.




Graph 4. Employed people at the building sector ordered by age (percentage distribution and thousand of people). Source: Spanish Statistics Institute.

### *3.1.2 Relations with other sectors*

The building sector is characterized by being a key sector for the Spanish economy owing to the important domino and strangulation effect it causes to the rest of productive sectors.

The next chart details which percentage of the production from each sector is necessary to satisfy the demand the building sector receives, so we obtain the sector whose production is more dependent from the sector's demand.

| Sector | % |
|---|---|
| Building | 86,324 |
| Production of other non-metallic mineral products | 77,700 |
| Production of concrete, lime and plaster | 76,159 |
| Extraction of non-metallic minerals | 53,523 |
| Pottery industries | 49,658 |
| Wood and cork industry | 33,816 |
| Production of metallic products | 33,410 |
| Machinery and domestic equipment rental | 27,343 |
| Production of machinery and electrical material | 26,952 |
| Production of glass and glass products | 20,606 |
| Recycling | 20,322 |
| Metallurgy | 18,848 |
| Machinery and mechanic equipment | 14,548 |
| Rubber and plastic matters industry | 13,844 |
| Land transport and pipeline transport | 13,621 |
| Extraction of metallic minerals | 12,828 |
| Forestry and forest exploitation | 11,949 |
| Extraction of anthracite, coal, lignite and peat | 11,781 |
| Transport related activities | 11,721 |
| Whole trade and intermediaries | 11,342 |
| Furniture and other manufacturing industries | 11,168 |
| Production and distribution of electrical energy | 10,162 |

Table 1. Direct and indirect production needed to satisfy the demand directed to building. Source: Building Industrial Observatory.

According to consulted experts, some related sector with that of building, have been positively affected since the CTE (Building Technical Code) came into effect, and they have introduced new equipments and professional specialties since the law included energy efficiency measures and, specially, the use of renewable energies. Despite the economic situation does not encourage investment, some sectors have committed theirselves to the energy efficiency and the renewable energies, specially, the industry, hotel business and trade (food).

The industry sector consider the energy efficiency and renewable energies a competitive advantage for its business, the relevant energy cost, as well as the improvement of its corporate image, paying attention to sustainability.

The great hotel chains have been pioneer in their bet for Energy Efficiency and Renewable Energies, since they have a high demand of constant heating and air-conditioning, and an adjustment of a 5% or 10% in consumption means a big saving on their operations.

Trade has experienced a relevant demand of energy efficiency, with a high demand of subsidies from the IDAE (Energy Saving and Diversification Institute), specially among the great hypermarket and supermarket chains as part of an energy saving plan, they have performed very important economic investments.

At office buildings, the extension of the energy efficiency is limited yet. Although new buildings are being introduced these measures at their design, just some corporate buildings show an effort on energy efficiency mainly related with the corporate image.

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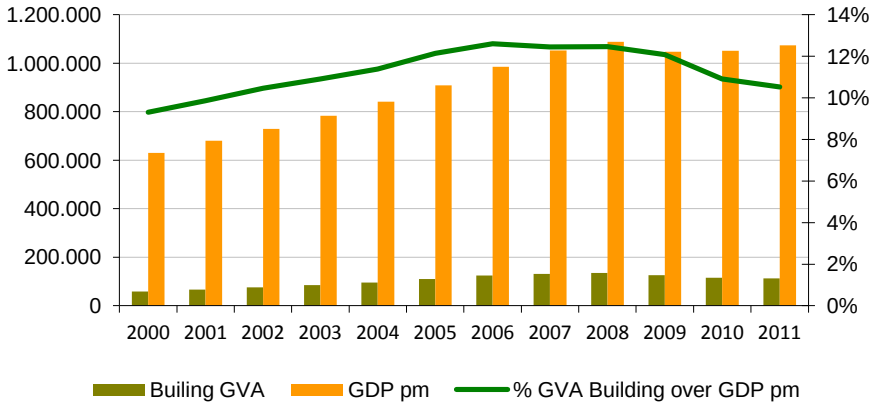
### 3.2 Economic contribution to GDP

The contribution of the building sector to national GDP throughout this series moved from 9.31% in 2000 to 10.53% in 2011. The greatest participation was reached in 2006, with a 12.60% of the Spanish GDP value.




Graph 5. Economic contribution of building sector. Source: Spanish Statistics Institute

### 3.3 Supply chain

*Extraction of building materials*

The sector of building materials extraction has worsened in the latest years. The total number of companies working on the extraction of building materials in Spain has fallen since 2008 and so it did the production, the net business cipher and the gross value absolute of the sector over the industry total. On the other hand, net exports of building materials have increased, moving from 78 million Euros in 2008 to an amount of 239 millions in 2010. The industry production rate recovers in 2010, as well as the industrial prices.

Regarding employment, the number of employed people on the sector has decreased from 2008 to 2010, from 42,000 to 25,300 people. Moreover, the salaried employment has increased. With respect to the workers' age, those younger than 29 have reduced their relative importance and the older ones have increased. The temporary contracts have fallen with respect to 2009 and so the number of foreigners. According to the education level of the sector's workers, it is observed that those with a level of compulsory education or lower level of education have decreased, those with a secondary education level have increased, and so those from professional training, they increase more than the previous ones. The higher education workers decreased from 2008 to 2009.

The expense in Research, Development and Innovation decreased from 2008 to 2009 from 8,27 million Euros to 3.93 million, and this also happened to the expense in Research and Development, both internal and external. Moreover, less and less companies work on Research and Development, although the total staff working on that increased in 2009 more than in 2008. The strenght of companies specialized in Research and Development has also decreased. On the contrary, the expense in innovation increased a 27.91% from 2008 to 2009. So it happened with the innovative strenght of the companies working on that, although this kind of companies grew less in 2009 than in 2008.

*Building materials production*

Likewise, at the building materials construction, the number of companies has fallen during this period for the total of the period. The whole business production and cipher of the sector have also dropped. The decrease in the number of companies has been an 8.30%, although the drop

of these two variables has been 40% and 39.63% respectively. So, the gross value absolute of the sector over the industry total has fallen a 3.01%, moving from representing the 9% in 2008 to the 5.6% in 2010. The net exports have been positive throughout the whole period and they have increased, going from 2,560 million Euros to 3,114 million. The investment in material has been decreasing, so as most of all of the variables, moving from 2,309 million Euros to 808 millions, and that means a drop in percentage of a 65.01%. Finally, both the IPI and the IPRI for these sectors worsened in 2009 and improved in 2010.

The materials production shows a relevant qualitative hop: Research, Development and Innovation have been promoted for the development of new materials adapted to energy efficiency, although specially, the material supplier has included on its product catalogue, the products from the renewable energies. Likewise, on the production of already existing materials, it is observed a relevant change regarding their quality, both from the production and the labelling point of views. The materials have now more efficiency, everything seeks the energy saving is strong. The supplier companies have also been forced to recycle and to offer, not only supply, but also maintenance and management. That is why they had to renew all of their technical knowledge and, in many cases, to hire a maintenance energy technical or manager.

Although the materials technical cards include the definition and properties of the product and they show if it has the qualities provided at the Building Technical Code, the experts state that including the energy labelling on products or materials used in building would be a competitive advantage (windows, boilers, heaters). Other measure, considered necessary by the experts, are the economic incentives by the Administration, since they are considered to be essential to extend the use of efficient building materials, products and systems, like for example, the Renove plans.

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### 3.4 Market tendencies and predictions

From the market predictions performed by EUROCONSTRUCT, it is expected that the negative tendency showed by the building sector in Europe during the second half of 2011 is interrupted in 2013 and 2014, when the growing rates are estimated at a value of 2%.

In Spain, the group predictions point out that the situation of Spain's economy is 'delicate', specially that of the building sector, 'critical', and moreover, there are not any indicator showing tendency change. For 2011, it is expected a contraction of the 19%, and for 2012, a contraction of the 9%.

By market area, the high housing stock existing on residential building remains and impede both the construction of more housing and the restoration activities. The perspectives for the building activity in 2012 show stagnation of the activity. The experts do back this information, and they maintain that, at present, new projects tends to zero, because there is not demand, because there is a production excedent, and because there is not much building urban land.

The non residential building for the period 2011-2012 will be much recessive (around -10% per year). The predictions for 2013-2014 move from +1.5% per year and, despite it shows certain growing, its value remains far from the usual production levels.

From the point of view of the experts, it is stated that the advance in Energy Efficiency and Renewable Energies on building is, at present, limited. Although there is an important movement regarding the energy efficiency and the renewable energies, it is needed to know what it really is and, specially, how to implement it profitably.

The constructions built during the latest 20 years, before the Building Technical Code, are quite poor constructions from the energy point of view, and that is why their restoration will be needed. That is why the challenge is that of restoration: but this is not free of any complexity, owing to work in already built spaces, with reduced execution periods and small budgets. It is considered to be necessary the development of new products, technologies and the arising of professionals with specialized knowledge. To face the restoration process will be necessary to give bonus and incentives its development through subsidies.

From a more general point of view, the experts state that the sector will only reach the aims 2020 if the sector specialization come with plans and incentives by the Administration, both in the field of renewable energies and that of energy efficiency.
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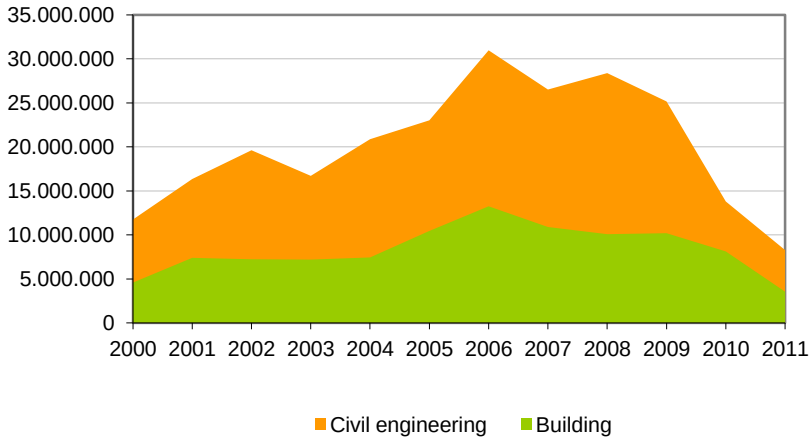
### 3.5 Main changes affecting it

This paragraphs tries to show the effect of some factors commonly described as demand factors. The analysis comes from the breaking down of the GDP on the demand side, that is to say, studying public expenditure indicators, investment and credit granted to companies and families.

*Public expenditure*

At first, it is necessary to point out a decrease in the public investment. For the quantification of the public expenditure, it has been taken the tender volume by the public administrations in Spain.

The variable followed a growing tendency until 2006 in both types of construction, except for the contraction of tender volume for civil engineering in 2003. From 2006, the variable tendency has been negative, except the temporary recovery of the budget for civil engineering in 2008.

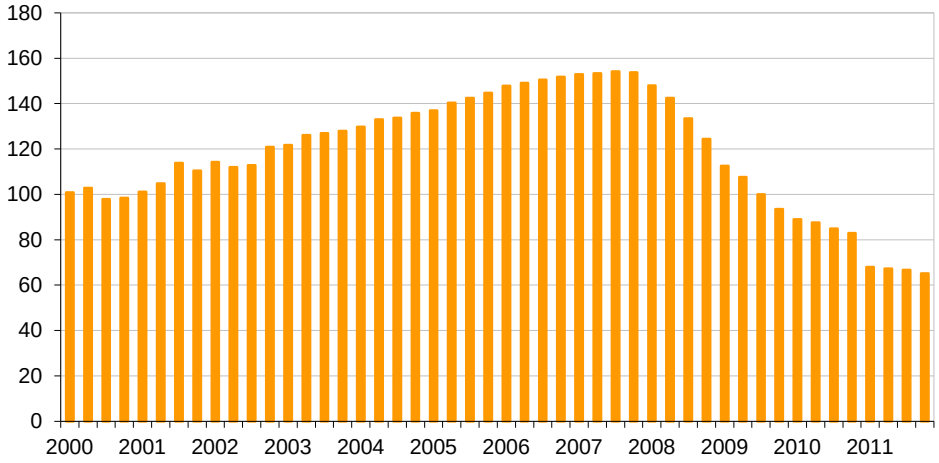



Graph 6. Tender official building (thousand of Euros). Source: Ministry of Development

The experts state the general public financial system works, as great results were obtained through public financing of Energy Efficiency and the use of Renewable Energies. The elimination of many deficient equipments has been promoted, and with little substantial public aid. The specific application of public expenditure for building with Energy Efficiency and Renewable Energies criteria is specially important as the private financial support to invest in the matter is practically nonexistent. Among other measures, it has been suggested the public incentives for research and development, as well as more support through tax deductions.

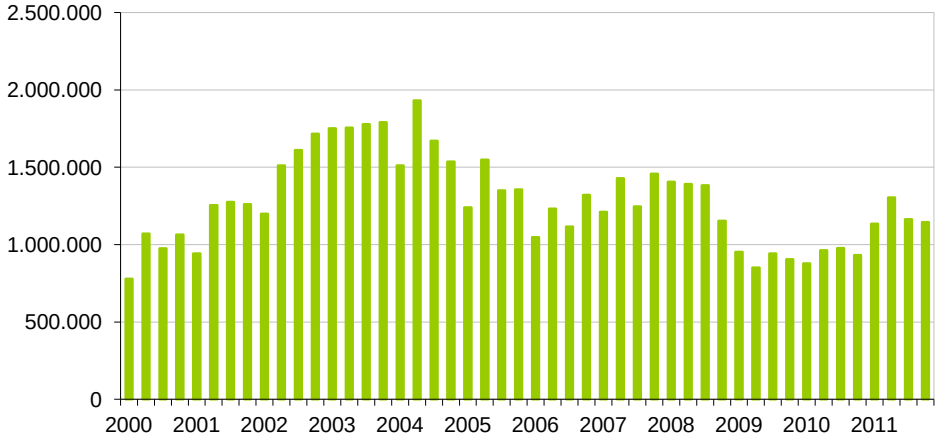
*Investment*

On the other hand, the internal investment in immovable assets opens the second part of this paragraph. This variable reached its maximum in 2007 and since then it has fallen until the index (2000 basis) at 65.15 points on the fourth quarter of 2011. The average year-on-year drop on the four quarters of 2011 was -22.43%.




Graph 7. Internal investment in housing. Index (2000 base = 100). Source: Bank of Spain[1].

The detail corresponding to foreign investment in immovable assets shows that during the first semester of 2011, the variable grew until it reached the levels before the strong fall by the end of 2008. In the second semester of the year, the variable slightly fell until it reached the level of 1,145 million Euros during the fourth quarter of 2011. Throughout the year, the average year-on-year variation rate was that of 26.75%.

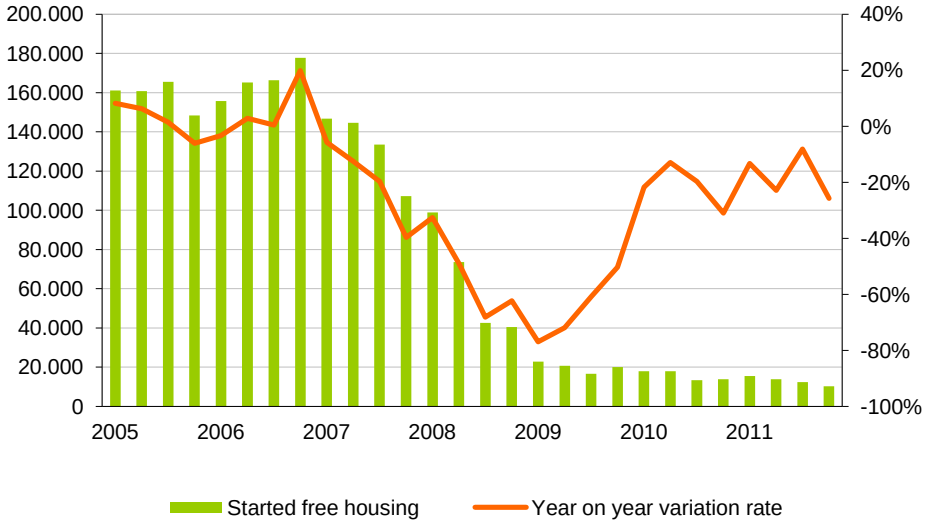



Graph 8. Foreign Direct investment in immovable assets (thousand of Euros). Source: Bank of Spain[3]

According to real estate agency registry statistics, the number of housing buying and selling registered during 2011 was a 16.97% lower than in 2010. The variable dropped again in 2011, registering an average quarterly value of 92,551 transactions.

On the other hand, the drop in the number of started buildings has been softened, maintaining the activity at minimum levels. The average year-on-year reduction rate in 2011 was a 17.50%, 3.84 percentage points less than 2010 rate and 47.49 percentage points less than that of 2009.

[3] Base 100 = 2000

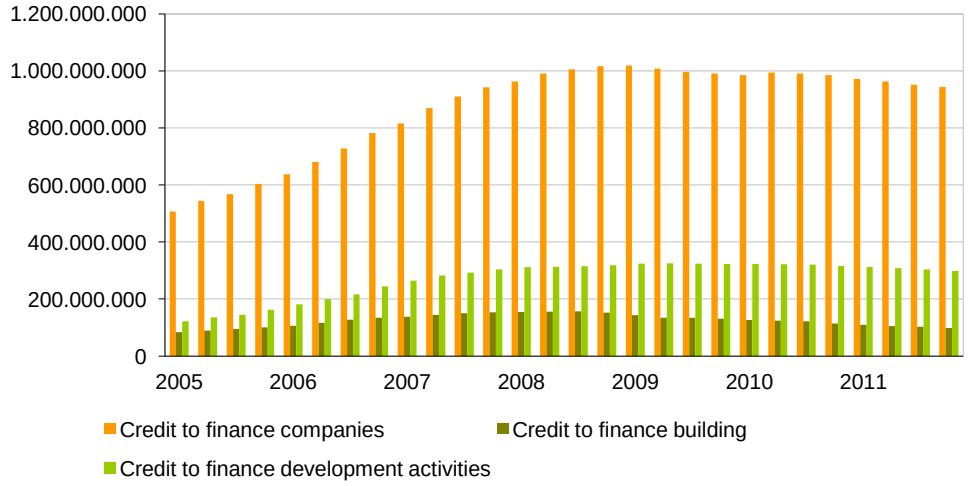



Graph 9. Free started housing (units and rates). Source: Bank of Spain

*Credit granted to companies and families*

Secondly, it is studied the access to credit by development companies and families.

In the field of productive activities, the highest contraction of credit has taken place, one more year, on the financing of the building sector activities. The drops in the granting of credits to the sector's agents were fixed by the end of 2011 in year-on-year rates of -13.98%.

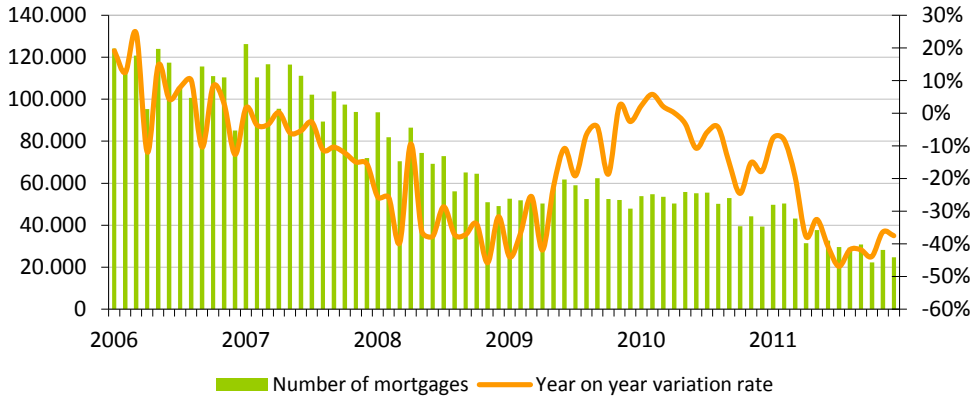



Graph 10. Credit to productive activities (thousand of Euros). Source: Bank of Spain.

The credit granted to homes has fallen to an average year-on-year rate of 1.81% in 2011. However, the amount to acquire and restore housing has maintained practically constant.


Graph 11.Credit to homes for housing (thousand of Euros). Source: Bank of Spain

The volume of mortgages constituted over housing reached in 2010, as an average, the 50,000 mortgages every month. The cipher has been reduced in more than 15,000 mortgages, with an average value of 34,111 mortgages every month in 2011. The global cipher of 2011 has experienced a drop of 32.36 with respect to previous exercise.



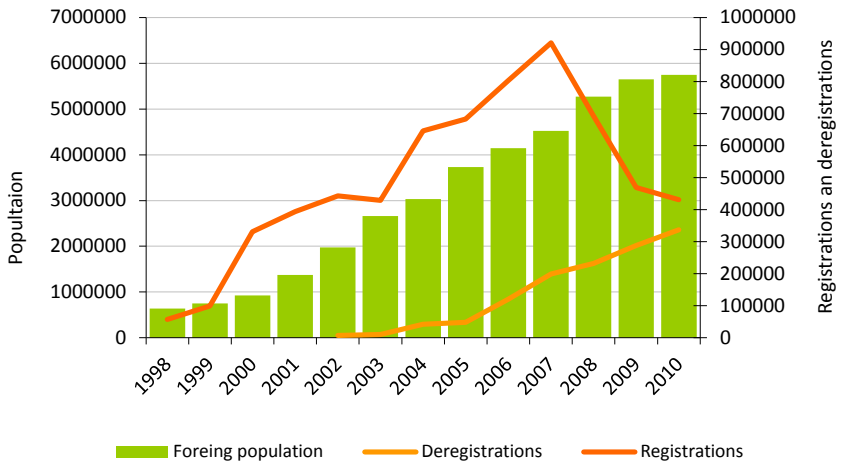

Graph 12. Mortgage constituted over housing (units). Source: Spanish Statistics Institute

### 3.6 Immigration and emigration

Two main factors are underline about the impact of migrations on the market of building and housing. On the one hand, the demographic factor plays an important role to determine the demand of housing and that is why the migration movements have a direct influence over the needs and demand of housing by the population. On the other hand, the building sector is historically the one that, in percentage terms, houses more foreign workers.

According to the importance of migratory movements, below it is studied the evolution of immigration during the latest years and its main features.

The immigration has been an essential phenomenon on the population evolution of Spain. Between 1998 and 2011, the population in Spain grew 7,337,842 inhabitants. A 69.7% of this increase is owed to immigration. Although the total cipher of foreigners in our country has increased from 1999 to 2001, the growth rythm has been reduced since 2009, until it reached its lower levels in 2011. During the assessed period, the foreign population has increased, moving from 637,085 people in 1998 to 6,751,487 in 2011, and that means an increase of more than 5 million people.




Graph 13. Evolution of foreign population in Spain. Source: Prepared with details from the Spanish Statistics

The increase in foreign population has been widespread for all the age groups, except that of people aged 15 to 34, who started to decrease since 2010 (a 2% in 2010 and a 3.8% in 2011. It is logical to think that this exit of foreigners from the country is related with the decrease in labour opportunities.

The keys the experts mention to this respect are:

- In general, the qualification of immigrant workforce is equal to the national one: there is a clear need to professionalize the sector regardless of the worker's origin.
- Good practices are not imported, but materials. Almost all the material systems, researches and development are performed abroad.
- Some high qualified professionals, such as engineers or architects, are moving abroad in search of opportunities, specially to countries where the building sector is emerging.

### 3.7 Black economy

According to the Spanish Royal Academy, black economy refers to all economic activity performed apart from the legal channels, without appearing on the fiscal or statistic registries. It is important to point out that, although we do not agree if black economy includes illegal activities, crimes, etc., those illegal activities nor those unregistered by law has not been assessed to quantify it.

The study of black economy, performed throughout the years by Dr. Friedrich Schneider, considers the percentage of GDP included on the trade transactions that are not declared in up to 31 countries of the European Union and other 5 of the OECD.

On the latest study The shadow economy in Europe (Friedrich Schneider, 2011), published by A.T. Kearney, the author estimates the black economy in Europe at 3.3 trillion Euros in 2011, that is to say, a 5% higher than the estimation performed for 2007. The percentage estimated for 2012 of the black economy in Spain is 0.8 percentage points over the average calculated for the 27 Europe, with a value of 19.2% of the GDP.

The level of the black economy varies according to the nature of the economic sector where these activities take place. In Spain, for example, in 2009[4], the 29.3% of the GDP arising from the building sector would correspond to activities performed apart from the regulation. This percentage was reduced in almost 3 percentage point with respect to that of 2008.

[4] Latest detail available of the percentage of black economy by economic area.

| | GDP (million Euros) | % black economy | Black economy (million Euros) |
|---|---|---|---|
| Agriculture, ranching, forestry | 26.132 | 11,0% | 2.871 |
| Fishing | 1.789 | 9,2% | 164 |
| Extractive industries | 1.929 | 0,0% | 0 |
| Manufacturing industry | 133.528 | 16,5% | 22.004 |
| Electricity, gas and water supply | 26.041 | 0,0% | 0 |
| Building | 113.516 | 29,3% | 33.255 |
| Wholesale and retailer trade; reparation of engine vehicles and motorbikes | 109.511 | 18,3% | 20.051 |
| Hotel business | 79.141 | 19,2% | 15.215 |
| Transport, storage and communications | 70.955 | 14,6% | 10.393 |
| Financial and insurance activities | 69.373 | 0,0% | 0 |
| Development activities and professional activities | 179.105 | 9,2% | 16.397 |
| Public Administration and defence; compulsory Social Security | 69.924 | 0,0% | 0 |
| Education | 54.770 | 0,0% | 0 |
| Health care and social services activities | 68.223 | 11,0% | 7.495 |
| Artistic, recreational and entertainment activities | 41.404 | 9,2% | 3.790 |
| Home activities such as domestic staff recruiters | 8.575 | 12,8% | 1.099 |
| Organizations and extraterritorial institutions activities | 0 | 5,5% | 0 |
| **Total** | **1.053.914** | | **132.735** |
| Entertainment, massages, prostitution, domestic services and others | | | 72.778 |
| **Total black economy** | | **19,5%** | **205.513** |

Table 2. Black economy by areas (million Euros and percentage). Source: Dr. Friedrich Schnaider, Johannes Kepler University of Linz, Austria; A.T. Kearney analysis.

The experts do state that there exists black economy in the sector and they point out that it mainly appears in the subsector of restoration, owing to the chances it offers for not declaring the activity. The new regulation on Energy Efficiency and Renewable Energies could be an opportunity to mitigate the problem, provided that the bonus and subsidies are conditioned to the declaration of economic activity and that of employment.

### 3.8 Involved professional profiles

According to the experts, the regulation change is going to mean a necessary improvement in the qualification of the professionals working on the sector, since it will produce demand of specialized workforce. Although new professional profiles related to the Renewable Energies have arisen, with respect to Energy Efficiency, the experts do not consider that new professional profiles appear, but that the existing ones will be required to recycle. It is considered to be necessary that all the building workers, wether construction or restoration, have a global knowledge so they could understand the importance of the requirements related to the changes in regulation and the proper consequences for the building sector.

Although companies always find positive to have qualified professionals, at present, and without a further development of Energy Efficiency, it does not mean a competitive advantage for companies; it will be if Energy Efficiency and the use of Renewable Energies is promoted in building. The companies will include this on their resume when it becomes a competence element since the customer requires it.

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For the identification of the different professional profiles involved in the installation of new building materials and systems, it is important to take into account the provisions appearing on the Building Technical Code, specially the paragraphs of the basic certificate of energy saving (DB-HE), and its relation with different project stages.

This paragraph shows part of the results from the study 'Impact of building technical code over the building processes', performed in 2010 at the Building Sector Industry Observatory, and some of its participants were:

- Spanish National Building Confederation (CNC)
- Spanish Building, Wood and Related State Federation of Comisiones Obreras [Trade union] (FECOMA-CCOO)
- Spanish Metal, Building and Related of Unión General de Trabajadores [Trade union] (MCA-UGT)
- Spanish Federation of Technological Innovation Companies (FEDIT)
- Spanish Building Labor Foundation (FLC)

To write this paragraph, we took as reference the work performed by Fundacion Laboral de Asturias on 'training needs at building sector and related sector by the impact of new regulations (Building Technical Code and environmental regulation)'. This study was performed thanks to the financial aid of the Ministry of Education and Science of the Principality of Asturias and the European Social Fund, through the calling for complementary measures for training.

| **Limitation of energy demand** | |
|---|---|
| **Stages** | **Involved professional profiles** |
| COVERS: Isolation, slope formation, roof structure, roof end and quality control**.** | ✓ Roof builder<br>✓ Isolation installer<br>✓ Installer of covers and rain networks<br>✓ Builder |
| EXTERNAL CLOSING: Façade placement, isolation, location de facades, insulations, pre frame on holes, joint sealing with adjoining buildings, expansion joints. Use of conventional materials, prefabricated and new materials. | ✓ Isolation installer<br>✓ Gasket sealing worker<br>✓ Builder<br>✓ Quality and environmental control Technician |
| PARTITIONS- Conventional partitions, prefabricated and new materials. Interior partitions, elevator space, pre frame installation on interior carpentry, built-in wardrobes. | ✓ Builder<br>✓ Locksmith |
| CARPENTRY- Internal and external carpentry instalment | ✓ Locksmith<br>✓ Aluminium carpentry and PVC installer |
| **Performance of thermal installations** | |
| **Stages** | **Involved professional profiles** |
| Air conditioning installations | ✓ Approved installer for hot sanitary water and air conditioning |
| **Energy efficiency of lighting installations** | |
| **Stages** | **Involved professional profiles** |
| Electrical installations | ✓ Electrician<br>✓ Lighting installer |
| **Minimum solar contribution of sanitary hot water** | |
| **Stages** | **Involved professional profiles** |
| Installations of sanitary hot water | ✓ Thermal solar installations installer.<br>✓ Thermal solar installations maintenance operator.<br>✓ Alternative energy systems Technician.<br>✓ Pipeline solar energy installer.<br>✓ Solar energy plates installer.<br>✓ Thermal Solar facility installer.<br>✓ Thermal Solar energy systems installer.<br>✓ Thermal solar facilities maintenance operator |
| Plumbing installations | ✓ Plumber |
| **Minimum photovoltaic contribution of electrical energy** | |
| **Stages** | **Involved professional profiles** |
| Electrical production | ✓ Photovoltaic solar facility installer<br>✓ Photovoltaic solar facility operator<br>✓ Solar energy plate installer<br>✓ Photovoltaic solar facility installer<br>✓ Wind and photovoltaic system installer<br>✓ Photovoltaic solar central operator<br>✓ Photovoltaic solar installation operator |

Table 3. Project stages and most professional profiles involved in the performance of the new building regulations. Source: 'Impact of the Building Technical Code on building processes', Building Sector Industry Observatory 2010.

The above charts have detailed the most affected profiles regarding energy saving. Although current situation of the building sector seems that all occupations, in general, will suffer modifications to improve the production and to increase professionality.

However, according to the results showed on the Building Industry Observatory, the occupation needing to refresh at this matter and moving to specific training actions are:

- ✓ Foreman
- ✓ Builder
- ✓ Plumber
- ✓ Heating and air conditioning installer
- ✓ Gas installer
- ✓ Quality control and environment technician
- ✓ Electrician
- ✓ Isolation installer

# 4. National policies and strategies to contribute to the EU 2020 energy targets in buildings

## 4.1 Summary of the set of measures applied or in progress

The Spanish national strategy to date responds to the principle of sustainability understood in its triple dimension of economic efficiency, social equity and environmental quality. At the moment, it gives priority to actions oriented towards the rehabilitation of buildings, the improvement of urban areas and territorial cohesion, given that the existing buildings are those that contribute most to the energy use, and it is forecast that, at least over the next ten years, the construction of new buildings will be significantly reduced in comparison with the previous economic cycle.

Given that the construction sector in Spain has traditionally been oriented towards the construction of new buildings, especially in what regards the residential aspects, the strategies aimed at rehabilitation of existing buildings have had, until now, a more reduced legal development than those related to new construction. The aforementioned strategies are implemented as follows:

### *4.1.1 Improvement of the energetic capacity of current construction stock*

- ✓ Promotion of initiatives aimed at increasing the energetic efficiency of old buildings by means of subventions or incentives (at national or autonomous level).
- ✓ Rehabilitation of the thermal insulation of existing buildings.
- ✓ Improvement of the energetic efficiency of thermal installations in existing buildings. Promotion of biomass use for thermal purposes in buildings, and a Renewal Scheme for high-capacity boilers.
- ✓ Improvement of the energetic efficiency of Interior Lighting Installations in existing buildings.
- ✓ Renovation of the municipal public lighting system with the aim of energetic efficiency.
- ✓ Home Appliances Renewal Scheme.
- ✓ Development of the cogeneration potential. Support for non-industrial cogeneration and micro-cogeneration.
- ✓ Tax allowances and economic support for the owners who initiate rehabilitation works.

### *4.1.2 Establishment of minimum energetic capacity standards for new and significantly renovated buildings, to be evidenced by means of energetic efficiency labels*

- ✓ Reform of the current Building Technical Code (CTE – Código Técnico de la Edificación) with the aim to increase energy savings and the capacity of new buildings, as well as the existing ones that are significantly upgraded through extension, modification, alteration or rehabilitation works.
- ✓ Enforcement of the Rules of Thermal Installations in Buildings (RITE – Reglamento de Instalaciones Térmicas de Edificios) which complement the CTE by establishing a basic legal framework which regulates the requirements of energetic efficiency and security that need to be fulfilled by the thermal installations in buildings: heating, air conditioning and domestic hot water, with the view to gradually replace the less energy-efficient installations.
- ✓ Energetic certification of new buildings with the aim to value the energetic efficiency of the estate as well as its $CO_2$ emissions, to be evidenced by means of energetic labels available to the buyers or users of such buildings at the moment of sale or rental.
- ✓ Energetic certification of existing buildings that will be required to obtain an energetic efficiency certificate within a certain time frame.
- ✓ Transposition of Directive 2010/31 with regard to buildings of very low energy consumption

*4.1.3 Improvement of existing urban tissue with the aim to improve the environmental quality and reduce energy consumption and CO2 emissions*

- ✓ Creation of new central areas, enhancement of the combined urban use and proximity.
- ✓ Giving priority to the recovery and rehabilitation of the cities faced with the creation of new expansion sectors; absorbing growth within the cities according to the criteria of compactness and physical and functional proximity, and the rational use of the infrastructure, facilities and services.
- ✓ Promoting measures oriented towards the integration into the urban tissue of facilities that are compatible with the residential function, with the aim to encourage the proximity of services and facilities for the resident community, avoiding unnecessary displacements and their consecutive environmental impact.
- ✓ Promotion of the Local Agenda 21 for tourism and of the Tourist Installations Renewal Scheme.

## 4.2. Action Plan for Energy Savings and Efficiency 2011-2020

Approved on 29th July, 2011 in fulfillment of directive 2006/32/CE on energy efficiency, it drafts an investment plan for the sector with a view to improving the energy efficiency of insulation systems, thermal installations and lighting of the existing construction stock, as well as the construction and integral rehabilitation of 8.2 million $m^2$ per year with a high energy qualification, creating an exclusive market for the construction of buildings of very low energy consumption.

With regard to equipment, the continuation of Home Appliances Renewal Scheme is proposed, with the aim to replace 500,000 devices /year (out of the estimated stock of 90 million appliances).

In particular, the aim is to enhance the construction or energetic rehabilitation of buildings that could achieve energy qualification A or B, by means of subsidies for buildings that comply with the requirements of RD 47/2007 and the specific rules established by each Autonomous Community:

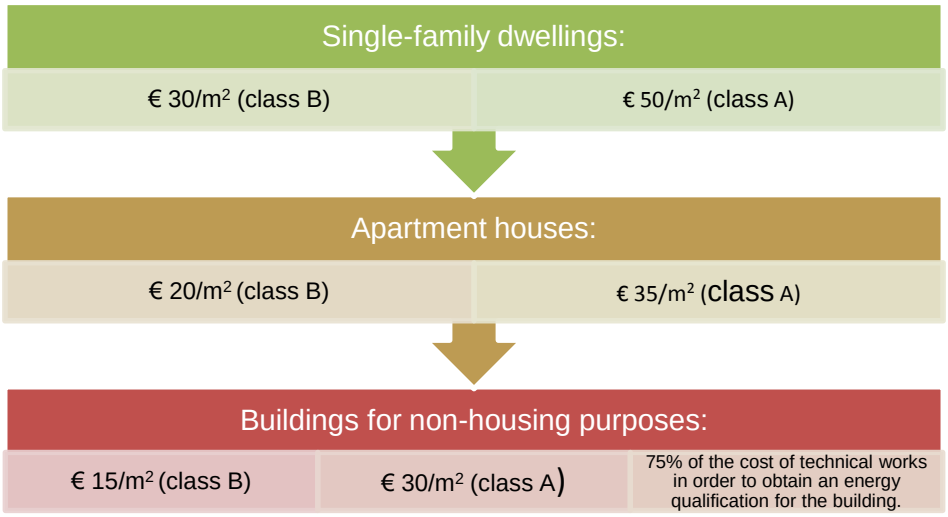



Figura 7. Types of grant

## 4.3 Compulsory rules on energy efficiency and renewable energies applied to the construction sector

### *4.3.1 Building Technical Code*

The Building Technical Code (CTE) is the legal framework that establishes the requirements to be fulfilled by buildings with regard to the basic security and habitability standards introduced by Law 38/1999 on Construction Regulation (LOE – Ley de Ordenación de la Edificación, 5th November 1999).

The Basic Quality Requirements that need to be fulfilled by buildings refer to the security and habitability, health, protection from noise and energy saving, detailed in various Base Documents.

The CTE seeks to answer society's demand in what concerns improving the quality of construction and, at the same time, to improve user protection and enhance sustainable development.

The Base Document (DB) relative to energy saving aims at establishing rules and procedures that will allow to meet the basic requirements of energy saving, as follows:

- ✓ **Basic Requirement HE 1: Limiting the energy demand** *Buildings* (new construction, or the modifications, alterations or rehabilitations of existing buildings with a useful surface superior to 1000 $m^2$, where more than 25% of the total perimeter is renovated) will have insulation adequately limiting the *energy demand* needed to achieve *thermal well-being* as a function of the local climate, the use of the building and the summer/winter pattern, as well as the proper characteristics of insulation and inertia, air permeability and exposure to solar radiation, reducing the risk of superficial and interstitial condensation humidity that might adversely affect the building's characteristics, and appropriately applying the *thermal bridges* in order to limit the loss or increase of heat and avoid hygrothe rmal issues.

- ✓ **Basic Requirement HE 2: Capacity of thermal installations** *Buildings* will have appropriate thermal installations designed to provide *thermal well-being* to their inhabitants. This requirement is embedded in the Rules of Thermal Installations in Buildings (RITE) currently in force, and its application will be defined in the *building project*.

- ✓ **Basic Requirement HE 3: Energy efficiency of lighting installations** *Buildings* (new construction, or the rehabilitation of existing buildings with a useful surface superior to 1000 $m^2$, where more than 25% of the illuminated surface is renovated) will have lighting installations adequate to the needs of their *users* and at the same time energetically efficient, with a control system that allows to adjust the lighting to the real occupation of the area, as well as a regulation system that will optimize the use of natural light, in the areas that fulfill certain conditions.

- ✓ **Basic Requirement HE 4: Minimum solar contribution to domestic hot water** In *buildings* with domestic hot water supply or an indoors swimming pool, excluding certain exceptions, part of the thermal energy needs will be covered by incorporating systems of reception, storage and use of low-temperature solar energy, adequate to the global solar radiation of the given site and the demand for hot water in the building or swimming pool. The values derived from this basic requirement will be considered as minimal, notwithstanding the values that can be established by the competent administrations as long as they contribute to sustainability, taking into account the local characteristics of the site.

- ✓ **Basic Requirement HE 5: Minimum photovoltaic contribution to electric energy** In supermarkets, commercial and entertainment centers, storage premises, administrative buildings, hotels, hostels, hospitals, clinics and exhibition sites with surface beyond a given threshold, or that exceed a certain residential capacity, systems

of reception and transformation of solar energy into electric energy through photovoltaic processes will be incorporated, for own use or network supply. The values derived from this basic requirement will be considered as minimal, notwithstanding stricter values that can be established by the competent administrations as long as they contribute to sustainability, taking into account the local characteristics of the site.

### *4.3.2 Rules of Thermal Installations in Buildings (RITE)*

The Rules of Thermal Installations in Buildings (RITE) establish the conditions that need to be fulfilled by installations designed to satisfy the demand for thermal well-being and hygiene through heating, air conditioning and domestic hot water installations, in order to achieve rational use of energy.

The main requirements for energy efficiency established by RITE are as follows:

- ✓ Increased energy capacity of heat and cold-generating equipment, as well as equipment designed for liquid transportation.
- ✓ Better insulation of thermal fluids equipment and pipelines.
- ✓ Better regulation and control in order to maintain the design conditions for air-conditioned sites.
- ✓ Use of all renewable energies available, especially solar energy and biomass.
- ✓ Incorporation of sub-systems for energy recovery and residual energy use.
- ✓ Compulsory use of consumption accounting systems in case of collective installations.
- ✓ Gradual elimination of more polluting solid fuels.
- ✓ Gradual elimination of less efficient generating equipment.

### *4.3.3 Energy efficiency certification for new construction buildings*

The energy efficiency certification is a requirement derived from Directive 2002/91/CE, transposed into the Spanish legal framework through Royal Decree 47/2007, which approves the Basic Procedure for energy efficiency certification for new construction buildings.

The aforementioned procedure establishes energy consumption standards within a qualification scale created on the basis of data obtained from a specific study of real estate stock in Spain, establishing limits and borders between each qualification grade as a function of the type of building and the environmental conditions of its location.

The application scope of RD 47/2007 includes both new construction buildings and the rehabilitations or alterations of existing buildings with a useful surface superior to 1000 $m^2$, where more than 25% of the total perimeter is renovated.

The aim is to promote energy efficiency in new construction buildings, not only by establishing minimum compliance standards, but also by supplying the buyer or user with comparative data on the building's energy performance, which is why two energy certificates are granted:

- ✓ Energy Certificate for the Project: undersigned by the director of the building project or the thermal installations project. Incorporated into the executive project of the building.
- ✓ Energy Certificate for finished construction: undersigned by the project management of the construction works and valid for 10 years, it ensures that the pre-established conditions were maintained during the project execution. This certificate has to be included in the Building Book and delivered to the building's owners.

The procedures to obtain the energy efficiency qualification of a building allow the choice between:

- ✓ General option, based on performance indicators and informatics programs that comply with the requirements of the calculation methodology set out in RD 47/2007.
- ✓ Simplified option, based on the fulfillment of a series of recommended conditions, referred to as technical solutions, that affect thermal insulation as well as thermal and lighting installations, and whose application leads to the granting of a given energy qualification.

It should be mentioned that RD 47/2007 opens the door to the regulation and register of energy certificates for buildings by the autonomous communities, making them active participants in the control of energy consumption and granting them a series of competencies which, to date, have been developing unequally between regions:

Existing autonomous regulations:

- ✓ Andalusia. Law of 25th June, 2008. Certificate Register.
- ✓ Galicia. Decree 42/2009. Certificate Register. External control.
- ✓ Canary Islands. Decree 26/2009. Certificate Register.
- ✓ Extremadura. Decree 136/2008. Certificate Register. External control.
- ✓ Valencia Community. Decree 112/2009. Certificate Register. External control.
- ✓ Catalonia. Non-official register, ICAEN website.

With the aim to homogenize the contents of energy certifications among different territories, the IDAE has initiated works upon a national register of informative character, based on the autonomous registers and gathering at least the following set of data for each building:

- ✓ Location of the building.
- ✓ Basic characteristics of thermal insulation (complete and hollow enclosures).
- ✓ Installations (heating, air conditioning, domestic hot water, lighting, renewable energies etc.).
- ✓ Primary energy consumption and CO2 emissions.

In the near future, this common register will become an important database for the analysis of the situation of construction stock in our country.

### *4.3.4 Energy efficiency certification for existing buildings*

On 2nd February, 2012, a project of Royal Decree on the basic procedure for energy efficiency certification for existing buildings was submitted for audience and parliamentary approval.

