



**TURNKEY
RETROFIT**



D 2.1 Market & PESTLE Analysis



Market & PESTLE Analysis

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EXECUTIVE SUMMARY

This report is the deliverable D2.1 of Task 2.1 corresponding to WP2 ‘Business models, exploitation and uptake’ of the TURNKEY RETROFIT project. The aim of this WP2 is to *implement and upscale economically viable business models which will set the foundation for an effective deployment and exploitation of the TURNKEY RETROFIT service in the replication, first in France, Ireland and Spain, and then EU countries, without the need for public subsidies. Also, it will provide a clear picture of the business opportunities ensuring a wide market uptake of the TURNKEY RETROFIT technical and business approach. It will also create a community of market actors committed to replicate the service in other regions and other EU countries after the end of the project.*

The energy renovation market has a tremendous potential for growth in the coming years, boosted by the need to meet the EU directives on energy efficiency and buildings performance. The Energy Efficiency Directive (2012/27/EU) and the Energy Performance of Buildings Directive (EPBD) ([2010/31/EU](#)) are the main legislative instruments to promote the energy performance of buildings and to boost renovation within the EU.

The focus on renovation is explained by that the building stock is responsible for 40% of the total primary energy consumption in Europe and responsible for 36% of its CO₂ emissions; there is a reality of inadequate and deficient housing, which causes high energy bills, health problems and a lower quality of life.

The current ratio of energy renovated buildings is very low, estimated between 0.4 - 1.2% per year [1], which is not enough to be able to meet the goals set by the EU. Therefore, Europe faces an ambitious challenge: increase the renovation rate (triple it), increase the renovation spending and increase the renovation depth, in order to meet its climate and energy goals. It is for this reason that, the renovation of the existing building stock represents an exceptional investment opportunity, with the capacity to boost the economy and generate local jobs.

The TURNKEY RETROFIT project will be developed as a homeowner-oriented renovation journey, that will be accessible through a user-friendly digital platform, and that comprises all aspects of a renovation process, from the moment the homeowner is first interested to renovate, to the decision to renovate and all the way until its completion. The TURNKEY RETROFIT service will facilitate this through providing information, guidance and offering the best technical solutions tailored to the user’s needs.

In order to define the business model of the TURNKEY RETROFIT service in each of the target countries, it is necessary, first of all, to undertake an analysis of the environment in which this service will be offered, with the aim to identify, analyse and understand the external factors that could affect its functioning. This document describes the analyses performed for the countries where the implementation of the new service is targeted: France, Ireland and Spain. The learnings will be considered, mainly, during the definition of the Business models (Task 2.2) and of the Sustainable exploitation and replication plans (Task 2.4). This exercise (analysis) is very important as it enables the implementation strategy to be adapted and tailored for the different markets.

To perform the analysis, it is necessary to use a tool that supports the identification of the strategic factors and helps in the understanding of the difficulties and challenges that can arise. In this case, the PESTLE tool has been employed. The PESTLE acronym refers to the factors that are analysed: Political, Economic, Social, Technological, Legal and Environmental.

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The PESTLE analyses presented in this report have been conducted by each of the organizations that will define and implement the service in their own country. This has allowed to have an in-depth analysis as each has a more detailed understanding of their own context. They have aided in the identification, analysis and assessment of the factors that will have to be taken into account in the countries where the TURNKEY RETROFIT service will be launched. In order to facilitate this type of analysis, a questionnaire with specific questions was prepared. Thus, once the factors are identified, a description of the reasons and an evaluation of their impact were carried out.

The main factors identified and analyzed in each country are the following:

- Political: government stability, government priorities, strategic framework to boost energy renovation in the building sector, existence of funding tools and grants.
- Economic: general economic situation (employment rate, GDP, inflation, private debt), spending in the renovation sector, fiscal incentives, cost for homeowners and developers.
- Social: culture (in favour or no) of energy rehabilitation, use of digital platforms, perception of value of sustainable dwellings, standard for rental sector.
- Technological: access to existing technological solutions, technological skills of professionals in the construction sector, R&D&i in the sector, development and use of platforms for the construction sector.
- Legal: building regulations, building's energy performance certificates.
- Environmental: concern and awareness of climate changes, framework for energy and climate.

Although these factors coincide in the three countries, the implications in each context are different, as it will be seen in the results of each of the different analyses.

Each country will have to take into account, when defining its business model, which elements to include in the design in order to try to mitigate the factors that have been identified as negative. And what other elements can be configured taking advantage of the factors detected in the environment that can favor the provision of the service.

The most evident conclusion, but it does not depend on us, is that each country should consider that energy efficiency must be their first priority, as the EU proposes, focusing on the energy renovation of buildings as the most cost-effective way to contribute towards achieving the EU objectives. Consequently, it will be necessary to establish ambitious policies that activate the demand and accelerate the private inversions in energy renovation. Without doubt it would be a great impulse for TURNKEY RETROFIT service.

INTRODUCTION

The TURNKEY RETROFIT project aims to define, develop and implement a new renovation service, whose main value proposition is to help the user throughout a renovation project. Currently, when someone decides to undertake a renovation project in their home, they must overcome numerous problems, as the process is so complex that it can often dissuade the user from even embarking on such a project. Common problems the building owner encounter include:

- The lack of knowledge regarding the possible solutions available on the market and which are best suited to the identified needed.
- The numerous players involved in this type of project, each developing works of a different nature.
- The lack of criteria for selecting the best supplier and the best offer (in terms of quality and prices).
- The lack of awareness on how to finance the project.

In addition, the perceived complexity of the renovation process, the low qualification level of building professionals and the unattractiveness of the energy renovation process, are all major barriers to renovation and hampering investments in renovation projects across the EU.

The TURNKEY RETROFIT project has set the aim of reaching €335 million investment pipeline for home renovation within the first 5 years (approximately 14,700 dwellings renovated, leading to 96.6 GWh/year Primary energy savings triggered) beyond the end of the project. The project will point to further European and international potential for replication.

To achieve this aim, the TURNKEY RETROFIT service has been defined as an oriented towards the homeowner-oriented renovation journey, that will be accessible through a user-friendly digital platform, and that comprises all aspects of a renovation process, from the moment the homeowner is first interested to renovate, to the decision to renovate and all the way until its completion. The TURNKEY RETROFIT service will facilitate this through providing information, guidance and offering the best technical solutions tailored to the user's needs.

The following actions are planned, amongst others, as a starting point for the TURNKEY RETROFIT business model definition:

- To analyse the business model of two existing French integrated renovation services (Izigloo and Operene), targeted at single-family and multi-family housing renovation, respectively. They are two innovative private models currently offering this service in France, which are currently operated without public subsidies. The TURNKEY RETROFIT service will be developed as an integration and enrichment of both of them.
- To take into account the results and conclusions from the study performed on the promising experiences of integrated renovation services in Europe (described in deliverable D.1.1) [2]
- To undertake an analysis of the environment in which the TURNKEY RETROFIT integrated renovation service will be offered, with an aim to identify, analyse and understand the external factors that affect its functioning.

This document describes the analyses performed for the countries where the implementation of new service is targeted: France, Ireland and Spain.

1. INTRODUCTION TO THE MARKET ANALYSIS

A market analysis is a study that should be performed before introducing a new product, or service, in a new environment. It includes the necessary information, that will enable the service managers to make the decision whether to enter the new market or not. It also helps them to navigate and design the most appropriate strategies.

The market “environment” includes all factors that, while being external to the business opportunity, can influence its development and success. The analysis of these factors will allow for the early detection of problems and for adaptation to the changing market conditions.

- Although most of them cannot be controlled or modified, it is important to understand the implications with either positive or negative effects.
- For a factor in the environment to be considered strategic, it has to have an effect on the implementation of the new service. Therefore, it is important to identify what the strategic factors are.