As in the case of new construction buildings, the ultimate aim of the decree is that all the existing buildings possess an Energy efficiency certificate which delivers objective information to the buyers and users in general.

The energy efficiency certificate for existing buildings will be similar to that of new construction buildings, and will consist of an energy efficiency label, granting each building an Energy Efficiency Class, varying from class A for the most energy-efficient buildings, to class G for the least efficient ones.

The novelty consists in the requirement that the certificates contain improvement recommendations to enhance energy efficiency.

From the point of view of professional profiles, the energy efficiency certificates will be undersigned by technicians with academic and professional titles that enable them to carry out construction or thermal installation projects, freely chosen by the building's owners.

The project of Royal Decree establishes different deadlines for obtaining energy efficiency certificates, as a function of nominal installed power and the building's use, and makes them compulsory in the following cases:

- ✓ The sale, rental or transfer of the building.

- ✓ If the building has a central heat or cold-generating installation superior to 400KW. This will mainly apply to tertiary sector buildings: hotels, hospitals, schools, administrative buildings.
- ✓ Moreover, it is established that all publicly or privately-owned buildings that provide public services to a significant number of people and, therefore, are frequently attended by the public, and whose total useful surface is superior to 1000 m2, will need to obligatorily exhibit the energy efficiency label in a prominent place clearly visible to the visitors.

The project of Royal Decree establishes the following voluntary and compulsory deadlines:
- Buildings with installed power P>1000kW
  - ✓ Voluntary period of 1 year starting from the effective implementation of the energy certification procedure.
  - ✓ Housing: 30% in the first year, 35% in the second year, 35% in the third year.
  - ✓ Non-housing use: 50% in the first year, 50% in the second year.

- Buildings with installed power 1000kW≥P>400kW
  - ✓ Voluntary period of 1 year starting from the effective implementation of the energy certification procedure.
  - ✓ Housing: 30% in the fourth year, 35% in the fifth year, 35% in the sixth year.
  - ✓ Non-housing use: 30% in the third year.

- Other cases
  - ✓ Housing: voluntary period of 6 years, in case of the building's sale, rental or transfer. After this period, certification will be compulsory.
  - ✓ Non-housing use: voluntary period of 5 years, in case of the building's sale, rental or transfer. After this period, certification will be compulsory.

Lastly, and as in the case of certificates for new construction buildings, the Autonomous Communities are also involved, granted with the following competencies and deadlines:
- ✓ To establish a calendar of periodical inspection of the energy efficiency of heat and cold-generating equipment and thermal installations – within 6 months of the RD publication.
- ✓ To establish a calendar and identify buildings that will need to obtain an energy certification – within 6 months of the RD publication.
- ✓ To publish statistical data on the certifications released on their territory – every 6 months.

- *Project of Law on Energy Efficiency and Renewable Energies*

This legislative project aims to provide private investors with major confidence, promote continuous development of technologies designed for renewable energy use, and to create a market for companies related to energy efficiency.

It seeks to meet the goal of 20% energy use from renewable sources in 2020, by enhancing the latter's implementation, improving the energy efficiency and increasing biofuel consumption.
It considers vital for the Public Administration to set the example in the design and application of policies that promote energy efficiency and renewable energies implementation, laying particular stress on the promotion of R&D projects in the sector.

It establishes that whenever a building is constructed, sold or rented, the owner, potential buyer or tenant will be provided with an energy efficiency certificate containing information on the energy performance of the building, calculated according to the official methodology and valid for a maximum of 10 years.

From the point of view of professional profiles, it enhances the figure of the energy project manager, whose appointment will be compulsory for buildings with total useful surface superior to 1000 $m^2$, with the aim to optimize the energy consumption of thermal and lighting installations and equipment.

The role of the energy project manager will be mainly to carry out a monthly follow-up on the energy consumption of the building and its $CO_2$ emissions, establishing adequate time frames for the operation of most energy-consuming installations and equipment, at least with regard to the thermal installations of heating, air conditioning and domestic hot water supply, as well as lighting and informatics equipment.

## 4.4. Legislation in the field of vocational education and training

*4.4.1. Legislation*

**A. SUBSYSTEM OF REGULATED PROFESSIONAL TRAINING**

In Section II of Organic Law 5/2002, 19th of June, of Vocational Training and Qualifications (official state gazette, 20th of June, 2002), various aspects of Vocational Training are specified. Perhaps the most important is article 10 in which it is specified that both academic degrees and certificates of professional standards constitute vocational training referred to the National Catalogue of Professional Qualifications.

On this basis, the Regulated Vocational Training is legislated in Organic Law 2/2006, 3rd of May, relating to education (official state gazette, 4th of May, 2006) in chapter V, articles 39 to 44, in which the general principles, objectives, access conditions, contents and organisation of available training, evaluation, degrees and validations are all described. This Law does not introduce any consistent changes in the organisation of initial vocational training since it basically establishes what was already regulated in the Law of General Organisation of the Educational System (LOGSE), 3rd of October, 1990 (official state gazette, 4th of October).

Later, Royal Decree 1538/2006, 15th of December, began the general organisation of vocational training in the educational system, beginning a process of flexibility from the initial training proposed in the Organic Act of Education (2006).

In addition, in 2007, an especially important Royal Decree 395/2007 was released. It regulates that currently known as Occupational Training (official state gazette, 11th of April). These changes named here are notable as they constitute four training initiatives: demand training; supply training; work-linked training; and other actions which support and accompany this training.

One year later, in 2008, Royal Decree 34/2008, 18th of January (official state gazette, 31st of January) was enacted through which certificates of professional standards are regulated, followed, in 2009, by Royal Decree 1224/2009, 19th of July (official state gazette, 25th of August) which specifies the procedure of recognising professional skills gained through experience.

Finally, Organic Law 4/2011, 11th of March (official state gazette, 12th of March), complementary to the Sustainable Economy Law 2/2011 (LES), modifies Organic Laws 5/2002 and 2/2006 with the aim of improving the adaptability of vocational training to the current labour market needs. To aid its development, Royal Decree 1147/2011, 19th of July, was published which establishes the general organisation of educational system vocational training, a long-lasting reform which introduces various important innovations including:

- ✓ Integration of the organisation of training with the PCPI's professional modules
- ✓ Specialised courses in training cycles
- ✓ Increased access to mid- and higher-grade cycles
- ✓ Flexibility of training available to guarantee that it adapts better to the demands of the socio-economic environment

Regulated vocational training consists of the specific professional modules of initial professional qualifications programmes, mid-grade training cycles, higher-grade training cycles and specialist courses.


Figure 8. Organisation of vocational training according to RD 1147/2011

According to Royal Decree 1147/2011, the educational system is aimed at the following objectives:

a) Qualify people for professional activity and contribute to the economic development of the country
b) Ease the adaptation of any professional and social changes which may be produced throughout life
c) Contribute to personal development once exercised by the citizen, favouring their inclusion, social cohesion and lifelong learning

Unfortunately, given the economic crisis, this Royal Decree is seriously limited by the appearance of the Royal Decree-law 14/2012, 20th of April, which takes emergency measures to limit public expenditure in the educational environment.

**B. SUBSYSTEM OF VOCATIONAL TRAINING**

This Subsystem was born as a result of the combination of legislation on occupational and continuous training, the law of Qualifications and Vocational Training, together with the EU's Lisbon Strategy 2010.

In the European Union, lifelong learning is considered "a working strategy within an economy based on knowledge".

This vocational training subsystem is legislated in Royal Decree 395/2007 which defines it as "the group of instruments and actions which has the objective of encouraging and extending training between companies, employees and the unemployed, responding to their needs and contributing to the development of an economy based on knowledge."

The objectives of this subsystem are:

1.- Favour lifelong training of workers, both employed and unemployed, improving vocational training and personal development.
2.- Provide workers with the suitable knowledge and skills required in the labour market and the needs of companies.
3.- Contribute to the improvement of productivity and competitiveness of companies.
4.- Improve the employability of workers, especially those with difficulties with finding or keeping a job.
5.- Promote the professional skills acquired by workers, whether through formal or informal training or through experience, as an object of accreditation.

Their initiatives are:

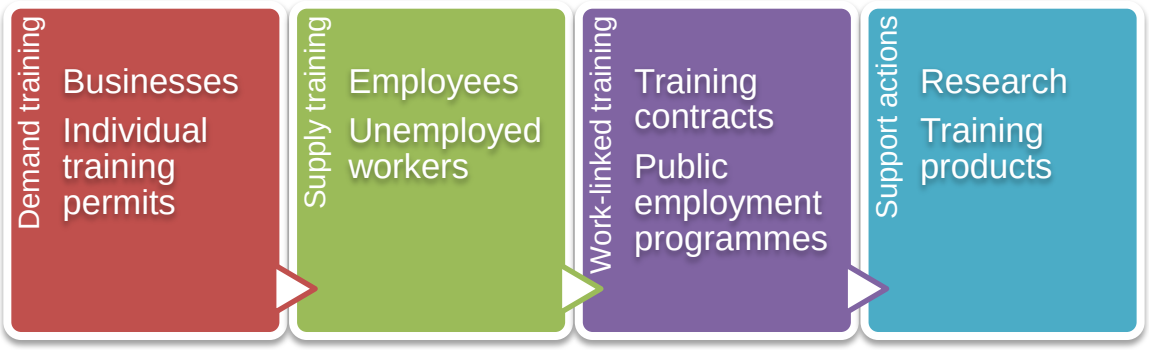



Figure 9. Training initiatives for employees

**a) Demand training:** this covers all of the training courses of companies and individual training permits, either completely or partially publicly funded, to answer the specific training needs of companies and their workers.

**b) Supply training:** this is the group of training plans directed as a priority towards employees and training courses directed at unemployed workers with the aim of offering them training which will prepare them for working professionally and access to jobs.

This training is managed fundamentally through the so-called Training Agreements which are signed by the Public Administrations (both national and regional) and social agents (businesses, unions) in the production sector, both nationally and regionally.

**c) Work-linked training:** this is composed of the training actions set by training contracts and by work-training public programs, allowing workers to ensure their training is compatible with the work they do in their job.

**d) Actions which support and accompany training:** they are those which improve the effectiveness of the vocational training subsystem. Generally, they consist of research and development actions for training products who aim to improve some of the many aspects related to vocational training in work.

Training is the responsibility of the Ministry of Employment and Social Security which manages it through the Spanish Public Employment Service and, in turn, by the Tripartite Foundation for Employment Training.

*4.4.2. National policy in relation to sustainability and green professional jobs and skills*

According to the PNUMA[5], green jobs are those which reduce companies' and economic sectors' environmental impacts, eventually reaching sustainable levels. These are jobs which help reduce the consumption of energy, primary materials and water through efficiency strategies, "decarbonise" the economy and reduce greenhouse gas emissions, reduce or avoid completely all forms of waste and contamination, and to protect and re-establish the ecosystems and biodiversity.

[5] UN Environment Programme

In this context, the Spanish government has already taken the initiative to deepen the transformation of the productive model through Sustainable Economy Law (LES) 2/2011, 4th of March, and the Strategy for a Sustainable Economy which conforms to a wider productive system strategic framework in the mid-term, taking on many of the necessary changes for incentivising and accelerating the development of a more competitive, more productive and more innovative economy. This strategic framework, taking into account the participation of society, contemplates structural changes, which, according to the reports, could generate up to 2,775,000 green jobs.

Based on this, the LES sets the ground for a new energy model based on secured supply, economic efficiency and respect for the environment. This way, emissions, saving, energy efficiency and renewable energy are aspects which are incorporated to legal order, in accordance with EU compromises for 2020: achieve 20% in energy saving, reduce CO2 emissions by 20% and also that 20% of all energy come from renewable sources.

Besides, sustainable mobility is stimulated through encouragement to buy ecologic vehicles by the Administration, also promoting urban renovation, by setting up faster and more efficient tools.

As explained in point 4.4.1, LES gives vital importance to Professional and Educational Training, dedicating Chapter VII entirely to this issue, among other important changes in the vocational training system. The organic aspects of this change are carried out through the Organic Law 4/2011, 11th March, complementing the LES and the Royal Decree 1147/2011. The aim is to facilitate the adaptation of training to the demands of the productive system, to broaden the availability of vocational training, make advances with regard to the integration of professional development within the educational system, and to reinforce educational administrations' cooperation.

In practice, the initiatives which are approved through the complementary Organic Law enable the update of the National Catalogue of Professional Qualifications as well as the modules of vocational training degrees and certificates of professional standards, and introduce the possibility of creating specialised courses and a distance education platform for the entire State. On the other hand, the necessary changes in legislation are adopted to promote movement between vocational training and diplomas, as well as vocational training and university.

Finally, through this Law, its being offered together with vocational training is promoted, as is the participation of social actors and greater collaboration with private companies.

It is also work highlighting the Spanish kingdom's national programme REFORMAS 2012 which aims to, amongst other objectives, to make the labour market more flexible, contributing to an increase in competitiveness, growth and employment due to more effective and efficient vocational training, considering dual vocational training amongst others, the promotion of skills evaluations and careers advice, etc., the updating of training certificates, and the promoting of access to training through new technologies.

*4.4.2. The National System for Professional Qualifications and Vocational Training (SNCFP)*

The SNCFP is a collection of instruments and actions necessary to promote and develop the integration of vocational training, through the **National Catalogue of Professional Qualifications** (CNCP). It aims to promote and develop the evaluation and accreditation of corresponding professional skills, in such a way that favours professional and social development, and covers the needs of the productive system.

*The SNCFP is made up of*

- ✓ The modular National Catalogue of Professional Qualification which includes the contents of vocational training associated with each qualification.

- ✓ A procedure of recognition, evaluation, accreditation and registration of professional qualifications.
- ✓ Training and guidance in terms of vocational training and jobs.
- ✓ The evaluation and improvement of the quality of the National System for Professional Qualifications and Vocational Training, in order to suitable training on its suitability to individual training needs and the needs of the productive system.


Figure 10: SNCFP instruments and actions

In developing the SNCFP, appropriate cooperation of the Social Agents with the Public Administrations, universities, chambers of commerce and training organisations is promoted.

To identify and update qualification needs, definition and training required, cooperation and consultation procedures have been established with the different productive sectors and social actors.

**Procedure of recognition, evaluation, accreditation and registration of professional qualifications**

This is a group of actions directed at recognising, evaluating and accrediting professional skills acquired through experience at work or other, non-formal training methods.

This evaluation and accreditation of professional skills is developed following criteria with the aim of guaranteeing the reliability, objectivity and technical rigour of the evaluation. The National Catalogue of Professional Qualification serves as an objective reference on this procedure.

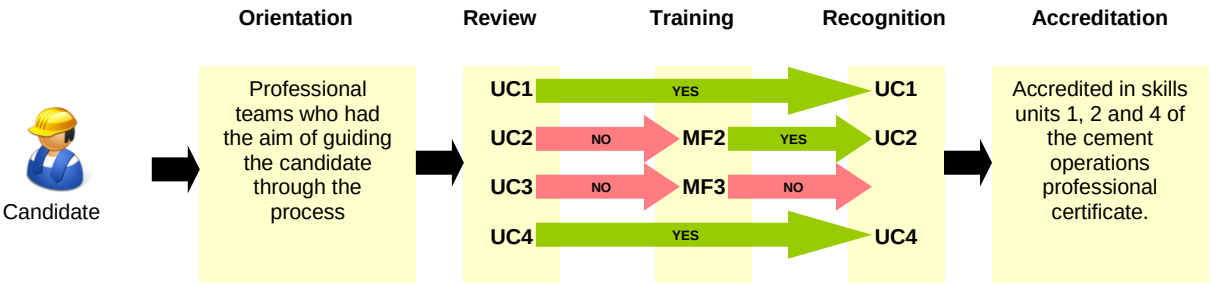



Figure 11: Simplified detail of the evaluation, recognition and accreditation process.

**The National Catalogue of Professional Qualifications (CNCP)**

The CNCP is the instrument of the SNCFP which orders professional qualifications subject to recognition and accreditation, identified in the productive system in terms of appropriate skills for professional use.

This consists of the most significant professional qualifications in the Spanish productive system, organised into professional families and levels. It constitutes the base for creating training for degrees and certificates of professional standards.

The CNCP includes the contents of the vocational training associated with each qualification, in agreement with a structure of articulated training modules.

The National Institute of Qualifications (INCUAL) is responsible for defining, creating and keeping the CNCP and the corresponding Vocational Training Modular Catalogue up to date.

*A. The Vocational Training Modular Catalogue (CMFP)*

The CMFP is the combination of training modules associated with the various skills units of each professional qualification. It provides a common reference for integrating vocational training which allows for lifelong learning to be promoted and taken advantage of.

On this basis, quality, up-to-date and suitable training is promoted and provided to various destinations, in agreement with expectations of professional progression and personal development.

Given its attention to the demands of the productive sectors in terms of training, it also aims towards increasing competitiveness through an increase in active population's qualifications.

*B. Professional Families and Levels of Qualification*

The SNCFP considers 26 professional families and 5 different levels of qualification:

| | | |
|---|---|---|
| 26 professional families | 1 | Skill in a reduced group of simple activities, within normal processes.<br>Limited knowledge and capabilities. |
| | 2 | Skill in specific activities which can be carried out without supervision.<br>Ability to use own instruments and techniques.<br><br>Knowledge of technical and scientific basics of the process. |
| | 3 | Skill in activities requiring skilled techniques which are carried out without supervision.<br>Supervision responsibilities in specialised and technical work.<br>Understanding of technical and scientific basics of the activities and processes. |
| | 4 | Skill in a wide range of complex activities.<br>Diversity of contexts with technical, scientific, economic or organisational variables.<br>Supervision responsibilities in work and assigning resources.<br><br>Ability to innovate to plan actions, develop projects, processes, products or services. |
| | 5 | Skill in a wide range of very complex activities, able to work alone.<br>Diversity of contexts which are, usually, essential.<br>Planning actions and designing products, processes or services.<br>Responsibility in management and leading. |

Table 4: Levels of qualification in the SNCFP

*C. CNCP Professional Qualifications*

There are currently 664 qualifications approved by the Council of Ministers and published in the Kingdom of Spain's Official State Gazette.

All professional qualifications have the following structure:

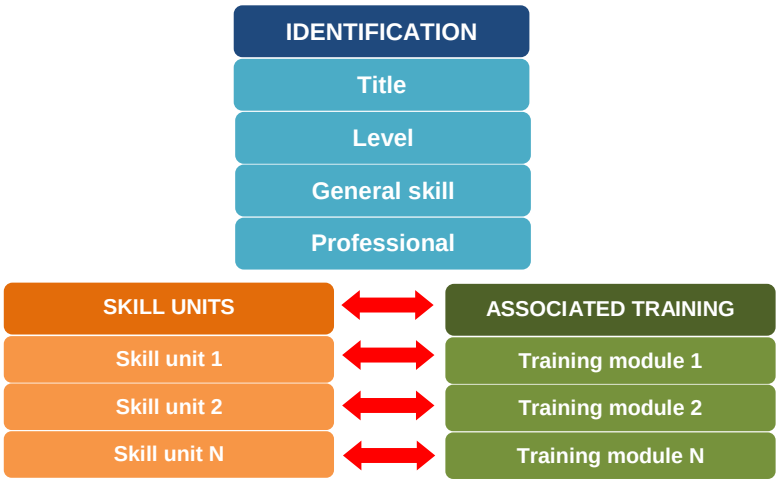



Figure 12: Structure of professional qualifications

**Guidance and training system**

Cooperation between training and technological experts of the various professional families guarantees a coordinated vision of the training and working world. As such, training and guidance is characterised by the following aspects:

- ✓ Coordination within the training and working environment
- ✓ Coordination between professionals in local, regional, national and European administrations.
- ✓ Transparency of professional qualifications
- ✓ Transparency of the working world.
- ✓ Interaction of the various professional families through forums.
- ✓ Networking with the Regional Communities' Monitoring Centres.
- ✓ Structured and contrasted training.

**Quality and evaluation of the system**

Law 5/2002, 19th of June, of Qualifications and Vocational Training, dedicates its section IV to the quality and evaluation of the system. The evaluation of the SNCFP has the final, basic aim of guaranteeing the effectiveness of its actions and its suitability to the labour market needs.

Its establishment and coordination of the evaluation processes correspond to the Government, having previously consulted the Vocational Training General Council without taking away from the skills attributed to the Regional Communities.

The European Union is developing various activities on the subject of vocational training quality. Among these are:

- ✓ Common Quality Assurance Framework CQAF - for VET in Europe.
- ✓ European Network on Quality Assurance in VET.

*4.4.3. The Spanish Qualifications Framework (MECU) and the European Qualifications Framework (EQF)*

**European Qualification Framework (EQF)**

The European Qualification Framework for Lifelong Learning (EQF) is a common European framework which allows European countries to compare their qualifications. Starting from a common frame of reference, it will improve the transparency, the ability to compare and transfer citizens' qualifications arranged with the practices of each Member State.

- ✓ It supports greater suitability between the needs of the labour market, education and training.
- ✓ It improves the validation of learning acquired through methods which differ from official teaching.
- ✓ It improves the transfer and use of qualifications between different countries and education and training systems.

The EQF allows for qualifications from different countries to be related on a common European reference scale. In practice, it will work like a qualification translation device. This will help students and workers to move around more easily.

The EQF uses 8 different reference levels based on learning results, what a person really knows and is capable of doing (knowledge, skills and competences), independently of the manner of acquisition.

**Spanish Qualifications Framework (MECU)**

The instrument which will allow recognised qualifications in Spain to be compared with the rest of Europe in the EQF is the Spanish Qualifications Framework (MECU) for lifelong learning.

A qualifications framework is an internationally-recognised structure in which all qualifications are described in a coherent way so that they can be related and compared, and which serves to ease the movement of people throughout Europe while retaining lifelong learning and job opportunities in the international market.

With the MECU, students, workers, employers, training organisations and, in general, all citizens will be able to better understand the national qualifications system.

Therefore, the MECU is basically an organisational structure of the various levels of learning, from the most basic to the most complex, and which includes:

- ✓ Teaching in training centres (schools, institutes, universities, training centres reliant on councils, authorised training institutions...)
- ✓ Learning at work (training activities, the work itself)
- ✓ Other methods of learning (NGOs, hobbies, cultural activities...)

The MECU is created taking into account the criteria for determining the levels. These are based on learning results, in other words, capabilities which have been acquired, independently of the learning method followed (educational system, work...).

As such, the MECU is a level structure organised in terms of the grade reached in various skills which are considered key for carrying out tasks in different professional sectors. It covers all levels from the basics to the most complex, independently of how they are acquired.

It is expected that the MECU will come into force in 2012, the year in which all new qualification certificates, diplomas and Europass documents issued by the relevant authorities carry references to levels corresponding to the MECU and the EQF.

*4.4.4. Other training and accreditation policies within the construction sector. The Professional Construction Card (TPC)*

The Professional Construction Card (TPC) is the document which forms the method of accrediting, among other details, the specific training received by the worker in terms of risk prevention at work, as well as the professional category and the periods of employment in the various businesses worked for.

Building on this base, its aims are:

- ✓ Accredit that the holder has, at least, received basic risk prevention at work training which is obligatory for all workers to work in companies which are subject to the Construction Sector General Collective Agreement V.
- ✓ Accredit the professional category of its holder and their experience within the sector.
- ✓ Accredit that the holder has been subjected to medical examinations in agreement with this Agreement.
- ✓ Accredit the training of any type which the holder has undertaken.
- ✓ Ease the holder's access to FLCservices.

The FLCis the organisation in charge of implementing, developing and delivering the TPC as proscribed in Law 32/2006 which regulates subcontracting within the construction sector and in the Construction Sector General Agreement V (2012-2016).


Figure 13. The Professional Construction Card

# 5. Statistics on building and energy sectors

## 5.1. Statistics on building sector

*5.1.1. Buildings designed principally for residential use*

### a. Total number of residential buildings

Population and building censuses are an important source of statistical information on the residential sector in Spain. According to the 2001 census, Spain contained 8.62 million building principally used for residential purposes.

Although that data will be updated once the 2011 figures are published, it has been estimated that more than **9.64 million buildings** designed for residential use are currently found in Spain's housing developments, according to the latest statistics released by the Ministry of Development on public works done between 2001 and 2011.

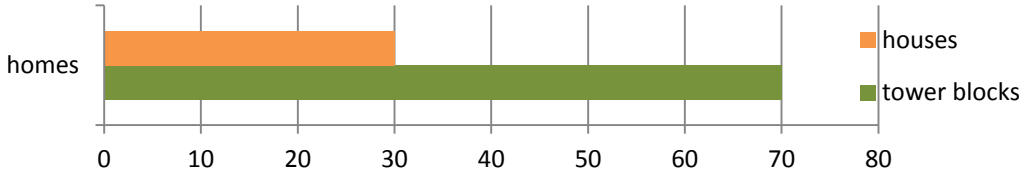
Given the growth of residential developments during the last decade, it is reasonable to assume that these developments won't increase significantly in the next few years when taking into account the current economic situation and that it has been predicted that population growth in Spain will decelerate or even reverse around 1.2% in the next 10 years if the current demographic tendencies remain the same (National Institute of Statistics [INE - Instituto Nacional de Estadistica]: Population Projection for Spain 2011-2021).

As a result, the predicted European objectives for buildings in the year 2020 of energy saving, energy production through renewable sources and reduction of emissions depends fundamentally on any actions and projects started on existing buildings.

### b. Percentage of houses and flats or apartments

The percentage of houses (as opposed to blocks of flats) with respect to the total is important to be taken into account in relation to energy consumption and generation of emissions associated with developments. Houses account for not only greater energy consumption but also a larger number of return trips (there and back in one day) in car due to work, trips to commercial areas or for entertainment.

During the 20th century, Spanish cities grew, influenced by a traditional dense city model. However, this tendency has changed in the last few decades and, currently, single houses account for 30% of the total.




Graph 14. Percentage of houses and tower blocks. Source: IDAE 2011. SECH-SPAHOUSEC PROJECT

### c. Home ownership

Home ownership is relevant in as far as possible initiatives in terms of rehabilitation and improvements in energy efficiency, since those enacting these improvements are also the ones who will benefit by saving money when energy is later saved.

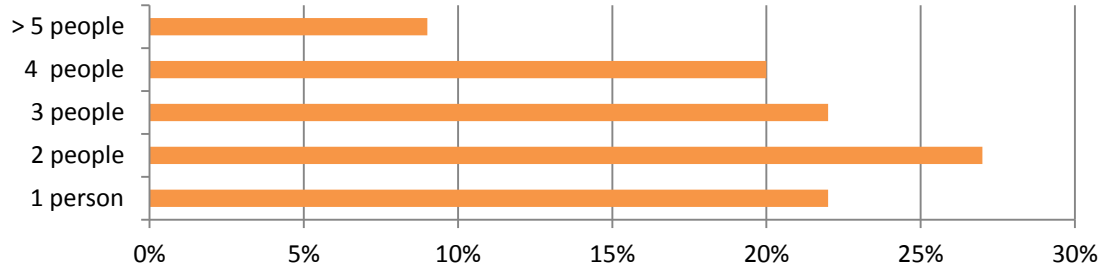
According to the National Institute of Statistics, in the year 2009, 82.1% of homes were owned.

### d. Size of the homes

The size of the home is also important in terms of total energy consumption. 64% of homes have a usable surface area of between 61 and 105 m², 21.8% have a surface of over 105 m², while 14.2% have a surface of under 61 m². (Source: National Institute of Statistics. Population and home census. 2001).

### e. Number of residents

The number of residents within each home is also a variable with significant repercussions on energy consumption. In 2010, Spain had an average of 2.7 people/home.




Graph 15. *Distribution of Homes according to Number of Residents.* Percentage of houses and tower blocks. Source: IDAE 2011. SECH-SPAHOUSEC PROJECT

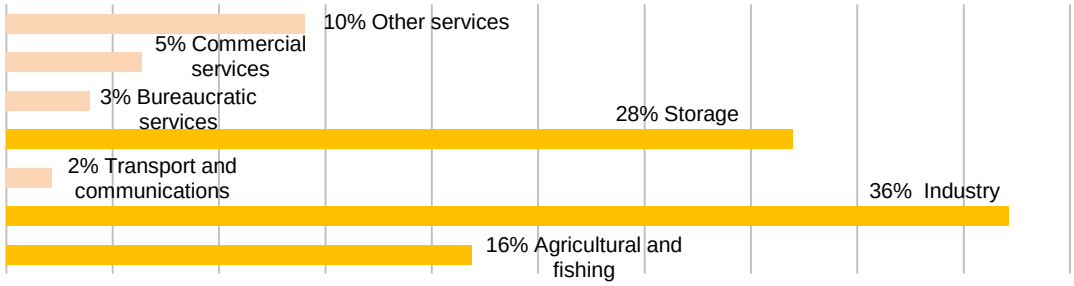
- *Buildings designed for non-residential use*

No specific information has been found on how many buildings in total or by percentage of type (residential, commercial, industrial, public) there are in Spain.

However, **89% of work licences granted for new buildings during the years 2003 and 2010 were for residential buildings** according to the Ministry of Development's information.

In Europe, residential buildings account for 75% of the total (Source: *Buildings Performance Institute Europe. Europe's buildings under the microscope*. 2011)

Within the range of non-residential buildings, there only exists data on the percentage of buildings that there are of each type and on new building licences issued by the Ministry of Development relative to the period 2003 to 2010.

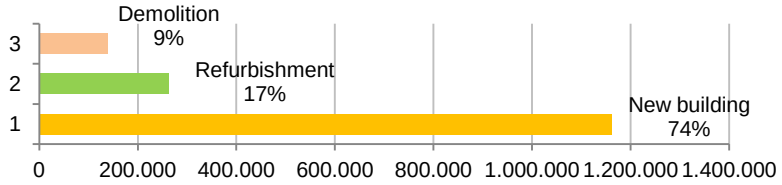



Graph 16.Percentage of new non-residential building licences issued between 2003 and 2010 (inclusive). Source: Elaboration of data using information from the Ministry of Development.

So **36% of all non-residential buildings correspond to industry, 28% to warehouses for the storage of stock** and 16% to agricultural and fishing installations, those being the most significant categories.

*5.1.3 Annual ratio of new constructions and refurbishment*

According to licences issued by town halls between 2003 and 2010, 17% were for refurbishment projects.



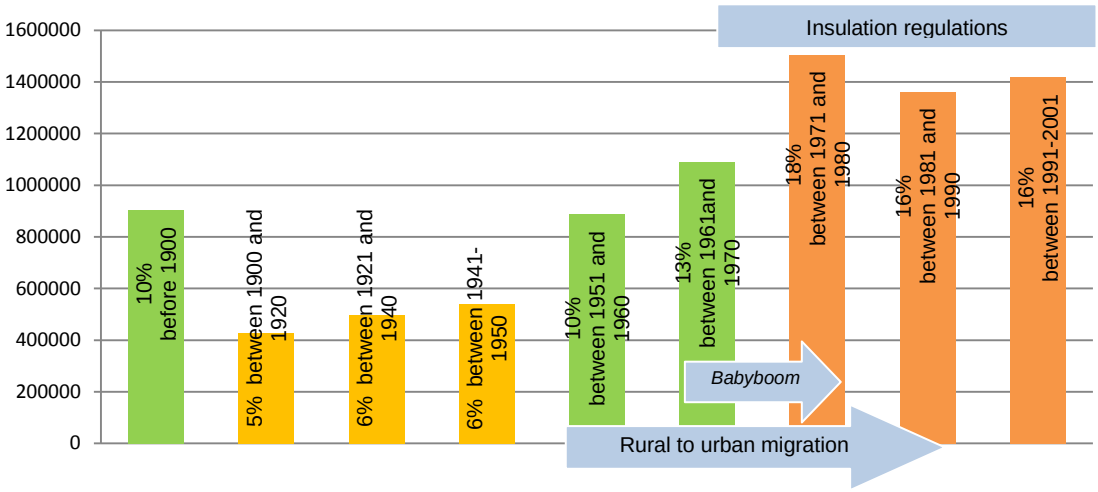

Graph 17.Percentage of the types of licences issued between 2003 and 2010. Source: elaboration of data using information from the Ministry of Development.

The percentage of licences issued for refurbishment maintained a slight increase until 2006, and the decrease produced from that year onwards was very slight compared with the decrease in licences issued for new buildings. *Source: Ministry of Development. "Construction of buildings and building works: municipal licences endorsed by project management". Madrid 2001.*

*5.1.4 Ratio of buildings with low energy consumption, annual ratio of new, energy-efficient buildings, and buildings with energy refurbishment.*

When it comes to energy consumption in these homes, it should be pointed out that NBE-CT 79 in 1979 was the first regulation which forced buildings in Spain to be thermally insulated.

The majority of existing houses in Spain were built after 1951, mostly during the 1970s (1971 to 1981), principally due to the peak in construction of buildings and large tower blocks.




Graph 18. Distribution of existing housing developments in 2001 according to date of construction. Source: NIS. "Population and home census." 2001.

To be exact, 49% of tower blocks were built before 1979, while only 33% of houses were built before that year (Source: IDAE. General Secretary of the Department of Planning and Studies. SECH-SPAHOUSEC PROJECT Analysis of energy consumption of the residential sector in Spain. July 2011).

In 2006, the Technical Building Code (CTE - Código Técnico de la Edificación) was approved and came into force in 2007. This tightened the thermal insulation requisites for buildings with licences issued after 2007.

As such, buildings constructed after 2007 have improved features in terms of their energy efficiency, however this is a very small percentage due to an unprecedented decrease in construction from that year onwards. In 2011, according to the Ministry of Development's data, 78,286 buildings were endorsed, compared to 865,000 in 2006.

According to the Homes and Environment survey, carried out in 2008 by the NIS, the principal **means of thermal insulation** which were adopted in Spanish homes were the installation of blinds or shutters (94.0% of homes), double-glazing (39.3%), awnings (23.0), thermal bridge breakers (11.4%), and installing tinted windows or solar protectors (4.1%).

In terms of income, homes with a monthly income of fewer than 1,100 euros net had lower levels of insulation which increases proportionally with income. (Source: NIS. Homes and Environment Survey. Press note. 2008).

### *5.1.5 Barriers to refurbishment of insulation and buildings and construction of new buildings with almost no consumption*

According to the savings plan 2008-2012 derived from the Spanish Energy Efficiency and Savings Strategy, elaborated by the Ministry of Industry, Energy and Tourism and developed by the IDAE, the main barrier to installing the proposed measures in existing buildings is the economy. The expenditure on energy represents 3% of the general building costs of buildings in the service sector and a similar percentage of the family budget for houses, all of which makes any saving measures proposed seem unattractive.

| Item | Percentage of the family budget |
|---|---|
| Electricity | 2,47% |
| Gas | 0,83% |
| Liquid fuels | 0,34% |
| Solid fuels | 0,04% |

Table 5. Percentage of the family budget which went towards buying energy products in 2010: Source: NIS. Family Budget Survey.

In this sense, it is worth pointing out the debt that customers have with the electricity sector which operates in Spain given that the costs of the activities mentioned are greater than the benefits received to cover them. The current government is trying to eliminate the deficit in the tariff by January 2013, and repay the deficit (24,000 million euros accumulated up to the year 2011) as from that date.

When it comes to new buildings, the barriers are more associated with administrative matters linked to dispersion of competition (autonomous communities and local administrations) and the large number of middlemen in the building process.

The decrease in credit issued to businesses, furniture developers and families complicates being an entrepreneur in improvements in energy efficiency and applications of facilities which provide energy from renewable sources in existing buildings. In the same way, it is also a barrier to the construction of new buildings in general.

Barriers related to the lack of a qualified workforce are listed in section 8 of this report.

The absence of incentives, mistakes of administrative management, lack of control for compliance with regulations or lack of information for residents and proprietors are some of the barriers to energy rehabilitation, as found by WWF España in their study "Potential energy saving and reduction of $CO_2$ emissions in existing housing developments in Spain in 2020".

### *5.1.6 Business operating in the sector*

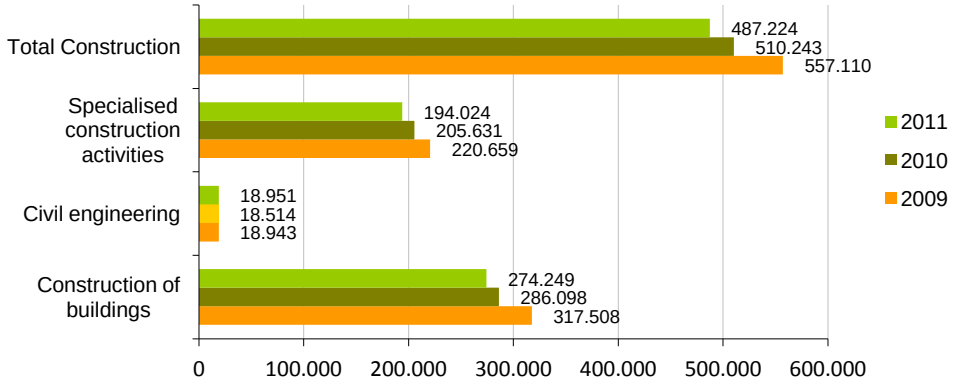
The sub-sectors most related to the research objectives are that of building construction (412) and specialised construction (43). These sub-sections consist of 375,434 businesses in 2011 which represents 77% of the total number of businesses in the construction sector.

Although the furniture development (411) and civil engineering (42) sectors are not strictly linked with the project, they are sometimes included in statistical analyses when there is no statistical information which allows more detailed work.

| | 2011 | 2010 | 2009 | Growth 2009-2001Abs. | Growth 2009-2011 % |
|---|---|---|---|---|---|
| **TOTAL CONSTRUCCIÓN** | **487.224** | **510.243** | **557.110** | **-69.886** | **-12,5%** |
| **41 Construction of Buildings** | **274.249** | **286.098** | **317.508** | **-43.259** | **-13,6%** |
| 411 Furniture development | 92.839 | 95.162 | 101.925 | -9.086 | -8,9% |
| 412 Construction of Buildings | 181.410 | 190.936 | 215.583 | -34.173 | -15,9% |
| **42 Civil engineering** | **18.951** | **18.514** | **18.943** | **8** | **0,0%** |
| 421 Motorway, railway, bridge and tunnel const. | 1.308 | 1.172 | 1.292 | 16 | 1,2% |
| 422 Construction of networks | 1.369 | 1.576 | 662 | 707 | 106,8% |
| 429 Construction of other C.E. projects | 16.274 | 15.766 | 16.989 | -715 | -4,2% |
| **43 Spec. construction activities** | **194.024** | **205.631** | **220.659** | **-26.635** | **-12,1%** |
| 431 Demolition and preparation of land | 14.353 | 15.305 | 14.500 | -147 | -1,0% |
| 432 Install. of electricity, plumbing, etc. | 88.491 | 92.147 | 95.935 | -7.444 | -7,8% |
| 433 Building finishing | 77.452 | 83.636 | 98.935 | -21.483 | -21,7% |
| 439 Other spec. construction activities | 13.728 | 14.543 | 11.289 | 2.439 | 21,6% |

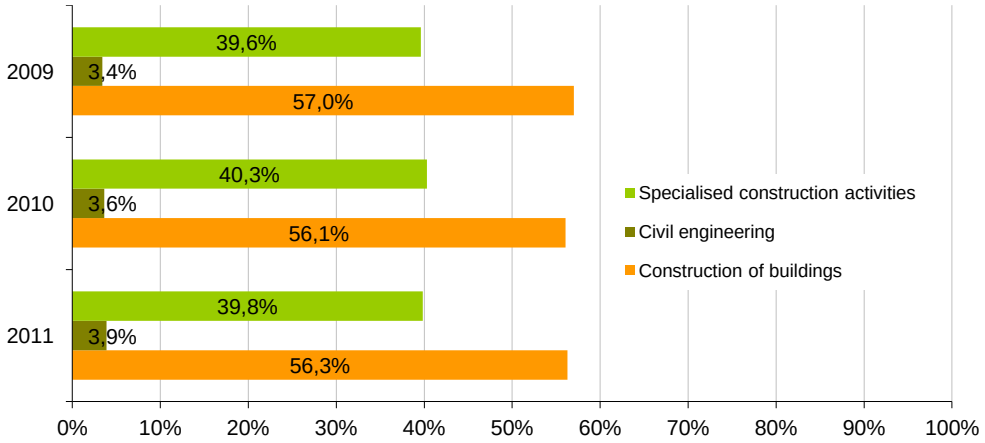
Table 6. Evolution of the volume of businesses in the construction sector by main economic activity Source: NIS. Central Directory of Businesses (DIRCE).

Business structure evolution since 2009 has seen a generalised decrease which reached 12.5% over the whole sector. There has also been a generalised decrease in sub-sectors related to energy efficiency, apart from in the Other spec. construction activities (439) sub-sector which has seen a growth of 21.6%. The construction sector in general has experienced a total loss of 69,886 business between 2009 and 2011, which were mostly from the sector dedicated to the construction of new buildings (43,259 fewer businesses) and the sector of specialised construction (26,635 fewer businesses).



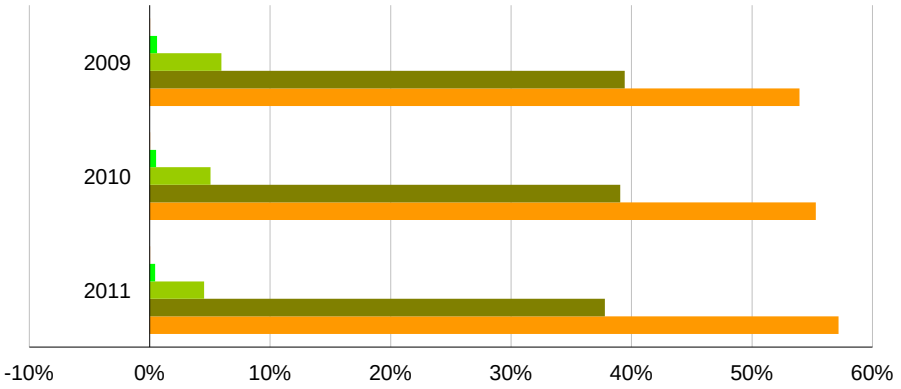

Graph 19. Evolution of the volume of businesses in the construction sector by main economic activity sector. Source: NIS. Central Directory of Businesses (DIRCE).

The internal structure of the sector has not substantially changed in last three years. The most notable change has been a slight increase of the civil engineering sector which has increased its share from 3.4% in 2009 to 3.9% in 2011.




Graph 20. Evolution of business structure in the construction sector by main activity. Source: NIS. Central Directory of Businesses (DIRCE).

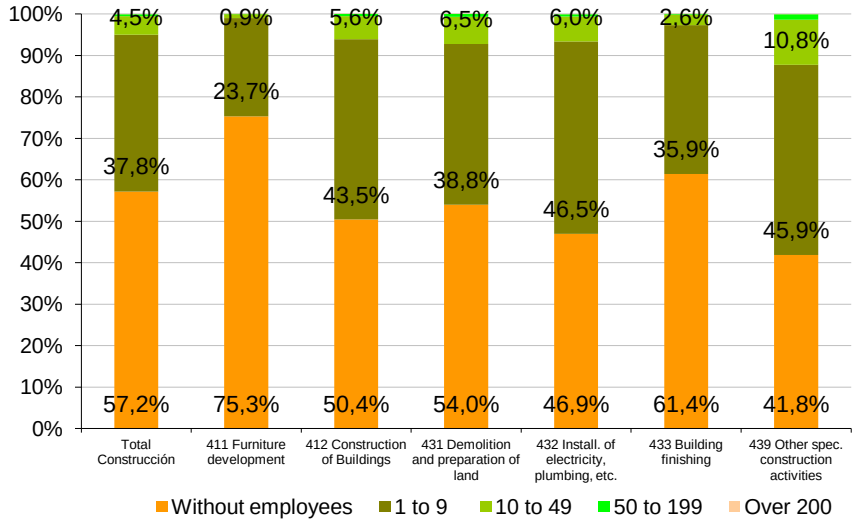
The majority of businesses in the sector have no salaried employees and these businesses' share in total has increased from 53.9% in 2009 to 57.2% in 2011. This change in the business structure in relation to the salaried employees has been marked by an intense and constant decrease in the share of small and medium-sized businesses (from 1 to 49 employees) which went from 45.3% in 2009 to 42.3% in 2011.




| | 2011 | 2010 | 2009 |
|---|---|---|---|
| Over 200 | 0,1% | 0,1% | 0,1% |
| 50 to 199 | 0,5% | 0,5% | 0,6% |
| 10 to 49 | 4,5% | 5,0% | 5,9% |
| 1 to 9 | 37,8% | 39,1% | 39,4% |
| Without employees | 57,2% | 55,3% | 53,9% |

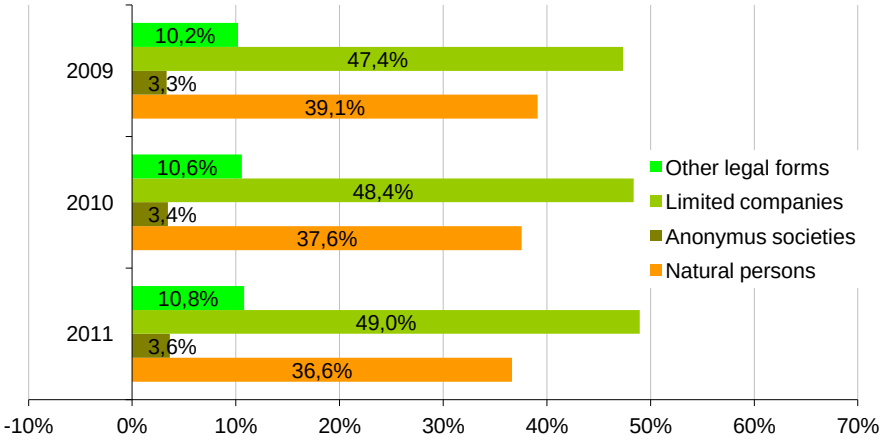
Graph 21. Evolution of business structure in the construction sector by salaried employees. Source: NIS. Central Directory of Businesses (DIRCE).

Small and medium-sized businesses constitute over 95% of the total in the sector and all sub-sectors. The proportion of businesses with no salaried employees or with fewer than 10 salaried employees constitutes over 90% of the businesses in all sub-sectors, apart from the group of companies principally dedicated to other specialised construction activities.




Graph 22. Evolution of business structure in the construction sector by salaried employees. Source: NIS. Central Directory of Businesses (DIRCE).

With respect to the legal status of these businesses, almost half are limited companies. The proportion has increased from 47.4% in 2009 to 49% in 2011. The other section with most weight in the sector is that with natural persons which has reduced from 39.1% in 2009 to 36.6% in 2011. Anonymous societies and those with other legal statuses have increased very slightly.




Graph 23. Evolution of business structure in the construction sector by legal status. Source: NIS. Central Directory of Businesses (DIRCE).

### 5.2 Statistics on current workforce in the sector

The working population in 2008 rose to 20,425,100 people and has experienced a decrease of 2,122,100 people up to the year 2011 which has meant a relative decrease of 10.4%. This decrease in the working population has been generalised over all sectors but the most intense decrease has been felt in the construction sector, where the workforce has decreased by 43.9% between 2008 and 2011, from 2,549,500 to 1,430,200 people.

| | 2011 | 2010 | 2009 | 2008 | Growth 2008-2001 (absolute value) | Growth 2008-2011 % |
|---|---|---|---|---|---|---|
| **Total** | 18.303.000 | 18.476.900 | 18.945.000 | 20.425.100 | -2.122.100 | -10,4% |
| **Agriculture** | 741.200 | 778.200 | 786.600 | 820.800 | -79.600 | -9,7% |
| **Industry** | 2.577.700 | 2.618.900 | 2.799.400 | 3.244.300 | -666.600 | -20,5% |
| **Construction** | 1.430.200 | 1.699.700 | 1.922.100 | 2.549.500 | -1.119.300 | -43,9% |
| **Services** | 13.553.900 | 13.380.100 | 13.436.900 | 13.810.600 | -256.700 | -1,9% |

Table 7. Workforce by sector 2008-2011 Source: NIS. 2011 Working Population Census

The proportion of workers in the construction sector, with respect to the total of all producing sectors, has gradually reduced from 12.5% in 2008 to 7.8% in 2011.

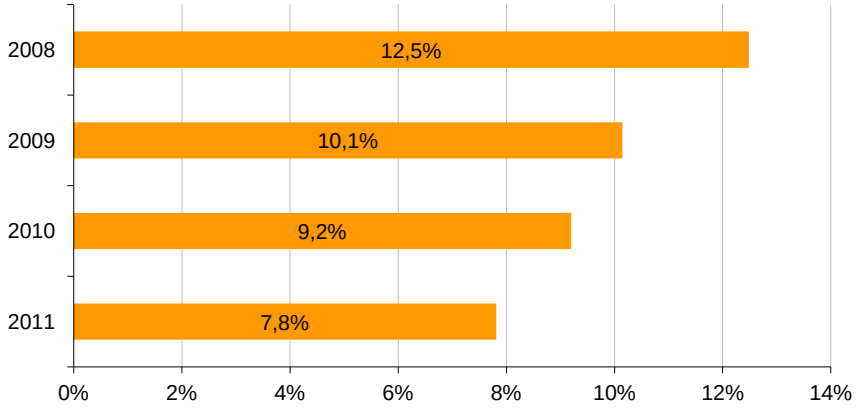



Figure 14. Evolution of the proportion of employees in the construction sector 2008-2011 Source: NIS. 2011 Working Population Census

Another way to analyse the size of the construction sector in terms of workforce is through the number of effective hours worked. Using this indicator, the construction sector worked 8.4% of the total hours. Contracted staff worked notably higher hours (11%) compared to salaried employees (7.8%).

| | Total | Construction | % of the Construction Sector |
|---|---|---|---|
| **TOTAL** | **620.447,6** | **51823,5** | **8,4%** |
| **Self-employed people: total** | **114.439,8** | **12577,4** | **11,0%** |
| Employer | 39.767,9 | 4574 | 11,5% |
| Employer without salaried or contr. staff | 70.173,4 | 7731 | 11,0% |
| Co-operative member | 1.213,5 | 84,1 | 6,9% |
| Family help | 3.285,0 | 188,4 | 5,7% |
| **Salaried staff: total** | **505.744,9** | **39246,1** | **7,8%** |
| Salaried staff in the public sector | 102.832,6 | 242,7 | 0,2% |
| Salaried staff in the private sector | 402.912,2 | 39003,4 | 9,7% |
| Other professional situation | 262.900,0 | 0 | -- |

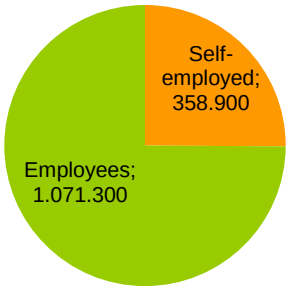
Table 8. Total number of effective hours worked (in thousands) by the entire workforce in the construction sector by professional status. Source: NIS. 2011 Working Population Census

The presence of foreign workers in the various sectors has been significant in the last decade in Spain, with the construction sector having the highest proportion of foreign workers employed in 2008 (25.1%). However, this proportion was reduced considerably to 19.8% in 2011.

This reduction in the percentage of foreign workers has been felt in the industry sector also, while the service sector has remained virtually unaltered and the agricultural sector has even increased slightly.

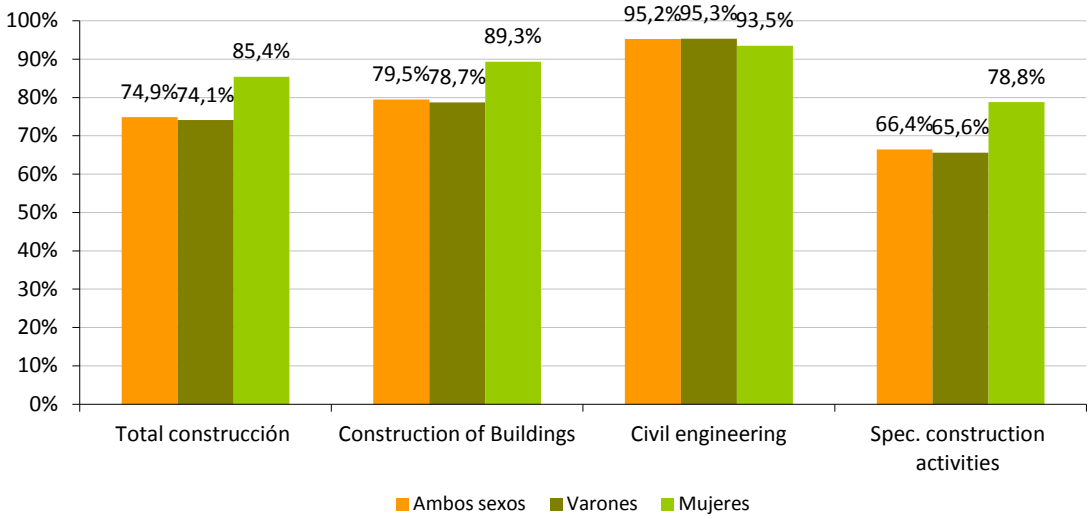

Graph 24. Percentage of foreign workers by economic sector. Source: NIS. Data derived from information from the IIT Working Population Census in 2011.

Of the total 1,430,200 employed people in the construction sector, 358,900 are not salaried workers which make up 25% of the total.




Graph 25. Distribution of employees in the construction sector according to their salary status. 2011. Source: NIS. 2011 Working Population Census

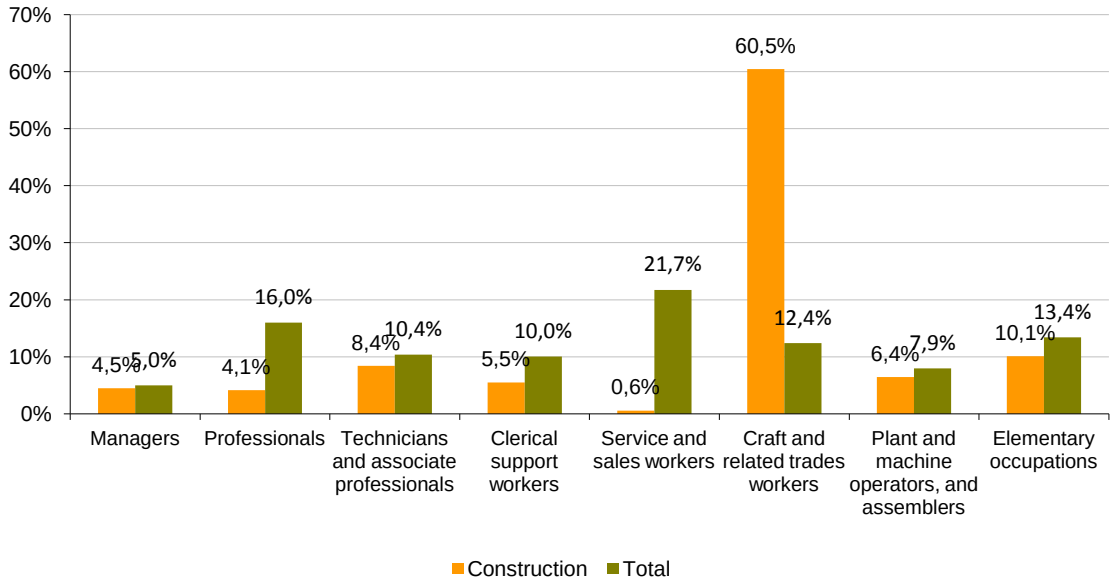
Focusing on the analysis of the proportion of salaried staff, the medium general value (74.9%) is noticeably higher among women (85.4%) in the sector in general, which is the same with women throughout the three sub-sectors. The highest proportion of salaried staff is found in the civil engineering sub-sector (95.2%).




Graph 26. Proportion of salaried staff in the construction sector and sub-sectors. 2011. Source: NIS. 2011 Working Population Census

The occupational structure in the construction sector, in comparison with the rest of the Spanish economy, places greater importance on qualified workers. Qualified workers represent 60% of employees in construction, compared to 12.4% over all sectors.

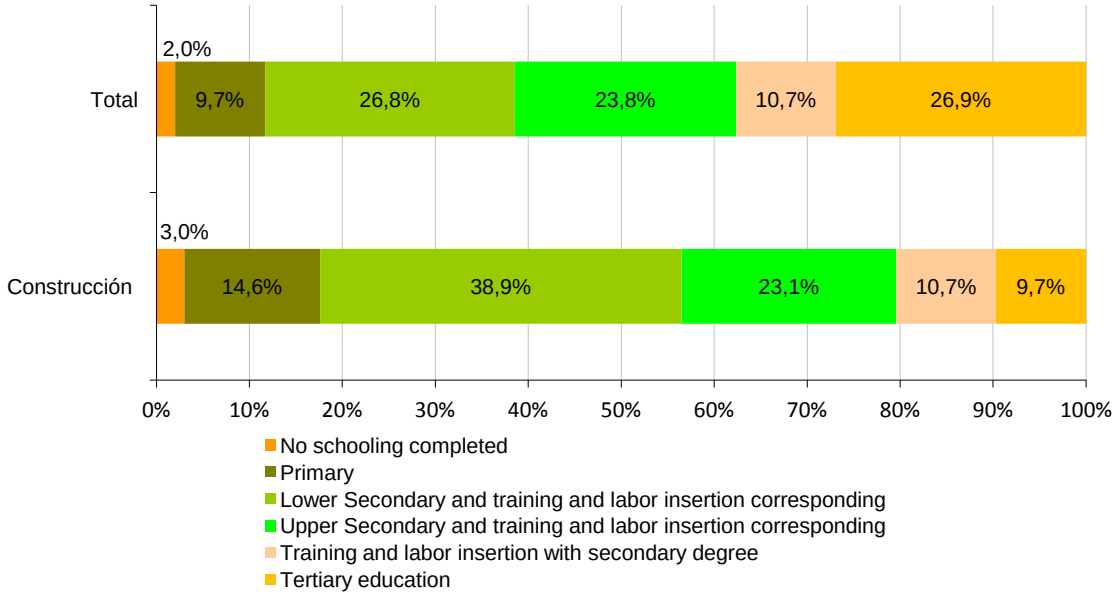
On the other hand, the sector represents a very low proportion of jobs at higher levels, such as technical and managerial staff, 8.6% among the construction sector and 21% among all sectors in total. It's also important to note a very low proportion of administrative staff. We can therefore conclude that the working structure in the construction sector is noted for having very few high-level staff and very many qualified staff at lower levels.




Graph 28.Sstructure of staff in the construction sector and the total of all workers in Spain. 2011. Source: NIS. Data derived from information from the IIT Working Population Census in 2011.

The construction sector's training structure is closely linked with the staff structure, since it is composed principally of qualified workers, which means that the level of training is inferior to other sectors of employment in Spain.

56.5% of employees in the construction sector have a level of education equivalent to the first stage of Secondary Education or lower, which contrasts with a considerably lower figure (38.5%) for the employees in other economic sectors. More specifically 38.9% of workers in the sector have reached the first level of secondary education and appropriate training, 14.6% have primary education as the limit of their studies, and 3% of employees have no level of education complete. On the other hand, in the construction sector, 9.7% of workers have completed some level of higher education while in economic sectors, this value is 26.9%.




Graph 29. Levels of education structure in the construction sector and the total of all workers in Spain. 2011. Source: NIS. Data derived from information from the IIT Working Population Census in 2011.

## 5.3. Statistics on energy consumption and renewable energy in businesses

This section has been almost completely created using data from the Energy Saving and Diversification Institute's (IDAE) study named Project SECH-SPAHOUSEC. Analysis of energy consumption of the residential sector in Spain.

### *5.3.1 Energy consumption in the residential sector*

The residential sector is key in the current energy context, given the importance of their energy needs which, in Spain and in terms of final energy, make up 17% of the final consumed total and 25% of the demand for electrical energy. Various factors explain these figures and their rising tendency, such as the number of homes, the greater comfort required by them and, therefore, the increase of equipment found inside them. All of this, brought about by increases in living standards and spending power, predicts further increases in the future in terms of energy demand in the residential sector.

According to the information found in Project SECH-SPAHOUSEC's Analysis of energy consumption in the residential sector in Spain, **the average consumption of a Spanish home is 10.521 kWh per year (0,038 TJ),** predominantly the consumption of fuels, in terms of final energy use: 1.8 times greater than use of electric. 62% of electricity is consumed by electric household appliances and, to a lesser extent, by lighting, cooking and heating and hot water appliances.

| | Final consumption (TJ) | | |
|---|---|---|---|
| | Electricity | Heating fuels | Total |
| Heating | 15.907 | 272.667 | 288.574 |
| Domestic hot water | 16.129 | 100.114 | 116.243 |
| Cooking facilities | 20.063 | 25.588 | 45.651 |
| Refrigeration | 5.042 | 107 | 5.148 |
| Lighting | 25.366 | | 25.366 |
| Electric household | 133.470 | | 133.470 |
| **Total consumption** | 215.978 | 398.475 | 614.453 |

Table 9. Breakdown of Thermal and Electrical Consumption Source: IDAE

70% of all Spanish homes have heating. Air conditioning is available in 35.5% of homes. The average temperature set for homes with heating is 21.3 degrees Centigrade. In homes with air conditioning, the average temperature is 22.3 degrees. (Source: NIS. Homes and Environment Survey. Press note. 2008).

When all services and equipment available in Spanish homes are taken into account, heating is the most demanding in terms of energy consumption, making up almost half of all the energy used in the residential sector (47%).

This is followed by electric household appliances, domestic hot water, cooking, lighting and air conditioning in order of energy consumption. Among the electric household appliances, other major energy consumers are refrigerators, washing machines, TVs and systems left on standby. This last category represents 2.3% of total consumption, almost three times that associated with refrigeration and about the same as that represented by TVs.

*5.3.2 Distribution of homes by climatic areas and consumption associated with each area*

With respect to the distribution of homes in various climatic areas, there is a greater concentration of people living in areas with a Mediterranean climate and less concentrated in areas with a continental climate, with the exception of Madrid and a few isolated areas in the north-east of the peninsula, and with more people in areas with an Atlantic climate.

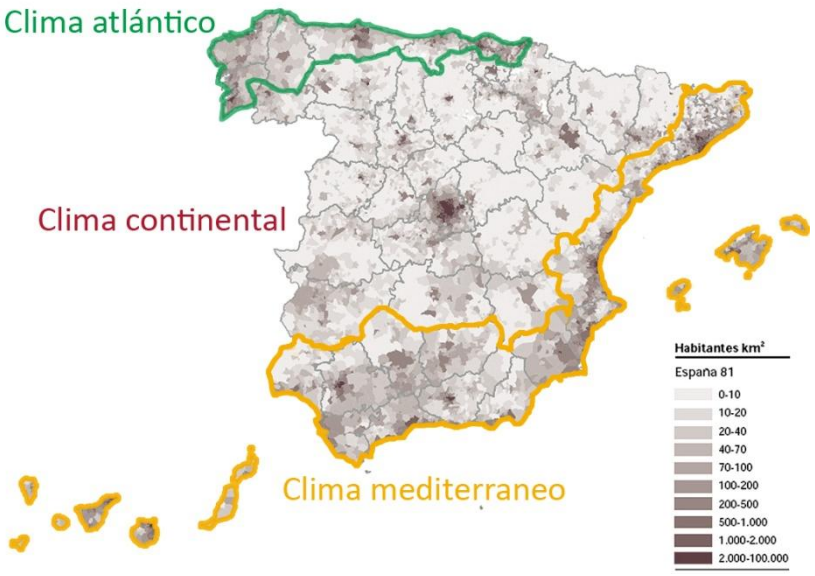



Figura 15: Distribution of the population in Spain in 2001 and types of climate. (Source: elaboration of information from the National Institute of Statistics and IDAE.)

In total, according to Project SECH-SPAHOUSEC**, almost half of the homes in Spain are found in areas with Mediterranean climates,** although in this area, there also exists a greater number of empty homes according to the Population and Home Census 2001, carried out by the National Institute of Statistics (see section 6.1).

In terms of number of homes, next in the list in the continental zone, though this area contains a greater number of second homes or those used for only part of the year (weekends and holidays), according to the 2001 Population and Home census, carried out by the National Institute of Statistics.

| | Houses | Tower Blocks | Total |
|---|---|---|---|
| North Atlantic | 580.240 | 1.673.181 | 2.253.421 |
| Continental | 1.649.042 | 4.133.792 | 5.782.834 |
| Mediterranean | 2.867.948 | 6.295.427 | 9.163.375 |
| **TOTAL** | 5.097.230 | 12.102.400 | 17.199.630 |

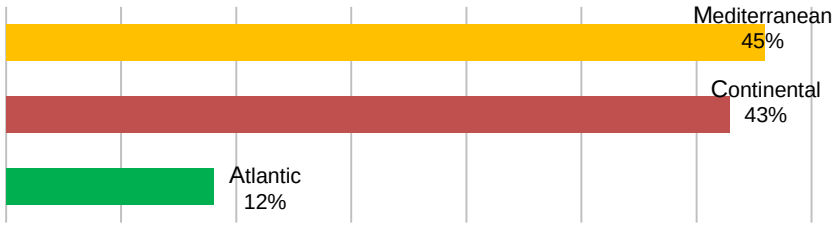
Table 10. Distribution of homes according to climatic areas and types of homes in Spain. Source: IDAE

However, if we apply average consumption to homes in each climatic area, taken from the SECH-SPAHOUSEC Project, we find that **the total consumption of homes located in the Mediterranean area is approximately the same as the total consumption of homes in the continental climate area.**

| Climatic Area | Average consumption of homes | Total number of homes | **Approximate total consumption of homes** |
|---|---|---|---|
| **North Atlantic** | 0,799 toe | 2.253.421 | 1.800.483,379 toe |
| **Continental** | 1,087 toe | 5.782.834 | 6.285.940,558 toe |
| **Mediterranean** | 0,719 toe | 9.163.375 | 6.588.466,625 toe |

Table 11. Total consumption of homes by climatic area Source: IDAE

On the other hand, in the following table, you can see the total consumption of homes located on the North Atlantic is significantly lower than those located in the other two climatic regions and represents approximately 12% of the total energy consumption by all houses in Spain.




Graph 30. Total consumption of homes found in each climatic area. Source: created using information found in the Population and Home Census 2001 produced by the National Institute of Statistics and Project SECH-SPAHOUSEC produced by IDAE.

### *5.3.3 Energy consumption of homes according to their typology*

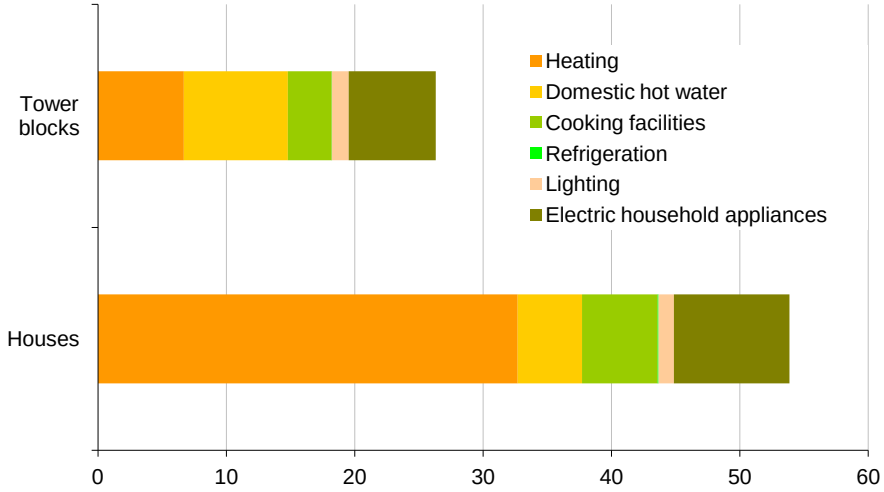
In terms of the unitary heating energy consumption of homes according to whether they are houses or tower blocks, it is worth highlighting that a house will always consume more energy since they have a greater surface area of walls exposed to the open air as well as floor in direct contact with the ground or open air.

In contrast, houses have greater potential for producing energy through renewable energy sources (solar thermal and photovoltaic) thanks to exactly the same reason they tend to lose more heat: a far higher percentage of wall and roof space exposed to the environment.

*5.3.4 Data on homes broken down by climatic area and type*

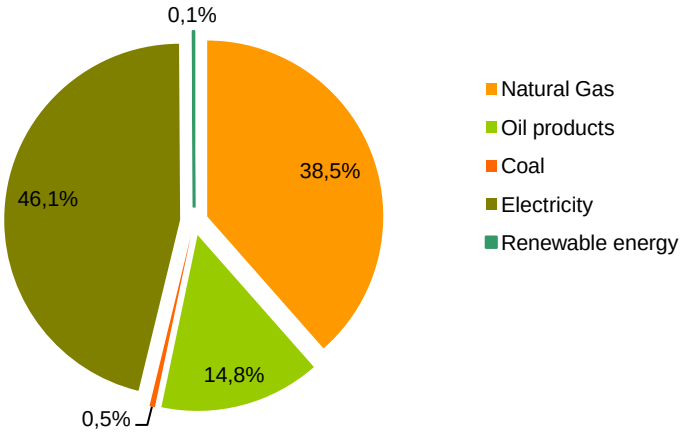
**a. North Atlantic Area**

Houses in the North Atlantic Area have a great difference in consumption compared to tower blocks. The location of tower blocks near to the coast while houses are located more towards the centre, with a harsher climate and older construction explains why **houses here consume close to 5 times the heating consumption than tower blocks in this area**.

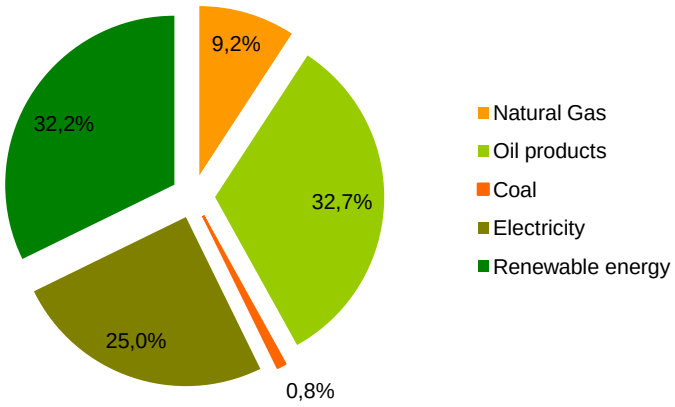



Graph 31. Unitary Energy consumption in the North Atlantic Area by type of Home (GJ/Home). Source: IDAE

Electricity is the dominant energy source in tower blocks as a consequence of the fact that heating is mostly provided with electrical equipment. As for the demand for houses, this is provided by both oil products and renewable energy in practically equal parts.



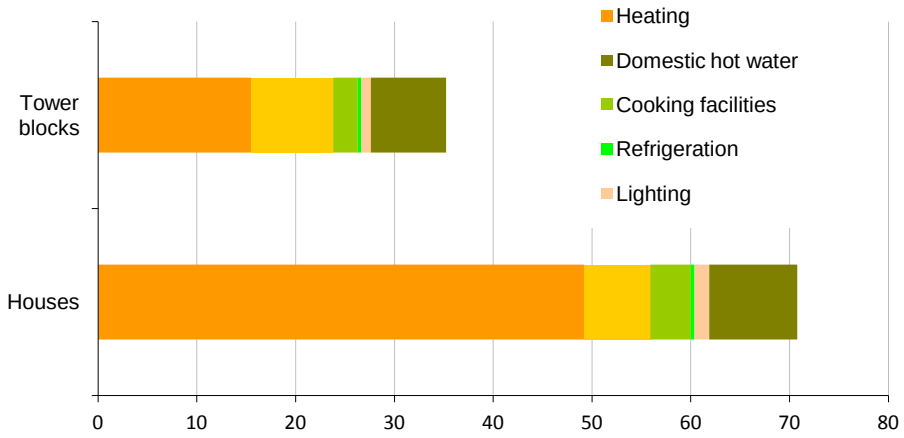

Graph 32. Fuel supply structure for the North Atlantic Area. Tower blocks. Source: IDAE




Graph 33. Fuel supply structure for the North Atlantic Area. Houses. Source: IDAE

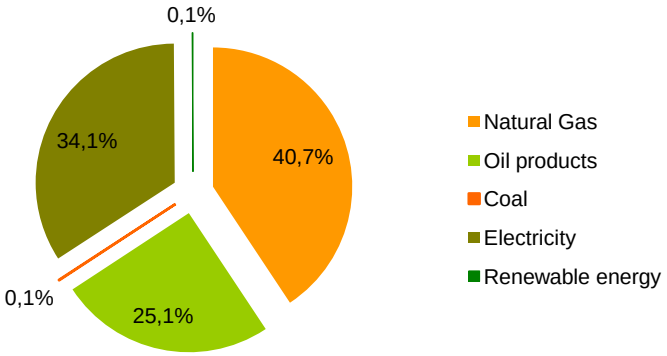
### b. Continental Area

Houses located in this zone consume considerably more energy than tower blocks, which is the same as that found in general throughout the country. The fact that the climate in this area is not regulated by climatic factors such as being close to the sea means that there is only a minor difference between the consumption in tower blocks and houses: **houses only consume a little more than 3 times that consumed in heating in tower blocks.**

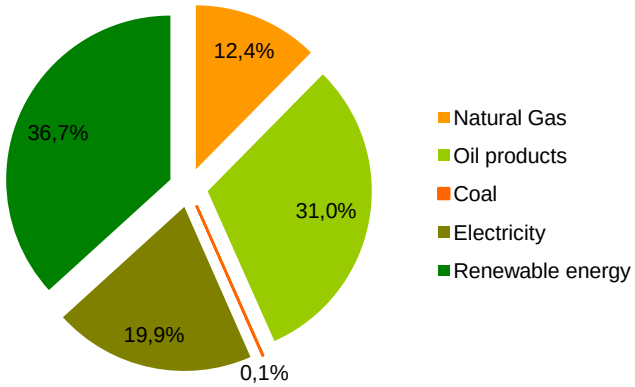



Graph 34. Unitary energy consumption in the Continental Area by type of home (GJ/Home). Source: IDAE

The consumption of renewable energy are found in homes in this area, as with energy coverage in other areas within Spain, clearly surpassing the consumption of oil products as a result of **greater agricultural and forest biomass potential** in this area and given the low population density through the areas with continental climate. In tower blocks, the chief energy source is natural gas followed by electricity.



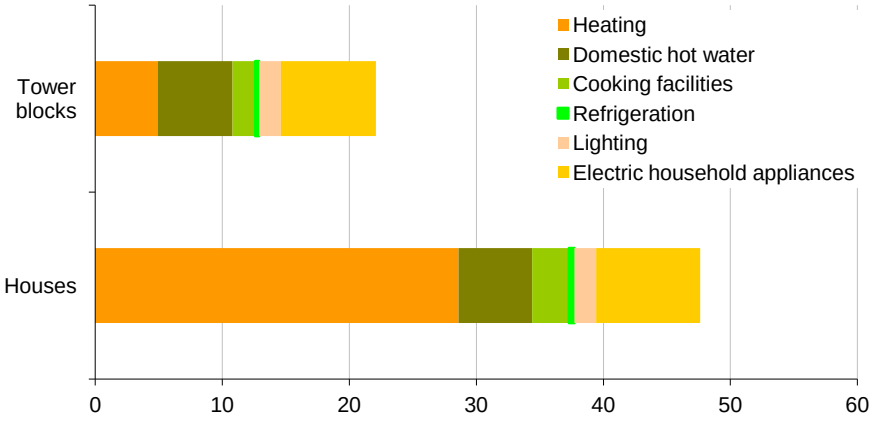

Graph 35. Fuel supply structure for the Continental Area. Tower blocks. Source: IDAE




Graph 36: fuel supply structure for the Continental Area. Houses. Source: IDAE

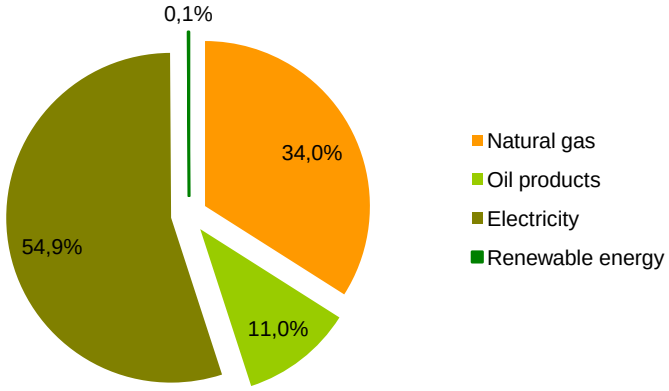
### c. Mediterranean Area

Like in the North Atlantic Area, houses in the Mediterranean area consume around **6 times more** energy compared to tower blocks in the same area. And once again, the location of collective accommodation near the coast together with a milder climate compared to the North Atlantic area mostly explain the differences in energy demand for each type of home.

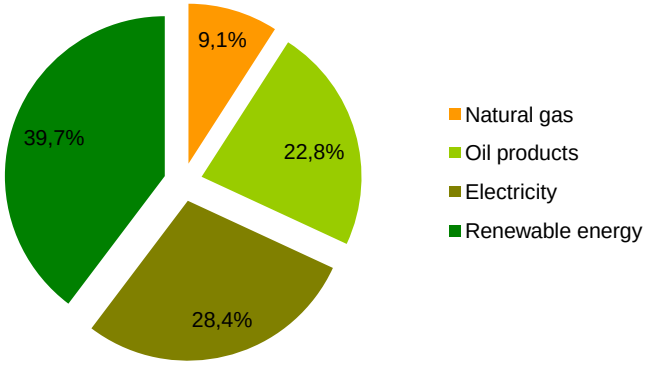



Graph 37. Unitary energy consumption in the Mediterranean Area by type of home (GJ/Home). Source: IDAE

With regard to the coverage of the residential energy demand in this region, electricity is the principal energy source in tower blocks, again due to the fact that part of the energy demands for heating are made using electrical equipment. Renewable energy is responsible for supplying most of the electricity demanded by houses.




Graph 38. Fuel supply structure for the Mediterranean Area. Tower blocks. Source: IDAE




Graph 39. Fuel supply structure for the Mediterranean Area. Houses. Source: IDAE

*5.3.5 Details of housing by climate zone and type of system or equipment*

**a. Heating**

Regarding the heating system, the single installations dominate the 82% of homes with heating, while the central heating is only present in the 8% of homes, percentage that moves up to 18% at the Continental zone.

The 70% of these homes have thermostat or any other system to regulate the temperature of the heating system. The majoritary heating equipment is the conventional boiler, present in almost half of the Spanish homes, and its maximum representativity appears in the continental zone and the block housing. In the Mediterranean zone, people prefer the electrical heating equipments such as reversible heat pumps, heaters and radiators. On the other hand, the introduction of more efficient equipments such as condensation boilers is yet limited, only 1% of homes with heating.

The average age of this equipment in Spain is 8.4 years, and the most modern are located in the Mediterranean zone, and the older ones in the Continental zone.

Regarding technology, the conventinal boilers do have an average age of 10 years, while the ages of condensation boilers are 5.6 and the reversible heat pumps are 5.6 to 6.6 respectively.

**b. Hot water**

For the production of hot water, the most used equipment is the single boiler, specially in the North Atlantic zone, where the average age of the equipments is 7 years.

The most used energy sources are natural gas (40%), butane (26%) and electricity (22%), and the importance order varies according to the type of climate zone and the type of housing.

**c. Refrigeration**

Regarding refrigeration, the dominant equipment is the reversible heat pump, with a penetration at national level of the 78%, and this cipher moves to 83% in the Mediterranean zone, and to 84% at single family housing.

The average age of the refrigeration systems in Spain is 6.2 years. The elecricity is the energy source of this kind of service in all the analyzed homes, and the 62% of homes do have any kind of temperature regulation.

**d. Kitchen**

Almost all the Spanish homes do have kitchen equipment, and most of them are gas kitchens (31%) and ceramic glass (30%).

The average age of the kitchen is 9 years, and there are not big differences by climate zones or types of housing. Gas kitchens are the older ones, more than 11 years of age, while the electrical ones are younger, specially the induction cooktops, aged only 3 years.

The energy source mainly used at Spanish kitchens is electricity, followed by natural gas or LPG. Natural gas is more present in the Mediterranean zone and the block housing, while LPG appears more at the North Atlantic area and the single family housing.

**e. Lightning**

With respect to lightning, the average number of light bulbs per home is around 23, equivalent to 3 per room. This number increases in the Mediterranean housing, as well as in the single family housing.

Light bulbs with more penetration (86%) at homes are that of low energy, although in absolute terms, the conventional light bulbs are the most abundant with an average of 8.3 light bulbs per home over the 7 low energy light bulbs per home. LED light bulbs just reach a 1% of penetration at Spanish homes, and the average number of light bulbs is insignificant.

**f. Electrical appliances**

The penetration of efficient electrical appliances at those homes who know their label (44%), according to the type of energy label, varies according to equipments, although fridges, washing machines and washer/dryer machines overcomes 50%. In general, the most known energy class is Class A, with a national average penetration of around 40% in all the equipments. However, as a whole, taking into account the most efficient classes (A, A+ and A++), the most efficient equipments at home are the fridges, washing machines and dishwashers. On the other hand, fridges and dishwashers are the equipments that have a more efficiency penetration level at present (Class A++).

The average age of the electrical name-brand appliances varies according to the equipments, although it varies in a range from 6 to 8 years; the minimum is for washing machines and dryer/washer machines with 6 years of average, and the maximum for ovens with 8 years.

The Standby option is present in most of homes. The 79% of homes with TV set has this kind of device, showing the decissive importance of the TV sets with respect to the total consumption associated to Standby, owing to the multiequipment of homes linked to these devices. In particular, every home has an average of 1.6 TV sets with standby.

The average age of these electrical appliances varies according to the equipments, their presence on the market and familiarity of homes; the maximum is for stack systems with around 9 years, and the minimum is for modem/DSL equipments, with almost 3 years of average age.

*5.3.6 The type of energy used in homes*

The consumption in the residential sector is two-thirds based on fuels, mostly oil products, natural gas and renewable energy.

| | Coal | Oil products | | | | Gas | Renewable energy | | | | | | | | Electricity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Biomass | | | | | | |
| | Anthracite | Liquefied Petroleum Gas | Gas oil | Others | TOTAL | Natural Gas | Solar Thermal | Geothermal | Charcoal | Wood | Pellets | Other solid biomass | TOTAL | | |
| | TJ | TJ | TJ | TJ | TJ | TJ | TJ | TJ | TJ | TJ | TJ | TJ | TJ | | MWh |
| Heating | 506 | 16.247 | 85.116 | -- | 101.363 | 70.977 | 432 | 254 | 805 | 97.695 | 202 | 434 | 99.135 | | 4.417.934 |
| Domestic hot water | 39 | 19.220 | 7.644 | -- | 26.864 | 65.568 | 5.402 | 143 | 247 | 1.469 | 168 | 213 | 2.097 | | 4.479.594 |
| Cooking facilities | 74 | 7.730 | | | 7730 | 16.704 | | | 90 | 989 | 1 | -- | 1079 | | 5572109 |
| Refrigeration | | | | | | | | 107 | | | | | | | 1400183 |
| Lighting | | | | | | | | | | | | | | | 7044741 |
| Electrical appliances | | | | | | | | | | | | | | | 37068412 |
| Total consumption | 619 | 43.197 | 92.760 | -- | 135.957 | 153.249 | 5.834 | 504 | 1.141 | 100.153 | 370 | 647 | 102.312 | | 59.982.973 |

Table 12. Breakdown of Energy sources Source: IDAE

On the other hand, it is worth highlighting that renewable energy sources are being more and more important, providing approximately as much energy as oil products.

However, not all renewable energy sources are directly usable by buildings. As such, we need to exclude wind, solar panel, hydraulic and biogas energy used to generate energy, even though they can be used for domestic purposes is very limited cases. Renewable energy sources most often used for buildings can be broken down into three types: biomass, geothermal and solar thermal.

### 5.4 Unavailable data

As has been seen in this text, statistical information in Spain on the residential sector is ample while data on non-residential buildings is fairly scarce.

However, the potential for saving energy in residential buildings (27%) is similar to that available for those in non-residential buildings (30%) according to the European Commission. (Source: European Commission. Estimated potential for energy saving by sector. EU-25 *baseline Scenario and Wuppertal Institute. 2005)*

There has also been no data found relating to renewable energy installed in these buildings. However, there is data on powers generators of various types installed.

| Renewable energy | National total |
|---|---|
| Hydraulic | 2.036 |
| Wind | 20.881 |
| Photovoltaic solar | 4.099 |
| Thermoelectric solar | 949 |
| Renewable thermal | 1.142 |

Table 13. Installed power sources relative to renewable energy sources, 31st December 2011. Source: Spanish Electricity Board

# 6. Existing vocational training

The sustainability objectives set by the European Union for 2020 raises a series of challenges for building workers' qualifications. On this path, the various changes are found which are established by the Building Technical Code, and which is obligatory for all new buildings and any other work related to large-scale extending, modifying, restoring or renovating of existing buildings.

These demands are generating important training needs for professionals tasked with implementing these new systems and element since it constitutes a new method of building which requires adaptation to these new requirements.

In addition, as has already been mentioned, it is worth pointing out that renovation of buildings, regardless of the type, is being driven by the Spanish government through the Home and Renovation National Plan 2009-2012, in which renovation is seen almost as a new sector which can absorb the unemployed workforce from the new construction building sector.

The acquisition of new skills or updating existing ones will require a large training effort, for which reason it is worth analysing the education and vocational training on offer related to Energy Efficiency and Renewable Energy within the building sector.

## 6.1. Vocational training referred to the National Catalogue of Professional Qualifications

Public training is structured around the National Vocational Training and Qualifications System. The SNCFP, as was explained earlier, is a collection of instruments and actions necessary to promote and develop the integration of vocational training, through the National Catalogue of Professional Qualifications.

As such, the National Catalogue of Vocational Training and Qualifications makes up the base for the elaboration of training for vocational training qualifications, certificates and modular and accumulative training associated with a skill unit, as well as others on offer.

Professional training consists of the collection of training courses which are designed to ensure qualified workers in various jobs, access to employment, and active participation in their economic, cultural and social lives which will encourage professional skills are acquired and kept up-to-date. It includes training vocational training within the education system, the actions of integration and reintegration of workers into job and continuous training within businesses.

The relationship between the National Vocational Training and Qualifications System, vocational training within the Education System and Vocational Training for employees is established in the laws:

- ✓ Organic Law 2/2006, 3rd of May, related to Education
- ✓ Organic Law 56/2003, 16th of December, related to employment
- ✓ Law 5/2002, 19th of June, related to qualifications and vocational training

From these starting blocks, the SNCFP has two important functions:

- ✓ Be the reference point for planning Initial Vocational Training and for Vocational Training for Employees.
- ✓ Be the reference point for the Initial Professional Qualification Programmes (PCPI), implemented by the ACs.

The official accreditation process can be carried out in two different ways: through conventional training, regulated by the Ministry of Education, Culture and Sport, and by the Ministry of Employment and Social Security for informal training; while the second method is through official accreditation of professional skills acquired through working experience.

The educational and working Administrations have established a mutual agreement, having first consulted the Vocational Training General Council, on the indicators and minimum quality requirements of training referred to the CNCP which guarantee the fundamental aspects of an Integrated Training System.

Vocational Training Degrees and Certificates of Professional Standards are official and valid throughout the state. Said degrees and certificates accredit the corresponding professional qualifications to those who have obtained them and, where appropriate, provide the corresponding academic effects.

The General Administration of the State, after consulting with the Vocational Training General Council, determines the degrees and certificates which constitute vocational training referred to the National Catalogue of Professional Qualifications.