The definition of the environment where the service will be offered implies deciding on its field of action. In this case, since the TURNKEY RETROFIT service will operate in three EU countries (France, Ireland and Spain), it is necessary to perform three different analyses, identifying the strategic factors in each area. Even though these may be the same in some cases, the implications in each context could be different, as will be seen in the results coming from each of the different analyses.

Given the great diversity and complexity that the analysis presents of the general environment, it is necessary to use a tool that aids in the identification of the strategic factors and that helps in the understanding of the difficulties and challenges that can arise. In this case, the PESTLE tool [3] has been employed.

1.1. PESTLE: A tool to study the environment

The PESTLE analysis is a tool that is used to identify the external macro forces that can influence the prospect of a new service, and which can have an effect on its development. The PESTLE acronym refers to the factors that are analysed: Political, Economic, Social, Technological, Legal and Environmental.

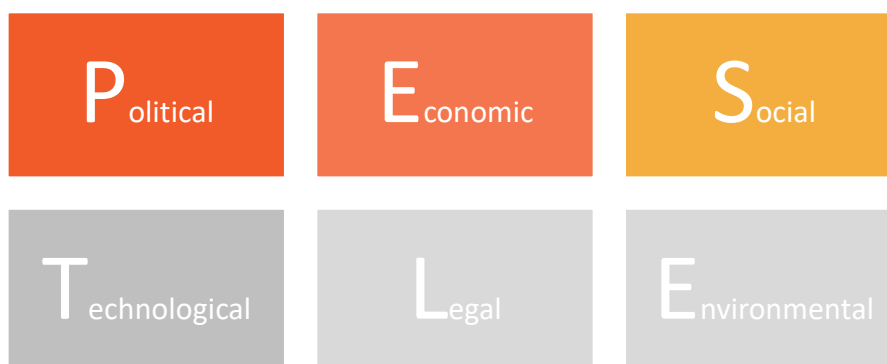


Figure 1 – PESTLE Analysis

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The PESTLE analysis in this report is a market analysis that only considers external factors that will have an impact on the TURNKEY RETROFIT service.

In order to perform this type of analysis, first one must consider which factors will affect the implementation and secondly what effect they will have. The factors to be considered in a PESTLE analysis are the following, which includes a series of questions that helps us guide the analysis.

- **Political factors:** Assesses in which way the government intervention can affect the provision of the service. Example of questions that guides the analysis:
 - Is the political situation stable in the country?
 - What is the main strategic framework for energy renovation in buildings? What does the country's long-term renovation strategy stipulate? Is the country's strategy favourable to the delivery of TURNKEY RETROFIT integrated renovation service?
 - What financial support measures are currently available for comprehensive renovation? Are they stable or likely to change?
 - Is the public support designed to favour more comprehensive energy renovation projects (such as the once that will be supported in the TURNKEY RETROFIT integrated renovation service) as compared to single-measure renovations?
- **Economic factors:** The macroeconomic context (current and future) can influence the supply of a service. Questions that guides the analysis:
 - What is the economic situation in the country? With respect to GDP: Is it growing, stable or decreasing?
 - What is the economic situation in the energy renovation sector?
 - Are there any fiscal incentives in favour of actions that lead to improvement in energy efficiency in buildings?
- **Social factors:** Considers which elements of society can facilitate or hinder the delivery of the renovation service. Questions that guides the analysis:
 - What cultural aspects are more important? Is there a culture in favour of energy rehabilitation? Is there confidence in the renovation and rehabilitation sector? Is there awareness of climate change?
 - What elements in society can facilitate or hinder the delivery of the TURNKEY RETROFIT integrated renovation service?
- **Technological factors:** Identifies technologies and infrastructures that can positively or negatively influence the service provision. Questions that guides the analysis:
 - Do the companies in the country have enough knowledge of the products, materials, technological solutions and services that exist in the market to offer their clients?
 - Do the companies try to have access to the necessary knowledge and qualifications in order to be able to implement them?
 - Does the government support Research & Development and Innovation in the area of energy efficiency (specific sector/challenge)?

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- Which emerging technologies could influence the service?
- **Legal factors:** This refers to those regulatory issues related to our business opportunity. Questions that guides the analysis:
 - What national regulatory elements can influence in boosting or hindering the TURNKEY RETROFIT integrated renovation service?
- **Environmental factors:** Considerations should include the trends in sustainability which could affect the business related to the service to be provided. Questions that guides the analysis:
 - What are the environmental considerations?

The purpose of the PESTLE analysis is not to describe a given socioeconomic system from the economic, social, political, technological, legal and environmental point of view, instead it is a general environment analysis which has the aim of understanding the difficulties and challenges that can arise. Thus, once the factors are identified a description of the reasons and an evaluation of their impact are carried out. In this case, this evaluation has been performed considering the following values:

- Very negative (--)
- Negative (-)
- Positive (+)
- Very positive (++)

1.2. Characteristics of the TURNKEY RETROFIT service

The PESTLE analysis has been put together by taking as a starting point the characteristics of the TURNKEY RETROFIT service, which are as follows:

- Integrated home renovation service (provided through one-stop-shops)
- Service-oriented model where the home-owner is offered tailor-made solutions through the whole customer journey
- Service that includes:
 - Energy diagnosis
 - Potential works (technical and economical offers)
 - Contacts with providers and installers and contracting of works
 - Structuring and provision of finance
 - Monitoring/onsite coordination of works and quality assurance
- Accessible through a user-friendly digital platform “Solutions4renovation”¹

¹ <https://www.turnkey-retrofit.eu/solutions4renovation> (available from 2020)

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- All services are conducted along the project, where the client only has a single contact during his renovation project
- Coordination of a network of building professional's in order to address the different tasks of an energy refurbishment project
- The service will address drivers of building renovation that go beyond a desire to reduce energy bills and increase asset value, such as home improvement, increased comfort, enhanced health & quality of life
- A service that guarantees results (reduce energy bills)
- A service that runs without the need for public subsidies

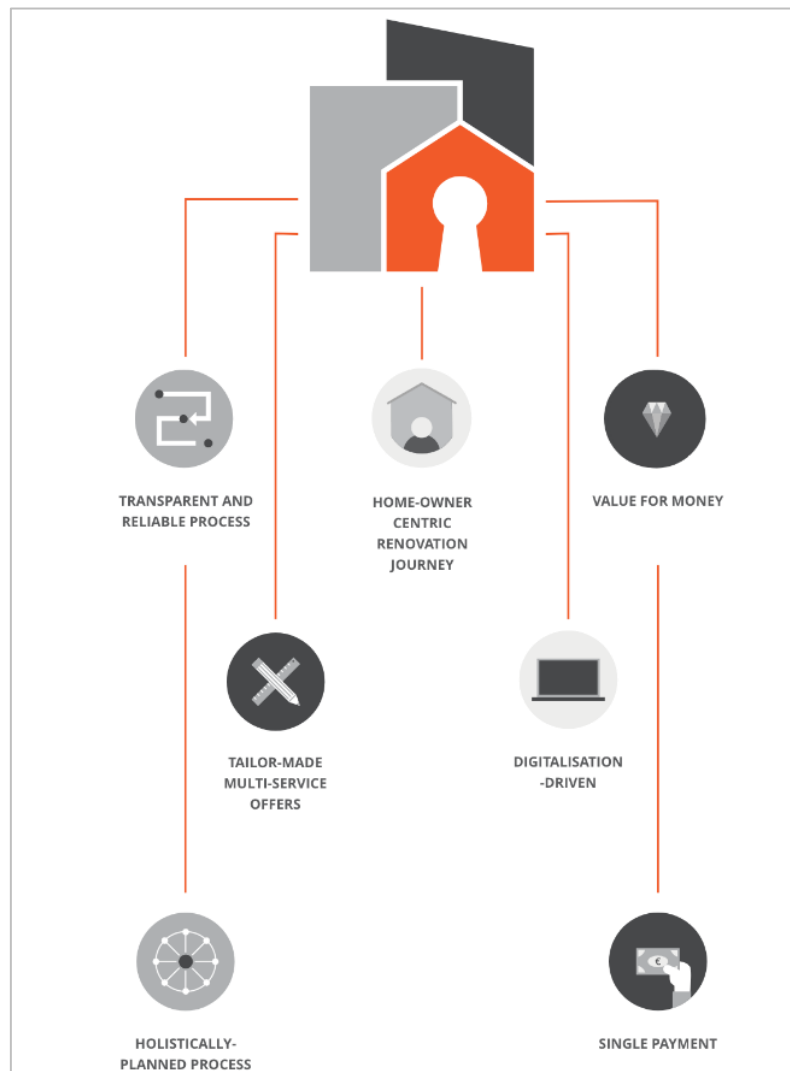


Figure 2 – Characteristics of the TURNKEY RETROFIT service

2. PESTLE ANALYSIS

The PESTLE analyses presented in this chapter have been conducted by each of the organizations who will define and implement the service in their own country, which has allowed for an in-depth analysis as they have a more detailed understanding of their own context where the TURNKEY RETROFIT service will be launched, aiding in the identification, analysis and assessment of the factors.

It has also been considered convenient to include an introductory part where all the building stock characteristics are described as these will allow to determine the residential buildings which should potentially be renovated and, thus, the national market for the TURNKEY RETROFIT service. The estimation is mainly based on the number of houses built before the 80s, as these are the ones that represent the highest potential for renovation, while knowing that most have not been renovated. In addition to the age of buildings, it also includes the general characteristics (single-family, multifamily buildings, ...), and their energy consumption.

Knowing the characteristics of the target market in each country is an important point of information in order to align the most appropriate types of products, solutions and technologies for each of the markets.

In addition, an overview of the European situation is included, which can provide information on the general trends for the development of this type of services related to the energy renovation of buildings.

2.1. Overview of the energy renovation market and integrated home renovation service market in EU

The energy renovation market has a tremendous potential for growth in the coming years, boosted by the need to meet the EU directives on energy efficiency and buildings performance. The “Clean energy for all Europeans package” declares that energy efficiency should be the first priority of the EU [4]. “Efficiency first” focuses to a great extent on energy renovation of buildings, which is considered the most cost-effective way to achieve the objectives that have been set, which include:

- Increase in energy efficiency at least by 32.5% in 2030, which the EU must meet as a whole.
- Achieve a highly energy-efficient and decarbonised building stock by 2050.

For this, the EU has set a comprehensive set of laws oriented towards improving energy efficiency in Europe. In particular, the Energy Efficiency Directive (2012/27/EU) and the Energy Performance of Buildings Directive (EPBD) (2010/31/EU) are the main legislative instruments to promote the energy performance of buildings and to boost renovation within the EU. In May 2019, the EC published the recommendation on building renovations, in which it set out the guidelines for Member States to follow to guarantee a successful transposition of the amended EPBD requirements. The Commission highlights the importance of the construction sector in achieving the energetic and climatic objectives of the EU and for the energy transition. It demands that the Member States adopt long-term renovation strategies and set out minimum requirements for energetic performance of any new buildings and existing buildings which are to undergo an important renovation process. The Member States will adopt all the necessary legal, regulatory and administrative provisions in order to meet the current Directive before March 10th.

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The long-term renovation strategies should comprise [5]:

- an overview of the national building stock;
- policies and actions to stimulate cost-effective deep renovation of buildings;
- policies and actions to target the worst performing buildings, split-incentive dilemmas, market failures, energy poverty and public buildings;
- an overview of national initiatives to promote smart technologies and skills and education in the construction and energy efficiency sectors;
- an estimate of expected energy savings and wider benefits, such as those related to health, safety and air quality;

Member States are also encouraged to “support the mobilisation of investments”, including “accessible and transparent advisory tools, such as one-stop-shops for consumers and energy advisory services, on relevant energy efficiency renovations and financing instruments”².

The focus on renovation is explained by that the building stock is responsible for 40% of the total primary energy consumption in Europe and responsible for 36% of its CO₂ emissions [6]; in particular, the residential sector accounts for almost a quarter of the EU final energy consumption [7]. This is because the residential building stock in the EU, shown in Figure 3 is relatively old. 35% are more than 50 years old [8], and in addition in the majority of countries in the EU these buildings were built before the introduction of the key building regulations [9].

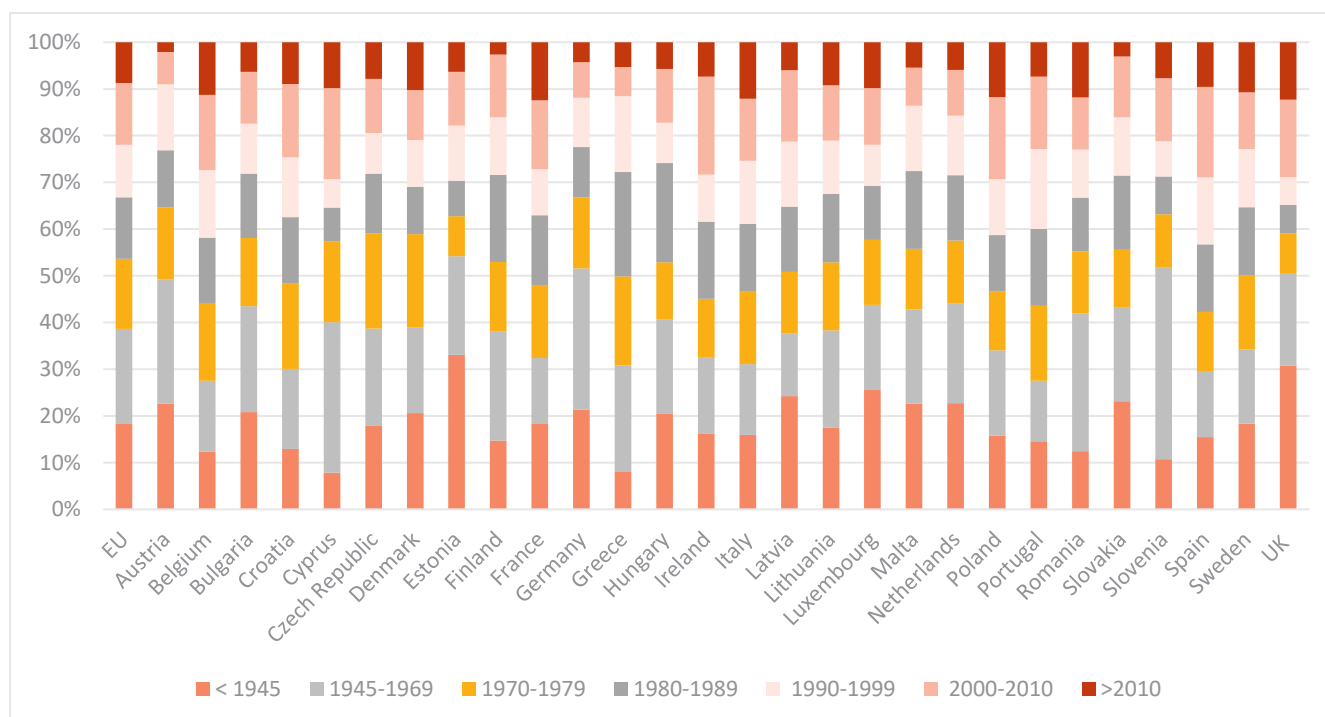


Figure 3 – Share of dwellings by year of construction, EU-28, <1945-2017, (%) (Source: [10])

² See Article 2a and 20(2) in EPBD, [2018/844](#)

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The current ratio of energy renovated buildings is very low, estimated between 0.4 - 1.2% per year [1], which is not enough to be able to meet the goals set by the EU. Linked to this point, it is important to highlight the lack of concise and precise data on the rates of building renovation throughout the whole of Europe.