*6.1.1. Description of training referred to the CNCP*

Training taken from the integrated training system is described below, grouped by level or method of access:

***Initial Professional Qualification Programmes***

Initial Professional Qualification Programmes (PCPI), are aimed at students who have not completed Obligatory Secondary Education, and aims, amongst other objectives, to ensure that all students reach professional skills relating to level 1 of the CNCP, as well as being satisfactorily inserted into a working environment and improving their basic skills to be able to study at other levels or subjects.
Students who pass the obligatory modules of these programmes obtain an academic certificate issued by the educational Administrations. This certificate accredits the professional skills related with the SNCFP, giving right to the corresponding certificates of professional standards issued by the working Administrations.
PCPI training related to EE and RE is as follows:

| | Code | Academic certification |
|---|---|---|
| EOC[6] | EOC271_1 | Auxiliary functions relating to bricklaying in factories and roofs. |
| EOC | EOC272_1 | Auxiliary functions relating to continuous coating in construction |
| EOC | EOC409_1 | Auxiliary functions relating to development and rigid finishes |
| EOC | EOC578_1 | Basic functions relating to techniques and light coatings in construction |
| ENA[7] | ENA620_1 | Basic functions relating to assembly, maintenance and installation of renewable energy |
| IMA[8] | IMA367_1 | Functions relating to plumbing and domestic air-conditioning and heating |

Table 14. PCPI Training in EE and RE

***Vocational Training Certificates***

Professional training in the educational system regulated by **Royal Decree 1538/2006, 15th of December**, consists of a combination of training cycles organised into professional modules of a variable length and with theoretic and practical content, suitable for various professional fields including a training module in work centres.

Training cycles are mid-grade and higher-grade and are referred to the National Catalogue of Professional Qualifications. The curriculum of this training is adjusted to the demands derived from the SNCFP.

[6] Civil Building Works
[7] Energy and Water
[8] Installations and maintenance

The aim of this vocational training is that students acquire the capabilities, among others, to allow them to develop the general competence relating to one or more qualifications from the studies conducted.

There are two types of degrees:

- ✓ A Technician degree is given after completing a mid-grade training cycle.
- ✓ A Superior Technician degree is given after completing a higher-grade training cycle.

For the purposes of research, mid-grade training is more important as well as the analysis carried out on mid-grade vocational training aimed at former professionals implied in the EE and RE regulations. The following training is available in the state:

| | Mid-grade Training Cycle |
|---|---|
| EOC | Construction Finishes |
| EOC | Construction |
| EOC | Bricklaying Work |
| IMA | Heat production installations |
| IMA | Air-Conditioning and Cooling Installations |
| IMA | Assembly and maintenance of cooling, heating and air-conditioning installations |

Table 15. Mid-Grade Training Cycle

| **Mid-Grade Training Cycle:** Construction Finishes (EOC) | |
|---|---|
| **General competences:** | **Professional Profiles:** |
| - Organise construction finishing jobs.<br>- Carry out coatings in sheets.<br>- Tiling and paving.<br>- Carry out continuous conglomerate coatings.<br>- Apply paints and varnishes<br>- Assemble and mount prefabricated panels.<br>- Check and have available means of security predicted in the work plan.<br>- Administrate, manage and promote a small business or workshop, when their grade allows it. | - Site foreman.<br>- Health and Safety Technician.<br>- Welding.<br>- Tiling.<br>- Paving.<br>- Plastering.<br>- Dresser.<br>- Plasterer.<br>- Industrial flooring installation.<br>- Synthetic pavement installation.<br>- Roofing with synthetic materials<br>- Glazing.<br>- Technical flooring installation.<br>- Ceiling tile installation. |

Table 16. Professional profiles and competences of the mid-grade training cycle **construction finishes (EOC)**

| **Mid-Grade Training Cycle:** Construction Technique (EOC) | |
|---|---|
| **General competences:** | **Professional Profiles:** |
| - Create and assemble casing, placing them according to design and guaranteeing the stability and rigidity of the whole.<br>- Create elements from fabricated concrete, creating and placing frames and cooperating in the placement of the concrete.<br>- Construct masonry both finished and to be finished with stone, brick and blocks, considering its positioning and complying with requirements.<br>- Complete plastering, plating and conversions with mortar, pastes and cement, applying techniques which leave a nice finish.<br>- Complete roofing jobs, using pending training systems, waterproof insulation, complementary elements and other suitable materials.<br>- Complete urbanisation jobs, laying pavements, registers and having linear pipelines without pressure, and singular and complementary elements.<br>- Laying horizontal and vertical faces, completing welding jobs with solid, plated and plastered pieces, guaranteeing they are flat and that there are suitable joints.<br>- Organise bricklaying and cementing sites, planning activities, assigning and adapting materials, human resources, methods of working and teams.<br>- Assess bricklaying and cementing jobs, measuring work units and organising budgets.<br>- Interpret construction plans, identifying their elements and finding dimensions. | - Team leader.<br>- Bricklayer.<br>- Mason.<br>- Site foreman.<br>- Paving.<br>- Pitman in plumbing networks.<br>- Creating frames or casing.<br>- Rebar worker.<br>- Roofer.<br>- Roof tiler.<br>- Coating painter.<br>- Plasterer.<br>- Waterproofing installer in buildings and public works.<br>- Terrace waterproofing installer. |

Table 17. Professional profiles and competences of the mid-grade training cycle **construction technique (EOC)**

| General competences: | Professional Profiles: |
|---|---|
| - Organise jobs relating to bricklaying, the construction of roofs and coatings.<br>- Carry out continuous conglomerate coatings.<br>- Carry out waterproofing jobs.<br>- Construct liquid-flow installations without pressure in good-quality, safe conditions.<br>- Check and have available means of security predicted in the work plan.<br>- Administrate, manage and promote a small business or workshop, when their grade allows it. | - Site foreman.<br>- Bricklayer.<br>- Roofer working with slate, tiles or asphalt.<br>- Insulation installer.<br>- Plastering.<br>- Dresser.<br>- Plasterer.<br>- Pipe layer. |

Table 18. Professional profiles and competences of the mid-grade training cycle **bricklaying work (EOC)**

| **Mid-Grade Training Cycle:** Heating installations technician | |
|---|---|
| **General competences:** | **Professional Profiles:** |
| - Fit equipment and other elements associated with heating installations, water and liquid heaters (circulators, heating exchanges, expansion vessels and piping, among others) in safe, good-quality and environmentally-friendly conditions, assuring they work.<br>- Fit electrical, regulating and control systems associated with heating, solar thermal, and liquid heating systems in safe, good-quality conditions, ensuring they work.<br>- Measure parameters and carry out tests and verifications on the installations, both functional and regulatory, to check and adjust its functioning.<br>- Repair, maintain and replace equipment and elements in installations, in good-quality, safe and environmentally-friendly conditions to ensure and restore working conditions. Complete installations, carrying out checks for security and to ensure the machines, automatic parts and security devices work after the installation is completed or maintained. | - Heating equipment installation/maintenance.<br>- Heating and hot water equipment installation/maintenance.<br>- Solar thermal equipment installation/maintenance.<br>- Water equipment installation/maintenance.<br>- Gas and combustible liquid equipment installation/maintenance. |

Table 19. Professional profiles and competences of the mid-grade training cycle **heat production installations technician (IMA)**

| **Mid-Grade Training Cycle:** Cooling and air-conditioning installations technician (IMA) | |
|---|---|
| **General competences:** | **Professional Profiles:** |
| - Design installations in agreement with technical documentation to guarantee the assembly, resolving any problems in performance and informing on other contingencies.<br>- Fit electrical, regulating and control systems associated with cooling, air-conditioning and ventilation systems in safe, good-quality conditions, ensuring they work.<br>- Apply connecting and mechanical techniques for the assembly and maintenance of cooling, air-conditioning and ventilation systems in good-quality, safe and environmentally-friendly conditions.<br>- Measure parameters and carry out tests and verifications on the installations, both functional and regulatory, to check and adjust its functioning.<br>- Locate and diagnose problems in the equipment and elements of the installations, using appropriate means and applying procedures established with appropriate safety in mind.<br>- Repair, maintain and replace equipment and elements in installations, in good-quality, safe and environmentally-friendly conditions to ensure and restore working conditions. | - Cooling installation in commercial premises.<br>- Cooling maintenance in commercial premises.<br>Cooling installation in industrial processes.<br>- Cooling maintenance in industrial premises.<br>- Installation/Assembly of air-conditioning and extraction-ventilation equipment, distribution networks and terminal equipment.<br>- Maintenance/Repair of air-conditioning and extraction-ventilation equipment, distribution networks and terminal equipment. |

Table 20. Professional profiles and competences of the mid-grade training cycle **air-conditioning and cooling installations technician (IMA)**

| **Mid-Grade Training Cycle:** Technician in the assembly and maintenance of cooling, heating and air-conditioning installations (IMA) | |
|---|---|
| **General competences:** | **Professional Profiles:** |
| - Assemble and maintain commercial and industrial refrigeration installations.<br>- Assemble and maintain air-conditioning and ventilation installations.<br>- Assemble and maintain heating installations.<br>- Assemble and maintain water and combustible gas networks.<br>- Administration, management and promotion of a small business or workshop. | - Install/maintain hot water and heating installations.<br>- Heating and air-conditioning equipment installation/maintenance.<br>- Install/maintain cooling.<br>- Gas installer.<br>- Maintain auxiliary production installations.<br>- Maintain process installations. |

Table 21. Professional profiles and competences of the mid-grade training cycle **Technician in assembly and maintenance of cooling, air-conditioning and heating installations (IMA)**

In addition to the training aimed at training level 2 workers, there is training aimed at level 3 professionals. Higher-grade training cycles relating to EE and RE are:

| | Higher-grade Training Cycle |
|---|---|
| EOC | Topographic and Town Planning Project Development |
| EOC | Construction Project Application and Development |
| EOC | Building Projects |
| EOC | Public Works Projects |
| EOC | Work Plans and Execution |
| ENA | Energy Efficiency and Solar Thermal Energy |
| ENA | Renewable Energy |
| IMA | Development of projects related to fluid and thermal installations |
| IMA | Maintenance of fluid and thermal installations |

Table 22. Higher-grade training cycles related to EE and RE

***Certificates of Professional Standards***

Certificates of professional standards regulated by **Royal Decree 34/2008, 18th of January**, consist of training courses aimed at the gaining and improvement of professional skills and qualifications. Training aimed at obtaining certificates of professional standards is carried out in a modular manner with the aim of favouring partial accreditation which can be accumulated which allows the worker to advance in their vocational training program regardless of their working situation at any given moment.

Each professional certificate accredits a professional qualification from the CNCP. Professional certificate training modules are those in the Vocational Training Modular Catalogue. Certificates of professional standards related with EE and RE and those aimed at building competence to level 1 and 2 are listed below:

| Family | Code | Level | Professional certificate |
|---|---|---|---|
| EOC | EOCB0108 | 2 | Bricklaying |
| EOC | EOCB0109 | 1 | Auxiliary functions relating to continuous coating in construction |
| EOC | EOCB0208 | 1 | Auxiliary functions relating to bricklaying in factories and roofs. |
| EOC | EOCI10 | 2 | Plumber |
| EOC | EOCL50 | 2 | Plasterer |
| ENA | ENAE0108 | 2 | Assembly and maintenance of photovoltaic solar installations |
| ENA | ENAE0208 | 2 | Assembly and maintenance of solar thermal installations |
| ENA | ENAS0110 | 2 | Assembly, implementation, maintenance, inspection and review of gas equipment installations |
| IMA | IMAI0108 | 1 | Functions relating to plumbing and domestic air-conditioning and heating |
| IMA | IMAR0208 | 2 | Assembly and maintenance of air-conditioning and ventilation-extraction installations |
| IMA | IMAR0408 | 2 | Assembly and maintenance of heating installations |

Table 23. Level 1 and 2 certificates of professional standards related with EE and RE

As regards certificates of professional standards aimed at training level 3 skills, it is worth naming the following, related with EE and RE

| Family | Code | Level | Professional certificate |
|---|---|---|---|
| ENA | ENAC0108 | 3 | Energy efficiency in buildings |
| ENA | ENAE0308 | 3 | Solar thermal installations projects and organisation |
| ENA | ENAE0408 | 3 | Management of the assembly and maintenance of wind farms |
| ENA | ENAE0508 | 3 | Photovoltaic solar installations projects and organisation |
| ENA | ENAS0208 | 3 | Management of the assembly and maintenance of gas networks |

| | | | |
|---|---|---|---|
| IMA | IMAR0109 | 3 | Development of air-conditioning and ventilation-extraction installations projects |
| IMA | IMAR0409 | 3 | Planning, management and carrying out of the maintenance, supervision and assembly of air-conditioning and ventilation-extraction installations |
| IMA | IMAR0508 | 3 | Development of heating installations projects |
| IMA | IMAR0509 | 3 | Planning, management and carrying out of the maintenance and supervision of the assembly of heating installations |

Table 24. Level 3 certificates of professional standards related with EE and RE

### *6.1.2. Description of training referred to the CNCP*

Currently, the vocational training referred to the CNCP and related with building works in EE and RE can be characterised as follows:

- ✓ Wide-ranging, comprehensive training.
- ✓ Current Vocational Training does not deal with all of the bases required to implement EE and RE, principally because it does not cover all of the related activities in the sector.
- ✓ The design processes of training must be improved, promoting design from a real reference point with a continental vision. This will allow workers to gain accreditation which will serve throughout Europe, in such a way that they can move around Europe more easily and, as a consequence, find more job offers. In this sense, for higher levels, there is a set of regulations which allows certificates to be used in any EU country. However, the same does not apply to lower levels, even though private businesses are those which, through training not referred to the CNCP, provide better solutions.
- ✓ Formal training in energy efficiency is aimed at high levels, 3 and 4. There is no sufficient training material directed at levels 1 and 2. Although the experts may consider specific technical training unnecessary, it may be convenient to provide a more general vision focused upon the activity being developed. As such, the possibility of transversal training on EE and RE is being considered for some professionals involved in the building trade.
- ✓ However, existing vocational training in relation to renewable energy covers levels 1, 2 and 3. In this context, both Initial Vocational Training and Vocational Training for Employees in RE make up a wider range of training which is directly related to the needs of the sector.
- ✓ Poor levels of participation of students in these professional families. In Mid-Grade training cycles, up to 60% of places are not taken, while about 30% at Higher-Grade are not taken.

### *6.1.3. Needs in monitoring instruments and training*

Professional training on this subject is not filled due to lack of demand. In training for employees, training courses in demand are those which have official accreditation or a professional ID card which allows for better performance of a job post. There is a great lack of awareness in less-qualified workers of the qualification needs which will be required in the sector in the future. For this reason, it is seen as doubly-important that careers advice take place between professionals and trainers.

The need for a professional advice and training mechanism in centres which provide Initial Vocational Training to workers has been detected. Training should be continuous and not a single action. A culture change is required for short-term, mid-term and long-term training. There must be a flexible plan with the ability to adapt to changes in the labour market and which produces a qualified workforce. Though there are training programs in place, it is necessary to develop them as well as guidance for the correct use of training

In relation to instruments which are used to follow or monitor skills and training requirements, there are professional monitoring centres. In the case of INCUAL, this is found on their website which has training gained from prospective studies on energy efficiency and renewable energy. There are also other professional monitoring centres in the Spanish Public Employment Service and in each of the employment ministries in the autonomous communities. However, it is

necessary to develop one of the pillars of the National System of Professional Qualifications which corresponds to quality and evaluation. This is one of the weak points of the training policies since there is no training on the current situation of training in the sector.

The evaluation of needs should be aimed at opportunities, identifying gaps in performance which will probably occur in the future and implementing proactive solutions to prevent them.

*6.1.4. Training demands profile*

Higher technical profiles are those which demand more training, continuing training to specialise in matters related to energy and energy efficiency. In addition, they are those who can better read what the labour market will require and so orient their training program appropriately. The current vocational training system gives the possibility of definite specialisation - something not offered in higher level courses - by jumping from one module to another. However, higher-level workers do not use these channels, with Masters or Postgraduate courses, or private training being those most demanded from universities.

On the other hand, workers with a lower level of training are not so open to receiving formal training. As a result, they use the path of regulated training to a lesser extent.

## 6.2. Vocational training not referred to the National Catalogue of Professional Qualifications

There are no data available on the provision of training on EE or RE in the building sector which is not referred to the CNCP. However, in the opinion of the experts consulted, there is a wide range of private training available related with energy efficiency (EE) and renewable energies (RE).

*6.2.1. Description of training not referred to the CNCP*

One of the most important sources for this type of training is the Tripartite Foundation for Employment Training which carries out a lot of this type of training since it holds exams to subsidise continuous training in companies. It has been estimated that around 14,000 people have been training in matters of energy efficiency.

Although no training is available on the total available, we can provide training from the entity which manages the largest volume of training in the construction sector, the Construction Labour Centre.

Analysis of the Construction Labour Centre's databases shows that since 2007 until the present, over 7,500 students have been training in courses related to the EU's 2020 objectives on energy in buildings, all closely related to saving or reusing energy.

| Training courses | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|
| Insulation | 35 | 75 | 25 | 40 | 124 |
| Technical Building Code | 61 | 222 | 52 | 107 | 71 |
| Waterproofing | 69 | 60 | 28 | 48 | 209 |
| Renovation | 389 | 377 | 237 | 411 | 206 |
| Sustainability | 250 | 686 | 572 | 1170 | 2005 |
| **TOTAL students in EE and RE training** | **804** | **1420** | **914** | **1776** | **2615** |

Table 25: Evolution of number of courses relating to EE and RE, carried out by the FLC. Source: Training from the FLC(FLC). Evolution of training courses.

Through the construction sector's training plans and the demands of construction companies, during the last few years, the majority of training for updating knowledge as regards energy saving has been directed at qualified technicians in charge of the project. Even so, there is a progressive tendency towards an increase in staff training on this subject.

The trends in training for the FLC has been one of more or less constant increase between 2007 and 2011, with the area of sustainability being that which has experienced the largest increase in trained students.

*6.2.2. Description of training not referred to the CNCP*

The example of the FLCand the opinion of experts who have been consulted has allowed the training on offer to be characterised as follows:

- ✓ It is fragmented and is being managed by a wide range of businesses, including associations, business organisations and the FLC.
- ✓ There are no suitable means for its certification.
- ✓ There is especially high availability in the field of sustainability in buildings
- ✓ It is dynamic and adapts to market needs
- ✓ It has been especially intense for qualified technicians
- ✓ There is a lack of training courses for unqualified technicians.
- ✓ The training channelled through training plans managed by social agents and subsidised training could be useful to bring training courses to unqualified workers.
- ✓ Subsidised training is a solution for businesses which could compensate for their training needs in EE and RE, even if, given the structure and characteristics of the construction sector, it is easier for large firms to access training rather than small or medium companies since they better fit the tissue of the sector.

*6.2.3. Accreditation of training not referred to the CNCP*

The most demanded training is that which includes accreditation since accredited training holds special relevance for workers.

Training which is not referred to the CNCP does not necessarily include official accreditation; in fact, the most common situation is that an institution which does not depend on administration will carry out the accreditation. As a result, experts consulted agree that it is necessary to create a public training certification checking system. It is considered correct that the Public Administration control the accreditation of unofficial training, through previously defined criteria.

One possibility for accreditation of this training would be to adapt unofficial training to the National System of Vocational Training and Qualifications (SNCFP) but there are problems related to the length of the publication process of certain certificates of professional standards.

In some cases, the time from starting the processing of a professional certificate to its publication can be very long. This delay has, therefore, a negative effect since when the certification process is complete, it may already be obsolete. This demonstrates the need for

updating and all it means. The SNCFP and training are not always, therefore, an up-to-date and sufficiently flexible frame of reference which suits the working world's needs.

Furthermore, accreditation of skills through professional experience is seen as vital within the construction sector; in other words, recognition of professional experience favours the relocation of untrained workers through a process of verifying their professional skills.

*6.2.4. Needs detected for improving the training available*

New materials incorporated from the Technical Building Code (CTE) have started a revolution in the sector. The problem is that workers don't have the necessary technical knowledge to be able to use them properly. As such, producers of materials play a very important role in the training of energy efficiency and renewable energy. Experts say that, from public bodies, essential professional qualification is guaranteed which will allow workers to enter into job roles. It then becomes the job of the businesses and material providers who have to invest in their specialisation.

**Obligatory** EE training is seen as desirable, especially to cover lower levels of qualifications since it is difficult for workers to access training courses by themselves due to various socio-culture reasons. As a result, a parallel has been established with what occurred in food safety and food handlers, where a Royal Decree was published extending obligations to all food companies, regardless of their size.

The value added by certified training must be assessed since the worker will perceive an increase in their *employment prospects*. In this sense, a marketing campaign must be carried out to inform workers in the sector on the importance of training.

Motivation and expectations of those currently deciding to undergo training are long-term considerations given the economic situation in the country and especially this sector, since training does not lead to an immediate improvement in work performance. **Job counselling** gains special relevance, as a result, especially within initial vocational training centres. Guidance given from public bodies is directed at the unemployed, showing the need to develop it for the employed.

Within the sector, there is clear polarisation of workers: on one hand, there are highly-qualified workers, and on the other, an unqualified mass of salaried workers. In the first group, there may be a problem of over-qualification and an excess of training while, in the other, there is no interest in training, meaning a need to increase motivation. One method of motivation may be related to practical training since workers in the sector tend to prefer this. As a result, improving the quality of training courses is necessary, improving the practical vision of training.

*6.2.5. Detection of needs and demand for training not referred to the CNCP.*

The Administration has a great responsibility for detecting needs as it establishes the regulatory framework in which training and qualifications are developed, but the social agents also have a key role when detecting needs, improving the training on offer and, above all, assessing vocational training.

The suitability of the training should be channelled through professional associations, though some are already very involved. The Public Organisms must be the ones that lead the process of worker awareness and motivation for them to be trained and improve their professional skills.

In a fragmented sector, such as the construction sector, in which sub-contracting is the norm, promoters of any building have a large responsibility and should demand at last a few from smaller businesses. There are currently training centres which work at the rhythm of the promoters, designing courses for subcontracting companies.

Experts agree that there is not sufficient demand for training in lower levels of qualification and that, where there is, it is not enough. In this sense, it must be considered that vocational training is created due to worker demand, and this does not agree with the needs the experts are detecting in the sector.

However, the true training needs are marked by the fabric of the industry, with a clear difference between the needs perceived by workers and what the businesses demand. The real needs, existing training and worker demands must be made more consistent.

At higher levels of university training (degrees and masters), demand is very high since there are a group of highly-qualified professionals who know their training needs and have the resources to find suitable training.

The main problem is providing training to lower level because workers do not understand what is being demanded in the sector, how it is evolving and where to find more training. It is necessary to motivate level 1 and 2 workers (auxiliary technicians and mid-grade technicians), in other words, those with low qualifications, to stimulate the demand.

## 6.3. Relevant national and regional training initiatives supported by the EU

The status quo of training is shown in this sub-section, showing some of the more relevant training initiatives supported by the European Union.

The European Union is developing within the field of education and training through its "Permanent Learning Programme". The **“permanent learning programme”** (PAP) attempts to contribute to the *‘‘creation of a society of advanced knowledge with sustainable economic development, more and better employment opportunities, and greater social cohesion’’.* The general aim is to allow transitioning between education and training systems through the various European countries involved such that it becomes a reference of quality for the world.

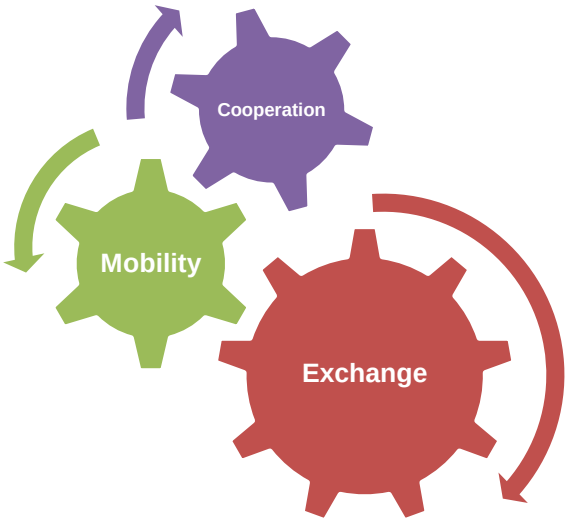



Figure 15. General aim of the PAP

The Permanent Learning Programme (PAP) is the **principal mechanism of European financing in the field of education and training**. The Permanent Learning Programme covers the period from 2007-2013 and replaces the programmes Socrates, Leonardo da Vinci and eLearning. It has a budget of 7 billion euros to finance projects and activities which stimulate exchange, cooperation and translation between the education and training systems within the EU with the aim of turning them into a world-class reference point.

The PAP consists of **four programmes**, each one of which awards help and subsidies to projects which increase international movement of people, promote bilateral and multilateral associations, and improve the quality of education and training systems through multilateral projects which promote, for example, innovation. These programmes cover the following:

| | |
|---|---|
| **Comenius** | • Needs for teaching and learning from all the participants of infant, primary and secondary education, as well as the centres and organisations which provide that education. |
| **Erasmus** | • Needs for teaching and learning from all the participants of formal higher education (including transnational stages for students at companies), as well as the centres and organisations which facilitate or provide that education or training. |
| **Leonardo da Vinci** | • Needs for teaching and learning from all the participants of professional training, as well as the centres and organisations which facilitate or provide that education or training. |
| **Grundtvig** | • Needs for teaching and learning from all the participants of all forms of adult professional education, as well as the centres and organisations which facilitate or provide that education. |

Figure 16. PAP programmes

*6.3.1. Leonardo da Vinci Programme*

The Leonardo da Vinci programme is aimed at the teaching and learning needs of all people involved in Vocational Training and education, such as institutes and organisations which provide this training.

The programme's **specific objectives** are:

- Support participants in training activities and continuous training, helping in the acquisition and use of knowledge, skills and qualifications with a view towards professional and personal development.
- Support improvements in quality and innovation of systems, institutes and practices of vocational training and education.
- Increase the appeal of Vocational Training and mobility for businesses and individuals, and ease mobility of workers in training.

As **operational objectives:**

Quantitatively and qualitatively improve the mobility of people in continuous and initial vocational training throughout Europe, with the aim of ensuring that stays within businesses reach, at least, 80,000 per year by the end of the Permanent Learning Programme.

- Quantitatively and qualitatively improve cooperation between centres or organisations which provide learning opportunities, businesses, social actors and other relevant organisms around Europe.
- Aid the development of innovative practices in the fields of non-tertiary vocational training and education, and in their transfer around different participating countries.
- Improve the transparency and recognition of qualifications and skills, including those acquired through formal or informal training.
- Promote the learning of modern foreign languages.
- Support the development of contents, services, pedagogy and innovative permanent learning practices, based on Training and Communication Technologies.

The **Leonardo da Vinci** Programme subsidises the following decentralised actions:

✓ **Mobility Projects**
- International stays in businesses or training centre for people in Initial Vocational Training (IVT)
- International stays in businesses or training centre for people in the labour market (PLM)
- Stays and exchanges - Mobility for Vocational Education and Training Professionals (VETPro)

✓ **Innovative Transference Multilateral projects**
✓ **Leonardo da Vinci Associations**
✓ **Preparatory visits**

The Leonardo da Vinci Programme also subsidises the following centralised actions (the European Commission is in charge of the selection process, and the Executive Agency is responsible for managing the selected projects):

- ✓ **Innovative Development Multilateral projects**
- ✓ **Thematic networks**

Following is a list of the **relevant initiatives developed both at a national and regional level and financed by the EU** within the permanent learning programme's scope, Leonardo Da Vinci[9] and related with energy efficiency and renewable energy training.

## YEAR 2008

| DEVELOPMENT OF GUIDE FOR ENERGY EFFICIENCY RENOVATION OF BUILDINGS – EURO ENEFF. 2,008 | |
|---|---|
| **LED BY** | CÁMARA DE CONSTRUCCIÓN BÚLGARA |
| **OBJECTIVES** | Develop a renovation guide to energy efficiency in buildings: "Foundations", "Exterior walls", "Doors and windows", "heating and cooling installations", "Alternative energy". The manual includes a technical methodology and active learning methods. |
| **SUITABLE FOR** | The intended audience for the project are teachers, trainers, tutors and work managers in the long-term. Indirect beneficiaries of the project are project managers and construction service customers. |
| **RESULTS** | The foreseen product is a multimedia e-learning manual which will be a useful tool for trainers, vocational training centre teachers, for construction technicians and small and medium construction companies. It will be presented through various methods: Recorded DVD, paper-based material and an interactive website. The focus of the training materials will be on renovation of homes - construction techniques, methods and good European practices. |
| **EUROPEAN ADDED VALUE** | The project support national and international provisions through innovative educational projects. |
| **INNOVATIVE CHARACTER** | It will contribute to the gathering existing pedagogic material in the sector. |
| **IMPACT** | Transference project for energy efficiency projects which will contribute to improving the acceptance and improvement of new learning methods within the construction industry. |
| **WEBSITE** | http://www.euroeneff.eu/welcome.php |

| TEAM ECOCONSTRUCTION. 2008 | |
|---|---|
| **LED BY** | TECHNICIEN BATIMENT BASSE CONSOMMATION VIENT. |
| **OBJECTIVES** | The project **TEAM Eco construction** answers the training needs of construction professionals specialising in eco-construction which appears as a consequence of the evolution of skills required for the current energy challenges. It is necessary to harmonise the various construction professionals' skills throughout the EU. |
| **SUITABLE FOR** | • **Businesses**: train staff as regards management of environmental quality within buildings, train businessmen and workers in construction techniques relating to eco-materials.<br>• **Job-seekers:** create an innovative "eco-builder" training program and qualification which can ease integration within companies or create a new one, accepting the challenge of an expanding market..<br>• **Indirect Beneficiaries:**<br>Training organisms related to the multinational network: use of pedagogic tools and training references.<br>Vocational organisations in the sector: Integration of this new training with professional qualifications. |
| **RESULTS** | • A multinational, methodological guide for the design of evaluation and training references.<br>• A multinational training and certification reference for the specialist "eco-builder". |

[9] The Leonardo da Vinci programme was chosen to illustrate EU initiatives on the subject of EE and RE because of the four belonging to the PAP, it is the only one which is clearly sectorial.

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| | • Detailed pedagogic materials for training the specialist "eco-builder".<br>• Pedagogic reference tools (databases, online courses, tutorials, etc.).<br>• Creation of a multinational network of centres with resources dedicated to eco-construction. |
| **EUROPEAN ADDED VALUE** | Establishment of training and an evaluation process for pilot companies in Latvia. Monitoring of activities by national work groups (vocational organisations, educational and vocational training institutes) |
| **INNOVATIVE CHARACTER** | The innovation in this project comes from creating specialist "eco-builder" "skills", "training" and "certification", as well as a multinational network of centres with eco-construction resources with the aim of better informing the actors involved in construction. |
| **IMPACT** | • Qualify staff in businesses in the speciality of eco-construction.<br>• Offer technical "eco-builder" evaluation and training to job-seekers.<br>• Facilitate the hiring of new staff, answering problems in workforce within this sector and attracting a higher number of women.<br>• Cultivate the loyalty of the workforce and increase possibilities of acquiring and validating new competences.<br>• Make pedagogic resources available to training organisms through the multinational network of resource centres.<br>• Propose a post-project certification device to each of the national authorities and vocational organisations in each of the member nations. |
| **WEBSITE** | www.leonardo-teamecoconstruction.eu |

| **EMPRESS. EUROPEAN MANAGEMENT PROGRAMME ON RENEWABLE ENERGY SOURCES. 2008** | |
|---|---|
| **LED BY** | CENIFER. Integrated National Renewable Energy Training Centre |
| **OBJECTIVES** | The principal objective of the EMPRES project was to transfer the renewable energy sources management programme to the rest of Europe in order to train RE business area supervisors and managers, and managers of public government entities in charge of promoting it. |
| **SUITABLE FOR** | European managers, executives and managers of RE company areas and managers of public government entities in charge of promoting it. |
| **RESULTS** | The principal result of this project with a mixed learning course: European Management Programme on Renewable Energy Sources (EMPRES). It seems to have impacted actively in Europe because the innovative RE sector is constantly demanding competent professionals with specific abilities in management skills. |
| **EUROPEAN ADDED VALUE** | This innovative programme was transferred to other EU countries: Poland, Lithuania and Hungary which, compared to Spain, are currently less-developed in the RE sector. |
| **INNOVATIVE CHARACTER** | An innovative solution for the improvement of the course was identified and adapted to be mixed learning. |
| **IMPACT** | The RE sector is one of the most dynamic in Europe. Currently, Spain and Germany are leading the development of RE in Europe, while the manufacturers of photovoltaic panels and wind turbines are world-class. As such, demand for professionals trained in management skills for this type of company is predicted. |
| **WEBSITE** | www.empres.eu |

## YEAR 2009

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| **LED BY** | FOUNDATION FOR RENEWABLE ENERGY TRAINING- CENIFER |
| **OBJECTIVES** | Transfer to the rest of Europe the "Management Programme on Renewable Energy (RE)" which was developed in Navarra starting 3 years ago on a national level. Said programme was to be transferred to other countries with less experience in the renewable energy sector (Hungary, Lithuania, and Poland). |
| **SUITABLE FOR** | Continuous training centres with training aimed at companies in the renewable energy sector, associations linked with training in the sector, universities with postgraduate courses, etc., as well as Public Administrations' supervisors, team leaders and managers, directors. |
| **RESULTS** | B-Learning training course (classroom and distance learning) with the aim of helping companies in the renewable energy sector find professionals trained and knowledgeable in specifics, culture, legislation, etc. of each country. |
| **EUROPEAN** | The project transfers the knowledge and experience accumulated by a country in the |

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| **ADDED VALUE** | Union within the Renewable Energy sector to new member countries which must quickly integrate into the renewable energy sector. |
| **INNOVATIVE CHARACTER** | The Renewable Energy Management programme was developed in Navarra was innovative from the point of view of the contents and the renewable energy sector since it was specific and aimed at an emergent sector which is growing rapidly on an international level. |
| **IMPACT** | It introduces international training which was only available on a local level, allowing countries in the consortium to have a Renewable Energy Management programme. |
| **WEBSITE** | http://www.empres.eu/ |

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| **LED BY** | COLEGIO OFICIAL DE INGENIEROS TÉCNICOS INDUSTRIALES DE LA RIOJA. |
| **OBJECTIVES** | Transfer the validated results of the "h2 training" project into continuous vocational training, aimed at training trainers in hydrogen and fuel cell technologies. |
| **SUITABLE FOR** | Organisations and workers in the hydrogen and renewable energy technologies sector, technical engineer professional schools, and the regional public authority with employment skills. |
| **RESULTS** | • Updated manual in four languages for continuous vocational training, adapted to the defined sectors (graduates and qualified engineers)<br>• Updated and reoriented virtual "e-Learning" platform.<br>• Classroom and distance training through created materials.<br>• Vocational training profile document.<br>• Training, with this new profile, of participants coming from continuous or vocational training environments in sectors associated with renewable energy and hydrogen technologies.<br>• Double-modality pilot course in terms of delivery, materials, multinational complementarity of methodology and focus of subject. |
| **EUROPEAN ADDED VALUE** | The added value comes from the existence of a legal framework of regulations which, with the application of its principles and strategies, allows for the implementation of a training project on an international scale which benefits the employment prospects of working with fuel cell and hydrogen technologies. |
| **INNOVATIVE CHARACTER** | New training products of interest to engineers and vocational schools and to vocational and continuous training of workers and unemployed at a medium technical level created with scientific, technological and pedagogic cooperation on an international level in answer to an emergent labour demand.<br>New methods of collaboration through involvement at an international pedagogic, technical and scientific level when defining, creating and validating materials for each level on a continental scale. |
| **IMPACT** | Progressive reinforcement of innovation linked to the development or implementation of new hydrogen technologies for vocational schools, employed and unemployed workers; vocational qualifications in an emerging sector: cooperation to reach competitiveness in jobs in the renewable energy sector; various actors available to spread the impact. |

| **FORMATE-BIO. 2,009** | |
|---|---|
| **LED BY** | AGENCIA EXTREMEÑA DE LA ENERGÍA. |
| **OBJECTIVES** | • Promote and improve employment (in general but starting with the environmental sector)<br>• Develop and widen qualifications for workers in matters related to biomass.<br>• Promote environmental innovation in businesses and sectors related to biomass.<br>• Promote the creation of new businesses in the environmental sector.<br>• Adapt economic activities to environmental training.<br>• Promote the sustainability of economic activities. |
| **SUITABLE FOR** | Workers and the unemployed in the sector with different levels of qualification. |
| **RESULTS** | Biomass training has been given over various levels to over 1,000 people over two years. |
| **INNOVATIVE CHARACTER** | The project optimises services provided by companies in the biomass chain thanks to the improvement of qualifications of workers in the sector. |
| **IMPACT** | The impact of this project is to make the Renewable Energy sector in Extremadura, specifically relating to Biomass through:<br>• Certified Biomass courses.<br>• Advice on creating your own company.<br>• Participation in a Biomass workers' Network. |

| WEBSITE | www.formatebio.es |
|---|---|

| TOWARDS A EUROPEAN QUALIFICATION FOR SERVICE AND MAINTENANCE IN THE SOLAR ENERGY SECTOR (SOLTEC). 2,009 | |
|---|---|
| LED BY | ASOCIACIÓN CLÚSTER DE LA ENERGÍA DE EXTREMADURA |
| OBJECTIVES | SolTec is driven by three key objectives:<br>• Offer a European standard in qualifications for operational training in the solar energy sector<br>• Increase the training budget in the solar energy sector<br>• Establish a network of knowledge for the solar energy sector |
| SUITABLE FOR | Workers and businesses in the solar energy sector |
| RESULTS | The SolTec initiative supports the employment prospects of workers and the competitiveness of the European labour market in the solar sector through the improvement of vocational training relating to service and maintenance. Despite the appearance of a truly European market, regulations on service and maintenance workers' qualifications remain local and national, such that they do not translate very well. As such, there are administrative obstacles to the objectives of the European syndicates which promote renewable energy and the PAP's objectives to reinforce international movement between countries of workers in the sector. |
| EUROPEAN ADDED VALUE | The project cycle will be completed with recognition throughout Europe and the adoption of the minimum established regulations through an extension of the network. |
| INNOVATIVE CHARACTER | The requirements of national and regional qualifications do not currently line up. Case-by-case solutions are required. These are costly, cause artificial delays and reduce the potential for cooperation. |
| IMPACT | SolTec members try to involve interested parties in the sector in the development of a common European profile of qualifications in service and maintenance, the development of a modular curriculum and a pilot training course for Europe which meets these requirements. The existence of national, pioneering initiatives will help the process. |
| WEBSITE | www.soltec-project.eu/2.html |

| ENERGY WEB INTERFACE FOR SKILLS ENABLING (ENERGY-WISE). 2009 | |
|---|---|
| LED BY | COVENTRY AND WARWICKSHIRE CHAMBER OF COMMERCE |
| OBJECTIVES | The main objective of the ENERGY-WISE project interface is improving the ability of European SMEs to become more efficient from an energy point of view.<br>Training in energy management techniques to provide administrative and technical qualification for energy managers, building operators and others responsible for energy efficiency with the opportunity to save energy, reduce carbon emissions, comply with the environmental objectives of their organisation and save money.<br>Allow participating small business to contribute to the European Union (Kyoto) objectives to reduce CO2 emissions, save money on energy bills and be more competitive in the global economy. |
| SUITABLE FOR | European SMEs |
| RESULTS | The principal result of the project is improving the ability of small businesses throughout Europe to complete their own preliminary energy audits as part of an evaluation of their energy use and, later, use these results to report on the development of an energy administration strategy. This is achieved through a simulation based on e-learning training materials which help the SMEs to acquire the necessary abilities and knowledge to carry out these audits. |
| INNOVATIVE CHARACTER | The ENERGY-WISE project is based on educational game technologies and other learning materials which are similar to those developed by the projects InTeLS and YENTELS. As such, the project is based on lessons learned by members of these projects and the technological support platforms they developed. |
| IMPACT | The ENERGY-WISE project meant the development of animated simulations, computer games and e-learning for technological platforms which allowed for the development of a final "made-to-measure product" and, therefore, easy to use by non-technical members and which answered a variety of linguistic, cultural and sectorial requirements. |
| WEBSITE | www.energy-wise.biz |

## YEAR 2010

| COMPETENCES FOR SUSTAINABLE ENERGY – COMPENER. 2010- | |
|---|---|
| **LED BY** | |
| **OBJECTIVES** | The COMPENER project attempts to answer the continuous evolution of the labour market and the needs for people to be qualified, which implies high levels of education and a different combination of capacities and aptitudes, especially in the energy sector. |
| **SUITABLE FOR** | Installers of heaters and biomass boilers integrated into buildings, small-scale solar photovoltaic and solar thermal systems, and surface geothermal systems and heat pumps. |
| **RESULTS** | • Examine the situation in member countries in terms of: the energy situation, demand for energy use, qualification systems and certification in the energy sector;<br>• Compile and report on the best practices for qualification and certification systems<br>• Gather, analyse and report on EC directives and national standards of member countries in the energy sectors<br>• Develop a manual on COMPENER abilities based on the EQF<br>• Define training programs for identified COMPENER professional figures;<br>• Develop a qualification and accreditation manual: including critical aspects of each COMPENER professional figure |
| **INNOVATIVE CHARACTER** | The innovative character of the project is based on its activities:<br>• The development of certification and qualification systems based on the EQF for professional competences in the energy sector;<br>• The transfer of e-learning training contents in the energy field developed in previous EU projects<br>• The transfer of the methodological configuration of the training for the qualification of energy managers (e-Quem project); |
| **IMPACT** | Development of vocational skills qualification and certification systems in the energy sector, in agreement with that specified in Directive 2009/28/EC on the promotion of the use of energy coming from renewable sources and which directive 2010/31/EC.<br>In particular, article 14 of Directive 2009/28/EC requires that every member State guarantee that by the 31st of December, 2012, certification qualification schemes or equivalents will be available for installers within this project. |
| **WEBSITE** | www.compener.enea.it |

| BIOTRANSF. TRANSFER OF METHODOLOGY FOR TRAINING ABOUT BIO-MASS PRODUCTION AND ITS IMPLEMENTATION. 2010 | |
|---|---|
| **LED BY** | PROFESSIONAL ASSOCIATION OF ENVIRONMENTAL COMPANIES. APROEMA |
| **OBJECTIVES** | Improve and innovate in the permanent training of female professionals who work in the environmental sector, through the transfer of experience developed by the project promoters in Spain to other European countries.<br>Transfer the results and innovations of the online course on the production of biomass by the Spanish promoter to European members and develop a new training tool to be implemented in countries involved in the project. |
| **SUITABLE FOR** | The intended audience are female professionals who work in the environmental sector. The indirect audience are: Professional associations within the environmental sector and the public entities of the sector. |
| **RESULTS** | Improve the training of professionals in the renewable energy sector, especially in the production of biomass with the aim of promoting its application at a local level. This training will help increase the sustainability of biomass and its application in Europe. It will also improve employment prospects for females in the renewable energy sector. Support renewable energy in this way for an important sector for the future as an alternative to other traditional economic sectors. |
| **EUROPEAN ADDED VALUE** | Help public organisms become aware of training needs in the renewable energy sector to create an EU debate on this matter. Our project will contribute by increasing the number of training courses in this sector and this better knowledge will help the fight against climate change. |
| **INNOVATIVE CHARACTER** | The objective of the project is to innovate and improve training within the environmental sector, especially for female professionals. This is all completed through a transfer of results to other EU countries and innovation of an e-learning platform course on the production of biomass with the aim of improving vocational |