The EPBD defines in its article n.º 2 “Major renovations” as those renovations where (a) *the total cost of the renovation relating to the building envelope or the technical building system is higher than 25% of the value of the building, excluding the value of the land upon which the building is situated*; or (b) *more than 25% of the surface of the building envelope undergoes renovation*. Member States may choose to apply option (a) or (b).

However, as Article 2 leaves each Member States to interpret and define differently major renovations, countries have chosen different ways to define and monitor them. To be able to carry out a comparison between the different countries, the EU ZEBRA2020 project [11] has developed an indicator known as “major renovation equivalent”, defined as follows: “a building's final energy demand for heating can be reduced by 50 to 80% (range depending on the country defined by national experts according to the current efficiency of the building stock)”.

In the following Figure 4 the % of the major renovation rates of residential buildings is shown across Member States:

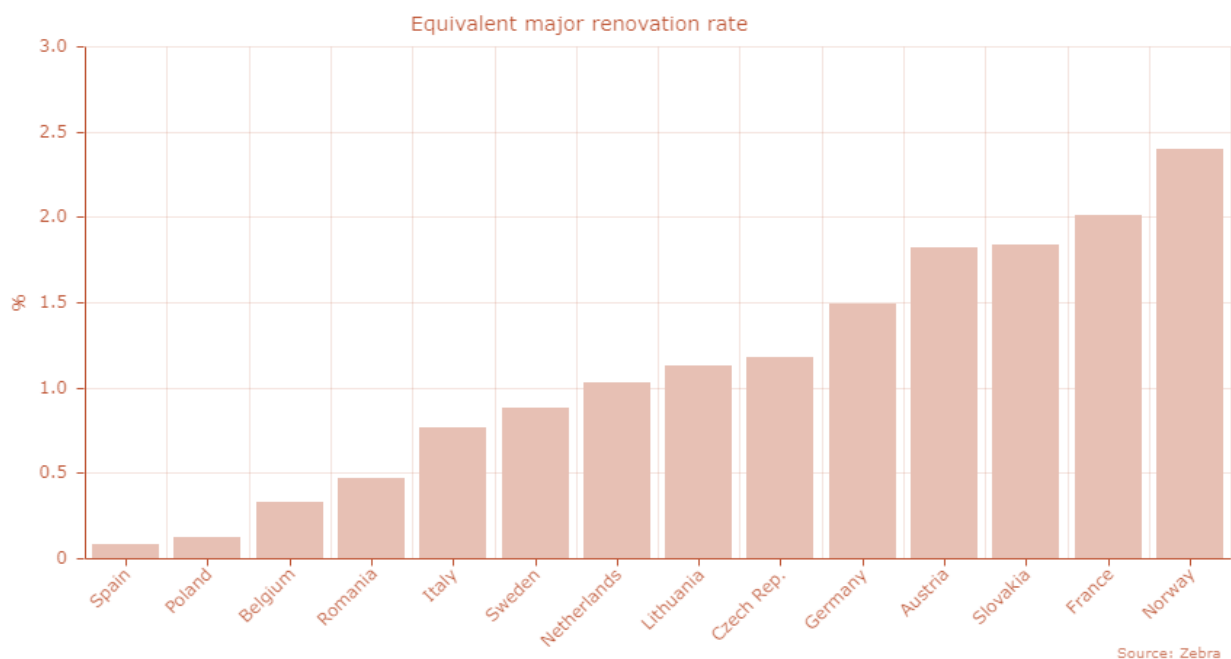


Figure 4 – Major renovation rates of residential buildings across Member States (Source: [11])

Beyond the differences between countries, the data give values that are very far from what they should be in order to meet the European directives. Out of the TURNKEY RETROFIT service targeted countries, France has an “Equivalent major rate” of 2.01% and Spain of 0.08%; while there is no such data for Ireland.

The ageing EU building stock, the priorities of the EU and the need to increase the rate of building renovation offers a great opportunity to TURNKEY RETROFIT service. In a 2016 report [6], it has been calculated that the potential buildings (residential and non-residential) to be renovated, in order to meet the EU targets, represents a huge

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market, as there are more than 110 million that should be renovated³ (based on the estimation that the EU building stock amounts to 210 million dwellings) [12].

A study conducted the same year describes that the energy renovation market plays an important role in the economy, amounting to a value of €109 billion (in 2015), consisting of 882,900 jobs in Europe [13]. This value has been calculated taking into account the whole energy renovation market in the selected 17 Member States (MS)⁴ for which EUROCONSTRUCT (who provide the data) is estimated at €82 billion and knowing that these 17 MS represent 75% of the total EU building market.

- Residential: €53 billion (17 MS market)
- Non-residential: €29 billion (17 MS market)
- Total energy renovation market: €82 billion (+25%)

In particular, the energy renovation market of residential buildings had the highest share, accounting for 65% of the total.

The energy renovation markets in France, Germany and Italy account for almost half of the EU total, the German being the one with 32% of the total residential energy renovation market (€16,750 million), followed by Italy with 19% (€10,084 million). The following estimations are also included for the size of the residential energy renovation market in the target countries for implementation of the TURNKEY RETROFIT service: France, €8,099 million (15%), Spain, €2,317 million (4%) and Ireland, €418 million (1%). And are shown in the following Figure 5.

³ Considering the age profile of buildings in the EU (35% of the EU's buildings are over 50 years old) and the slow replacement rates

⁴ Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Poland, Portugal, Slovakia, Spain, Sweden, The Netherlands and the United Kingdom

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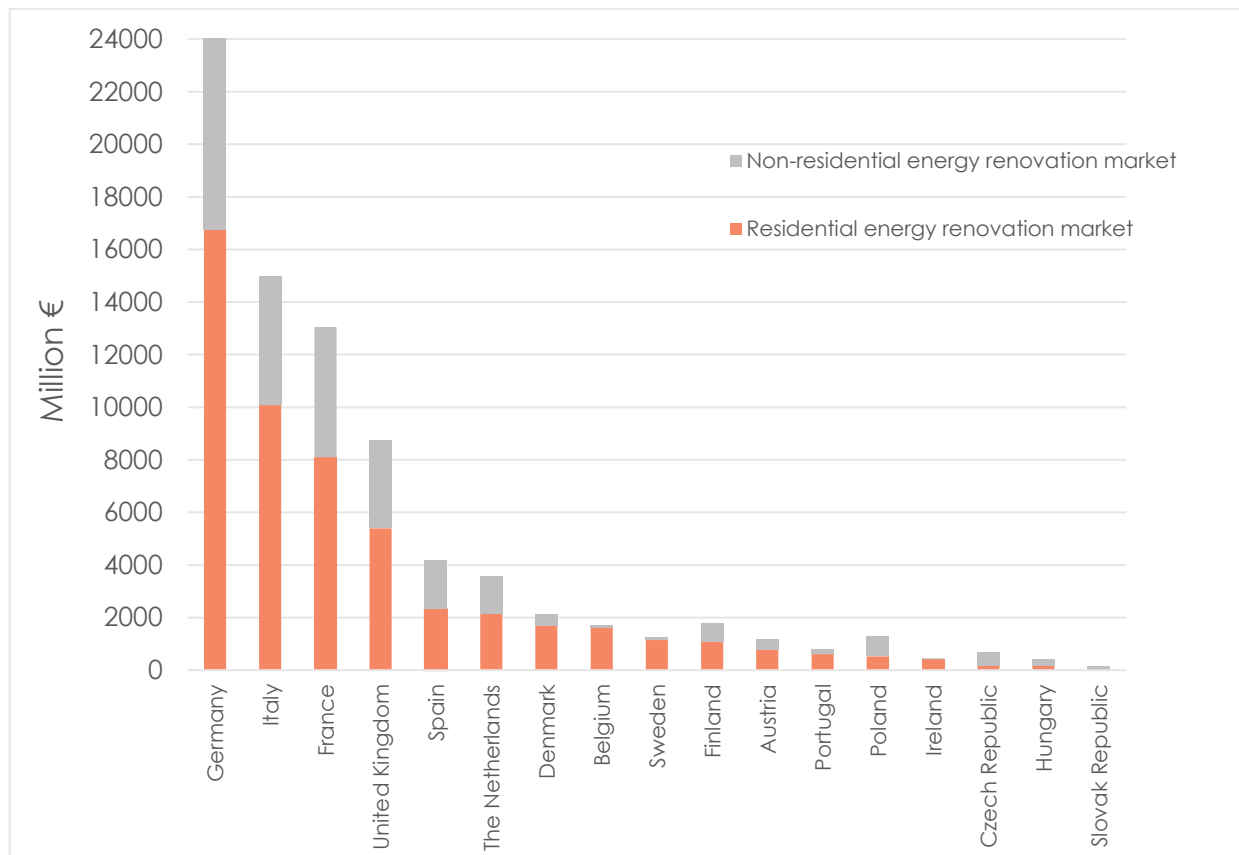


Figure 5 – Estimations for the size of the residential and non-residential energy renovation market (Source: [13])

The following actions are needed in order to reach the target market volume figure of €122 billion with approximately 988,200 additional jobs in the sector [13], if energy saving objectives of 40% for 2030 are met:

- **Increase the renovation rate**

The renovation rates need to ramp up from the current rate of around 1% of total floor area renovated annually, to between 2.5% and 3% p.a. from next year [13]. The final renovation rate is determined by the speed with which activity is ramped up, as illustrated in the figure below. While Figure 6 is a couple years old, it illustrates the urgency of increase renovation activity in order to meet the regions 2050-vision for the building stock.

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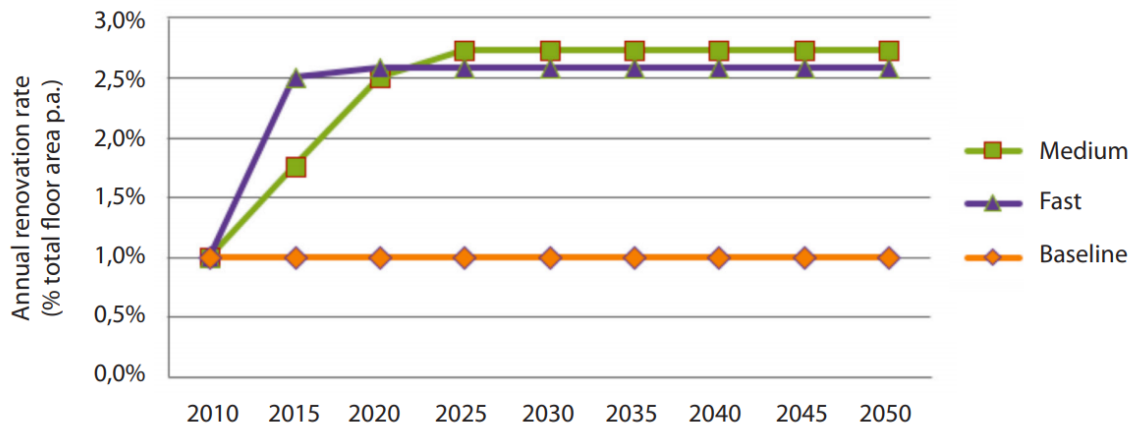


Figure 6 – Required increase (annual) in renovation rate to achieve 90% CO₂ (Source: [14])

- **Increase the renovation spending**

According to the European Construction Sector Observatory, the average share of renovation spending (including non-energy efficiency related innovations) out of households' disposable income varies. As can be seen in Figure 7 they are Poland, Romania and Slovakia which spend more than 2.5% of their disposable income on renovation. Of the Turnkey Retrofit service targeted countries, France spends more than average, Spain close to average and Ireland much less than average on renovations.

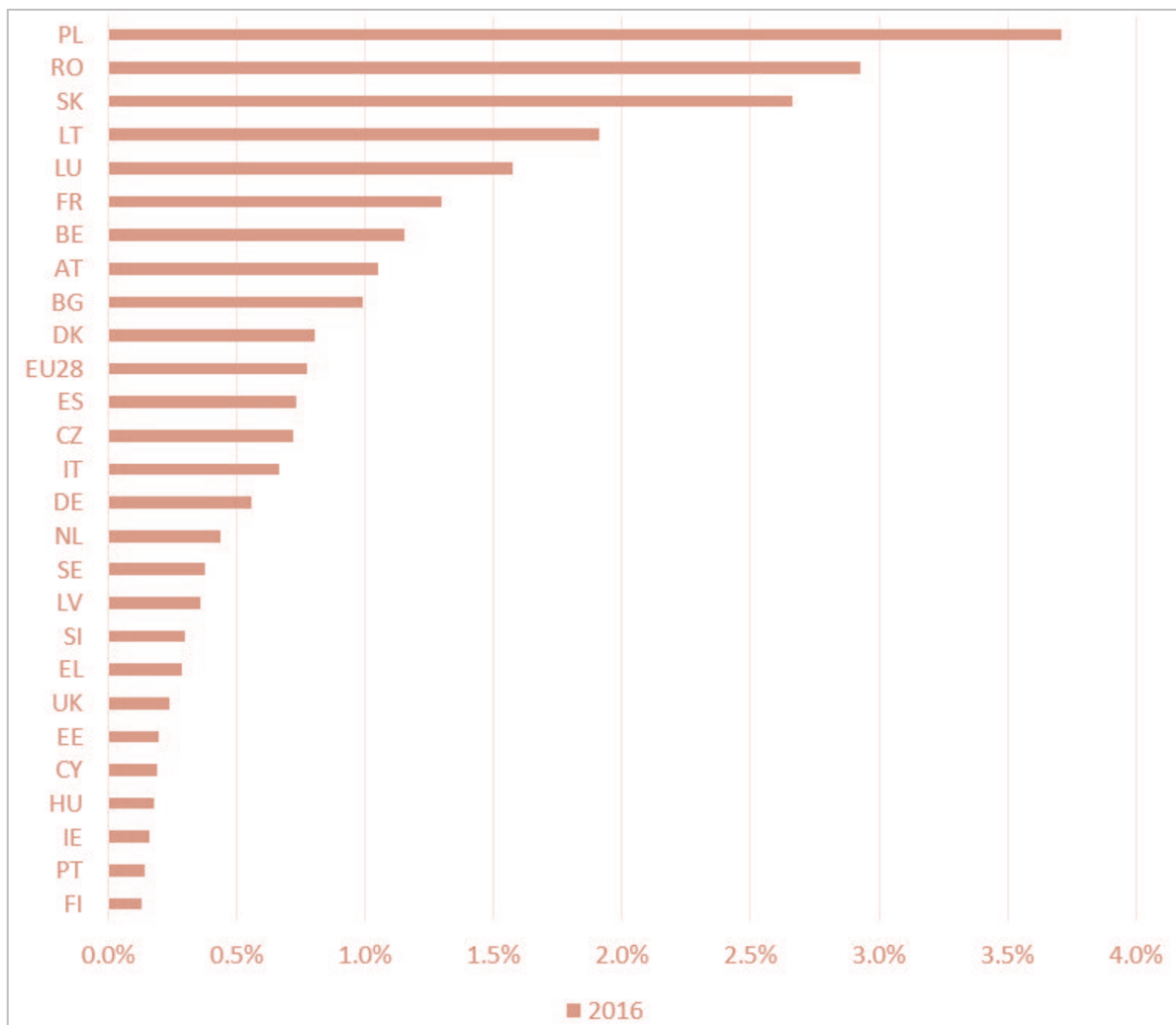


Figure 7 – Renovation spending as % of disposable income, EU-28, 2016 (%) (Source: [10])

- **Increase the renovation depth**

Most renovations today aim to renew one, or a few, part(s) of the building. A study by the German Federal Office for Building and Regional Planning (BBSR) reveals that only 6% of renovations are done in one step primarily due to high investment costs and disruption. Another study reveals that the rate is similar in Sweden at 5% [15]. The fragmented renovation measures are rarely planned for the long-term, which often causes lock-in effects hampering the cost-effective path for the building to become highly energy efficient.