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| | training in this area. |
| **IMPACT** | The project is prepared to respond to market needs and its methodology and innovative contents are easily transferable. To ensure its efficiency, it will be adapted to the context in each country. |
| **WEBSITE** | www.aproema.com/BIOTRANSF |

| **ECO-EFICIENCIA. TRANSFER OF INNOVATION IN EXPERT METHODOLOGIES FOR QUALIFICATIONS IN ECO-EFFICIENCY IN SMES AND THE FIGHT AGAINST CLIMATE CHANGE. 2,010** | |
|---|---|
| **LED BY** | ZARAGOZA CHAMBER OF COMMERCE |
| **OBJECTIVES** | • Favour, through qualification processes together with workers, the unemployed and businesses, the application of eco-efficiency measures in SMEs to contribute to the fight against climate change.<br>• Link this methodology as a strategy for assessing continuous vocational training to benefit through economic saving and reduction in CO2 emissions in the business.<br>• Develop professional profiles adapted to new environmental requirements and the evolution of the labour market, working simultaneously with workers, businesses and the unemployed. |
| **SUITABLE FOR** | The unemployed, workers and businesses |
| **RESULTS** | After completing the expert qualification of 20 unemployed (mid- or higher-level), the ECO-EFICIENCIA programme is developed to workshops in which 20 workers are formed into a pool of 20 SMEs to implement eco-efficient measures as a group learning practical exercise.<br>For the programme, the knowledge applied is:<br>I. The PREPARE methodology, developed in Austria, which is designed to generate a toolkit aimed at directing the environmental evaluation processes in companies to identify possible sources of environmental damage, resolutions and a gradual focus towards EMAS.<br>II. The OPTIMA project, driven from La Rioja, which looks to show potential economic optimisation derived from environmental improvements applied to SMEs and generate a good practice guide and better environmental techniques applied to companies. |
| **EUROPEAN ADDED VALUE** | There will also be an international monitoring centre created which will integrate 200 expert entities on an international level interested in exchanging experiences to update measures and technologies to give continuity to the project once the transfer of the project has been finalised. |
| **INNOVATIVE CHARACTER** | I. The PREPARE methodology<br>II. The LIFE OPTIMA project |
| **IMPACT** | In this project, an open monitoring centre has been created for the participation of businesses, chambers of commerce and institutes concerned about the transfer action which will favour large-scale sharing and effective exploitation of results derived from implementing the model in European SMEs after it has been finalised. This will integrate the entities and businesses interested in exchanging experiences to update the measures and technologies in agreement with the progress of the technique and the express aim of continuing the project once the transfer project which is being developed under "the Leonardo Sub-program" has been finalised. |
| **WEBSITE** | www.eco-pymes.eu |

| **ENEF. ENERGY EFFICIENCY IN THE BUILDING SECTOR: A SUSTAINABLE FUTURE. 2,010** | |
|---|---|
| **LED BY** | EUROCREA MERCHANT (EURO) |
| **OBJECTIVES** | The ENEF project's objective is the design of training modules and contents for businessmen and directors in the construction industry. This training will focus on energy efficiency in buildings. This project will contribute to the optimal cost of energy efficiency and the reduction of emissions which carries important reductions of emissions and savings of costs of member States.<br>The principal objective of the project is to alleviate the lack of knowledge in businessmen and directors in the construction industry through the use of new methodologies and training modules on European regulations, trying to capture the points in common between the various applications in each country. |
| **SUITABLE FOR** | Businessman, managers and directors in the construction industry. |
| **RESULTS** | The learning contents offer construction sector businessmen and managers the |

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| | opportunity to develop through continuous training.<br>Seven modules are made available in which each different area and aspect of energy savings in buildings are dealt with. They speak about the legislation applicable in each member county and in Europe such as marketing, façade thermal insulation, glazing and so on.<br>The deficiencies of the current training system relating to energy efficiency in buildings is analysed in depth as well as the lessons to be learned from each of the best-developed systems in member countries. The proposal is to cooperate in order to change the situation mentioned in the previous point through a new vision of the subject.<br>There is an excessively fragmented vision of the components of the system (buildings, machinery, photovoltaic panels, control systems, lighting), losing sight of their integration in a single framework which takes the entire system into account. This fragmentation of the regulations, the language and specialities, destroys the majority of the potential of energy efficiency and renewable energy which could be exploited. The general focus must be redefined, away from the idea of low efficiency by substituting one component at a time and towards the idea of complete, energy-efficient architectural development. |
| **EUROPEAN ADDED VALUE** | This project has the aim of created an focus of accessible training in member countries, the majority of which are in Europe, enriched by an e-learning platform, simulations of visual elements and practices of interest within the construction industry. |
| **INNOVATIVE CHARACTER** | The innovative character of this project is based on the focus of accessible training enriched by an e-learning platform, simulations of visual elements and practices of interest within the construction industry whose final results will be seen in terms of: reduction of emissions, improvement of comfort and quality of interior air, quality of construction, and, indirectly for the owners, a better prospects for selling property and better access to preferential mortgage financing.<br>Training contents will be composed of different modules. The member network has been formed with the aim of complying with the project tasks in the most suitable way, including experts on environmental matters and entities with experience in European training projects. The association's internal material will be disseminated in English and each member will translate the training material to their own language. |
| **IMPACT** | The gaps in the current training system relating to energy efficiency in buildings will be analysed as well as the lessons to be learned from each of the best-developed systems in member countries. |
| **WEBSITE** | www.enef-project.eu |

## YEAR 2011

| **e-SKILL. QUALIFICATION, ICT AND ENVIRONMENTAL CULTURE IN THE CONSTRUCTION SECTOR. 2,011** | |
|---|---|
| **LED BY** | FEDERACIÓN VALENCIANA DE EMPRESARIOS DE LA CONSTRUCCIÓN (FEVEC) |
| **OBJECTIVES** | The principal objective of e-SKILL is to improve the competences of construction workers, especially in the environmental sector, through the development of a training package based on ICT and with an international focus, as well as promoting a new green culture in the sector, helping to standardise training throughout Europe and promoting the recognition of construction workers' qualifications. |
| **SUITABLE FOR** | Principally for unqualified workers in the construction sector. |
| **RESULTS** | The results of e-SKILL will be:<br>• A tool repository composed of easy-to-use, innovative and ICT-based training materials.<br>• A new training methodology based on ICT.<br>• e-SKILL website.<br>• e-SKILL diploma. |
| **EUROPEAN ADDED VALUE** | The EC's latest reports underline the lack of qualified workers for the future needs of the market, especially in terms of green skills for which the construction sector will be one of the priority sectors in which highly-qualified workers will be needed in the coming years. |
| **INNOVATIVE CHARACTER** | The boom in real estate produced in the last few years has favoured the enormous growth of the sector, advertising unqualified workers to enter construction companies. After this boom, the crisis and recession, this sector was one of the most-affected, generating an ever-increasing level of unemployment. Currently, the situation is still |

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| | very difficult since the majority of workers are not qualified. |
| **IMPACT** | e-SKILL will support works low-level or no qualifications (mainly) in the construction sector to improve their skills and obtain formal recognition throughout Europe, aligned with the new strategy for new qualifications for new businesses, launched by the EC and especially aimed at environmental skills. As a secondary objective, e-SKILL will promote the use of ICT resources as a training method. |
| **WEBSITE** | http://www.e-skill.eu/es/ |

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| **LED BY** | ASOCIACIÓN CLÚSTER DE LA ENERGÍA DE EXTREMADURA |
| **OBJECTIVES** | Its objective is to develop a stable academic structure to train specific professionals for this energy sector. The participants in this programme, which has been developed over two years, will receive a professional certificate which accredits their knowledge on biomass and its technological development.<br>Transfer training structures for the biomass boiler installation sector based on a similar project developed for the solar energy sector which will allow a qualification system to be established in the future in agreement with the needs of the market. |
| **SUITABLE FOR** | Biomass sector workers and businesses. Trainers. The unemployed in the energy sector (heating and air-conditioning installers). |
| **RESULTS** | Develop a specific Vocational Training structure for the biomass sector on a European level through the improvements of professionals' skills and abilities. Four biomass boiler installer qualification national proposals (based on the developed European qualification structure). |
| **EUROPEAN ADDED VALUE** | The European added value is based on the transfer of innovation from Spain (with the support of Northern European countries with years of experience in the development of the Biomass Market and vocational training) to Eastern countries with less experience in education and training in this sector. |
| **INNOVATIVE CHARACTER** | The tools and products developed make it easy to adapt the contents to other renewable energy fields and different geographical contexts.<br>Create a professional certificate which accredits knowledge on biomass and its technological development. |
| **IMPACT** | The principal, short-term impact is to obtain a qualification system, educational material and tools for workers in the field of biomass. Employees in the biomass sector will increase their capabilities and qualifications to improve their mobility within the European biomass labour market in growth.<br>The businesses in the biomass sector will have better-qualified employees who can efficiently exploit the potential of the biomass market.<br>Create a bio-construction training centre network.<br>Develop new professional profiles, especially in the area of bio-climatic construction.<br>Identify the true requirements, minimum knowledge, experience and equipment which technicians must have to be able to work as a biomass installer at a domestic level. |
| **WEBSITE** | http://euvet-project.eu/ |

# 7. CURRENT GAPS IN TRAINING AND NEEDS FOR 2020

## 7.1. Evolution of the workforce

As mentioned in chapter 5, the decrease in the number of employed in the last four years has been significant and generalised over all productive sectors. This loss in the workforce has been especially intense in the construction sector in which the number of employees dropped by 43.9% between 2008 and 2011, from 2,549,500 to 1,430,200 people according to EPA data referring to the second quarter of the last 4 years.

The analysis is now being elaborated, beginning with social security affiliation data, referring to December 2011 and 2010, in order to see the evolution of the workforce together with the economic activity, especially detailing the different subsectors of activity in the construction sector.

In the period from the last months of 2010 to the end of 2011, the construction sector has lost more than 15% of its affiliates, a percentage which follows the general trend of reduction of affiliates (2.1%) but quantitatively much greater than the rest of the productive sectors.

| Activity sector | No of affiliates December 2010 | No of affiliates December 2011 | Annual variation (absolute) | Annual variation (%) |
|---|---|---|---|---|
| **Agriculture** | 1,227,868 | 1,224,466 | -3,402 | -0.28 |
| **Industry** | 2,240,889 | 2,160,772 | -80,117 | -3.58 |
| **Construction** | 1,424,318 | 1,209,261 | -215,057 | -15.10 |
| **Services** | 12,435,565 | 12,344,873 | -90,692 | -0.73 |
| **No description** | 150,566 | 173,424 | 22,858 | 15.18 |
| **Total** | 17,479,206 | 17,112,796 | -36.6410 | -2.10 |

Table 26. Evolution of the dynamics of employment by sector through the number of social security affiliates. Source: Ministry of Employment and Social Security SS affiliation statistics between 2010 and 2011.

Within the construction sector, all activity subsectors have seen the volume of social security affiliated workforce reduced, with especially large reductions in the construction of liquid networks, roofing, electrical and telecommunications networks, test drilling and boring, and construction of residential buildings.

However, subsectors focused on installations (electricity, plumbing, heating, air conditioning and carpentry) as well as other specialised construction activities have seen smaller reductions, with the drop in the number of social security affiliates being under 10%.

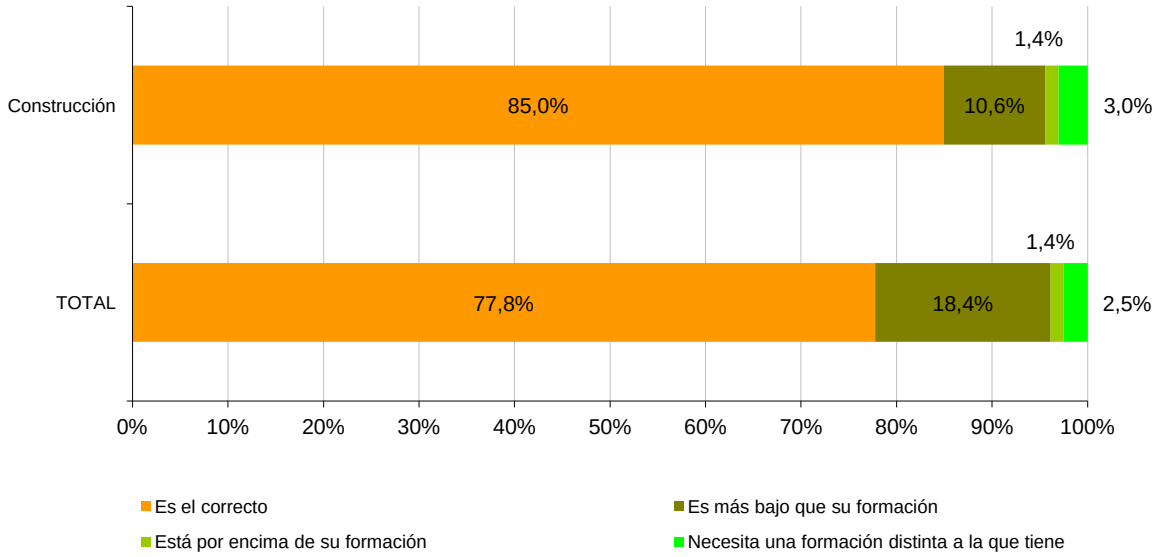
| CNAE Type of activity (CNAE 2009) | No of affiliates December 2010 (absolute) | No of affiliates December 2011 (absolute) | Annual Variation (absolute) | Annual Variation (%) |
|---|---|---|---|---|
| **41.10 Furniture development** | 68,518 | 60,708 | -7,810 | -11.40 |
| **41.21 Construction of Residential Buildings** | 431,333 | 343,619 | -87,714 | -20.34 |
| **41.22 Construction of Non-Residential Buildings** | 48585 | 39381 | -9204 | -18.94 |
| **42.11 Construction of motorways and roads** | 11721 | 10476 | -1245 | -10.62 |
| **42.12 Construction of surface and underground railways** | 2532 | 2334 | -198 | -7.82 |
| **42.13 Construction of bridges and tunnels** | 10931 | 9018 | -1913 | -17.50 |

| | | | | |
|---|---|---|---|---|
| **42.21 Construction of liquid networks** | 7975 | 5973 | -2002 | -25.10 |
| **42.22 Construction of electrical and telecommunications networks** | 43254 | 33397 | -9857 | -22.79 |
| **42.91 Hydraulic works** | 867 | 769 | -98 | -11.30 |
| **42.99 Construction of other civil engineering projects** | 7735 | 6537 | -1198 | -15.49 |
| **43.11 Demolition** | 78640 | 64949 | -13691 | -17.41 |
| **43.12 Preparation of land** | 27910 | 23195 | -4715 | -16.89 |
| **43.13 Test drilling and boring** | 2891 | 2292 | -599 | -20.72 |
| **43.21 Electrical installations** | 213843 | 193128 | -20715 | -9.69 |
| **43.22 Plumbing, heating and air conditioning installations** | 104887 | 94996 | -9891 | -9.43 |
| **43.29 Other construction works installations** | 69554 | 60681 | -8873 | -12.76 |
| **43.31 Plastering** | 26942 | 23145 | -3797 | -14.09 |
| **43.32 Carpentry installation** | 29442 | 28682 | -760 | -2.58 |
| **43.33 Floor and wall covering** | 30062 | 24962 | -5100 | -16.96 |
| **43.34 Painting and glazing** | 46563 | 40392 | -6171 | -13.25 |
| **43.39 Other building finishing** | 39783 | 33061 | -6722 | -16.90 |
| **43.91 Roofing construction** | 8148 | 6152 | -1,996 | -24.50 |
| **43.99 Other specialised construction activities** | 112202 | 101414 | -10788 | -9.61 |

Table 27. Evolution of the dynamics of employment by construction subsector through the number of social security affiliates. Source: Ministry of Employment and Social Security SS affiliation statistics between 2010 and 2011.

### Relationship between workers and training

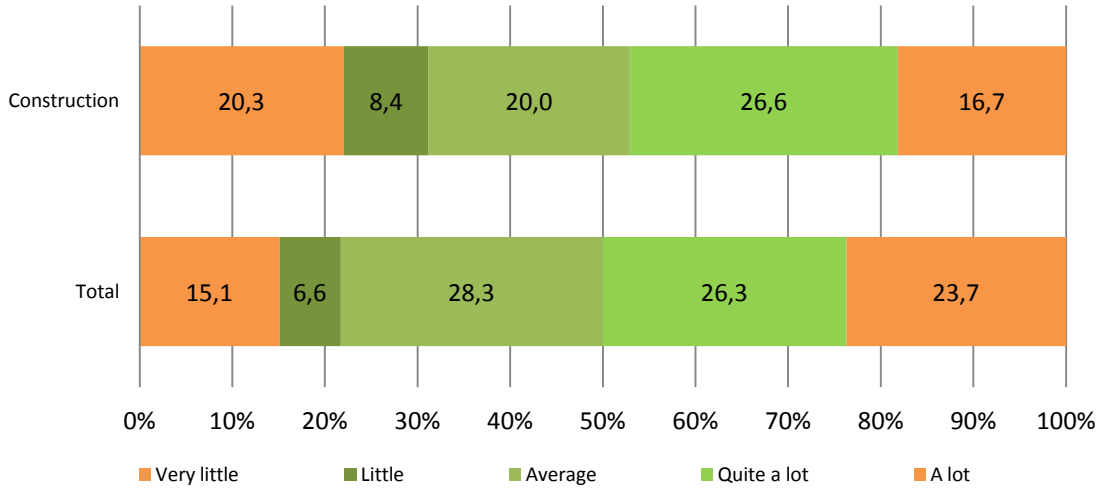
Looking at the relationship between job roles and the training of workers in those roles, workers believe that this training is correct in 85% of cases. Over-qualification of workers in job roles occurs in 10.6% of cases, while under-qualification (1.4%) or the need to undergo a different type of training from that already possessed (3%) make up a total of 4.4% of employees who need to update their training to adapt to the requirement of their job roles, a situation which is slightly greater than that in the economy as a whole, 3.8%.




Graph 40. Employees according to the job and the training they have. Source: Ministry of Work and Immigration: Quality of Life at Work Survey 2010.

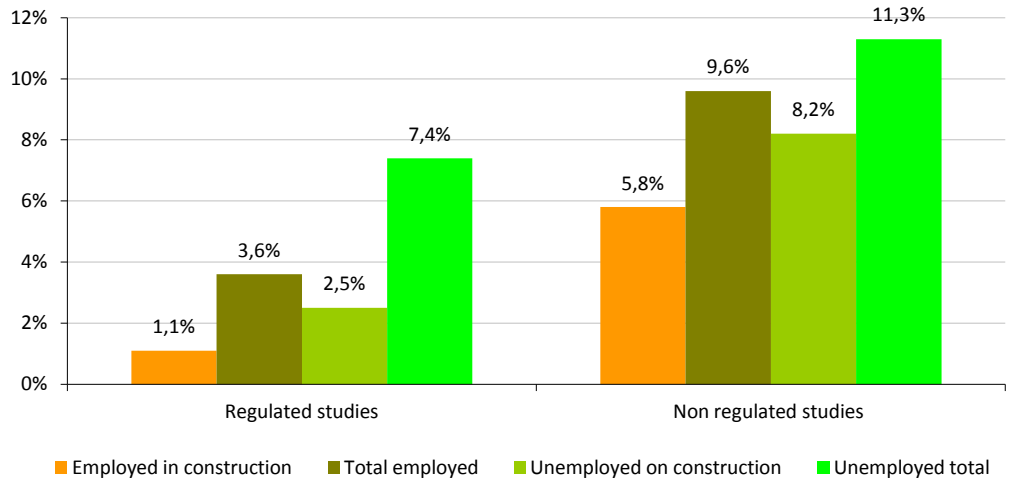
Beyond the correct relationship between training and job roles, looking at the usefulness of academic training to job roles, 28.7% of workers declare that academic training has little or very

little use within the work they carry out, a proportion which is considerably higher than employees as a whole (21.7%).



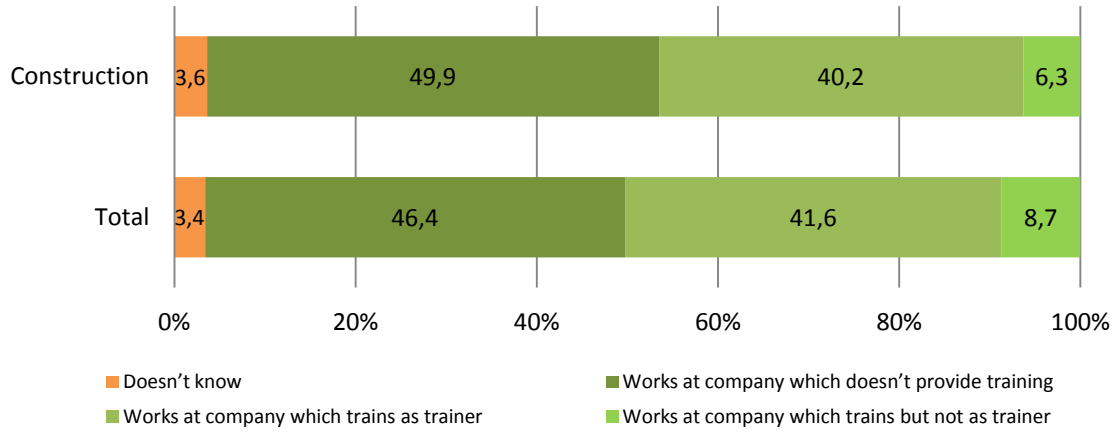

Graph 41. Distribution of employees according to the usefulness of academic training they have to the job they do. Source: Ministry of Work and Immigration: Quality of Life at Work Survey 2010.

Training within the working population of the construction sector is proportionately lower than that throughout the general working population. Only 1.1% of the employed and 2.5% of the unemployed in the sector attend regulated training and, although unregulated training rises to 5.8% for employees and 8.2% for the unemployed, these figures are lower than training for the working population as a whole, where 7.4% and 11.3% of the unemployed study regulated and unregulated courses respectively.



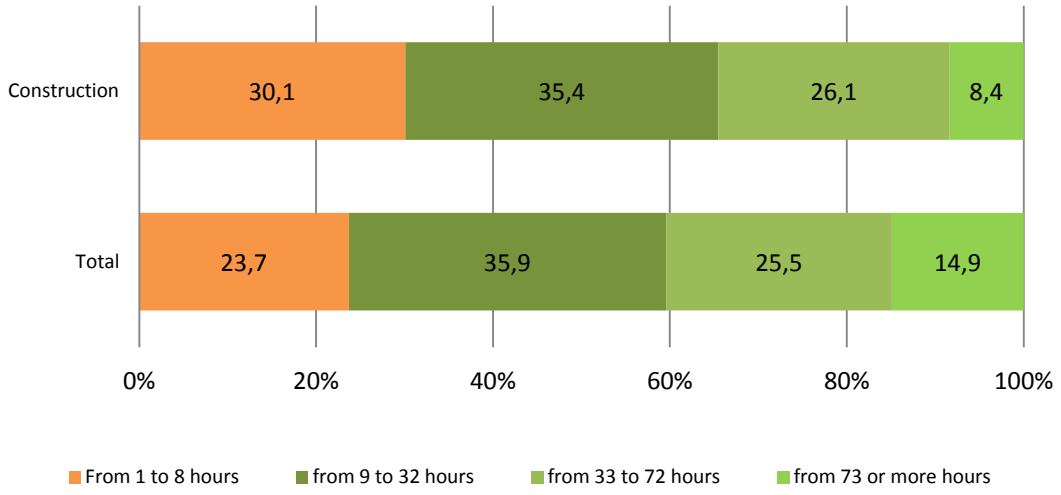

Graph 42. Percentage of employed and unemployed which study regulated or unregulated training in the construction sector and in total. Source: NIS. Data derived from training from the IIT Working Population Census in 2011.

With respect to the promotion of training by businesses, 49.9% of salaried staff in construction working in businesses which do not provide training to their employees, 40.2% work in companies which train their own employees and 6.3% do not undergo training although the companies do provide training to their employees.



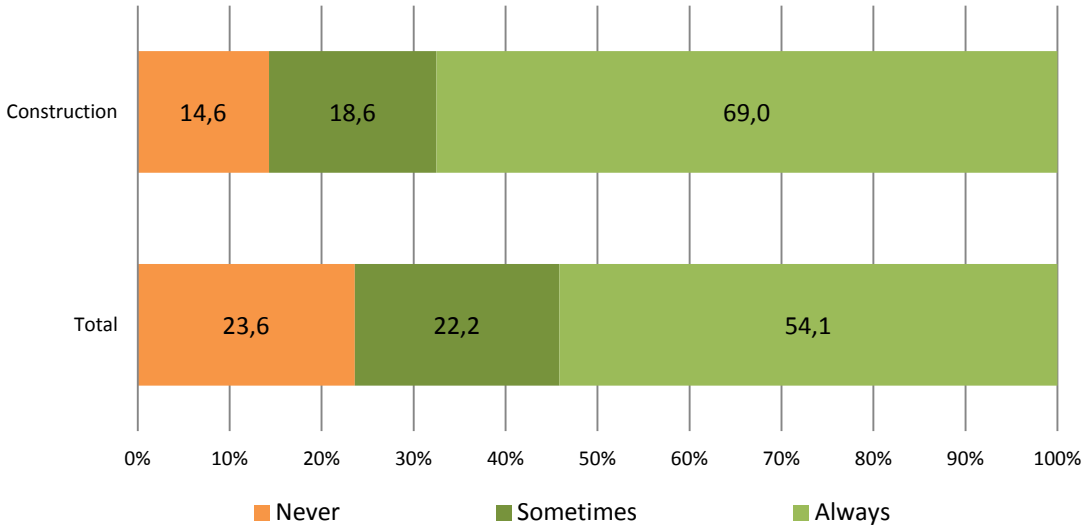

Graph 43. Salaried staff according to whether they belong to businesses which provide training to employees and whether they participate in training courses. Source: Ministry of Work and Immigration: Quality of Life at Work Survey 2010.

Salaried staff in the construction sector which have undergone training courses have generally (65.5%) invested less than 33 hours per year. 8.3% of salaried staff in the construction sector have devoted 73 hours or more per year compared to 14.9% of all salaried staff.




Graph 44. Salaried staff who participate in training course according to the number of hours per year they attend said courses. Source: Ministry of Work and Immigration: Quality of Life at Work Survey 2010.

The majority (69%) of salaried staff who participated in training courses organised and funded by their companies have always done so during the working day, a notably lower proportion (16.1%) sometimes did so during the working day, and 14.6% have never done so during the working day or, which is the same, have always done so outside of working hours.




Graph 45. Salaried staff who participate in training courses organised and funded by their company, according to whether said courses were carried out within working hours. Source: Ministry of Work and Immigration: Quality of Life at Work Survey 2010.

**Relationship with Vocational Training**

In the most recent Vocational Training courses, the number of inscribed students has significantly increased. Even so, it is still far from the desirable number, especially with respect to mid-grade training.

For the 2009/2010 course, the last one for which there is definite data, the number of students in the first degree course was 319,457 compared to 172,972 in the first course of mid-grade training cycles. Within Spain, 64.8% of students who finish their obligatory education choose to study for degrees compared to 35.2% who study Vocational Training, 23 percentage points away from the EU27 average figures in which 58% of students follow Vocational Training studies after finishing their obligatory school studies.

There are multiple causes of this difference, but one important difference is the general society's perception that Vocational Training is seen as a valid option only for those students with lower sets of results at school.

In total, the number of Vocational Training students in our country is 4,664,859 citizens. In global terms, the number of professionals trained with certificates in the construction sector is 311,714, which, in relative terms, is 6.7% of the total number of Vocational Training certificate holders in Spain.

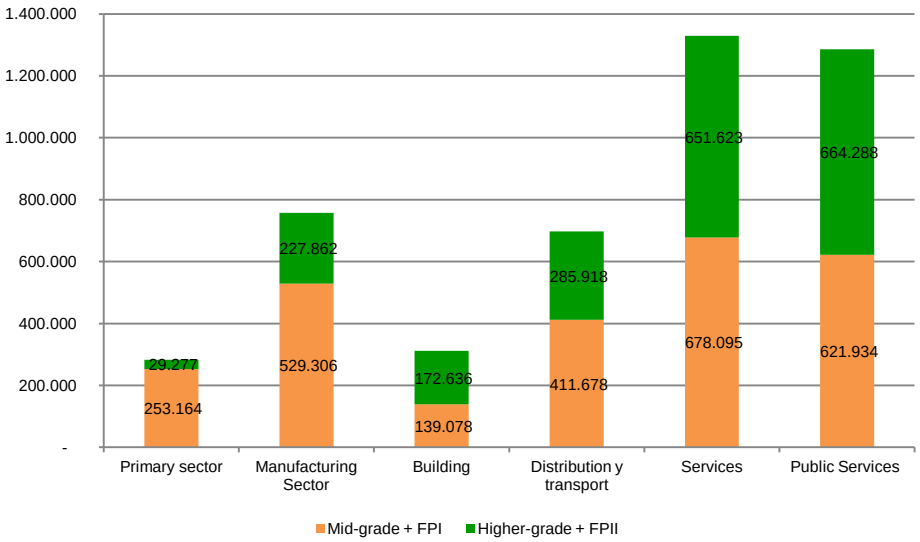
The total number of Mid-Grade certificate holders in the construction sector is 29,288 which represents only 5.3% of the total number of Mid-Grade certificate holders. The number of Higher-Grade certificate holders reaches 49,266, making up 8.5% of the total of Higher-Grade certificate holders.

With respect to FPI and FPII (Vocational Training I and II), the sector has 233,160 certificate holders (109,790 in FPI and 123,370 in FPII) which makes up 6.6% of the total certificate holders corresponding to the General Education Law study plan from 1970.

If we take in account that, according to Spanish National Accounts (NSI) data, the weight of employment in the construction sector is greater than 9% of the total, there is a large training deficit of workers in the sector compared to workers in other productive sectors.

| | LOGSE/LOE | | | | | LGE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| PRODUCTIVE SECTORS | Mid-Grade (GM) | % GM per sector | Higher Grade (GS) | % GS per sector | TOTAL TRAINING LOGSE/LOE | FPI | FPII | TOTAL TRAINING LGE | % FPI AND FPII per sector | TOTAL TRAINING |
| Manufacturing sector | 53313 | 9.6% | 8355 | 1.4% | 61668 | 199851 | 20922 | 220773 | 6.3% | 282441 |
| Manufacturing sector | 111465 | 20.1% | 65026 | 11.2% | 176491 | 417841 | 162836 | 580677 | 16.4% | 757168 |
| Construction | 29288 | 5.3% | 49266 | 8.5% | 78554 | 109790 | 123370 | 233160 | 6.6% | 311714 |
| Distribution and transport | 86694 | 15.6% | 81594 | 14.1% | 168288 | 324984 | 204324 | 529308 | 15.0% | 697596 |
| Services | 142798 | 25.8% | 185957 | 32.1% | 328755 | 535297 | 465666 | 1000963 | 28.4% | 1329718 |
| Public Services | 130971 | 23.6% | 189571 | 32.7% | 320542 | 490963 | 474717 | 965680 | 27.4% | 1286222 |
| TOTAL | 554529 | 100.0% | 579769 | 100.0% | 1134298 | 2078726 | 1451835 | 3530561 | 100.0% | 4664859 |

Table 28. Data from the degree register for LOGSE, LOE y LGE Vocational Training certificate holders. Source: Ministry of Education: Map of the Vocational Training on offer in Spain 2010




Graph 46. Distribution of mid-grade and higher-grade certificate holders according to sector Source: Ministry of Education: Map of the Vocational Training on offer in Spain 2010

These figures are low if we take into account that by the year 2020, in Spain, we will have a workforce of 20,309,000 people, 50% of which must have a mid-level of qualification obtained, fundamentally, through Mid-Grade Vocational Training although, as has been mentioned, Higher-Grade Vocational Training, by virtue of its suitable balance between specialisation and multi-disciplinary focus, it could be suitable in some cases for needed qualifications.

## 7.2. Training needs.

As has been reiterated during this analysis, the construction sector has a significant quantity of workers with low levels of qualifications, at least formal ones, due to various factors:

- Traditionally, many workers in this sector have learned through work experience.
- Recognition of training is low and so the motivation for it is correspondingly low.
- Activity is the sector has been high in recent years, favouring employment of unqualified workers. Only in some specific roles has it been necessary to accredit skills.
- Sub-contracting does not favour continuous training of workers.
- The physical lack of workforce can be a large barrier when it comes to attending training courses outside of working hours.

However, the economic crisis, which has considerably affected the sector and has caused many workers to lose their jobs, and, above all, the new building regulations will presumably change this trend, causing the recognition of construction workers' skills to become more important.

In this sense, the reality is that construction workers do not currently have the qualifications necessary to develop energy efficiency and renewable energy in buildings. Even so, this lack of qualification is not equal across all levels. Professionals related to the design of buildings (architects and engineers) have the necessary qualifications and are becoming undergoing further training to obtain these specific skills, through masters or postgraduate degrees.

It is in the qualification of production professionals where larger skill gaps are detected, making it essential to answer this need as they are the ones in the correct position to carry out the work.

For the detection and identification of skills required for each job and level of competence, an important step is to observe and analyse various sources of training.

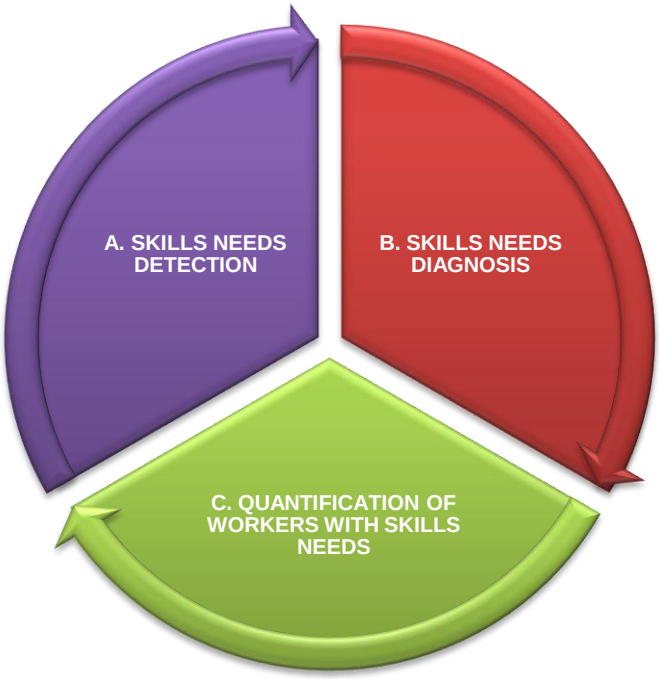



Figure 17. Analysis methodology for detecting and identifying skills needs

## A. DETECTION OF NECESSARY SKILLS

According to the experts interviewed, there are three main points to be observed to **detect new skills**: legislation, the classification of economic and occupational activities, and innovative businesses. These are all inter-related.

*A.1. Legislation*

From the development regulations, there is a need to carry out new tasks and procedures which, in some cases, implies new jobs and, in others, for existing jobs to acquire new skills and abilities.

In this sense, the construction sector has been affected by the appearance of different regulations related with sustainability (CTE, RITE, NBE-CT-79, directive 2002/91/EC, etc.) which will force current professions to learn new, specialised skills to guarantee the compliance of energy efficiency demands introduced.

In the same manner, by looking at international legislation, principally European, with better development in terms of sustainability, there is the possibility of jumping ahead of future changes which will be produced in Spain, anticipating new market opportunities in relation to skills and the number of professionals which will be required to answer the regulatory framework.

*A.2. CNAE/NACE and CNO/ISCO*

In relation to the study of economic activities (CNAE), through the analysis of movements produced in the different modes of each activity, it can be seen where the growth of economic activities is produced. The orientation must also be taken into account: if there is a niche market due to an increase in the demand for a certain product or service, it is possible that no new skills will be discovered, but if there is an innovation, there may be.

The analysis of occupations (CNO) must focus on the volume of workers according to these different modes of activity, in such a way that the area with the greatest number of workers can be known as well as where increases in employment are being produced.

As such, the creation of new skills must head towards emergent activities with a positive trend in employment considering the total volume of workers within each professional category. Even if establishing a threshold from which it is necessary to design new skills, this is very complex. As a result, complementary observation of these classifications at a European level (NACE and ISCO) is very useful to detecting trends and possible projections of activities and jobs.

*A.3. Innovative companies*

Observing innovative, market-leading companies in the sector provides vital training since they are the first to apply the regulations, often anticipating them, being the true engines of change. The presence of new skills can be detected.

Generally, large businesses are those which invest more in R&D. New technologies implemented as a result, which workers are related to it and which functions they carry out must be analysed. On occasions, they develop their own specific training courses on said innovations, something which should be used to improve the rest of the sector. For example, Acciona, at one of the expert debates in this study, related some of their experiences in the energy accumulation field for energy self-sufficiency in buildings. The analysis of this experience showed which jobs and tasks were involved in this innovative activity.

Small businesses in general do not innovate so much, though there is a type of small business which is distinguished by their risk/reward profile and their great potential to grow, whose activity is associated with innovation and development of technologies. These are start-up companies. Start-up companies are organisations with a great capacity for change which develop innovative highly-desired or required products or services. In this type of SME, new skills can also be found.

Within the sector, evolution towards sustainability while carrying out works is a popular activity determined by the application of innovative construction solutions and new materials. As a result, businesses which develop these new materials and solutions and construction company suppliers can determine the skill required by the people who install the final products.

*A.4. Other fields of observation*

Other sources of training which, according to experts, can help identify and define new skills are:

- **SEPE:** training on offers of employment which the public employment service doesn't cover, i.e., job positions which are difficult to fill, generally because they require highly-qualified people.
- **FTFE:** demand training which cannot be managed and, therefore, does not give a suitable answer, but which is demanded anyway by companies.
- **Eures Network**: identification of occupational trends in Europe.
- Social agents: training on businesspeople and workers on the type of skills and professionals needed.
- **Subsidies:** the development of a certain activity within the field of EE and the use of RE can be determined through the availability of subsidies, even if the process feeds back, i.e., subsidies are given wherever the need is detected due to legislation or demand.
- **Monitoring Centres:** they provide training on the situation, evolution and perspectives of the labour market.
- **Energy certification in buildings:** given that the trend in the sector focuses on energy renovation in terms of deficiencies detected in buildings, some stages of activity will presumably be given priority over others, which will show the most required skills. In general, buildings are inefficient despite the pre-existing regulations.
- **Private demand:** the increase of the demand for comfort in buildings will require the implementation of ever-more intense energy systems, such as air-conditioning.

## B. ASSESSMENT OF NECESSARY SKILLS

Below are the results obtained from the **panel of experts**, in which the importance of occupations linked to the different stages of the activities relating to energy efficiency and the use of renewable energy in buildings and the most relevant skills for their performance are analysed.

As a result, key informants have been sent a list of new skills as well as transformations of existing ones relating to professions and the stages of the activity in question so the they assess the level of importance of each one of the skills on a scale of 1 to 5, with 1 being "skill is not at all important to energy sustainability objectives" and 5 being "skill is very important to energy sustainability objectives".

It should be noted that since this is a qualitative methodology, the sample represented is not related to probabilities and therefore cannot be understand to have statistical meaning. However, the selection of experts that participated in the panel, despite not being probabilistic, had a preliminary analysis of the suitability of the experts taking part relating to their knowledge and experience in various aspects regarding the matter, being shown to be key informants. In addition, the training analysis was complemented with training gained through in-depth interviews which took place during this stage.

*B.1. Stages of the work*

Firstly, the assessment values on the importance of each **stage of activity** of a job relating to energy efficiency and the use of renewable energy.

The first three stages are written which gained an average score of over 4.

| STAGE | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|
| Carpentry: Interior and exterior carpentry assembly | 4.31 | 0.75 | 3 |
| Hot water installations. | 4.13 | 0.86 | 2 |
| External closures, placement of façades... | 4.12 | 0.77 | 3 |
| Roofing: Insulation | 3.97 | 0.87 | 1 |
| Plumbing installations | 3.92 | 0.97 | 2 |
| Electricity generation | 3.92 | 0.95 | 2 |
| Partitions: Conventional partitions | 3.90 | 0.81 | 2 |
| Air-conditioning installations | 3.88 | 0.89 | 2 |
| Gas installations | 3.78 | 0.71 | 2 |
| Electrical installations | 3.64 | 1.05 | 1 |
| **General total** | **3.89** | **0.93** | **1** |

Table 29. Assessment of the importance of each stage of a job relating to energy efficiency (scale 1 to 5). Source: panel of experts on skill gaps, Construction Labour Centre.

### 1. PVC and aluminium (assembly of interior and exterior carpentry)

This stage of activity is considered the most important or vital to buildings in terms of energy efficiency with an average score of 4.31 with 3 being the lowest score received from the experts. The deviation is also very small, meaning the average distance each score has from the average (0.75) expressed in the same units as the variable.

In addition, according to training obtained in the interviews, for different reasons such as subsidies, private demand, necessary economic investment, etc., the assembly of exterior metalwork will have an elevated level of development, even when it does not involve an elevated number of workers. A small team or "small crews" can change all of the windows in a building.

**2. Exterior closures (façades, insulation, base frames, etc.)**

External closures also have a key role to play. The experts scored its importance to energy efficiency in buildings with an average of 4.12, with 3 being the lowest score and 0.77 being its deviation with respect to the mathematical average.

Within the different activities, the experts interviewed consider that the placing of façades and insulation in the activity which involves the greatest number of workers, something which will have to be taken into account when it comes to designing training courses.

**3. Hot water installations.**

The hot water installation stage gained an average score of 4.13 with 2 being the lowest score obtained, with a deviation of 0.86. The focus of this stage is principally related to the use of renewable energy, especially solar thermal installations.

This is an activity which has been being developed for some time in Spain based on CTE regulations and, fundamentally, by public subsidies aimed at using and taking advantage of solar energy. Its development may be expensive owing to a question of costs: the installation and equipment have a low cost and quickly depreciate.

In the opinion the experts interviewed, although this activity uses new materials which require specific abilities to be installed, specialist businesses relating to this sector are those who directly train their workers. The experts believe that later in this stage, fewer skills gaps will be found. If there is an increase in demand, there will be a greater need for professionals who, as a result, will have been trained.

*B.2. Production job positions.*

Next, the assessment values on the importance of each **job role** relating to works in the sector of energy efficiency and the use of renewable energy.

The average and minimum scores received, and the average deviation can be seen in the following table. The occupations of greater importance will be shown, i.e. those that received an average score of over 4 and a minimum of 3.

| OCCUPATION | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|
| Joint sealant operator | 4.36 | 0.64 | 3 |
| PVC and aluminium assembler | 4.26 | 0.74 | 3 |
| Environmental and quality control technician | 4.26 | 0.79 | 3 |
| Locksmith | 4.25 | 0.72 | 3 |
| Solar thermal installation operator | 4.13 | 0.86 | 2 |
| Bricklayer | 4.08 | 0.79 | 2 |
| Installer of heat generation system through geothermal energy | 3.97 | 0.83 | 2 |
| Installer of heat generation system through biomass combustion | 3.97 | 0.90 | 2 |

| | | | |
|---|---|---|---|
| Plumber | 3.92 | 0.97 | 2 |
| Photovoltaic installations operator | 3.92 | 0.95 | 2 |
| Installer authorised for hot water and air-conditioning systems | 3.84 | 0.90 | 2 |
| Roofing and rainwater network installers | 3.83 | 1.21 | 1 |
| Insulation installer, roofer | 3.82 | 0.75 | 3 |
| Gas installer | 3.78 | 0.71 | 2 |
| Lighting installer | 3.75 | 1.30 | 1 |
| Insulation installer | 3.73 | 0.75 | 3 |
| Electrician | 3.64 | 1.03 | 1 |
| **General total** | **3.89** | **0.93** | **2** |

Table 30. Assessment of the importance of each production job of work relating to energy efficiency (scale 1 to 5). Source: panel of experts on skill gaps, Construction Labour Centre.

The job role which obtained the best score in relation to its importance for energy efficiency in buildings is that of joint sealant operator which got an average score of 4.36 with 0.64 being the standard deviation with respect to the mean score.

The second most important occupation, according to the experts' scores is the PVC and aluminium metalwork assembler with an average score of 4.26, the minimum score being 3 and a deviation of 0.74.

The environmental and quality control technical also received an average score of 4.26 with a deviation of 0.79.

A locksmith is the fourth most important job for buildings with EE and RE criteria according to the experts consulted with an average score of 4.26, a minimum of 3 and a deviation of 0.72.

*B.3. Related stages and occupations*

Training on the most-relevant production jobs related with the stages of the activity brings a more complete vision of energy efficiency needs for professionals and technicians.

Below is a list of the average scores given by the experts for each job role in each stage, as well as the minimum values and the standard deviations which is useful for making comparisons.