It will be necessary to establish ambitious policies that activate the demand and accelerate the private inversions in energy renovation. It is therefore of utmost importance that each country considers that energy efficiency should be the first priority, as the EU proposes, focusing on the energy renovation of buildings as the most cost-effective way to contribute towards achieving the EU objectives. In addition, it will also be absolutely necessary to boost the much-needed change in this sector, which will allow it to be more efficient and to create new business models that are

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attractive and encourage the owners to undertake energy renovations in their buildings, eliminating any of the current hurdles.

Overview of the integrated home renovation service market

The energy renovation market has enormous growth potential driven mainly by the ageing EU building stock and the related policy objectives. If Member States adopt their policies in compliance with EU guidelines and work in favour of their environments to drive an increase in the annual renovation rate (3% objective), the actors involved in the renovation sector will have a great opportunity to position themselves in the market if they are able to offer a differentiated value proposition to their customers.

To adopt a competitive strategy, companies can implement new technologies to increase their productivity and efficiency, to develop new solutions and products, to tackle more complex projects, to have new communication channels with suppliers and customers. Figure 8 shows which technologies are most likely to be exploited in the construction sector.

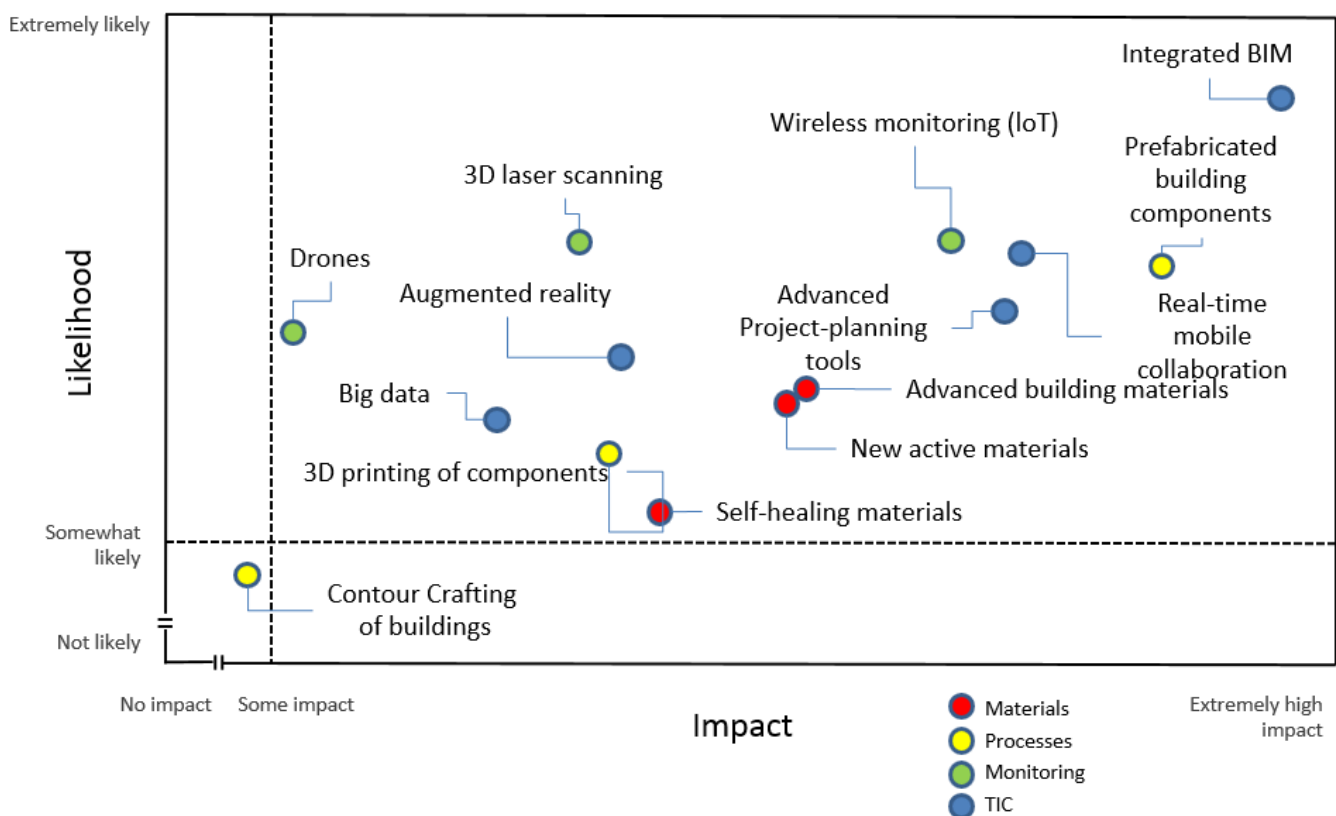


Figure 8 – Impact – Likelihood matrix of new technologies (Source: [16])

But they also need to think about and decide on their coverage in the value chain, i.e. the scope of their services: this can be from design and engineering to the execution of the energy rehabilitation project, including also the management of financing. The objective: to offer an integrated solution to the market.

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For this, companies have different options to be able to answer them:

- Develop the necessary knowledge internally.
- Improve collaboration with other suppliers at the project level.
- Improve industry-level collaboration by partnering with other companies as part of a value chain integration strategy.

The home renovation market remains highly fragmented and largely dominated by micro-enterprises offering unique products or services [17]. This complicates the process:

- From the customer's perspective: the owner considers that the energy renovation project of his house is a tricky process; that the management of the different professionals can be an important burden; difficulty in making decisions; doubts about which can be the best offer; etc.
- From the perspective of suppliers: uncertainty about who is responsible for certain jobs when coordination fails, insufficient communication, lack of knowledge of the work of other suppliers, difficulty in accessing individual customers who do not request only a part of the work but want everything, etc.

Offering an integrated solution to the customer means that the user does not have to deal with all the entry points of a complex renewal value chain with several interlocutors, but only has a single-entry point to cover the whole renovation process.

On the other hand, for suppliers, the offer of integrated solutions allows them to capture a market niche in which to satisfy the specific needs of customers, from individual packages to full-service solutions [18].

In order to be able to offer these integrated solutions, i.e. the elaboration of a more structured and holistic offer, the support to the owners of the houses in the taking of decisions, the proposal of a set of solutions to measure, the coordinated execution of the project assuring the quality, etc. there are companies that have opted for:

- Business models with which they extend the scope of the service they currently provide. In other words, they offer new services complementary to their nuclear activity, which may be provided by other suppliers in the value chain (the same or improved). The following Figure 9 summarises the actors involved, what their nuclear activity is and how they are expanding their services by offering others in the value chain:

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Figure 9 – The role of certain market actors in the renovation value chain (Source: [19])

- Collaboration with other companies. For the main suppliers of the rehabilitation process (architects, engineers, installers, financial partners, etc.), offering integrated solutions allows them to better position themselves in the market. Although in this case, there may be difficulties in understanding the perspectives of others and therefore translating their ideas into a common strategy.

On this line, one-stop-shops (OSS) is aimed at providing integrated renovation services for existing buildings⁵.