As in the tables previously shown, the most relevant data are shown first.

| STAGE | OCCUPATION | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| Carpentry: Interior and exterior carpentry assembly | Locksmith | 4.42 | 0.76 | 3 |
| | PVC and aluminium assembler | 4.26 | 0.74 | 3 |
| Hot water installations. | Solar thermal installation operator | 4.13 | 0.86 | 2 |
| External closures, placement of façades... | Bricklayer | 4.42 | 0.57 | 3 |
| | Joint sealant operator | 4.36 | 0.64 | 3 |
| | Environmental and quality control technician | 4.26 | 0.79 | 3 |

| STAGE | OCCUPATION | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| | Insulation installer | 3.73 | 0.75 | 3 |
| Roofing: Insulation... | Bricklayer | 4.50 | 0.50 | 4 |
| | Roofing and rainwater network installers | 3.83 | 1.21 | 1 |
| | Insulation installer, roofer | 3.82 | 0.75 | 3 |
| Plumbing installations | Plumber | 3.92 | 0.97 | 2 |
| Electricity generation | Photovoltaic installations operator | 3.92 | 0.95 | 2 |
| Partitions: Conventional partitions | Locksmith | 4.17 | 0.69 | 3 |
| | Bricklayer | 3.72 | 0.84 | 2 |
| Air-conditioning installations | Installer of heat generation systems through geothermal energy | 3.97 | 0.83 | 2 |
| | Installer of heat generation system through biomass combustion | 3.97 | 0.90 | 2 |
| | Installer authorised for hot water and air-conditioning systems | 3.84 | 0.90 | 2 |
| Gas installations | Gas installer | 3.78 | 0.71 | 2 |
| Electrical installations | Lighting installer | 3.75 | 1.30 | 1 |
| | Electrician | 3.64 | 1.03 | 1 |

Table 31. Assessment of the importance of each production job of work relating to energy efficiency (scale 1 to 5). Source: panel of experts on skills gaps, Construction Labour Centre.

The locksmith and the PVC and aluminium assembler obtained an average of 4.42 and 4.26 respectively in the Carpentry stage: interior and exterior carpentry assembly which, as mentioned before, was the activity seen as the most important by our key informants.

The locksmith job role was also scored in the Partitions stage: conventional partitions, with an average of 4.17, and with the experts largely agreeing on this score since there is a low deviation of 0.69 with respect to the average.

In relation to hot water Installations, we saw earlier that the focus of this activity is determined by the use of solar thermal energy and, as a consequence, the solar thermal installations operator has received a high average score of 4.13 out of 5, even when the lowest score received was 2.

In the activity External closures: placement of façades..., the job bricklayer received the best score in relation to its importance to EE and RE in buildings, with an average score of 4.42 and one of the lowest deviations (0.57). Within this stage of activity, joint sealant operators and environmental and quality control technicians were given high scores of 4.36 and 4.26 respectively.

Bricklayer was also revealed to be very important for energy efficiency in buildings in the Roofing: Insulation... stage with an average of 4.50 out of 5. In addition, it is the occupation which received the highest minimum score (4), with a deviation of only 0.50.

*B4. Emergent skills.*

To determine **emergent skills**, experts have been asked to try to identify hierarchically the various skill requirements of existing jobs in various stages of work, based on their opinion and taking into account the criteria in the Technical Building Code (CTE).

In the Carpentry stage: Interior and exterior carpentry assembly, preventing thermal bridges is also considered important for the closure in order to comply with the limitation of thermal demand and gaps for air to filter in, with an average score of 4.42.

In this stage, installing specific thermal insulation on PVC and aluminium, and breaking any thermal bridges in order to comply with the established conditions limiting the effectiveness of the locksmith, a skill which is relative to the PVC and aluminium assembler, is the one which received the highest average score (4.50) and also the skill with the highest minimum value (4).

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| Locksmith | Breaking thermal bridges to comply with the limitation of thermal demand and air leaking in. | 4.42 | 0.76 | 3 |
| PVC and aluminium assembler | Installing specific thermal insulation on PVC and aluminium, and breaking any thermal bridges in order to comply with the established conditions limiting the effectiveness of the closure | 4.50 | 0.50 | 4 |
| | Identify the characteristic parameters used in glazing and its installation to assess the compliance of limitation conditions on thermal demand and avoid condensation and air leaking in. | 4.00 | 0.85 | 3 |

Table 32. STAGE: Carpentry: Interior and exterior carpentry assembly Source: panel of experts on skill gaps, Construction Labour Centre.

In the hot water installation stage, among the skills relevant to solar thermal installation operators, there are the assembly of collectors, equipment and hydraulic circuits in solar thermal installations (4.42) and installation and operation of solar thermal installations (4.42), the first of which received more agreement amongst the experts with a deviation of 0.49.

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| Solar thermal installation operator | Assembly of collectors, equipment and hydraulic circuits in solar thermal installations. | 4.42 | 0.49 | 4 |
| | Installation and operation of solar thermal installations | 4.42 | 0.76 | 3 |
| | Assembly of electrical equipment and circuits in solar thermal installations. | 4.25 | 0.60 | 3 |
| | Redesign solar thermal installations | 3.42 | 1.04 | 2 |

Table 33. STAGE: Hot water installations. Source: panel of experts on skill gaps, Construction Labour Centre.

In the stage relating to external closures (placement of façades, ...), the bricklayer is the most relevant, being the one who installs the construction materials used as insulating elements, considering their hygrothermal properties such as placement, position and dimensions to limit the thermal demands of the building, the presence of condensation, air leaking in and the passing of heat from heated areas to non-heated areas, their main skill, with an average score of 4.58 and a minimum score of 4.

Relating to the role of insulation installer, installing thermal and water insulation, considering their placement, position and dimensions in order to comply with thermal conductivity and the minimum established level of permeability for the closure has a high level of importance (4.50 average and 4 minimum).

Within the environmental and quality control technician role, identifying and contrasting the hygrothermal parameters of materials in order to limit the thermal demand of the building, the presence of condensation and air leaks is the most relevant skill with an average score of 4.50.

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| Bricklayer | Install the construction materials used as insulating elements, considering their hygrothermal properties such as placement, position and dimensions to limit the thermal demands of the building, the presence of condensation, air leaking in and the passing of heat from heated areas to non-heated areas | 4.58 | 0.49 | 4 |
| | Install thermal and water insulation, considering their placement, position and dimensions in order to comply with thermal conductivity and the minimum established level of permeability for the closure | 4.25 | 0.60 | 3 |
| Insulation installer | Install thermal and water insulation, considering their placement, position and dimensions to comply with the limits for thermal conductivity and the minimum level of permeability established for the closure. | 4.50 | 0.50 | 4 |
| | Identify the hygrothermal properties of construction materials with the aim of limiting the thermal demand of buildings, the presence of condensation and air leaks. | 3.36 | 0.48 | 3 |
| | Identify the hygrothermal and acoustic parameters of the insulation used and of the closure itself with the aim of limiting the thermal demand of buildings, the presence of condensation, air leaks and the level of noise. | 3.20 | 0.40 | 3 |
| Joint sealant operator | Install joint sealants for thermal bridges found in the closures. | 4.36 | 0.64 | 3 |
| Environmental and quality control technician | Identify and contrast the hygrothermal parameters of materials in order to limit the thermal demand of the building, the presence of condensation and air leaks. | 4.50 | 0.65 | 3 |
| | Check the characteristics of the construction materials and the mechanisms used to limit the thermal demand of buildings, the presence of condensation, air leaks and the level of noise. | 4.00 | 0.85 | 3 |

Table 34. STAGE: External closures: placement of façades. Source: panel of experts on skill gaps, Construction Labour Centre.

In the stage relating to Roofing (insulation,...), the installation of construction materials used as insulating elements in the roof, considering their hygrothermal properties, their placement, position and dimensions to limit the thermal demand of the closure, the presence of condensation and air leaks, one of a bricklayer's skills, was given an average score of 4.50 It should also be noted that the minimum score received was 4 out of 5.

The installation of thermal insulation in roofs while complying with the limits established for this closure, one of a roofer's skills, has also been considered important in relation to energy efficiency in buildings with an average score of 4.50 and a minimum value of 3.

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| Bricklayer | Installation of construction materials used as insulating elements in the roof, considering their hygrothermal properties, their placement, position and dimensions to limit the thermal demand of the closure, the presence of condensation and air leaks. | 4.50 | 0.50 | 4 |

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| Roofing and rainwater network installers | Assembly of roofs, gutters and rainwater drainpipes limiting the risk of the presence of water coming from precipitation, run-offs, condensation, etc., ensuring its removal without causing damage or allowing it to stagnate or enter the building. | 3.83 | 1.21 | 1 |
| Insulation installer, roofer | Install thermal insulation in roofs while complying with the limits established for this closure | 4.50 | 0.65 | 3 |
| | Identify the thermal and water parameters of the materials install to limit the thermal demand of the closure, the presence of condensation and air leaks as well as the presence of rainwater and run-offs (HS-1). | 3.55 | 0.50 | 3 |
| | Identify the hygrothermal and acoustic parameters of specific insulation and of the closure itself with the aim of limiting the thermal demand of buildings, the presence of condensation, air leaks and the level of noise. | 3.36 | 0.48 | 3 |

Table 35. STAGE: Roofing: Insulation. Source: panel of experts on skill gaps, Construction Labour Centre.

In the installation of plumbing, the job the plumber has in assembling and installing the heat generation systems which use solar thermal energy to be used for providing hot water, heating systems which work at low temperatures and swimming pool heating systems is their most important with an average score of 4.50 and a minimum value of 4 out of 5.

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| Plumber | Assemble and install heat generation systems which use solar thermal energy to be used for providing hot water, heating systems which work at low temperatures and swimming pool heating systems. | 4.50 | 0.50 | 4 |
| | Have systems available which allow for water to be saved and consumed sustainably. | 4.33 | 0.75 | 3 |
| | Assemble and install horizontal or vertical collection systems which capture geothermal energy from the ground, with a combination of thermodynamic or geothermal heat pumps, to be used to cover heating and hot water demands in the home as well as refrigeration during the summer. | 4.33 | 0.62 | 3 |
| | Install geothermal heat pumps and the hydraulic circuits within them to be applied to heating circuits. | 4.27 | 0.62 | 3 |
| | Install heat generation systems to be used for hot water which use aerothermal energy (external, unheated air). | 4.18 | 0.57 | 3 |
| | Install geothermal heat pumps and the hydraulic circuits within them to be applied to hot water tanks. | 4.09 | 0.67 | 3 |
| | Carry out mechanical resistance and leak tests on the entire interior installation, in particular the hot water system, to ensure the correct operation of all components. | 4.08 | 1.11 | 2 |
| | Install heating systems through low-temperature sensors: floors, walls, roofs and radiating skirting boards. | 4.08 | 1.04 | 2 |

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| | Install geothermal heat pumps and the hydraulic circuits within them to be applied to heating swimming pools. | 3.91 | 0.67 | 3 |
| | Identify all elements which compose an installation (connections, the general installation and other related sections), carrying out installations with appropriate materials, considering their resistance to corrosion and possible variations in temperature, preventing substances from the material itself entering the water which would cause pollution. | 3.73 | 1.21 | 2 |
| | Have valve systems to prevent liquids from travelling in the wrong direction. | 3.73 | 1.14 | 2 |
| | Check the minimum, instant flows of water and pressure conditions for each type of hygienic equipment. | 3.64 | 0.77 | 2 |
| | Use techniques which maintain the quality of the water and save it. | 3.58 | 0.86 | 2 |
| | Identify the different devices which could be installed in taps to save water. | 3.50 | 1.26 | 2 |
| | Identify the different water treatment systems in order to comply with the requirements of both the water and the treatment process itself. | 3.30 | 0.90 | 2 |
| | Correctly indicate any installations which are not suitable for human consumption so that they can be easily and unmistakeably identified as such. | 3.27 | 1.05 | 2 |

Table 36. STAGE: Plumbing installations. Source: panel of experts on skill gaps, Construction Labour Centre.

In the electricity generation stage, the photovoltaic installations operator fundamentally requires to be able to maintain photovoltaic solar installations which received a score of 4.17 although the minimum value given by the experts is 2.

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| Photovoltaic installations operator | Maintain photovoltaic solar installations | 4.17 | 0.90 | 2 |
| | Assemble photovoltaic solar installations. | 4.08 | 0.86 | 2 |
| | Redesign photovoltaic solar installations. | 3.50 | 0.96 | 2 |

Table 37. STAGE: Electricity generation. Source: panel of experts on skill gaps, Construction Labour Centre.

In the Partitions stage, the locksmith is the most important occupation, with the breaking of thermal bridges in order to comply with the limits of thermal demands and air leaks being the most central skill with an average score of 4.25.

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| Locksmith | Break thermal bridges to comply with the limitation of thermal demand and air leaks. | 4.25 | 0.72 | 3 |
| | Install thermal and water insulation, considering their placement, position and dimensions to comply with the limits for thermal conductivity and the minimum level of permeability established for the roof. | 4.08 | 0.64 | 3 |
| Bricklayer | Use new materials and techniques to comply with the conditions which limit thermal demand and avoid condensation and air leaks. | 3.75 | 0.72 | 3 |

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| | Install specific acoustic and thermal insulation in the interior partitions to comply with established limits and avoid the transmission of heat. | 3.75 | 0.92 | 2 |
| | Identify characteristic parameters of construction materials to limit thermal demand, avoid condensation and air leaks, and reduce acoustic transmission. | 3.67 | 0.85 | 2 |

Table 38. STAGE: Partitions: Conventional partitions. Source: panel of experts on skill gaps, Construction Labour Centre.

Relative to air-conditioning installations, in the experts' opinions, the most important skill the installer of heat generation systems through geothermal energy needs is carrying out tests to avoid stagnancy and ensure hydraulic balance in the system, with an average of 4.27 out of 5.

The installer of heat generation systems through biomass combustion requires the regulation of combustion in terms of quality and characteristics of the biomass used, guaranteeing better performance of the boiler. This was decided by the experts, giving this skill an average value of 4.36 and a minimum value of 3.

The installer of authorised for hot water and air-conditioning systems needs skills in assembly, testing and cleaning; in corrective and preventive maintenance (ITE 08); in verification that all equipment, elements and materials of a thermal installation comply with the ITE 04; in receiving materials, partial tests and implementation of thermal installations (ITE 06) as well as carrying out specific and individual installations (ITE 09 and 10) in order to comply with conditions relating to thermal well-being, hygiene, security, rational use of energy, environmental protection and permanently high levels of performance in the installation. This skill was given a score of 4.36 with a minimum value of 2.

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| Installer of heat generation systems through geothermal energy | Carry out tests to avoid stagnancy and ensure hydraulic balance in the system | 4.27 | 0.75 | 3 |
| | Establish the geometry and availability of the fields of geothermal capture, no of probes, length and depth of the geothermal probe, distance between probes, etc. | 3.91 | 0.90 | 2 |
| | Analysis of the technical parameters of the soil, its thermal diffusivity and conductivity, and the existence of groundwater in the thermal capacity of the earth. | 3.73 | 0.75 | 2 |
| Installer of heat generation system through biomass combustion | Regulation of combustion relating to the quality and characteristics of the biomass used, guaranteeing better performance in the boiler. | 4.36 | 0.64 | 3 |
| | Establish the size and geometric conditions of the solid non-fossil fuel storage silos. | 3.80 | 0.87 | 2 |
| | Establish the characteristics of the connection between the silo and the biomass production systems (pneumatic systems, worms, etc.) | 3.70 | 1.00 | 2 |
| Installer authorised for hot water and air-conditioning systems | Assembly, testing and cleaning; in corrective and preventive maintenance (ITE 08); verify that all equipment, elements and materials of a thermal installation comply with the ITE 04; receive materials, partial tests and implementation of thermal installations (ITE 06); and carry out specific and individual installations (ITE 09 and 10) in order to comply with conditions relating to thermal well-being, hygiene, security, rational use of energy, environmental protection and permanently high levels of performance in the installation. | 4.36 | 0.88 | 2 |
| | Install heating systems through low-temperature sensors to reduce annual energy consumption. | 4.20 | 0.75 | 3 |
| | Create action plans for intervening using corrective or preventive maintenance to repair any breakdowns. | 4.10 | 0.70 | 3 |
| | Assess the minimum thermal contribution which must be covered by renewable energy in order to | 4.10 | 0.94 | 2 |

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| | optimise the building's global energy savings in combination with the rest of the thermal equipment in the building. | | | |
| | Establish the operations which allow for evaluation of the installation's operational parameters to ensure its correct operation. | 3.91 | 1.00 | 2 |
| | Create test procedures and specifications to ensure correct operation and check correct assembly of piping including its subsequent use. | 3.90 | 0.83 | 3 |
| | Evaluate the thermal demand of a building to choose the most appropriate energy source and apply savings and energy efficiency measures to reduce energy consumption. | 3.90 | 0.94 | 2 |
| | Apply and establish design conditions for solar thermal, geothermal or biomass energy collection and transmission in agreement with the specifications laid down in the CTE HE4. | 3.90 | 0.94 | 2 |
| | Establish the preventive maintenance and monitoring plan to ensure energy efficiency and correct functioning of the installation. | 3.82 | 0.94 | 2 |
| | Identify maintenance operations and their frequency for each component of the hydraulic circuit for hot water services, as well as carrying out maintenance operations on biomass, geothermal or solar thermal energy installations to comply with the preventive maintenance plan established for the hot water production installation. | 3.82 | 1.03 | 2 |
| | Identify the different options for natural, hybrid and mechanical ventilation to ensure optimal assembly of the ventilation system. | 3.73 | 0.86 | 2 |
| | Develop predictive, preventive and corrective maintenance plans. | 3.70 | 0.64 | 3 |
| | Apply technical, planning and organisational criteria to guarantee the quality of the materials and equipment used during assembly or maintenance. | 3.70 | 0.78 | 2 |
| | Evaluate the annual performance of the installation to compare the reduction in CO emissions with traditional fossil fuels. | 3.70 | 0.78 | 2 |
| | Evaluate the performance of heat and cooling generators to apply corrective and optimisation measures. | 3.70 | 1.00 | 2 |
| | Identify the necessary heat or cold recycling systems to improve thermal performance as well as improving their energy saving potential | 3.60 | 0.80 | 2 |
| | Identify the components of a solar thermal or geothermal energy hydraulic collection and transmission circuit to carry out installation and maintenance. | 3.50 | 0.81 | 2 |
| | Apply measures to prevent and treat corrosion to avoid leaks and lengthen the life of the installation in service. | 3.50 | 0.92 | 2 |

Table 39. STAGE: Air-conditioning installations. Source: panel of experts on skill gaps, Construction Labour Centre.

In relation to gas installations in buildings, a gas installer's most important skill is the assembly, modification or extension, maintenance and repair of installations. This skill was given an average score of 4.17 with a standard deviation with respect to the average of 0.69.

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| Gas installer | Assemble, modify or extend, maintain and repair installations | 4.17 | 0.69 | 3 |
| | Verify installations and leave them ready for use, carry out regulated trials and tests and issue installation certificates | 3.50 | 0.65 | 2 |

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| | Regular revisions, trials, regulatory tests and issue revision certificates. | 3.67 | 0.62 | 3 |

Table 40. STAGE: Gas installations. Source: panel of experts on skill gaps, Construction Labour Centre.

Finally, in relation to electrical installations, the lighting installer is the most relevant occupation, with the installation of normal lighting in agreement with the project and regulations in order to ensure suitable illumination in the building being the skill required from these professionals. Its importance is 3.75 out of 5, with 1 being the minimum value.

The electrician requires skills applied to manual regulation and control systems, as well as time delay or detection systems in areas used less often to favour conditions in which energy consumption is reduced (4.17), as well as selecting elements which comply with specific regulations with each type of material in order to improve energy efficiency (4.17).

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| Lighting installer | Install normal lighting in agreement with the project and regulations in order to ensure suitable illumination in the building. | 3.75 | 1.30 | 1 |
| Electrician | Apply manual regulation and control systems, as well as time delay or detection systems in areas used less often to favour conditions in which energy consumption is reduced. | 4.17 | 0.69 | 3 |
| | Select elements which comply with specific regulations with each type of material in order to improve energy efficiency. | 4.17 | 0.69 | 3 |
| | Verify that the lighting installed limits the losses of its auxiliary equipment so that the total power of the equipment and lighting is below the limits set. | 4.00 | 0.74 | 3 |
| | Verify that the Installation Energy Efficiency Value (VEEI) is below the limits established to optimise the total power of the illumination parameters which define the quality and comfort of the level of lighting. | 3.92 | 0.76 | 3 |
| | Define and carry out preventive maintenance and monitoring on the installation, including all necessary operations to ensure its correct functioning and compliance with the minimum lifespan expectations. Carry out frequency and maintenance operations on each component of the photovoltaic installation. | 3.83 | 0.55 | 3 |
| | In the case of installations connected to the network, guarantee the correct application of the technical conditions from Royal Decree 1663/2000 as well as all aspects applicable to legislation in force. | 3.82 | 0.72 | 2 |
| | Set the operations which allow for evaluation of the photovoltaic installation's operational parameters to ensure its correct operation. | 3.82 | 0.94 | 2 |
| | Check that the groups of lighting and equipment have the manufacturer's certificate to accredit the power of the whole and favour the reduction of electrical consumption. | 3.75 | 0.92 | 2 |
| | Check the existence of a lighting installations maintenance plan to guarantee the suitable engineering parameters and energy efficiency of the installation. | 3.75 | 0.92 | 2 |
| | Carry out the electrical lighting installation in agreement with the project for correct illumination of the building suitable for normal use. | 3.73 | 0.86 | 2 |
| | Complete the lighting engineering calculations. | 3.70 | 0.90 | 2 |
| | Determine losses due to inclination, orientation and shadows in the collection system to ensure the installation is correctly dimensioned. | 3.58 | 0.86 | 2 |
| | Verify that the level of dazzling from interior lighting installations be adjusted to the lighting parameters which define the quality and comfort of the lighting level. | 3.18 | 0.72 | 2 |

| OCCUPATION | SKILL | Average SCORE | SCORE standard deviation | Minimum SCORE |
|---|---|---|---|---|
| | Carry out the electrical installation of emergency lighting to guarantee a minimum level of lighting in the case of emergency evacuation of the building (SU-4). | 3.00 | 1.35 | 1 |
| | Carry out the installation of grounding as per the project to limit the risk of damage due to lightning (SU-8). | 2.91 | 1.50 | 1 |
| | Carry out the installation of a lightning conductor to limit the risk of damage due to lightning (SU-8). | 2.83 | 1.40 | 1 |

Table 41. STAGE: Electrical installations. Source: panel of experts on skill gaps, Construction Labour Centre.

### C. QUANTIFYING THE NUMBER OF WORKERS WITH NECESSARY SKILLS

Quantifying the workforce with EE training needs is a difficult task, perhaps related more to the future of the activity than with the job roles themselves. In other words, the current situation showing a lack of activity in the sector requires forecasting more so than an analysis of the current situation.

In this sense, the experts interviewed point out that the main thing is to take into account that the sector will be reoriented towards renovation, including energy, so that from this starting point, the predominant sub-activities can be defined and, as a result, the occupations and tasks that will be required.

Primarily, experts determine that the new work will be something which lasts a long time and that renovation will not be able to absorb all of the workers in the sector. As such, of all of the employees in the sector, the percentage of workers which experts consider could be linked to energy efficiency and the use of renewable energy varies - in the best of cases - between 25 and 35%, though this proportion may increase in the future if there is sufficient funding and monitoring to ensure compliance with regulations.

To this respect, there are currently regulations which force new construction projects to comply with energy ratings. It is hoped that this will become the rule for existing buildings too. Looking to the future, the expectation is that the demand for professionals will increase and, as a consequence, new skills profiles will appear which are currently undefined.

However, to comply with the regulatory requirements and specifically the 2020 objectives, 100% of workers involved in energy renovation, as in new works, will require extra knowledge on the subject, even if it does not need to be a lot.

## 7.3. Qualification needs

Training is considered a necessary element for the generation of skills in energy efficiency at all level. The traditional acquisition of skills in the work of this sector is not of much use in the current context in which building experience has not taken energy efficiency criteria into account.

Although it is mostly the higher levels of qualification which are considered essential - since they are the ones responsible for designing and managing - the production workforce must have, at least, some general knowledge on everything which their job covers to ensure that they carry out the work correctly. Perhaps the intermediate-level workers are those who require, in a greater measure, energy efficiency training since these intermediate levels are the ones who often need to use new materials and techniques, understand instructions from the managers and coordinate and orientate the lower-level workers.

Given that productive processes in the building sector covers a wide variety of stages in which there is a high number of people with different professional profiles, experts consider that there must be some basic generic subjects which are taught to all workers in the same way that risk prevention at work materials are taught.

The greatest difficulty stems from the fact that every building has its unique points while all training has to be standardised. If this were not the case, it would be necessary to design an *ad hoc* training course for every single project.

*7.3.1. Existing accreditation and training structures*

There is currently a national system which defines skills, the SNCFP, though this is a technical document which does not define any training plans. In the SNCFP, all worker skills are divided into twenty-six professional families. These twenty-six families are then further divided into five skill levels which define the skills from very basic (1) to very advanced (5).

The qualifications are translated to the working world through certificates of professional standards, from the Ministry of Employment through the SEPE, and the training environment through the Ministry of Education through the Sub-directorate General of Professional Training and Guidance.

Both ministries are the organisms responsible for deciding which qualifications are necessary in each of their fields, i.e., they develop the education policy.

The Ministry of Education designs very wide-ranging and general programmes, although they work to divide them into concrete skills units so that they are specific. The process of updating and generating new qualifications and skills is slow, both in terms of vocational training and university degrees. In addition, knowledge evolves at a rate which formal education does not cover. Teaching does not advance at the same rate as the market and so, in many cases, knowledge acquired through regulated training is obsolete.

This is so much the case that in study plans, either university or Vocational Training, still has not considered specific contents for energy efficiency in buildings, until now. It is in these specialist studies, masters or postgraduate, where possibilities of accessing this specific training are found.

The Ministry of Employment designs more specific and concrete training both for employed and unemployed workers. The specialist catalogue regulated by the SEPE is permanently updated since it needs to help the unemployed to be reintroduced into jobs with skills for which training is required. Training for employees (FTFE), especially demand training which is that requested by companies, is training which is quite up-to-date and in agreement with market needs.

In relation to accreditation, the most important point is that training with greater demand is that which is accredited. For workers, training for which they will receive some special official recognition has special relevance.

In the sector, where many unqualified workers are employed, accreditation for training gained through professional experience is seen as key. In other words, the recognition of working experience favours the reintroduction of unqualified workers who did not complete their school studies through a process of verifying their professional skills.

In this sense, experts have considered that certificates of professional standards may be those which best fit the needs of the sector since they have greater flexibility and do not require any former qualifications to be accessed.

In addition, to make training more attractive to workers in the sector, it is suggested that the training courses be short with a maximum duration of 40 hours and focused on practical work, closer to the concept of *practical training* than *classroom-based training*.

*7.3.2. Characteristics of existing training*

Current Vocational Training does not deal with all of the bases required to implement EE and RE, principally because it does not cover all of the related activities in the sector.

The majority of available training for sustainable buildings is aimed towards highly-qualified professional profiles, and, as a result, there is a consensus that they are the principal intended audience since building sustainability depends largely on them.
It is not, therefore, in this group that the largest collection of skills gaps are found, since the training currently available can answer the needs of this group.

However, there is no sufficient training material directed at lower levels. Although the experts may consider specific technical training unnecessary, it may be convenient to provide a more general vision focused upon the activity being developed.

Experts suggest that, essential professional qualifications are guaranteed by the public bodies so that workers can get a job and then, later, the construction sector and material providers are those who invest in their specialisation.

In this sense, the companies that manufacture new sustainable materials have the chance of bring quicker and more immediate solutions, promoting their innovations so that they can be used by workers in the construction process with the aim of correctly complying with their predicted uses. They are the ones who can contribute to the creation of more dynamic and current training courses, lending their materials or products as teaching material. In fact, many manufacturing organisations in the sector are already doing this (ATEDY, ATECYR, HISPALIT, etc.)

#### *7.3.3. Training centres*

The network of centres in which Initial Vocational Training is given is very diverse. This network is formed by specific Vocational Training courses, integrated employment centres and national reference centres.

The problem is that there are few centres which provide training on this subject.

#### *7.3.4. Trainers*

As regards trainers' qualifications, the SNCFP establishes the requirements with which trainers must comply for each skill level in each professional family.

The fundamental problem is that there is no prior definition of the skills required in the subject of energy efficiency for buildings nor of trainers' requirements. In addition, there is an extra problem: there is no subsequent evaluation system which guarantees the quality and suitability of the trainer or teacher.

Therefore, as there is the need to design training courses which answer workers' skills needs, especially in carrying out their work, there is a further need to define the qualifications required by trainers.

To this question, experts have considered that in addition to regulated training or learning, trainers must have professional experience in sustainable buildings so that they can answer questions on real-life work situations.

## 7.4. Monitoring needs

In relation to instruments which are used to follow or monitor skills and training requirements, there are professional and occupational monitoring centres.

- ✓ At a **national level**, the Ministry of Education and the Ministry of Employment are those who manage the Monitoring Centres: the INCUAL Professional Monitoring Centre and the SEPE Occupational Monitoring Centre respectively.

- ✓ At a **regional level**, each of the Departments of Employment have their own regional Monitoring Centres.

| SCOPE | TITLE | LINK |
|---|---|---|
| **MINISTRY OF EDUCATION AND CULTURE** | Professional Monitoring Centre | National Institute of Qualifications |
| **MINISTRY OF EMPLOYMENT AND SOCIAL SECURITY** | SEPE Occupational Monitoring Centre | Spanish Public Employment Service |
| **MINISTRY OF INDUSTRY** | Construction Industrial Monitoring Centre | Industrial Monitoring Centres - Industry and SMEs - Mº de Industria. |
| ANDALUCÍA | Argos Monitoring Centre | SAE (Andalusian Employment Service) |
| ARAGÓN | Labour Market Monitoring Centre | INAEM (Aragonese Employment Institute) |
| CANARIES | Canary Islands Employment and Training Monitoring Centre | OBECAN (Canary Islands Employment and Training Monitoring Centre) |
| CANTABRIA | Training and Employment Monitoring Centre | SCE (Cantabrian Employment Service) |
| CASTILLA Y LEÓN | Regional Employment Monitoring Centre | ECyL (Public Employment Service of Castilla y León) |
| CATALONIA | Observatori del Treball | Departament de Treball |
| COMUNIDAD VALENCIANA | Servef | SERVEF (Valencia Training and Employment Service) |
| EXTREMADURA | Employment Monitoring Centre | SEXPE (Extremaduran Public Employment Service) |
| GALICIA | Occupational Monitoring Centre | SERVIZO PÚBLICO DE EMPREGO |
| BALEARIC ISLANDS | Observatori del Treball | Server d'Ocupació de les Illes Balears |
| LA RIOJA | Training and Employment Monitoring Centre | Riojan Employment Service |
| CASTILLA LA MANCHA | Occupational Monitoring Centre | SEPECAM (Public Employment Service of Castilla la Mancha) |
| MADRID | Regional Employment and Training Monitoring Centre | Regional Employment Service |
| REGION OF MURCIA | Occupational Monitoring Centre | Regional Training and Employment Service of the Region of Murcia |
| NAVARRA | Navarre Employment Monitoring Centre | Navarre Employment Service |

| SCOPE | TITLE | LINK |
|---|---|---|
| PAÍS VASCO | Labour Market Monitoring Centre | EGAILAN SA |
| PRINCIPADO DE ASTURIAS | Monitoring Centre of the Public Employment Service of the Principality of Asturias | Directorate General of Development and Employment of the Principality of Asturias |

Table 42. Network of labour market monitoring centres

**PROFESSIONAL MONITORING CENTRE (INCUAL)**

The **Professional Monitoring Centre** is an area within the National Institute of Qualifications (INCUAL) which provides training on the evolution of the supply and demand of professions, occupations and profiles in the labour market.

In addition, the Professional Monitoring Centre, as a part of INCUAL, participates in defining, creating and updating the National Catalogue of Professional Qualifications (CNCP).

The basic objective of the Monitoring Centre is the observation of qualifications and their evolution. Royal Decree 375/1999, 5th of March, through which INCUAL was created, establishes that within its structure is a Monitoring Centre with a database which actively promotes the cooperation of the rest of the sectorial and territorial monitoring centres which may exist that it should meet the following aims:

- Establish the procedures and agreements necessary to ensure the cooperation and feedback of training between the various professional monitoring centres.
- Provide training on the evolution of the demand and supply of professions, occupations and profiles within the labour market, also taking into account the professional classification systems arising from the collective group of businesses, among others.

The Professional Monitoring Centre researches each of the professional families found in the Catalogue, carrying out training and economic studies, always starting with the consultation of official and knowledgeable sources within the sectors that take part in the Professional Family.

Reports are released periodically for each one of the professional families on their evolutions as regards training and labour configuration.

In addition, more in-depth sectorial studies are carried out which research the observation of certain professional families. The fundamental aspects analysed include the following:

- The socio-economic characteristics of the professional family and their relationship with other sectors.
- The structure of the productive fabric: products and services, markets, organisations structures and models, as well as quality assurance.
- Productive processes: technologies, research, development and innovation (R&D) and critical competitive factors.
- The characterisation of the professionals in the family: job posts, occupations and professional qualifications.
- Training of workers, description of training, skills needs and associated training.
- The general prospects of the professional family, especially in employment, qualifications and training.
- The regulatory framework.

**OCCUPATIONAL MONITORING CENTRE (SEPE)**

This is a technical unit within the National Public Employment Service which analyses the situation and trends of the market to anticipate the challenges and requires it presents.
The Occupational Monitoring Centre of the National Public Employment Service has a network of professionals distributed between the central service and the 52 Spanish State provinces.

- The SEPE Occupational Monitoring Centre studies: The situation, evolution and perspectives of the Labour Market.
- The trend in the sectors of activity.
- The capacity to generate employment and its quality, the jobs and activities with a future, and the territories with the greatest potential to generate it.
- The training needs of workers and demanded professional requirements.
- The changes produced in the labour market which modify job descriptions.
- The situation of some groups relating to work.
- Geographic mobility in the labour market.
- The Occupational Monitoring Centre also cooperates and collaborates with the regional Public Employment Service Monitoring Centres and other institutional monitoring centres on a national and international scale.

The SEPE Monitoring Centre publishes the following reports:

- Monthly:

– Occupations and economic activities with a positive trend in employment.
– The labour market for holders of university degrees and vocational training certificates.
– The occupational labour market.

- Quarterly:

– Quarterly Mobility Bulletin
– Quarterly Labour Market Bulletin

- Biannually:

– Notes on the Labour Market (CMT).

- Annual:

– National Labour Market Report

- Regional:

– National and Regional Labour Market reports for the female population, for the handicapped, for young people, for people over the age of 45 and for foreign workers.
– The Labour Market and Mobility between Spain and Portugal
– DBM: Basic Mobility Training. Hiring and geographical mobility of workers in Spain..

- Monographs:

– Prospective study on the self-propulsion sector.
– Prospective study on renewable energy.

- Other products outside of its scope: Labour Market Reports:

– Hispano – Luso
– European Employment Services (EURES)
– European Social Fund (FSE)
– Technical assistance in prospective and organisational model activities (RED) in different countries throughout Central and South America.

**CONSTRUCTION SECTOR INDUSTRIAL MONITORING CENTRE (MITyC)**

In the last few years, the Spanish industry has been growing in front of the challenge of an increase in price competition and in products coming from other countries, not just neighbouring countries but also other countries which are becoming more and more integrated into a globalised economy which, until only a few years ago, had not represented strong competition.

Among the various measures implemented by the Public Administration in response to this situation is the creation of Industrial Monitoring Centres. As a result, the Ministry of Industry, Tourism and Commerce (MITyC) created ten industrial monitoring centres for sectors key to the Spanish productive fabric and which are affected by the current growing competition from other countries.

In 2009, the Construction Industrial Monitoring Centre was created which has three collaborative members:

.- Construction Labour Centre.
.- Spanish Federation of Innovation and Technology (FEDIT)
- Ministry of Industry, Tourism and Commerce.

The objective of these Industrial Monitoring Centres is to join forces to develop and modernise the industrial sectors in order to increase the productive and exporting capacity of companies, to consolidate investment and employment, to modernise technology and adapt to the new competitive international conditions.

To achieve their general Objectives as well as the specific demands they face, the Monitoring Centre carries out Construction sector analysis studies to provide quantitative and qualitative training in order to better analyse the situation in the sector in terms of the productive and occupational structure, the current technological and commercial situation, etc.

To publicise the Monitoring Centre's worker to agents within the sector, a day is held each year in which the results of their activities, and their principal conclusions and recommendations are disseminated.

**Strengths and Weaknesses of the Monitoring Centres**

- The Monitoring Centres are a very useful tool when it comes to detecting competitive mismatches and the existence of gaps in certain occupations.

- The network of Monitoring Centres has come a long way and its development has reached an optimal level in the last few years.

- The need for coordination between the existing Monitoring Centres has been detected for which it will be necessary to improve synergy and establish a form of leadership.

- They are not very versatile instruments and lack the immediacy that businesses request. The reality of the market is moving ahead. 

# 8. BARRIERS

After the different kind of analyses carried out, the following types of barriers can be identified:

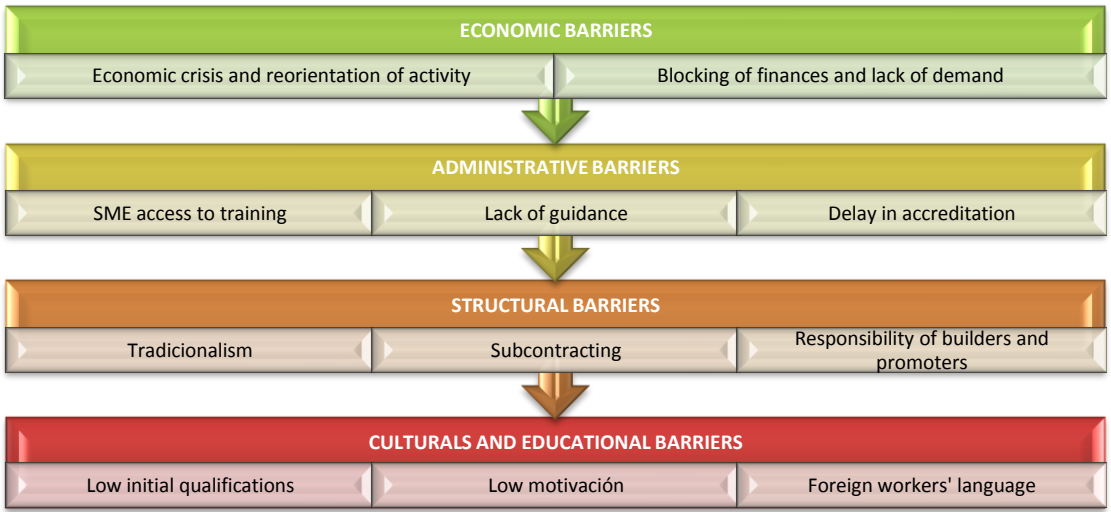



Figure 18 Barrier types

## 8.1. Economic barriers

*8.1.1. Economic crisis and reorientation of activity*

The building sector has been one of the most affected areas due to the economic situation, and this has caused a lack of demand, the destruction of employment and the blocking of financing, among other causes.

All the interviewees share the vision of a paralysed sector, whose opportunity for reactivation mainly lies in the reactivation of business parks, especially dedicated to energy efficiency. However, even though energy efficiency renovation is a very popular idea for the reactivation of the sector, experts consider that there are some elements which make such reorientation difficult.

- Firstly, because of the specific nature of renovation tasks - being smaller than the tasks carried out for a new building work - the amount of employment that will be generated will be on a much smaller scale too.

- The complexity of the tasks which have to be done during building work renovation are different too; the job is done on previously used elements, the space is limited, deadlines are reduced as well, and in most cases it requires a higher level of training than new building sites.

- The kind of company in charge of these tasks is also smaller than the ones who control new building works. These companies constitute the majority of the sector, but at the same time they are the ones who have the greatest difficulties in obtaining training and improving their workers' qualifications.

- The laws which can affect building renovation are very varied, with different by-laws, laws, decrees, etc., with different jurisdictions and, in many cases, conflicting with one another, like the Building Code, Sustainable Economy Act, Building Regulations, or the Law for Urban Rents. These different regulations hinder the possibilities of putting renovation into action.

- In this regard, a lack of coordination exists between the different agents and the competent administrations. The role of both these administrations and the agents is key to this issue, but it is hard to coordinate.

- Lack of energy renovation demand is also an important aspect to consider, as it is the proprietors who must finance at least a part of the investment using their own resources. Due to the harsh economic situation there is no private investment, no ecological awareness, and the only investments that occur are on subsiding programmes, like Renewal plans.

*8.1.2. Blocking of financing and lack of demand*

One of the most problematic aspects related to the crisis is the blocking of financing, which has worsened the situation in the sector.

This lack of financing has paralysed the demand for flats, leaving a large amount of buildings empty. The developers possess a large quantity of products but they cannot sell them because of economic difficulties. There are ghost neighbourhoods where hardly anybody lives, and where nobody will want to live because it lacks basic services.

Furthermore, banks, energy companies, renovation companies and users consider investing their capital in recovery projects as a very risky and complex movement to make.

In this current situation, the main problem lies in short-term objectives, so any future possible savings obtained from renovation are intangible. In this regard, one of the most negative aspects of this crisis is the reduction of long-term investment.

## 8.2. Administrative Barriers

*8.2.1. SMEs access to training*

This reduction of long-term investment not only slows down economic activity but also affects training.

In a paralysed sector, only focusing on short-term decisions and complex sub-activities, training investment looks uncertain. Mainly, because a large proportion of SMEs are not aware of subsidisation opportunities as regards training, and also because many small and medium-sized enterprises do not know what their needs are and where those needs are heading.

A problem that has been detected by experts is the difficulties encountered to obtain subsidised training from the regions. Through autonomous communities there are certain subsidies, for example, competitiveness plans. Through business associations, the regions can also access adequate training plans. However, this access is very limited because of its lack of advertising and adjustment to needs.

It is subsidised training which SMEs and individuals usually access – if they manage to access any – where the training is offered on a universal basis, despite the fact that specialised demand training is that most requested by companies. This training, however, is only accessed by big companies, not small ones. All of this implies that the kind of access SMEs have doesn't impact on their competitiveness.

*8.2.2. Lack of guidance*

Experts agree that there is not enough training available for the lowest qualification levels, and where there is, it is not adequate. In this regard, we have to consider that training is created in relation to what is demanded, and currently, these courses do not seem to be compatible with the needs the experts are detecting for the sector. So employment guidance acquires special significance, especially in relation to those training centres and companies. The main problem is to reach the lowest qualification levels, because they are not aware of the demands that are important to the sector, how it evolves and where to look for the training.

*8.2.3. Delays in degrees and accreditations*

Taking into account the characteristics of the sector and its workers, experts agree that the certificates of professional standards which the Public Employment Service (SEPE) elaborates in collaboration with the national reference centres are a key element to giving answers to the educational needs of the sector. However, the administrative delay from the organisms which are in charge of publishing the qualifications can be detrimental for the training. There is another additional problem which is the insufficient number of certified centres. This slows down the training process which aims at obtaining certificates of professional standards.

## 8.3. Structural barriers in the sector

*8.3.1. Traditionalism of the sector*

The building sector is formed, like the rest of the economic activities of the country, by SMEs and micro-SMEs. In most of the smaller production units of the sector, traditionalism and low industrialisation are predominant features, unlike big companies.

In the current economic context, where economic activity is limited, it would be positive to improve workers' training level. In this regard, it is important to point out that informal training activity, during employment or company training, tends to be lower in this sector, compared to the whole economic area.

Nonetheless, it is supposed that if companies detected a rise of the specialisation demand as regards energy efficiency, they would have a bigger interest to train and accredit. However, in fact nowadays the sector is not demanding energy efficiency.

*8.3.2. Sub-contracting*

The reality of construction is that its productive processes covers a wide variety of stages with a large amount of companies involved, and a large amount of workers with different professional profiles.

Big companies rarely employ workers whose degrees are below "site foreman"; from that to lower levels, it is the subcontracted SMEs who provide the workers. It is therefore in the SMEs where the real need for training lies, even when the experts focus their responsibility and attention on big companies when the time comes to hire subcontracted workers. Moreover, it is expected that big companies assume the responsibility to train such professionals. Mainly because the relation between the company's dimension and the execution of training courses is directly proportional: for SMEs workers the access to training is more complex than for big company's workers, because the latter has a training course plan.