The idea of a one-stop shop service is to focus on helping the homeowner make the best decisions that will lead to an optimal renovation project. And for that, the main challenge for a success of an OSS model is to have a clear understanding of the house owner needs in the local context.

Integrated home renovation services, provided through OSS, have existed in Europe for more than 10 years. But the current knowledge about this business structure is still quite limited [18].

A study has been carried out that analyses different types of OSS that exist today in the EU and concludes that they are a good option to bridge the gap between the fragmented supply and demand side. The study analyses 23 existing case studies in Europe, whereof 7 no longer exist. Of the 16 operational OSS, those that have received public funds (a total of 12) are the most complex and those that offer a real variety of tailor-made solutions for clients [18]

⁵ The concept is included in the Directive 2018/844/EU (See Article 2a and 20(2) in EPBD, 2018/844), which amends the Directive 2010/31/EU on the energy performance of buildings (EPBD) and Directive 2012/27/EU on energy efficiency (EED)

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In the TURNKEY RETROFIT project, D1.1 Benchmarking of promising experiences of integrated renovation services in Europe [2] nine integrated renovation services are analyzed (among them, there are 3 that also appear in the previous study: BetterHome, Oktave RetrofitWorks). The report shows that there are several different types of OSS, in terms of governance, target groups and success. They also offer different value propositions.

Most of the existing models have been developed in north-west Europe (Nordics, Benelux, France, UK and Ireland). With the new EPBD provisions together with a general growing focus on energy renovations, it is likely that many new integrated home renovation services will start in the coming years.

OSS can play different roles under different business model concepts, such as (i) industry-driven, where manufacturers and installers aim to extend their businesses; (ii) consultant-driven, where they develop customer-related business models; (iii) energy service company-driven, where they extend the value-added solutions; (iv) local government-driven, where the programmes are generally climate or energy related; and (v) cooperative-type, where they aim at societal benefits beyond energy or cost savings. The nine cases analysed in this report represent four of these five roles⁶.

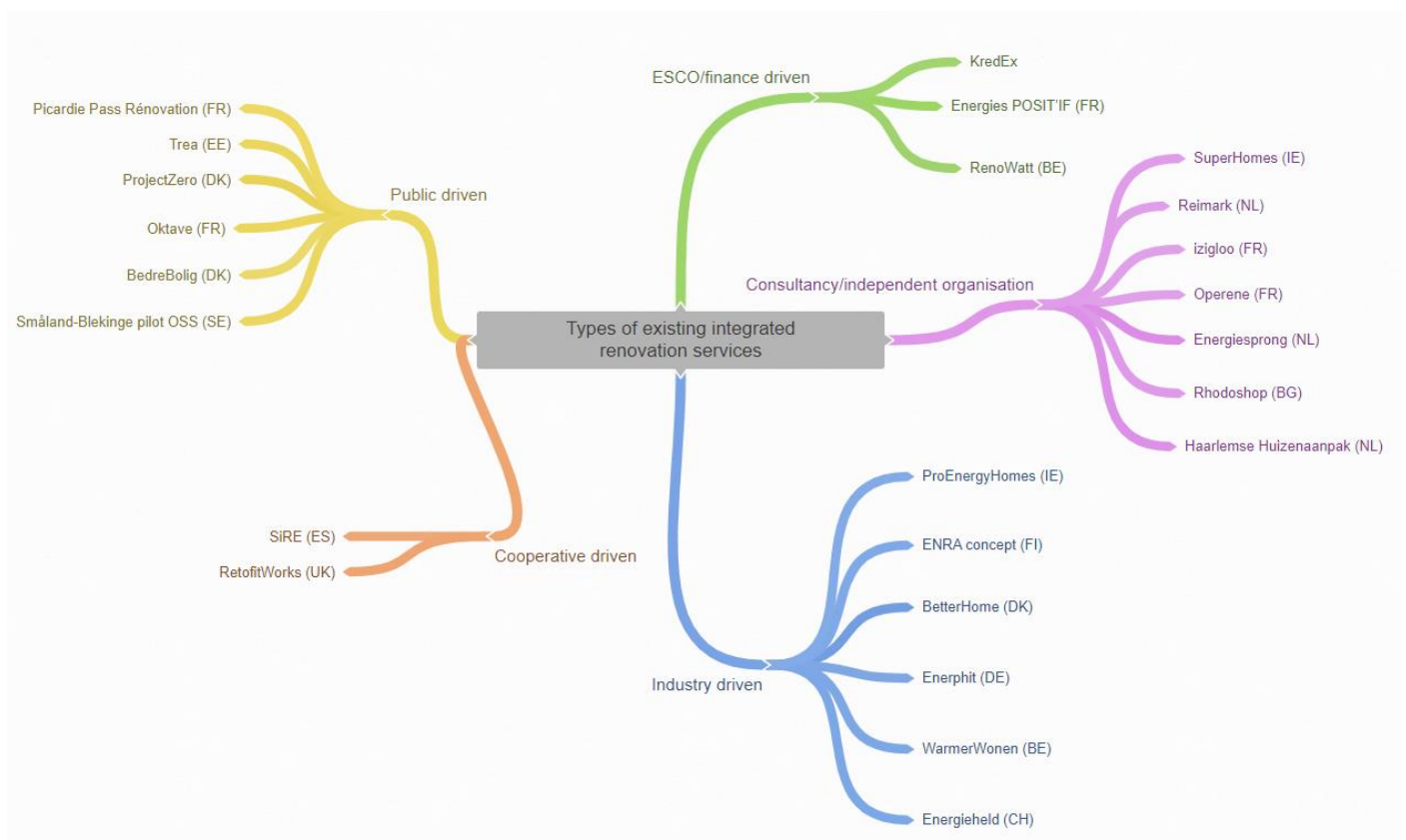


Figure 10 – Compilation of existing OSS (compilation by Turnkey Retrofit consortium)

⁶ (i) BetterHome and ProenergyHomes, (ii) Operene, Izigloo, SuperHomes and to some extent Energiesprong, (iv) Oktave (local semi-public company), (v) SiRE and RetrofitWorks

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Most of the existing business model concepts focus on residential buildings, including single-family houses, multi-family buildings, as well as social housing and public buildings. Few existing OSS focus primarily on commercial buildings.

It is expected that the development of these new business models necessary to provide this integrated solution, mainly with the collaboration of SMEs in a fragmented market (collaborative business development), will result in an increase in home renovations, which will achieve the target of 3%.

The PESTLE analyses carried out are intended to provide an input to try to analyse whether the necessary conditions are in place for a service such as TURNKEY RETROFIT could be offered as a one-stop-shop in the target countries.

2.2. France

Building stock characteristics

About two-thirds of French residential buildings are single-family buildings [10]. Multi-family dwellings are on average 32% smaller than single-family dwelling, with an average size of 62m², compared to 90m² for single-family dwellings. The type of single-family dwellings has an impact on the space heating energy performances because of different insulation characteristics implying different specific space heating consumption (due to different wall area in contact with the outdoor): a semidetached house consumes on average 15% less per m² than a detached dwelling. The stock of individual dwellings built before 1975 (target buildings) is composed by 22% of semi-detached houses while detached houses represents 78%.

- Total building stock built before 1975 (priority target in the context of TURNKEY RETROFIT): 15,680,000 dwellings.
- Average energy consumption of 203.5 kWh/m²/year for single-family houses, and 182.7 for multi-family dwellings.

Energy performance certificates gives an indication of the energy performance of the building stock.