The sub-contracting of third-parties to perform different activities brings a marked division of tasks which, even when they increase productivity, it also implies a risk of fragmenting control of the executions of each of the phases and loss of the project's global view, with the resulting drop in the worker involvement.

It is quite likely that the high degree of sub-contracting hides precarious jobs and workers' low qualifications. Moreover, when building companies hire staff for a building work, labour continuity is not long enough.

*8.3.3. Developers and Building firms Responsibilities*

According to the experts, big building firms and developers have had a big part of responsibility as regards construction in Spain. In the few cases in which the Technical Building Code (CTE) has been applied in the building of tower blocks, these norms have been used to the minimum, merely responding to basic obligatory specifications.

The reason for this situation is the lack of demand. This means that while energy efficiency and sustainability do not create added value and a stand-out element for building firms and developers, these will not invest beyond what is demanded by the law, purely for reasons of profitability.

Nonetheless, the experts consider that existing regulations, if applied effectively, would be enough. However, in spite of the legislation being ample enough, there is no control on the effective implementation of the building work.

This is why even when big building companies and developers exert social responsibility and include efficient designs and materials in their projects, project managers do not follow their correct development, implementation or application, altering the possible energy advantages that design and materials can provide.

## 8.4. Educational and cultural barriers

*8.4.1. Workers low initial qualifications.*

In the building sector there is a clear polarisation of workers: on the one hand, a highly qualified group of workers, and on the other hand, a non-qualified wage bill. The building industry has been traditionally composed by workers who have failed at school, which causes, in general, lack of initiative and apathy regarding specialisation.

The workers belonging to the lowest sector of the industry do not possess the habit or motivation to improve their training. This is why it would be more than desirable to enforce energy efficiency training, mostly to cover the lowest qualification levels, where training is limited due to different sociocultural causes.

*8.4.2. Motivation.*

Because of the economic situation the country and this sector in particular is going through, training is not immediately turned into improvements in employment, and thus there is little motivation from workers. These motivational issues can be extended to individuals, SMEs and micro-SMEs within the sector.

Even when training allows for qualification improvement and the acquisition of new skills, it is usually not enough to achieve the effort it requires. The obligatory nature or the need for qualification is considered as an essential driving force.

*8.4.3. The language of foreign workers.*

Many foreign workers are hired for the building sector, and even when many of them speak Spanish, there are still a big percentage of workers who do not, preventing the access to a desirable training process.

# 9. Conclusions.

## 9.1. Conclusions.

The gathering of training from the diverse primary and secondary sources, as well as their contrast, has allowed for the following conclusions:

- The buildings created during the past twenty years, before the Technical Building Code (CTE), are quite deficient from an energy point of view, and so some kind of renovation is necessary.
- The advances made in EE and RE as regards building is scarce nowadays. Although an important movement exists around energy efficiency and renewable energy, there is not enough training about what it really is and mostly, about how to implement this knowledge to obtain a profit.
- There is an economy based on the sector, especially in the subsector of renovation.
- The new EE and RE regulations can be an opportunity to help the submerged economy problem, as long as there are bonuses and subsidies which are conditioned to the economic activity and employment.
- In spite of the economic situation not promoting investment, some sectors are betting on energy efficiency and renewable energy, such as industry, hotel and catering trade and commerce (food industry).
- The lack of incentives, the failures of administrative management, the lack of norms fulfilment or the absence of training to users and building proprietors are some of the barriers which prevent energy renovation.
- A special application of public expenditure is necessary for building criteria related to EE and RE, due to the fact that private investment on this subject is practically null.
- Training design processes must be improved, focusing this design on real referents and the specific European characteristics.
- Cross-disciplinary training on EE and RE for certain professional profiles focused on building, especially levels 1 and 2, is a good option to generate the necessary skills as regards building.
- Formal energy efficiency training is aimed at high profiles, levels 3 and 4. There is not enough training as regards this subject which can be used for levels 1 and 2.
- Subsidised training can be a solution so that companies are able to fulfil their training needs in relation to EE and RE.
- Offers channelled through training plans managed by social agents can be useful for bringing together the training course and non-qualified workers.
- Training which is not referred to CNCP is more dynamic and adapts better to market requirements than training which is referred to CNCP.
- Training which is not referred to CNCP is fragmented and is being managed by a wide group of entities, among which we can find associations and business organisations, as well as Construction Labour Foundation.
- The most popular demand is the one which is accredited. It is of special relevance to workers, as the training that they receive has is officially recognised.
- The workers who have a lower training level are less open to receiving any kind of training.

- The SNCFP establishes the requirements which trainers must fulfil, for each skill level in each professional family. However, it is necessary to define the qualifications which trainers will need as regards building EE and RE.

- Apart from formal training, it is fundamental for trainers (regarding construction EE and RE) to have professional experience in sustainable building, so that they can provide answers to real situations.

- There is very little participation of students in building and civil works professional families.

- There is no subsequent evaluation system which guarantees the trainer's quality and adaptation.

- It is considered appropriate that the Public Administration controls, through previously defined criteria, non-official training accreditation given.

- It is considered desirable for EE training to be obligatory, to cover the lowest qualification levels, where, for different sociocultural reasons, workers almost never access training willingly.

- Energy renovation is an opportunity for the development of the building sector, as building stocks present important deficiencies. During renovation activity phases will presumably prevail among others, thus specifying the most necessary skills.

- Accreditation of skills gained through experience will be useful for giving importance to existing skills and acknowledging construction workers' qualifications.

- The new building legislation will give a chance to improve qualification levels in workers and to generate new jobs. In both cases, the acquisition of new competences and skills will be essential.

- Companies which develop new materials and solutions for the building sector may determine the required competences that people setting them up will need.

- It is important to detect the need for coordination between the monitoring centres in existence. In order to do that, it would be necessary to enhance the synergy and to establish leadership.

- Monitoring Centres constitute a very useful tool when detecting skill mismatches and some occupational gaps.

- Monitoring Centres are needs or demands monitoring instruments, as they provide date about the current situation, evolution and perspective of the labour market.

- Blocking financing and the economic crisis are the most important barriers which prevent EE and RE training. Another three barriers which notably slow training down are: little training available for individuals and micro-SMEs, lack of training guidance and low initial worker qualifications.

## 9.2. Validation of the results

As the final stage of the analysis, a validation of the final results has been carried out through a validation panel in which the main conclusions have been valued, with the objective of detecting whether the results obtained throughout the situation's diagnosis process regarding energy efficiency are correct according to experts.

The ten experts on the subject who form the panel have taken part in some of the analysis phases, like architecture and building specialists, energy efficiency entities and training and professional qualifications organisations.

The group met personally for two hours. During this meeting the panel was given a questionnaire with the main conclusions obtained, so that each of the members could agree or disagree with the stated

conclusions. Afterwards a debate took place about some of the issues still open to discussion or without a clear conclusion, and which would be useful to define the purpose and objective of the study.

*9.2.1. Validation questionnaire results*

In the validation questionnaire some statements are presented with the aim of the experts pointing out their agreement or disagreement over them, using a scale. This is a 1 to 4 scale, 1 being "absolute disagreement" and 4 being "absolute agreement",

After this the data is recorded and some basic statistics are drawn, calculating the average value, the standard deviation and the minimum value, as well as the top quartile or inferior quartile, and the third quartile or higher quartile.

Specifically, and through consulting blocks, the following results have been obtained:

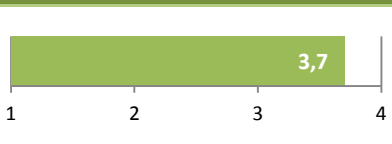
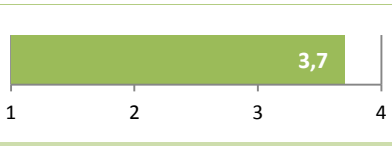
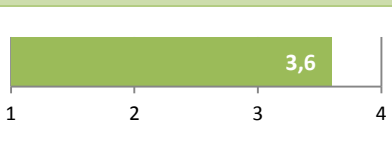
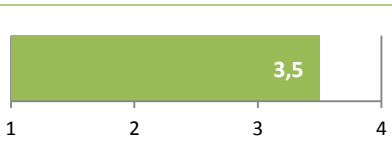
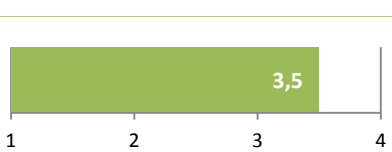
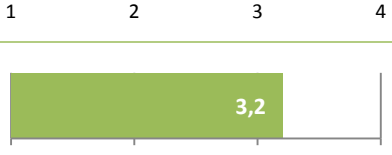
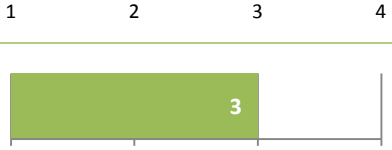
| STATEMENTS | | | | | | 1= Absolute disagreement<br>Absolute agreement=4 |
|---|---|---|---|---|---|---|
| **The type of buildings which have been made during the past twenty years, before CTE are rather deficient from an energy point of view, so renovation is necessary.** | | | | | |  |
| **Avg: 3.7** | Mode: 4 | Dev: 0.64 | Min: 2 | $Q_1$: 4 | $Q_2$: 4 | |
| **The advances made in EE and RE as regards construction are scarce nowadays. Although an important movement exists around energy efficiency and renewable energy, there is not enough training about what it really is and, especially, about how to implement this knowledge to obtain a profit.** | | | | | |  |
| **Avg: 3.7** | Mode: 4 | Dev: 0.46 | Min: 3 | $Q_1$: 3 | $Q_2$: 4 | |
| **The rise in private comfort demand in buildings will require the implementation of more intensive energy use systems, such as air-conditioning.** | | | | | |  |
| **Avg: 3,**6 | Mode: 4 | Dev: 0.49 | Min: 3 | $Q_1$: 3 | $Q_2$: 4 | |
| **In general, buildings present great deficiencies in spite of the existing rules.** | | | | | |  |
| **Avg: 3,**5 | Mode: 4 | Dev: 0.67 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 | |
| **There is an economy based on the sector, especially in the subsector of renovation.** | | | | | |  |
| **Avg: 3,**5 | Mode: 4 | Dev: 0.71 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 | |
| **In spite of the economic situation not promoting investment, some sectors are betting on energy efficiency and renewable energy, such as industry, hotel and catering trade and commerce (food industry).** | | | | | |  |
| **Avg: 3,**2 | Mode: 3 | Dev: 0.60 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 | |
| **The building sector and related areas have been positively affected since the introduction of the CTE, and have brought in equipment and new professional specialisations, thanks to the incorporation of energy efficiency norms and most importantly, the use of renewable energy.** | | | | | |  |
| **Avg: 3,**0 | Mode: 3 | Dev: 0.63 | Min: 2 | $Q_1$: 3 | $Q_2$: 3 | |

Table 43. Validation of conclusions about energy efficiency situation within the sector, FLC validation groups of experts.

As can be seen in the chart, the great majority of the members forming the panel agree with the main conclusions obtained about energy efficiency's current situation within the sector, all the values being above 3 in the agreement scale.
They especially emphasise three propositions which obtained the highest values:

The degree of agreement is high in relation to the fact that the advances in energy efficiency and the use of renewable energy for building in Spain is limited. And, even when there are major changes in relation to this, there is still not enough knowledge about what it really is, and how to implement it in a cost-effective way. This is the statement experts agree most with. In this way, based on the average rating, a 3.70 percentage of agreement has been obtained, 4 meaning absolute agreement, the average rating and 3 the minimum value given. The consensus is generalised as sample of typical deviation (0.46).

The fact that a rise of the private comfort demand in buildings will require the establishment of more intensive systems towards the use of energy, like acclimatisation, also presents a high average value (3.60). With regards to this conclusion, the inferior quartile is placed in valuation 3, which means that three quarters of the experts' valuations coincide with that figure or are above it. The difference in relation to the average value is 0.49 points.

The third statement where the most positive values are found is the one that refers to the energy deficiency buildings possess during these last twenty years, before CTE. These buildings will require energy renovation. This statement has obtained an average value of 3.70, the first quartile being 4, meaning there is total agreement. This reflects that 75% of values have scored 4 and only 25% of the values have scored below that figure.

| STATEMENTS | | | | | | 1= Absolute agreement<br>Absolute agreement=4 |
|---|---|---|---|---|---|---|
| **The lack of incentives, the failures of administrative management, the lack of compliance with regulations or the absence of training for users and building owners are some of the barriers which prevent energy renovation.** | | | | | |  |
| **Avg: 3.4** | Mode: 3 | Dev: 0.49 | Min: 3 | $Q_1$:3 | $Q_2$: 4 | |
| **The new EE and RE regulations can be an opportunity to help the submerged economy problem, as long as there are bonuses and subsidies which are conditioned to economic activity and employment.** | | | | | |  |
| **Avg: 3.3** | Mode: 3 | Dev: 0.64 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 | |
| **A special application of public expenditure is necessary for building criteria related to EE and RE, due to the fact that private investment on this subject is practically null.** | | | | | |  |
| **Avg: 3,**2 | Mode: 3 | Dev: 0.60 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 | |

Table 44. Conclusions validation regarding public strategies, FLC validation experts group.

In relation to the obtained conclusions through the analysis of public strategies and official measures developed to favour energy efficiency and the use of renewable energy in the building area, it is also observed that the experts forming the panel agree with each of the stated conclusions. All the statements show average values above 3, in accordance with the typical deviations below 0.65. In all of them the lower quartile is situated in 3 and the higher one in 4.

**Provision of national education and vocational training for workers within the building sector related to EE and RE.**

The conclusions about training provision that exists for trades and workers that focuses on energy efficiency and renewable energy the experts grant validity to most statements with an average level of consensus of 3 or higher.

It can be observed on the charts listed below that some of the mentioned statements have not obtained scores which reflect the experts' agreement towards them.

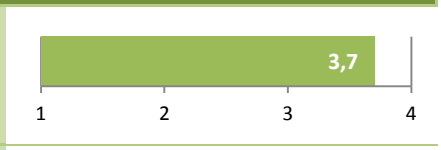
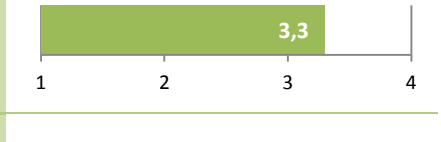
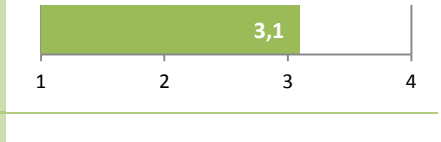
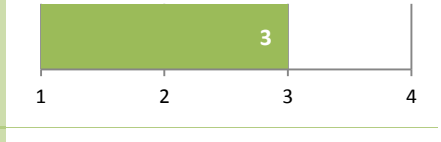
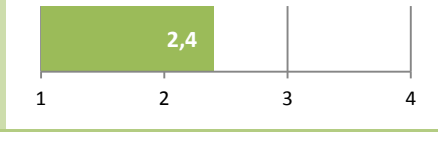
| STATEMENTS | | | | | | 1= Absolute disagreement<br>Absolute agreement=4 |
|---|---|---|---|---|---|---|
| **Training design processes must be improved, focusing this design on real reference points and specific European characteristics.** | | | | | |  |
| **Avg: 3.7** | Mode: 4 | Dev: 0.46 | Min: 3 | $Q_1$: 3 | $Q_2$: 4 | |
| **Cross-disciplinary training on EE and RE for certain professional profiles focused on building, especially levels 1 and 2, is a good option for generate the necessary skills as regards construction.** | | | | | |  |
| **Avg: 3.3** | Mode: 4 | Dev: 0.78 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 | |
| **Formal energy efficiency training is aimed at high profiles, levels 3 and 4. There is not enough training as regards this subject which can be used for levels 1 and 2.** | | | | | |  |
| **Avg: 3,**1 | Mode: 3 | Dev: 0.70 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 | |
| **Vocational training referring to CNCP, and related with building activities and EE and RE could be characterised as broad in general.** | | | | | |  |
| **Avg: 3,**0 | Mode: 3 | Dev: 0.63 | Min: 2 | $Q_1$: 3 | $Q_2$: 3 | |
| **Initial Vocational Training and Vocational Employment Training in EE and RE form one broad group of training, directly related to the different needs of the sector.** | | | | | |  |
| **Avg: 2.6** | Mode: 2 | Dev: 0.83 | Min: 2 | $Q_1$: 3 | $Q_2$: 3 | |
| **The Vocational Training offered nowadays does not tackle all the competences related to the implementation of energy efficiency and renewable energy. This is mainly due to the fact that this training does not deal with all the possible works that EE and RE construction contemplate.** | | | | | |  |
| **Avg:** 2.4 | Avg:2 | Dev: 0.80 | Min: 1 | $Q_1$: 2 | $Q_2$: 3 | |

Table 45. Validation of conclusions about official training characterisation, FLC validation experts groups.

In the conclusion a higher level of agreement is observed among the experts in relation to the existent official training, and it is clear that it is necessary to improve such training, encouraging design from a real perspective and with a focus in Europe, with an average qualification of 3.70, 3 being the lower quartile, which reflects that 75% of the experts agree or completely agree.

Regarding the conclusion about competences and activities related to energy efficiency the vocational public training system deals with, and which concludes that such needed competences are not taken into consideration, the experts consider it a valid statement. This is because most of them pointed out they disagree with it (Mo=2), because such skills are not being tackled through the vocational training system.

As regards initial vocational training and vocational training for employees related to renewable energy, it had been concluded, throughout this analysis that it is broad and adequate for the sector needs. However, when these conclusions are validated, the experts have not considered this to be so, as most of them has pointed out they do not agree with it (Mo=2).

## Characteristics of non-official training

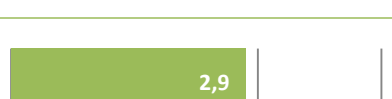
| STATEMENTS | | | | | | 1= Absolute disagreement Absolute agreement=4 |
|---|---|---|---|---|---|---|
| **Subsidised training can be a solution so that companies are able to fulfil their training needs in relation to EE and RE.** | | | | | |   |
| **Avg: 3.6** | Mode: 4 | Dev: 0.68 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 | |
| **Offers channelled through training plans managed by social agents can be useful for bringing together the training course and non-qualified workers.** | | | | | |   |
| **Avg: 3.5** | Mode: 3 | Dev: 0.5 | Min: 3 | $Q_1$: 3 | $Q_2$: 4 | |
| **The training which is not referred to CNCP is more dynamic and it adapts better to market requirements than training which is referred to CNCP.** | | | | | |   |
| **Avg: 3,**3 | Mode: 3 | Dev: 0.67 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 | |
| **The training which is not referred to CNCP is fragmented and is being managed by a wide group of entities, among which we can find associations and business organisations, as well as the Construction Labour Foundation.** | | | | | |   |
| **Avg: 3,**3 | Mode: 3 | Dev: 0.67 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 | |
| **SMEs have very little chance of accessing EE and RE training.** | | | | | |   |
| **Avg: 3,**0 | Mode: 4 | Dev: 1.15 | Min: 1 | $Q_1$: 2 | $Q_2$: 4 | |
| **There is a gap regarding training courses for non-qualified workers.** | | | | | |   |
| **Avg: 3.0** | Mode: 3 | Dev: 0.77 | Min: 2 | $Q_1$: 2 | $Q_2$: 4 | |
| **The training which is not related to CNCP is particularly important in building sustainability.** | | | | | |   |
| Avg: 2.9 | **Mode: 2** | **Dev: 0.87** | **Min: 2** | **$Q_1$: 2** | **$Q_2$: 4** | |
| **Training which is not referred to CNCP has the adequate means for certification.** | | | | | |   |
| Avg: 2,**3** | **Mode: 1** | **Dev: 1.15** | **Min: 1** | **$Q_1$: 1** | **$Q_2$: 3** | |

Table 46. Validation of conclusions about non-official training, FLC validation experts groups.

Within non-official training, subsidised training comes across as a solution so that companies con fulfil its energy efficiency and renewable energy training needs, with an average agreement value from the experts of 3.56 out of 4. Besides, training focused through training plans and which is administered by social agents can be a useful tool to bring training offers closer to non-qualified workers. This is what three quarters of the experts agree with, as can be observed in the lower quartile's position (3.00).
Regarding training which is not referred to the National Catalogue of Professional Qualifications, two conclusions have not been validated by the experts:
. — The one indicating that this training possesses the right means for its accreditation (Mo=1).
. — The one stating that important training is available for building sustainability (Mo=2).

## Detected Needs

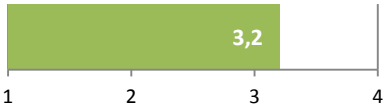
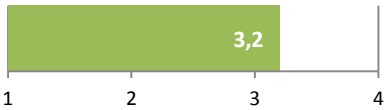
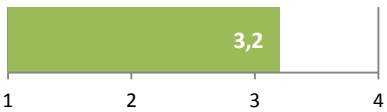
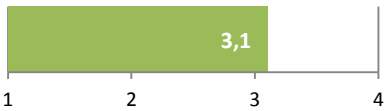
| STATEMENTS | | | | | | 1= Absolute disagreement Absolute agreement=4 |
|---|---|---|---|---|---|---|
| **The most popular training is that which is accredited. It is of special relevance to workers, as the training that they receive is officially recognised.** | | | | | | |
| **Avg: 3.8** | Mode: 4 | Dev: 0.4 | Min: 3 | $Q_1$: 4 | $Q_2$: 4 |   |
| **The workers who have a lower training level are less open to receiving any kind of training.** | | | | | | |
| **Avg: 3.5** | Avg:4 | Dev: 0.5 | Min: 3 | $Q_1$: 3 | $Q_2$: 4 |   |
| **However, it is necessary to define the qualifications which trainers will need as regards building EE and RE.** | | | | | | |
| **Avg: 3,**4 | Mode: 4 | Dev: 0.66 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 |   |
| **Apart from a formal training, it is fundamental for trainers (regarding EE and RE in construction) to have professional experience in sustainable building, so that they can provide answers to real situations.** | | | | | | |
| **Avg: 3,**3 | Mode: 3 | Dev: 0.46 | Min: 3 | $Q_1$: 3 | $Q_2$: 4 |   |
| **There is very little participation of students in building and civil works professional families.** | | | | | | |
| **Avg: 3.3** | Mode: 4 | Dev: 0.88 | Min: 2 | $Q_1$: 2 | $Q_2$: 4 |   |
| **There is no subsequent evaluation system which guarantees the trainer's quality and adaptation.** | | | | | | |
| **Avg: 3.2** | Mode: 4 | Dev: 0.92 | Min: 2 | $Q_1$: 2 | $Q_2$: 4 |   |
| **It is considered appropriate that the Public Administration controls, through previously defined criteria, non-official training accreditation given.** | | | | | | |
| Avg: **3.2** | **Mode: 4** | **Dev: 0.87** | **Min: 2** | **$Q_1$: 2** | **$Q_2$: 4** |   |
| **It is considered desirable the obligatory nature of EE training, to cover the lowest qualification levels, where, for different sociocultural reasons, workers hardly access training willingly.** | | | | | | |
| Avg: **3.2** | **Mode: 4** | **Dev: 0.75** | **Min: 2** | **$Q_1$: 3** | **$Q_2$: 4** |   |
| **The SNCFP establishes the requirements which trainers must fulfil, for each competence level in each professional family.** | | | | | | |
| Avg: **3,1** | **Mode: 3** | **Dev: 0.33** | **Min: 3** | **$Q_1$: 3** | **$Q_2$: 3** |   |
| **There are very few centres where training related to building EE and RE is given.** | | | | | | |
| Avg: **3.0** | **Mode: 4** | **Dev: 1.05** | **Min: 1** | **$Q_1$: 2** | **$Q_2$: 4** |   |
| **The SNCFP forms an updated reference framework, flexible enough and in keeping with real EE and RE training.** | | | | | | |
| Avg: 2.8 | Mode: 3 | Dev: 0.63 | Min: 2 | Q1: 2 | Q2: 3 |   |

Table 47. Conclusions validation regarding detected needs, FLC validation experts group.

It is necessary to point out that all the experts agree with the fact that the most demanded form of training is the one which is accredited. This is because it acquires special relevance for workers, as it is officially recognised. In this way, the average value obtained is 3.80, 4 being the value where the average, the higher and lower quartiles are situated.

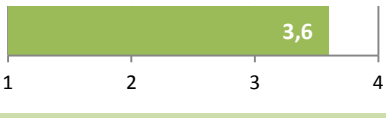
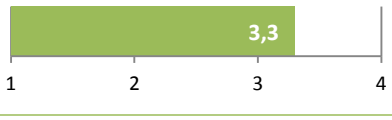
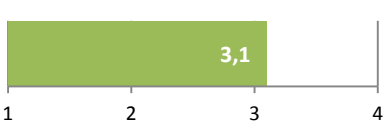
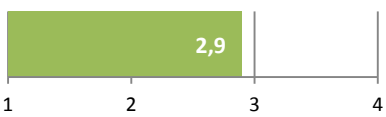
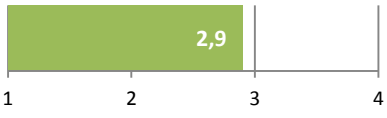
There is also absolute agreement in relation to the idea that workers with low training knowledge are less open to receiving training. In this way, the most-frequent value among experts has been 4, completely agree, 3.50 being the average and 0.50 being the standard deviation.

The average value regarding the need to define qualifications will need tutors with knowledge of energy efficiency and building renewable energy is 3.40, 4 being the most-frequent value.

The average value within the experts shows disagreement (average of 2.78) regarding the fact that the National System of Qualifications and Vocational Training becomes an updated reference framework, flexible enough and aware of the current energy efficiency and renewable energy situation. However, the most frequent or average value is 3, 0.63 being the deviation.

**Skills gaps.**

In relation to the skills gaps detected agreement has been reached among the experts over the majority of the stated conclusions. In spite of this, some discrepancies have been found.

| STATEMENTS | | | | | | 1= Absolute disagreement<br>Absolute agreement=4 |
|---|---|---|---|---|---|---|
| **Energy renovation is an opportunity for the development of the building sector, as buildings present important deficiencies. During renovation activity phases will presumably prevail among others, thus specifying the most necessary competences.** | | | | | |  |
| **Avg: 3.8** | Mode: 4 | Dev: 0.4 | Min: 3 | $Q_1$: 4 | $Q_2$: 4 | |
| **Legislation development implies the need to carry out new tasks and procedures which, in some occasions, mean new occupations, and in some other cases, the acquisition of new competences and skills are needed within already existing occupations.** | | | | | |  |
| **Avg: 3.6** | Avg:4 | Dev: 0.66 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 | |
| **Competence accreditation through experience will be useful to give importance to the existing competences and to acknowledge building workers' qualifications.** | | | | | |  |
| **Avg: 3,**3 | Mode: 3 | Dev: 0.64 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 | |
| **The new building legislation will give a chance to improve qualification levels in workers and to generate new jobs.** | | | | | |  |
| **Avg: 3,**2 | Mode: 3 | Dev: 0.75 | Min: 2 | $Q_1$: 3 | $Q_2$: 4 | |
| **Companies which develop new materials and solutions for the building sector may determine the required competences that people setting them up will need.** | | | | | |  |
| **Avg: 3.1** | Mode: 4 | Dev: 0.87 | Min: 2 | $Q_1$: 2 | $Q_2$: 4 | |
| **The economic crisis which affects the building sector involves a chance to improve workers qualification levels.** | | | | | |  |
| **Avg: 2.9** | Mode: 2 | Dev: 0.83 | Min: 2 | $Q_1$: 2 | $Q_2$: 4 | |
| **The workers who perform their job as higher technicians (designing, calculating or coordinating projects) have the necessary qualifications for the development of EE and RE within the building sector.** | | | | | |  |
| Avg: **2.9** | **Mode: 3** | **Dev: 0.74** | **Min: 2** | **$Q_1$: 2** | **$Q_2$: 3** | |
| **The workers on the building site have the necessary qualifications for the development of energy efficiency and renewable energy within the sector.** | | | | | |  |

| | | | | | | |
|---|---|---|---|---|---|---|
| Avg: **1.8** | **Mode: 2** | **Dev: 0.42** | **Min: 1** | **$Q_1$: 2** | **$Q_2$: 2** | |

Table 48. Conclusions validation regarding skills gaps, FLC validation experts group.

It is necessary to point out the agreement among experts in relation to the fact that energy renovation constitutes an opportunity for the development of the building sector, as there are several deficiencies on buildings. During renovation activity phases will presumably prevail among others, thus specifying the most necessary competences. This statement has obtained an average value of 3.80, 4 being an absolute agreement the average value, as well as the lower and higher quartiles.

Legislation development (CTE, RITE, NBE-CT-79, directive 2002/91/CE, etc.) implies the need to carry out new tasks and procedures which, in some occasions, mean new occupations, and in some other cases, the acquisition of new competences and skills are needed within already existing occupations. This agreement has been reached by experts, with an average value of 3.60.

The validation questionnaire results show that experts do not consider that the economic crisis can suppose an opportunity to improve workers professional qualifications, with an average value of 2.90, and a more frequent value of 2, which is a disagreement.

The statement which says that the workers who perform execution tasks on the building site have the necessary qualifications for the development of energy efficiency and renewable energy within the building sector. has obtained the lowest value, with an average of 1.78 and a higher quartile of 2. This indicates that three fourths of the values are placed in such position or below, leaving only 25% of the values above it.

**Monitoring needs.**

In relation to the monitoring instruments and needs detected, a high value has not been obtained by the experts compared to the other blocks, even when three out of the five conclusions has been globally rectified.

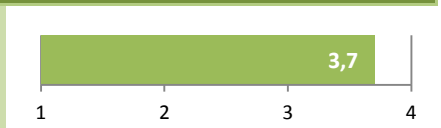
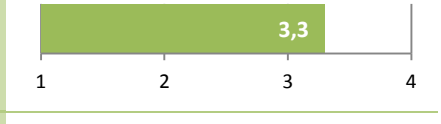
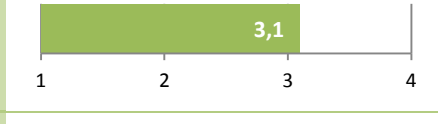
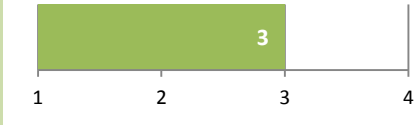
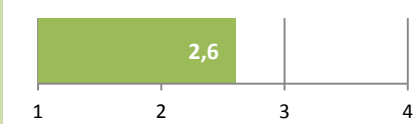
| STATEMENTS | | | | | | 1= Absolute disagreement<br>Absolute agreement=4 |
|---|---|---|---|---|---|---|
| **It is important to detect the need for coordination between the monitoring centres in existence. In order to do that, it would be necessary to enhance the synergy and to establish leadership.** | | | | | |  |
| **Avg: 3.6** | Mode: 4 | Dev: 0.49 | Min: 3 | $Q_1$: 3 | $Q_2$: 4 | |
| **Monitoring Centres constitute a very useful tool when detecting competence mismatches and some occupational gaps.** | | | | | |  |
| **Avg: 3.1** | Mode: 3 | Dev: 0.57 | Min: 2 | $Q_1$: 3 | $Q_2$: 3 | |
| **Monitoring Centres are needs or demands monitoring instruments, as they provide date about the current situation, evolution and perspective of the labour market.** | | | | | |  |
| **Avg: 3,**0 | Mode: 3 | Dev: 0.45 | Min: 2 | $Q_1$: 3 | $Q_2$:3 | |
| **The network of monitoring centres has improved greatly, and its development has reached an optimum level during the past years.** | | | | | |  |
| **Avg: 2.6** | Mode: 3 | Dev: 0.48 | Min: 2 | $Q_1$: 2 | $Q_2$: 3 | |
| **They are not very agile instruments, as they lack the immediacy that companies ask for. Reality market goes ahead.** | | | | | |  |
| **Avg: 2.6** | Mode: 2 | Dev: 0.86 | Min: 2 | $Q_1$: 2 | $Q_2$: 3 | |

Table 49. Conclusions validation regarding monitoring needs, FLC validation experts group.

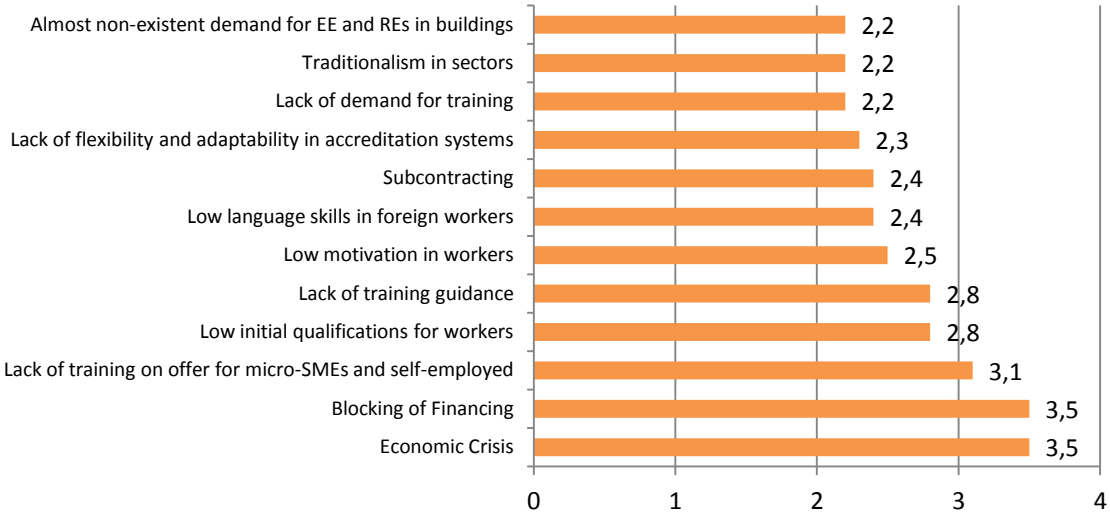
The agreement showing the need to increase the coordination between monitoring centres and to establish the leadership is highlighted, with an average value more frequent than 4, it being an absolute agreement. As far as disagreement is concerned, the statement which establishes that monitoring centres are not very dynamic instruments and they lack the immediacy that markets need has a mode of 2, 2.6 being the average.

### Existing barriers.

As regards the known barriers which prevent building energy efficiency development, the experts have been asked to value from 1 to 4, the importance of each one of these barriers, considering them as obstacles to achieve qualifications from EE and RE workers; 1 being very little importance and 4 being very important.

The blocking of financing and the economic crisis have become barriers which have obtained values of higher importance, with an average value of 3.5 and a mode of 4.

It has also been pointed out that the lack of training available for individuals and micro-SMEs constitutes a very important barrier (3.1), as well as the little guidance about training, and workers initial qualifications, both with an average of 2.8.




Graph 47 Average score regarding the importance of different barriers to worker training in EE and RE, FLC validation expert group.

| BARRIERS | AVERAGE | MODE | STD.DEV. | MIN | $Q_1$ | $Q_3$ |
|---|---|---|---|---|---|---|
| **Blocking of financing** | 3.50 | 4.00 | 0.50 | 3.00 | 3.00 | 4.00 |
| **Economic crisis and activity reorientation** | 3.50 | 4.00 | 0.67 | 2.00 | 3.00 | 4.00 |
| **Little training available for individuals and micro-SMEs.** | 3.10 | 3.00 | 0.70 | 2.00 | 3.00 | 3.75 |
| **Lack of training guidance.** | 2.80 | 3.00 | 0.87 | 1.00 | 2.25 | 3.00 |
| **Workers low initial qualifications.** | 2.80 | 3.00 | 0.60 | 2.00 | 2.25 | 3.00 |
| **Workers low motivation.** | 2.50 | 3.00 | 0.92 | 1.00 | 2.00 | 3.00 |
| **Sub-contracting** | 2.44 | 2.00 | 1.07 | 1.00 | 2.00 | 3.00 |
| **Little knowledge of the language in foreign workers.** | 2.40 | 2.00 | 0.80 | 1.00 | 2.00 | 3.00 |
| **Lack of flexibility and adaptability in accreditation systems.** | 2.30 | 2.00 | 0.90 | 1.00 | 2.00 | 3.00 |
| **Almost non-existent demand for EE and RE building.** | 2.22 | 3.00 | 0.79 | 1.00 | 2.00 | 3.00 |
| **Traditionalism of the sector** | 2.22 | 3.00 | 1.03 | 1.00 | 1.00 | 3.00 |
| **Lack of training demand.** | 2.20 | 3.00 | 0.75 | 1.00 | 2.00 | 3.00 |

Table 50. Average value and statistics regarding the importance of different barriers to enable workers training in EE and RE, FLC validation expert group.

**VALIDATION GROUP RESULTS**

Below are the conclusions obtained during the group session, where a debate was started about the following issues:

- Submerged economy within the sector and its connection to energy efficiency. Measures to reduce it.
- Workforce needed for energy renovation in buildings.
- Keys to sustainable building. Influence of energy certification in building energy efficiency.
- Public strategies which are being developed and legislative needs.
- Relation between climatic areas and worker competence.

Regarding the data on the **submerged economy** within the sector which some studies calculate at around 29% of GDPpm, a debate is created around energy efficiency in the economy, i.e. if in the expert's opinion there is also a submerged economy inside the "energy side" of construction.

Regarding this, the members of the panel coincide with the fact that this situation takes place in the same way as in normal building conditions, whether it incorporates energy efficiency measures. In this respect, in big building sites, the probability of carrying out illegal activities is not very high, although it increases as the size of the building site becomes smaller, mainly in the case of small changes done at individual scale.
The explanation for this lies in the fact that in a large building site, the obtaining of Promotion and Industry permissions are required, even when the lack of coordination that exists between administrations encourages the probabilities of these kinds of actions.

In any case, it seems that most part of the submerged economy can be seen in buildings at a small scale, especially in the amount of the amount declared. It is very usual to declare smaller amounts, as well as not to declare any amount at all.
Until now, the energy issue has not made a notable difference in relation to submerged economy: there is a significant proportion of non-declared activity, mainly dealing with renovation at a small scale.

However, some of the activities which are related with energy efficiency are harder to carry out, as they require the intervention of qualified staff. "*It is not the same to wall up a new room than to replace the boiler".*

Besides, in general, these activities cost more money, which means that if an individual desires to install a boiler or some windows, he or she may prefer to have a bill to be able to claim any breakdown or failure during the installation.

Taking this situation into account, the panel considers that subsidies or bonuses, like Renewal plans, are effective tools, not only to encourage economic activities, but also so that this activity is legal. "*The impression is that the only way to control it is through subsidies"*.

It is not necessary, according to the experts, for the subsidy to be large. As long as the subsidised amount compensates VAT, it is more than convenient for the individual.

Another way of helping the reduction of submerged economy is through legislation. According to the experts, the current legislation is not inadequate, but lacks subsequent inspection, and, above all, that the municipal technicians possess the right qualifications. This is why even in the cases when the technicians go to inspect the sites, they do not check appropriately, for example, if the kilowatts declared are the kilowatts that were actually installed, either because of not fulfilling their functions or because of lack of knowledge.

To conclude, the main measures to mitigate submerged economy are: increase in economic incentives, subsidies, tax deductions and the correct execution of the law, through inspection, control and penalties.

In relation to **workforce**, it is difficult to state how much of it would be needed for the energy renovation of buildings, because an important reactivation of the sector is not expected, due to the economic crisis.

The Draft Royal Decree approves the basic procedures for the certification of energy efficiency in buildings, as the framework which will regulate the activity and the workforce necessary to fulfil its dispositions.

> *"The Draft Royal Decree states the obligation to provide the buyers or users of any building a **certificate of energy efficiency** which must include objectives in training about the energy characteristics of buildings. In this way, it will be easy to evaluate and compare the building's energy efficiency, with the objective of favouring high energy efficiency buildings and energy saving investments".*
>
> *"The time limits are established […] for the Autonomous Regions' competent agencies to create a **statistical inventory** of the different certifications done by these entities, as a vital planning mechanism to improve energy efficiency in sites and the commitment with its legislations ".*
>
> *"All new buildings created as from the 31st December, 2020 will be **Nearly zero energy buildings**. The minimum requirements which these buildings must possess will be determined by the Technical Building Code".*
>
> *''In addition, the public will have access to periodically updated registries, published by **qualified or accredited experts or companies** who will offer these kinds of services to access this kind of training".*

According to the mentioned text, experts consider that most job posts are going to be related to the staff who will certify. There are two main aspects regarding this issue:

- On the one hand, this will equate energy certification with assessed values, considering the model will be similar, with the danger of the activities being regulated by the laws of the market; so in the same way that state agencies have their assessors, they could also have their energy certifiers.

- But on the other hand, the kind of profile the members of the panel consider is going to be demanded will be level three and four, in order to create the energy certification report as well as the audits. Apart from this, in order to implement the saving measures, profiles one and two with specific training will be used. Regarding the quantification of workers to these profiles, the current workforce will be more than sufficient to absorb the activity: *"There is more than enough workforce at the moment".*

Among the **keys for sustainable construction**, energy building qualification seems a positive measure, transparent to the user. The method that will be used for labelling, using letter scales and colours, is easy to understand for citizens, who are already familiar with this kind of labelling system, as it is also used for appliances. This labelling can influence the decision to buy once the market is active again; this has already happened in other European countries, such as France.

There is also, as it has been previously pointed out, certain suspicion towards an objective and effective way of building certification, calling into question its translation towards a better and real management of the energy characteristics of a building. In this case, it will be necessary to perform the adequate audits with certain regulations and protocol, also establishing the required monitoring and control.

In general, big energy renovation plans are only put into action when there are needs which are not exclusively energy, i.e., when normal renovation takes place. For energy reasons only, in spite of the legislation, this is very unlikely to happen, unless a strong impulse takes place.

These encouragements happen within a certain situation: subsidies.

- For example, in the façade plan in Madrid, renovation happens if there is a high level of subsidisation, and, moreover, if the renovation is done taking into account efficiency criteria, the level of subsidy is even higher.
- Or, for instance, that the IBI value is lower according to building energy efficiency criteria, or if the efficiency is improved in relation to the original qualification.
- However, Madrid's town hall's measure of increasing IBI in empty households is not considered correct, because in order to favour sustainability in Spanish cities, positive encouragement is more effective than penalties.

The experts also consider public awareness as a very important factor with regards to energy issues. This is an essential aspect for the development of energy efficiency and the use of renewable energy in buildings. However, the lack of advertising campaigns to inform the public about the advantages of energy efficiency and energy saving affects the idea negatively.

It is logical to think that the biggest influence regarding the consumption of energy in households will come from changes in people's habits, although this is a very long process. To change these habits will take time. Big companies' interest can become an obstacle in this regard.

**National strategies** can favour the development of energy efficiency and sustainable cities. For that to occur, they should focus on:

- Improve energy benefits in buildings
- Establish minimum energy benefits in new and renovated buildings through efficient energy labelling.
- Improve urban fabric to favour environmental quality and to reduce energy consumption and CO2 emissions.

In relation to this, the experts manifest their disagreement, because in spite of "trials" being made, these are not experiencing very positive outcomes.

Some projects like the eco-*neighbourhood* in Vallecas, Madrid, are controversial, and not even experts agree on whether those projects are well designed and whether they could have positive results.

The eco-neighbourhood in Vallecas consists of a group of houses which will utilise alternative energy financed through Plan E from the government. It will be provided with a thermal power plant with six boilers which will consume a total of 810 m3/h gas every day of the year. Taking advantage of this gas consumption, sanitary water and heating will be heated up. In the higher section of the plan there will be 48 fuel cells of 30 kw each, and each fuel cell will have an individual gas exit. These exits will be joined together in six chimneys, each of them with a height of between 35 and 42 metres.

This central heating and hot water system is known as "District Heating", this is, a giant boiler which supplies heating and water to buildings and households.

This project is also taken into account in San Agustín de Guadalix, and it is thought to provide for 1800 households. However, only 90 are enabled, so the central installation cannot start, with a minimum production of 20 or 25% when only 5% is available.

This idea is attractive in theory, but when it is put into action, distribution and maintenance costs are extremely high. Because of this, it is necessary to define these projects in a better way, taking into consideration the real market.

On the other hand, protection measures, like vegetation or strategic building orientation, as well as thermal insulation ( wall insulation, façade insulation - main entrance, patios and dividing walls- and closures - carpentry, glasses and other closure elements - and floor insulation) are easier and better options, which should be boosted.

Experts agree that there are very good intentions regarding environmental legislation, but when these ideas are put into practice, a lot of difficulties come up.

There is also the problem of legal framework, with norms which overlap or contradict themselves, or which generate disparities among the territories. Which kind of cities do we want in twenty years' time? The answer to this question should become the foundation for the design of general urban plans.

The last issue discussed by the panel of experts relates to the possibility of making a difference between needed energy efficiency and renewable energy professional competence taking into account the **climatic areas**.

In relation to this, the general opinion among the experts is that for each competence, an identical plan or training programme will have to be designed. For this to happen, it will be necessary to acquire the same skills and knowledge, for example, to set up boilers or biomass. Now, even though the curricular design should be homogeneous along the territory, the training would have to be tailored to the different climatic areas, since the type of weather will determine the type of work that will have to be done. So for example, in the Canary Islands region the energy efficiency measures will not be different from the ones in the province of Leon.

For this reason, it is essential to have knowledge about the climate characteristics of each region, since the building will not react in the same way if the weather is humid or dry, and this will affect the type of measures to take. However, this is considered essential knowledge for managers of the work and not so much for the workers themselves who don't need to take this kind of decision.

As a result, it must not be forgotten that geographic mobility of workers must be favoured as well as taking into account that there are neighbouring regions which may have different climates in which a single business or worker can carry out their work.

Training in the public system works through territorial adaptation, at the level of demand for the courses and their curricular design in which the Autonomous Communities design more or less 50% of the total curriculum. As such, the reference point is common, the CNCP, and the certificates issued are valid nationally, guaranteeing that any obtained in any Community is valid throughout the country, meaning that professionals are free to move around the country.

There is, therefore, an agreement in which training materials must be general, even if the training offered should be specific. The demand for the courses will decide the question.

## 9.3. Prospective Analysis. Delphi panel.

Once the current situation relating to energy efficiency and use of renewable energy in buildings is described, below is a possible future scenario relating to the 2020 objectives. The objective is to detect if there are threats, of what type and what magnitude, or, on the contrary, show the potential opportunities to determine possible alternatives to achieve these objectives.

These aims have been reached using a Delphi methodology. The analysis of the results is done by presenting the degree of agreement with the corresponding statements to the main conclusions of the first round of the Delphi panel on the near future of the construction sector relating to energy efficiency and the use of renewable energy.

The Delphi method has the following fundamental characteristics:

- ✓ **Anonymous:** during the panel, no expert knows the identity of any other member of the debate.
- ✓ **Controlled feedback and iteration:** the iteration process is achieved through being shown the questionnaire several times. As the results obtained from the previous round are presented, the experts find out the different points of view and can change their opinion if the arguments presented seem more appropriate than their own initial thoughts.

- ✓ **Increase in the amount of training:** the number of factors or elements considered by a group is greater than can be considered by only one person.

For this study, the Delphi methodology designed includes the following stages:

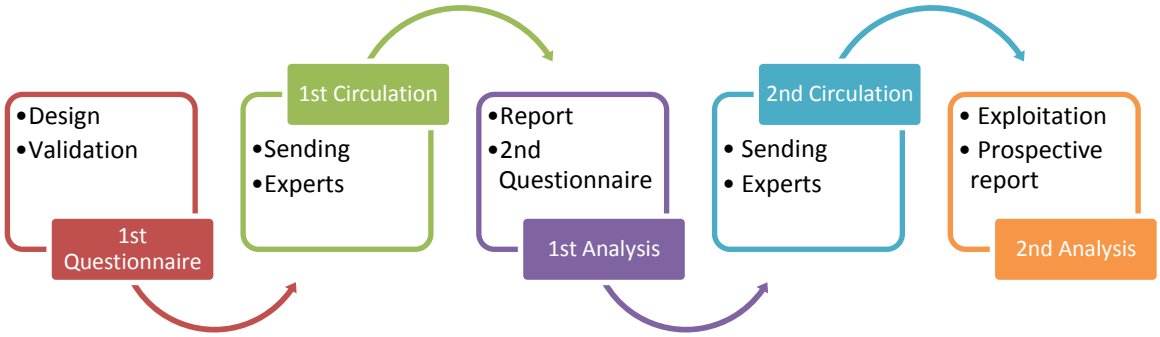



Figure 19 Stages of the Delphi methodology

- ✓ Design of the **first questionnaire**
- ✓ **First circulation**: the questionnaire is sent to the panellists with the arguments to be considered.
- ✓ The research team exploits the opinions received and creates a preliminary report of the conclusions from the first round.
- ✓ **Second circulation:** from this report, a second questionnaire is designed to be sent to the participating experts who state their level of agreement on the first conclusions obtained on a scale of 1 to 4, with 1 being absolute disagreement and 4 being absolute agreement.
- ✓ Finally, the exploitation and definitive analysis of the results is done.

As the questionnaires are sent electronically, a good response was received from that. To promote the involvement of participants, three e-mails are sent per participant and round, supporting the monitoring by telephone.

In the first round, from a total of 49 experts, 27 answers were received (55.1%) and in the second, from 50 experts, 29 answers were received (58%) which represents a valid index to draw conclusions. It must be remembered that the initial sample was increased in order to achieve the number of answers desired. Suitable consistency of sources was also achieved, obtaining participation of all of the initially-identified groups of interest, increasing, as a result, the quality of training.

The statistical analysis is focused on the calculation of the mean, the mode and the minimum value. Methods of deviation have also been used too: standard deviation, lower quartile and upper quartile. The standard deviation indicates the distance of the scores from the mean; in other words, if the standard deviation is small, the data are grouped closely to the mean and the consensus is high, and if it is big, the data are scattered. The first quartile value indicates that 25% of the scores are less than or equal to it and that the remaining the answers have higher values. The third quartile is the value below which three quarters (75%) of the scores are found, with the other 25% being equal or greater than it.

Given that we are looking at a scale of 1 to 4, with 1 being absolute disagreement and 4 being absolute agreement, some statistics are given below.

*9.3.1. Evolution of energy efficiency in the sector.*

In relation to the evolution of energy efficiency and the use of renewable energy in the sector in the next few years, the major conclusions reached by experts in which there was a consensus after the first round of the Delphi were sent to them again, requesting them to score the prediction again.

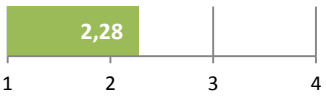
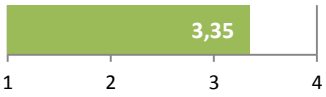
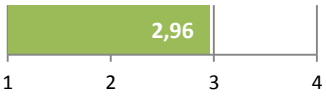
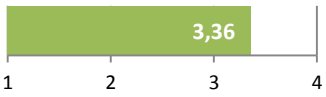
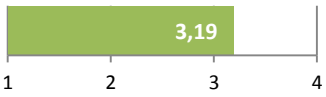
| | | | | 1= Absolute disagreement<br>Absolute agreement=4 |
|---|---|---|---|---|
| **The implementation of energy efficient solutions in buildings will mostly contribute to reaching 20% of energy production with RE.** | | | |  |
| Mode: 2 | Std. Dev.:0,92 | Q1:2 | Q3: 3 | |
| **The implementation of energy efficient solutions in buildings will contribute to saving 20% of energy consumed.** | | | |  |
| Mode: 3 | Std. Dev.:0,62 | Q1:3 | Q3: 4 | |
| **In three years, it is hoped that energy certificates will exist for buying/selling and renting buildings according to the Royal Decree as well as an administrations register for certified building.** | | | |  |
| Mode: 3 | Std. Dev.:0,85 | Q1:3 | Q3: 4 | |
| **The possible alternative for buildings to reach the 2020 objectives is the renovation of buildings with efficiency criteria.** | | | |  |
| Mode: 4 | Std. Dev.:0,79 | Q1:3 | Q3: 4 | |
| **The principal public strategy which will favour the implementation of energy solutions and measures is the development of economic help and fiscal measures.** | | | |  |
| Mode: 3 | Std. Dev.:0,77 | Q1:3 | Q3: 4 | |

Table 51. Validation of statements for the forecasts of the Evolution of energy efficiency in the sector, FLC.

So if in the first round the experts answered, regarding the 20/20/20 objectives, with more than 40% of their answers that the implementation of energy efficient solutions would possibly contribute, in the near future, to the production of 20% of energy needs with renewable energy, in the second round of the panel, this premise obtained an average value of 2.28, indicating disagreement. The upper quartile shows that 75% of experts gave a score of under 3.

On the other hand, the implementation of energy efficient solutions in buildings will contribute to saving 20% of energy consumed. The average score for this statement is 3.35, agreement, with 2 being the minimum value and 3 being the first quartile, indicating that the remaining answers were giving scores equal to or greater than 3.

As regards the consideration that the renovation of buildings with efficiency criteria is the possible alternative to reaching the 2020 objectives, it can be seen that this conclusion from the first Delphi round also obtained a high level of consensus: the most frequent score given, i.e. the mode, is 4, meaning total agreement.

In relation to the public strategies, indicated by the experts in the first round of the panel, which should be developed to favour reaching the 2020 objectives, the experts believe that fiscal measures and economic help favouring energy efficiency are essential. This statement was giving a score of 3.19 (agreement) and a lower quartile ($Q_1$) of 3, i.e. only 25% of the experts gave a score below this value.

In relation to this, within the next three years or so, it is hoped that energy certificates will exist for buying/selling and renting buildings according to the Royal Decree as well as an administrations register for certified building. This statement received a low score by the experts with a value of 2.96 and a minimum value of 1. However, the most common score given was 3, agreement, with a standard deviation of 0.85 with respect to the average.

*9.3.2. Barriers to the development of energy efficiency*

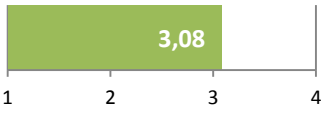
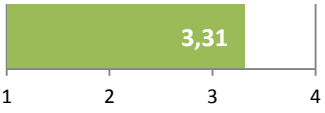
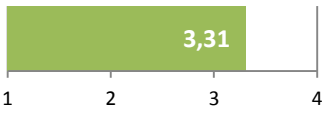
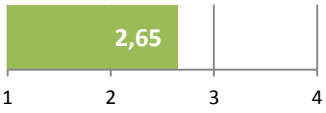
| | | | | 1= Absolute disagreement<br>Absolute agreement=4 |
|---|---|---|---|---|
| **In the next few years, the largest barrier to development in the sector will be the lack of coordination of energy efficiency skills between the various agents and administrations.** | | | |  |
| Mode: 3 | Std. Dev.:0,83 | Q1:3 | Q3: 4 | |
| **To overcome the barrier of workers' low qualifications, systems must be implemented to accredit the qualification of workers in this sector.** | | | |  |
| Mode: 4 | Std. Dev.:0,82 | Q1:3 | Q3: 4 | |
| **The major difficulties of access to training which will continue in the near future are: lack of time, resources, knowledge of training and economic situation.** | | | |  |
| Mode: 4 | Std. Dev.:0,82 | Q1:3 | Q3: 4 | |
| **No noticeable reduction will be produced in EE and RE system prices for customers and so their implementation will not be favoured.** | | | |  |
| Mode: 3 | Std. Dev.:1,11 | Q1:4 | Q3: 4 | |

Table 52. Validation of statements for the future of barriers to development of energy efficiency, FLC.

With respect to the various barriers to the development of energy efficiency which have been detected throughout this analysis of the status quo, in the first round of the panel, the experts focused on training aspects, the lack of coordination between administrations and the final price situation.

One important barrier is unqualified workers: experts agree that implementing a qualification accreditation system could help resolve these problems with an average score of 3.31 and a mode, or most common score, of 4, absolute agreement.

The experts showed agreement with the conclusion which stated that the principal difficulties with access to training which will continue in the near future will be: lack of time and knowledge of training available, limited resources and their economic situation, with an average score of 3.31 with the most common value being 4 (absolute agreement), although the lowest score was 1, and the standard deviation was 0.82 points.

Relating to the statement on the lack of coordination between the different agents and administrations with skills on the subject of buildings, experts agreed that it was an important barrier to take into account with an average score of 3.08 with a standard deviation of 0.83. The first quartile is found at the value 3, meaning that 75% of the scores given were above 3.

On the other hand, throughout the analysis, the experts indicated that the incorporation of energy efficiency criteria in buildings could imply an increase in costs which would be passed on to the end customer. Giving the current economic situation, in which the buying and selling of housing has virtually stopped, increasing the price could be a barrier to its implementation.

To this respect, in the first Delphi round, the experts were asked whether a noticeable reduction would be produced in the prices of the energy efficiency and renewable energy systems for the consumer which would favour their installation, and their opinions were divided. However, 44% indicated that, in

their opinion, although such a discount would be desirable, it would not happen. Presenting this conclusion to the experts in the second round, the opinions were still divided. As such, the proposition "No noticeable reduction will be produced in EE and RE system prices for customers and so their implementation will not be favoured" obtained a greater standard deviation, 1.11.

In general, the experts who believe prices will be reduced think this will occur due to a rise in demand which will reduce prices as a result. Those who do not believe in the reduction consider that the implementation of efficient systems could be favoured without having to substantially reduce the prices since the principal measures which will be carried out will not necessarily imply a rise in prices and these systems quickly pay for themselves.

*9.3.3. Measures to overcome barriers.*

Among the measures which could help resolve the existing barriers, user awareness is considered fundamental since, in the opinion of the experts, there will be no demand as long as there is no knowledge of the importance of sustainability and reductions in energy use.

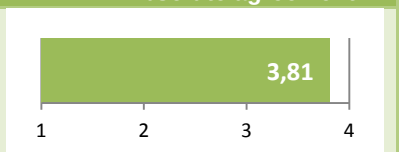
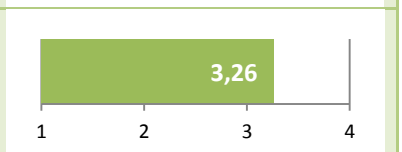
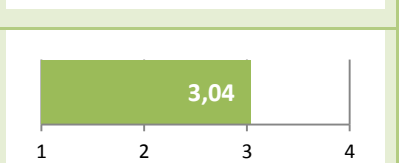
| | | | | 1= Absolute disagreement<br>Absolute agreement=4 |
|---|---|---|---|---|
| **For effective development of energy efficiency, it will be necessary to increase user awareness through campaigns.** | | | |  |
| Mode: 4 | Std. Dev.:0,47 | Q1:4 | Q3: 4 | |
| **To alleviate the slowing down, caused by the economic crisis, of the implementation of energy efficient measures, steps must be taken to increase awareness and to make these installations obligatory within energy regulations.** | | | |  |
| Mode: 4 | Std. Dev.:0,80 | Q1: 3 | Q3: 4 | |
| **Strict changes must be made (training, energy certification, being obligatory,...) in the existing regulations to boost energy renovation projects.** | | | |  |
| Mode: 3 | Std. Dev.:0,85 | Q1: 3 | Q3: 4 | |

Table 53. Validation of statements for the future of methods to overcome barriers, FLC.

The statement relating to awareness campaigns gained the higher score of the entire questionnaire (3.81). The majority of experts agree on its importance for developing energy efficiency: the third quartile ($Q_3$) and the mode (Mo) have values of 4, meaning absolute agreement. The standard deviation (□), the distance that the scores have from the average, is 0.47, expressed in the same units as the score.

Together with public awareness, the experts believe that making the regulations obligatory can help improve the level of employment in the sector, gaining an average score of 3.26, with the most frequent value being 4 and the deviation being 0.80 since the minimum value was a 1.

They also agree that changes should be made regarding the existing regulations to boost energy renovation projects, with an average score of 3.04, a modal value of 3 and a standard deviation of 0.85.

*9.3.4. Research, development and innovation (R&D&I)*

In relation to innovation and the technological sector, there is no consensus with respect to the positive influence of R&D on the improvement of efficient systems in buildings, with an average of 2.70. However, it must be indicated that the mode, or most frequent value, given by experts is 3, which indicates agreement, the minimum value being 3 and a standard deviation of 0.85.

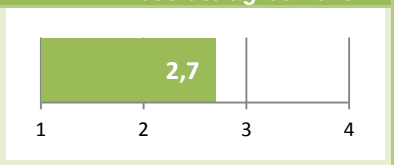
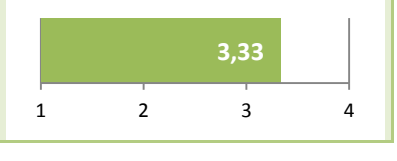
| | | | | 1= Absolute disagreement<br>Absolute agreement=4 |
|---|---|---|---|---|
| **The evolution of technology will improve energy efficiency in buildings and renewable energy production within the next three years, especially due to the development of more efficient systems (R&D).** | | | |  |
| Mode: 3 | Std. Dev.:0,85 | Q1:2 | Q3: 3 | |
| **Future innovation in the sector will principally affect the improvement of constructive processes and systems while carrying out works.** | | | |  |
| Mode: 3 | Std. Dev.:0,69 | Q1:3 | Q3: 3 | |
| **Future innovation will require new working methods and interaction among professionals in the sector.** | | | |  |
| Mode: 4 | Std. Dev.:0,67 | Q1:3 | Q3: 4 | |

Table 54. Validation of statements for the future of research, development and innovation, FLC.

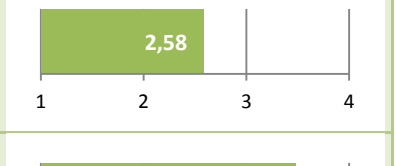
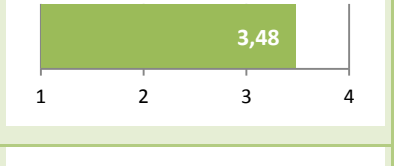
The experts agree that innovation will improve the constructive systems and processes when carrying out works, with this statement receiving a mean and a mode of 3, and a low standard deviation of 0.69.

The experts also consider that future innovation will require the development of new working methods and interaction among professionals in the sector with an average of 3.33. The most common score given was 4, absolute agreement. The lower quartile shows that only 25% of the values given were below 3.

With respect to skills which will be required, experts strongly agreed that workers in the sector must specialise on matters of energy efficiency, use of materials and management of resources, with an average score of 3.44, a mode or most-frequent value of 4, and a low standard deviation, 0.57. As a result, the training of workers must be aimed at technologies and applying new materials, sustainability and management of resources with an average score of 3.44 and a most-frequent value ($M_o$) of 4, absolute agreement.

*9.3.5. Training systems*

In relation to training, the experts in general did not agree (average of 2.58) that training for employees through certificates of professional standards was the most suitable to train workers in energy efficiency and renewable energy, despite the fact that many experts did agree ($M_o$=3, agreement). The upper quartile shows that three quarters of the opinions had values of 3 or lower.

| | | | | 1= Absolute disagreement<br>Absolute agreement=4 |
|---|---|---|---|---|
| **The ideal system for vocational training in EE and RE is training for employees through certificates of professional standards.** | | | |  |
| Mode: 3 | Std. Dev.:0,88 | Q1:2 | Q3: 3 | |
| **The three types of training (vocational training degrees; training for employees: continuous; and training for employees: certificates of professional standards) complement one another to improve qualifications in terms of the levels of specialisation.** | | | |  |
| Mode: 4 | Std. Dev.:0,64 | Q1:3 | Q3: 4 | |
| **All training systems are important but continuous training and certificates of professional standards offer quicker results and have the capacity to train in innovative techniques. They better recognise the market needs.** | | | |  |

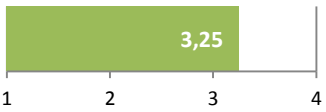
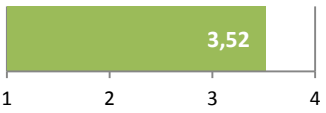
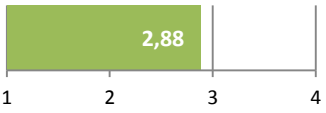
| | | | | |
|---|---|---|---|---|
| Mode: 3 | Std. Dev.:0,82 | Q1:2 | Q3: 4 | |
| **Vocational training must be redesigned as vocational training adapted to the student and the professional.** | | | | |
| Mode: 3 | Std. Dev.:0,72 | Q1:3 | Q3: 4 |  |
| **Training accreditation adds value to a worker's CV and is a guarantee for the company which hires them.** | | | | |
| Mode: 4 | Std. Dev.:0,83 | Q1:3 | Q3: 4 |  |
| **The most relevant category of training to offer on this subject is mixed-activity followed by classroom training.** | | | | |
| Mode: 2 | Std. Dev.:0,82 | Q1:2 | Q3: 4 |  |

Table 55. Validation of statements for the future of training systems, FLC.

However, there is a high level of agreement on how the three training systems (vocational training degrees; training for employees: continuous; and training for employees: certificates of professional standards) complement one another to improve qualifications in terms of the levels of specialisation, getting an average score of 3.48 with the most common value being 4, absolute agreement, and the minimum, 2, with a low deviation of 0.64 points.

With respect to certificates of professional standards and continuously training being, as was pointed out in the first round of the panel, training systems which more quickly adapt to the needs of the sector, experts did not show themselves to agree with that in this second round, with an average score of 2.96. Even so, the mode of this statement was one of agreement ($M_o$=3).

On the other hand, the experts did agree that vocational training must be adapted to the student and the professional and that training accreditation adds value, both for the user and for the companies, gaining average values of 3.25 and 3.52 respectively.

In relation to the statement that the ideal category of training to offer on this subject is mixed-activity followed by classroom learning, the upper quartile shows that 75% of experts scored under a 4 with 25% of scores being equal or above ($Q_3$=4), while the average score was 2.88.

*9.3.6. Current training availability*

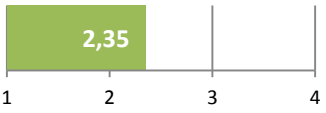
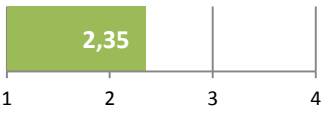
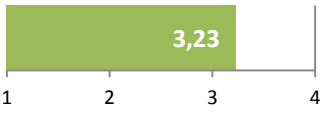
| | | | | 1= Absolute disagreement<br>Absolute agreement=4 |
|---|---|---|---|---|
| **The existing training resources are sufficient to cover the future needs of training in EE and RE.** | | | | |
| Mode: 2 | Std. Dev.:0,68 | Q1:2 | Q3: 3 |  |
| **The contents of existing training courses are suitable for covering the future needs of training in EE and RE.** | | | | |
| Mode: 2 | Std. Dev.:0,68 | Q1:2 | Q3: 3 |  |
| **The training supply and demand in the sector will increase in the next three years due to the changes in regulations and the development paths of the construction sector.** | | | | |
| Mode: 4 | Std. Dev.:0,75 | Q1:3 | Q3: 4 |  |

Table 56. Validation of statements for the future of training which is currently available, FLC.

In analysing the training currently available, the experts did not agree that the training on offer had sufficient resources to cover training needs as regards energy efficiency and renewable energy with an average of 2.35 (disagreement) and a mode of 2. Neither did they consider that the existing training was suitable for covering training needs on this subject.

In relation to the influence of changes in regulations and their influence in the evolution of training supply and demand, the experts agreed that an increase in the supply and demand of this training will be produced, with an average score of 3.23, a mode of 4 and a lower quartile of 3, showing that three quarters of the scores given by the experts were found above said value.

# 10. Collaborators

| ENTITY | PERSON |
|---|---|
| **Agencia Valenciana de la Energía (AVEN)** | Oscar Arauz |
| **AM Arquitectura y Urbanismo** | Oscar Redondo Rivera |
| **Asociación de Promotores Inmobiliarios de Madrid (ASPRIMA)** | Marta Torres |
| **Asociación Española para la Calidad (AEC)** | Diana Tallo |
| **Asociación Nacional de Fabricantes de Materiales Aislantes (ANDIMAT)** | Luís Mateo |
| **Asociación técnica y empresarial del yeso (ATEDY)** | Enrique Beléndez |
| **Ayuntamiento de Coria** | Isidoro Fagundo |
| **CCOO FECOMA** | Vicente Sánchez |
| **Centro de Referencia Nacional de Formación Profesional en Edificación y Obra Civil** | José Manuel García del Cid |
| **Confederación Intersindical Galega (CIG)** | Oliver Alvarez Barranco |
| **Confederación Nacional de la Construcción (CNC)** | Begoña Leyva |
| **Escuela de Organización Industrial (EOI)** | Julián González |
| **Fundación Laboral de la Construcción** | Mª del Puy Jiménez |
| **Fundación Laboral de la Construcción** | José Antonio Viejo |
| **Fundación Laboral de la Construcción de Aragón** | José Alberto Andrés |
| **Fundación Laboral de la Construcción de Navarra** | Marta Silvero |
| **Fundación Tripartita para la formación en el empleo (FTFE)** | Manuela Hernán |
| **Green Building Council** | Dolores Huerta |
| **Grupo Ortiz** | Juan Manuel Ortega |
| **IES Virgen de la Paloma** | David Martín |
| **IES Virgen de la Paloma** | Juan José García Ortiz |
| **Ingeniería Consultoría ARC3** | Helena Granados |
| **Instituto Nacional de las Cualificaciones (INCUAL)** | José Antonio Quiles |
| **Instituto Nacional de las Cualificaciones (INCUAL)** | Celia Rollón Blanco |
| **Instituto Nacional de las Cualificaciones (INCUAL)** | José Luis Palomar |
| **Instituto Nacional de las Cualificaciones (INCUAL)** | Cesar Souto |
| **Instituto para la diversificación y ahorro de la energía (IDAE)** | Aitor Domínguez |
| **Instituto para la diversificación y ahorro de la energía (IDAE)** | Fernando García |
| **Instituto Tecnológico de la Construcción AIDICO** | Ana Barella |
| **Instituto Tecnológico de la Construcción AIDICO** | Álvaro Pastor |
| **MCA-UGT** | Santiago Ramírez |
| **Ministerio de Fomento** | Javier Serra |
| **Servicio Público de Empleo Estatal (SEPE)** | Elena Martín Checa |
| **Structuralia** | Inmaculada Blázquez |
| **TECNALIA** | Ana Huidobro |
| **Universidad Europea de Madrid** | Mº del Mar Cenalmor |

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# 12. Annexes. Research instruments

**DETAIL SEMISTRUCTURED INTERVIEWS SCRIPT FOR THE CHARACTERIZATION OF BUILDING SECTOR**

## Caracterización del sector de la construcción. Tendencias de mercado y previsiones. Principales cambios que lo afectan.

**Objetivo general del estudio:**

Identificar y cuantificar las **necesidades de mano de obra cualificada** en EE y EERR para el año 2020.

**Objetivos específicos de esta fase:**

Caracterización de la situación actual según los expertos, más allá de los datos cuantitativos del sector existentes (PIB; número de licitaciones; visados de obra nueva; índice de costes; tasas de empleo y paro; etc.), mediante indicadores que analicen el contexto actual y las previsiones para el futuro del sector.

**Perfil entrevistado:**

Actores clave del sector

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### 3.1. Información histórica: Relaciones con otros sectores.

1. En relación a la eficiencia energética y el uso de energías renovables en el sector de la construcción, ¿en qué medida se han visto **afectadas** las siguientes actividades?:
   .- las industrias proveedoras de materiales
   .- las empresas instaladoras
   .- los proveedores de energía
   .- las empresas de mantenimiento y gestión

2. ¿Hasta qué punto **otros sectores**: hostelería, comercio, servicios (oficinas) están **apostando por la EE** en sus edificios? (ventaja competitiva)

### 3.3. Cadena de suministro de materiales y desarrollo de sistemas constructivos.

3. ¿Tienen en cuenta los **nuevos proyectos** de edificación y/o rehabilitación el uso de materiales y tecnologías que mejoren el confort y el ahorro de energía en las viviendas?

4. ¿Aportan los proveedores las **fichas técnicas de los materiales** relativas a la EE en sus productos?

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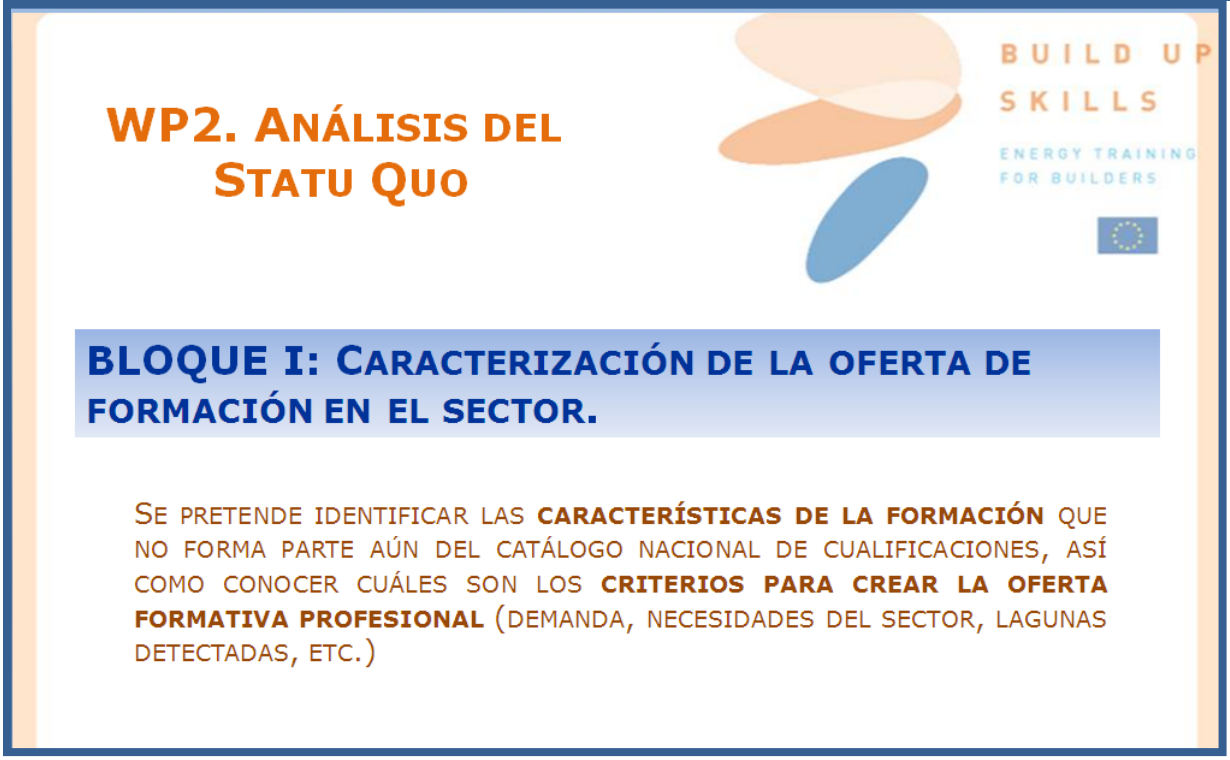
## DETAIL FOCUS GROUP SCRIPT FOR THE OFFER EDUCATION AND TRAINING BASED ON CNCP

**DETAIL FOCUS GROUP SCRIPT THE OFFER EDUCATION AND VOCATIONAL TRAINING BASED ON CNCP**

## SCRIPT DETAILS PANEL OF EXPERTS ON GAPS BETWEEN THE CURRENT SITUATION COMPETENCE AND NEEDS FOR 2020

# WP2. ANÁLISIS DEL STATU QUO

BUILD UP SKILLS
ENERGY TRAINING FOR BUILDERS

## PANEL DE EXPERTOS

"LAGUNAS COMPETENCIALES ENTRE LA ACTUAL SITUACIÓN Y LAS NECESIDADES PARA 2020, EN LO REFERIDO A LA CUALIFICACIÓN NECESARIA EN MATERIA DE EFICIENCIA ENERGÉTICA Y ENERGÍAS RENOVABLES"

# WP2. ANÁLISIS DEL STATU QUO

BUILD UP SKILLS
ENERGY TRAINING FOR BUILDERS

## BLOQUE I: NECESIDADES DE FORMACIÓN.

**CURSOS** E **ITINERARIOS FORMATIVOS** REQUERIDOS -NUEVOS O EXISTENTES SUSCEPTIBLES DE SER ACTUALIZADOS- PARA CUALIFICAR; FORMADORES REQUERIDOS Y ESTRUCTURAS DE FORMACIÓN PARA LLEVAR A CABO LA FORMACIÓN.

# DETAIL SURVEY EXPERT PANEL GAPS BETWEEN THE CURRENT SITUATION COMPETENCE AND NEEDS FOR 2020

**PANEL DE EXPERTOS**

**Lagunas competenciales entre la actual situación y las necesidades para 2020, en lo referido a las necesidades de cualificación en eficiencia energética y energías renovables**

La actividad tiene como objetivo, la elaboración de listado de competencias preferentes en las cualificaciones profesionales necesarias en el sector, para cumplir con los objetivos de sostenibilidad energética marcados por la Unión Europea para 2020, y así dar respuesta a las necesidades de formación que surgirán en relación con la eficiencia energética de los edificios.

Los objetivos de sostenibilidad energética 20/20/20 se resumen en:

1. Mejorar la eficiencia energética en un 20%
2. Conseguir que el 20% de la energía proceda de fuentes renovables
3. Reducir en un 20% las emisiones de CO2 a la atmosfera

A continuación, se presenta un listado de las competencias, nuevas o transformaciones de las ya existentes, que pueden influir en la cualificaciones necesarias para el cumplimiento del plan 20/20/20 en lo que a edificación se refiere. Estas competencias han sido asociadas a las ocupaciones ya existentes o a las nuevas ocupaciones que surgirán, así como a las fases de actividad afectadas.

Le pedimos que realice una **valoración para establecer como de importarte es cada una de las competencias para cubrir las necesidades, que en el ámbito de la edificación se generaran para el cumplimiento de los objetivos antedichos**. Para ello deberá valorar cada una de las competencias con valores de 1 a 5, siendo el valor 1 "competencia **nada importante** para la consecución de los objetivos de sostenibilidad energética" y el valor 5 "competencia **muy importante** para la consecución de los objetivos de sostenibilidad energética". Los valores intermedios (2, 3 y 4) permitirán ajustar la valoración.

Junto a cada competencia, existe un espacio dedicado a la realización de las observaciones que pueda considerar oportunas

| OCUPACIÓN | FASE DE ACTIVIDAD | COMPETENCIA | VALOR | OBSERVACIONES |
|---|---|---|---|---|
| Albañil | Cubiertas: Aislamiento, formación de pendientes, estructura del tejado, acabado del tejado y control de calidad | o Ejecutar la puesta en obra de los materiales de construcción utilizados como elementos aislantes de la cubierta, considerando sus propiedades higrotérmicas, su colocación, su posición y sus dimensiones para limitar la demanda térmica del cerramiento, la presencia de condensaciones y las infiltraciones de aire. | | |
| | Cerramientos exteriores: Colocación de fachadas, aislamientos, premarcos en los huecos, sellado de juntas con edificios colindantes, juntas de dilatación. Utilización de materiales convencionales, prefabricados y nuevos materiales | o Ejecutar la puesta en obra de los materiales de construcción utilizados como elementos aislantes, considerando sus propiedades higrotérmicas así como la colocación, posición y dimensiones para limitar la demanda térmica del edificio, la presencia de condensaciones, las infiltraciones de aire y la transmisión de calor entre zonas calefactadas y no calefactadas. | | |
| | | o Realizar la puesta en obra de nuevos materiales con funciones de aislamiento en los cerramientos para el cumplimiento de las condiciones higrotérmicas y acústicas establecidas para dichos cerramientos. | | |
| | Tabiquería: Tabiques convencionales, prefabricados, y nuevos materiales. Particiones | o Ejecutar la puesta en obra de aislamientos térmicos y acústicos específicos en las particiones interiores para el cumplir las condiciones límites establecidas y evitar la transmisión de calor. | | |
| | | o Identificar parámetros característicos de materiales de | | |

**SCRIPT DETAIL FOCUS GROUP EXPERT FOR RELATED BARRIERS QUALIFICATION OF CONSTRUCTION WORKERS**

## WP2. ANÁLISIS DEL STATU QUO

BUILD UP SKILLS
ENERGY TRAINING FOR BUILDERS

### GRUPO DE EXPERTOS

**"IDENTIFICACIÓN Y ANÁLISIS DE BARRERAS RELACIONADAS CON LA CUALIFICACIÓN DE LOS TRABAJADORES DE LA CONSTRUCCIÓN QUE PODRÍAN DIFICULTAR LOS LOGROS DEL PAÍS PARA ALCANZAR LOS OBJETIVOS 2020 EN EL SECTOR DE LA EDIFICACIÓN."**

## WP2. ANÁLISIS DEL STATU QUO

BUILD UP SKILLS
ENERGY TRAINING FOR BUILDERS

### IDENTIFICACIÓN Y ANÁLISIS DE LAS BARRERAS.

**Barreras económicas**

- ☐ Crisis económica y freno de la actividad económica.
- ☐ Financiación de la formación.
- ☐ Escasez de demanda.

**Barreras administrativas**

- ☐ Demora en los títulos y acreditaciones.
- ☐ Dificultad para la movilidad en el espacio europeo.
- ☐ Acceso de las PYMES a la formación.

**DETAIL QUESTIONNAIRE FOR EXPERTS PANEL**

**VALIDATION OF RESULTS**

# PANEL DE VALIDACIÓN

**ANALISIS DEL STATU QUO DEL SECTOR DE LA EDIFICACION EN MATERIA DE EFICIENCIA ENERGÉTICA Y USO DE ENERGÍAS RENOVABLES.**

A continuación, se presentan una serie de afirmaciones correspondientes a las principales conclusiones del análisis del Statu Quo del sector de la edificación en materia de eficiencia energética y uso de energías renovables.

Le pedimos que señale su grado de acuerdo o desacuerdo con las siguientes afirmaciones, siendo 1 el grado de menor acuerdo (en completo desacuerdo) y 4 el grado de mayor acuerdo (totalmente de acuerdo).

| AFIRMACIONES | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| El sector de la construcción, y sectores afines se han visto afectados positivamente desde la entrada en vigor del CTE, y han introducido equipamientos y especialidades profesionales nuevas, gracias a la incorporación en la normativa de medidas de eficiencia energética y, sobre todo, del uso de energías renovables. | | | | |
| A pesar de que la coyuntura económica no alienta las inversiones, algunos sectores están apostando por la eficiencia energética y las energías renovables, sobre todo, la industria, la hostelería (hoteles) y el comercio (alimentación). | | | | |
| Las edificaciones que se han hecho en los últimos veinte años, antes del CTE, son construcciones bastante deficientes desde el punto de vista energético, por lo que será necesaria su rehabilitación. | | | | |
| En general, los edificios del parque edificado presentan gran ineficiencia a pesar de las normativas preexistentes. | | | | |
| El avance en EE y el uso de EERR en la edificación es, a día de hoy, escaso. Si bien existe un movimiento importante en torno a la eficiencia energética y las energías renovables, falta conocimiento de lo que realmente es y sobre todo, cómo implementarlo de manera rentable. | | | | |
| Es necesaria la aplicación específica de gasto público para la edificación con criterios de EE y EERR, en la medida en que el apoyo financiero privado para invertir en materia es prácticamente inexistente. | | | | |
| Existe economía sumergida en el sector, y especialmente en el subsector de rehabilitación. | | | | |

# DELPHI SURVEY DETAIL FIRST ROUND

## GUION DELPHI 1ª RONDA

***Antes de dar comienzo a la cumplimentación del documento, le indicamos que toda la información que nos faciliten será tratada conforme a La Ley Orgánica 15/1999 de Protección de Datos de Carácter Personal (LOPD).***

**Alcance de la eficiencia energética en la edificación. Perspectivas futuras.**

**P.1.** ¿A qué cree Ud. que va a contribuir, en mayor medida, la implementación de soluciones energéticas eficientes en la edificación? Explique brevemente su respuesta por favor.

- ☐ Contribuirá a reducir un 20% las emisiones de efecto invernadero.
- ☐ Contribuirá a ahorrar un 20% del consumo de energía.
- ☐ Contribuirá a alcanzar el 20% de producción energética con EE.

| ¿Por qué? |
| --- |
| |

**P.2.** En un periodo aproximado de tres años, indique qué tipo de desarrollo considera que tendrá la certificación energética de los edificios.

| |
| --- |
| |

**P.3.** Teniendo en cuenta que la mayor parte del parque edificado en España se ha construido sin considerar los criterios de eficiencia energética ¿cuáles considera que son las posibles alternativas en la edificación para alcanzar los objetivos 2020?

| Principales alternativas del sector |
| --- |
| |

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# DELPHI SURVEY DETAIL SECOND ROUND

## GUION DELPHI 2ª RONDA

### ANÁLISIS PROSPECTIVO DEL SECTOR DE LA EDIFICACIÓN EN MATERIA DE EFICIENCIA ENERGÉTICA Y USO DE ENERGÍAS RENOVABLES

A continuación, se presentan una serie de afirmaciones correspondientes a las principales conclusiones de la primera ronda del Panel Delphi sobre el futuro próximo de del sector de la edificación en materia de eficiencia energética y uso de energías renovables.

Le pedimos que señale su grado de acuerdo o desacuerdo con las siguientes afirmaciones, siendo 1 el grado de menor acuerdo (en completo desacuerdo) y 4 el grado de mayor acuerdo (totalmente de acuerdo).

Antes de dar comienzo a la cumplimentación del documento, le indicamos que toda la información que nos faciliten será tratada conforme a La Ley Orgánica 15/1999 de Protección de Datos de Carácter Personal (LOPD).

| AFIRMACIONES | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| La implementación de soluciones energéticas eficientes en la edificación contribuirá principalmente a alcanzar el 20% de producción energética con EE así como a ahorrar un 20% del consumo de energía. Ambos aspectos están directamente relacionados. | | | | |
| En un periodo aproximado de tres años, se espera que exista el certificado energético para la compra-venta y alquiler de edificios según RD, así como un registro de las administraciones de los edificios certificados. | | | | |
| La posible alternativa en la edificación para alcanzar los objetivos 2020 es la rehabilitación de edificios con criterios de eficiencia. | | | | |
| La principal estrategia pública que favorecerá la implantación de medidas y soluciones energéticas es el desarrollo de medidas fiscales y ayudas económicas. | | | | |
| Para el efectivo desarrollo de la eficiencia energética será conveniente aumentar la sensibilización de los usuarios mediante campañas de divulgación. | | | | |
| La evolución tecnológica va a mejorar, en los próximos tres años, la eficiencia energética de los edificios y la producción de energía renovable, principalmente porque el desarrollo de sistemas más eficientes (I+D+I) | | | | |
| Los campos de innovación futura en el sector afectarán principalmente a la | | | | |

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# BACK COVER

## BUILD UP Skills

**The EU Sustainable Building Workforce Initiative in the field of energy efficiency and renewable energy**

BUILD UP Skills is a strategic initiative under the Intelligent Energy Europe (IEE) programme to boost continuing or further education and training of craftsmen and other on-site construction workers and systems installers in the building sector. The final aim is to increase the number of qualified workers across Europe to deliver renovations offering a high energy performance as well as new, nearly zero-energy buildings. The initiative addresses skills in relation to energy efficiency and renewable energy in all types of buildings.

BUILD UP Skills has two phases:

I. First, the objective is to set up national qualification platforms and roadmaps to successfully train the building workforce in order to meet the targets for 2020 and beyond.

II. Based on these roadmaps, the second step is to facilitate the introduction of new and/or the upgrading of existing qualification and training schemes.

Throughout the whole duration of the initiative, regular exchange activities are organised at EU level to underline the European dimension of this important initiative and to foster the learning among countries.

The BUILD UP Skills Initiative contributes to the objectives of two flagship initiatives of the Commission's 'Europe 2020' strategy — 'Resource-efficient Europe' and 'An Agenda for new skills and jobs'. It is part of the Commission's Energy Efficiency Action Plan 2011. It will also enhance interactions with the existing structures and funding instruments like the European Social Fund (ESF) and the Lifelong Learning Programme and will be based on the European Qualification Framework (EQF) and its learning outcome approach.