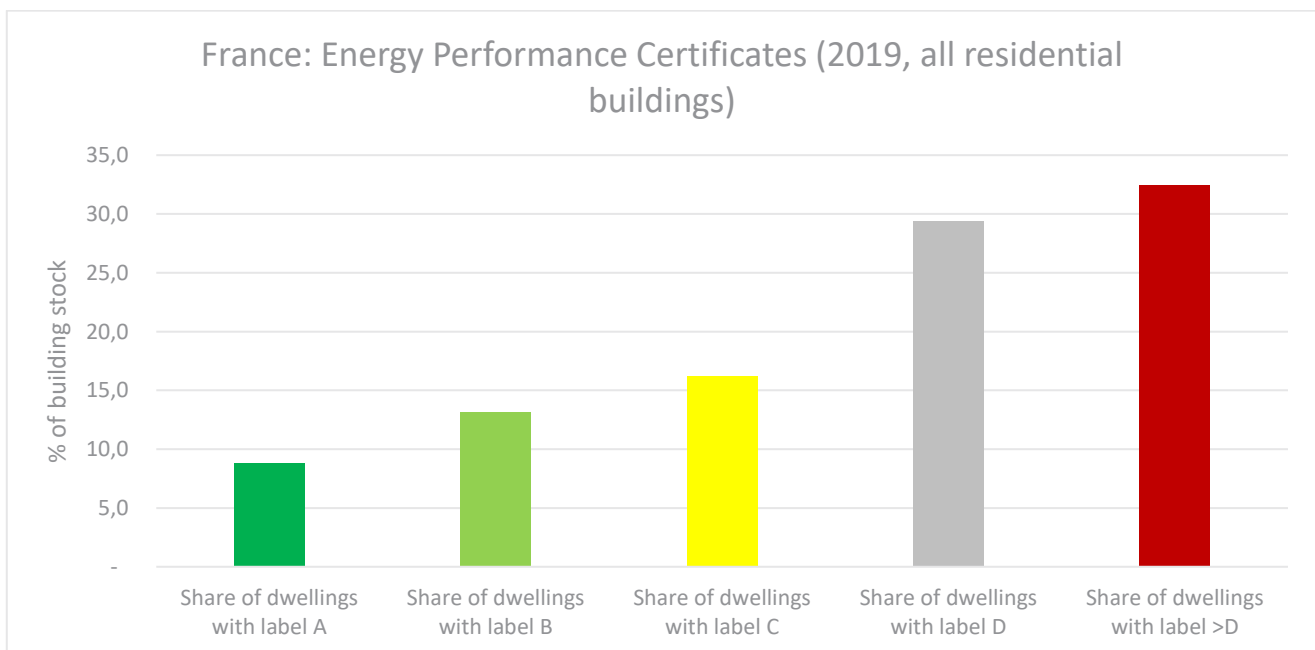


Figure 11 – France: Energy Performance Certificates (2019, all residential buildings) (Source: BPIE)

Summary of the factors and their impact

A summary of the factors identified and their impact on the business opportunities required to run and upscale the TURNKEY RETROFIT service in France is given in Table 1. Reasoning for the assessed impact of the factors is detailed in the following sections. The scale for the impact assessment is:

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- Very negative (--)
- Negative (-)
- Positive (+)
- Very positive (++)

	(- -)	(-)	(+)	(+ +)
Political		Policy low efficiency	Stable and favourable policy towards energy efficiency French regions have launched innovative policies to increase rate and depth	
Economic	Worrying rise of the Private Debt	Low employment rate Fiscal incentives low efficiency	Strong health, social and environmental rankings	
Social		French people are not ready to use services based entirely on web platform	Growing concern and awareness of climate change	
Technological		Lack of highly qualified	Quality (certification) mark for renovation	
Legal			Construction products reuse	Thermal regulation for existing buildings
Environmental	Adverse impact of renovations: embedded energy, material		Old building stock with high energy consumption Adaptability to climate change impacts	

Table 1 – Summary of the factors identified and their impact on the business opportunities required to run and upscale the TURNKEY RETROFIT service in France

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Description of the factors

Political factors

In a political context, factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in France are:

- Stable and favourable policy towards energy efficiency
- A strong strategic overarching framework
- Numerous supports and incentives tools
- Policy efficiency

Stable and favourable policy towards energy efficiency

Buildings' energy renovation has been a priority of the French government for several years. A significant number of policies have been enforced to tackle this topic and this should continue for the coming years. During the last presidential election in 2017 it was one of the only political issues whose importance seemed to lead to a consensus among all candidates [20].

The current government's ambition is to reach the goal of carbon neutrality by 2050. Three different kind of actions are in place to complete that challenge:

- Financial incentives for owners
- Set goals and milestones
- Professional training

With the law on energy transition and green growth (LTECV), the national low-carbon strategy (SNBC) and the multi-year energy planning (EPP), France has set many goals for energy renovation.

Clarification is needed [21], given the proliferation of energy, climate, social and economic objectives. It is therefore necessary to better prioritize the objectives, to drive more effectively this priority, but also to make it more understandable for the French.

A strong strategic overarching framework

In 2017 the French government launched the "Plan de renovation énergétique du bâtiment" (PREB), a program that sets ambitious retrofitting targets and helps to finance the energy retrofit of buildings. The Plan is structured in 12 actions subdivided into four axes:

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Figure 12 - 4 working's axes of the major renovation program (PREB) in France

The plan will dedicate €14 billion over a five-year period to finance the renovation of 500,000 housing units per year. Highly energy inefficient buildings, so called “passoires énergétiques”, are a special priority of the plan with the targeted energy refurbishment of 150,000 per year of those buildings, occupied by households in energy insecurity. Affordable prices for the interventions are a major objective of the plan.

This plan was submitted for consultation and a new version was released in April 2018 [22]. The plan now includes a simplification and increase of current public incentives, improved and more reliable energy diagnostics, enhanced and streamlined methods and training to increase quality of the work carried out by professionals, especially in the context of deep renovations.

Numerous supports and incentives tools

The strategic overarching framework PREB is supported by several tools. In addition to the financial tools described below in the Economic section of this report, several services offer their support and advice to facilitate renovation works, each from a different angle (e.g. connecting with public incentives, learning about renovation techniques, etc.)

- FAIRE⁷: a public website allowing people who wish to carry out energy renovation work in their home to learn about the different public support and incentives they can benefit from. The website provides:
 - Everyday life advice on energy savings
 - Energy renovation advice
 - A directory of renovation professionals
- ‘Renovation Info Service’ offices: 450 renovation information physical offices spread throughout France, offering a free, simple and direct service.
- ‘Habiter mieux’ by Anah: social energy efficiency refurbishment programme to support low-income owners in the renovation of their properties (financial support, thermal diagnostic, follow-up of the renovation operation)
- SPPEH, ‘Service Public de la Performance Énergétique de l’habitat’: created by the 2015 energy transition law, to provide practical advices to individual owners to support the realization of their renovation projects.

⁷ FAIRE (formerly « Renovation info service »): <https://www.faire.fr/>

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This one-stop shop is coordinated by the regions and implemented at local level. Although appreciated by the actors of the construction sector, the financing of this service is threatened: the French Energy and Environment National Agency (Ademe) plans to gradually reduce its budgets [23].

- SARE, ‘Service d’accompagnement pour la rénovation énergétique’: should be launched on 1 January 2020 and be financed by the White certificates. SARE will focus on the following areas of work: (1) support of individuals, including energy audits carried out to make the right diagnosis before starting housing renovation; and (2) training of building construction actors.

Policy efficiency

To scale up building renovation it won’t be enough to bring additional funding but to also focus on the adjustment and coherence of regulatory systems, in order to guarantee the effectiveness of public support tools. This requires the necessary harmonization and simplification of existing tools according to the Think tank IDDRI [24].

French people understand the benefits of renovation work, but in order to actually get things done, they need to be supported by clear incentives and support tools

“There is still a clear lack of awareness of the multiple available support services and incentives. As an example, only one French citizen among five has already heard about the “Renovation Info Service” physical offices” [25].

Economic factors

Various economic factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in France are:

- General economic situation
- Fiscal incentives
- Fiscal incentives efficiency
- Economic situation of the building renovation sector

General economic situation

Stable Gross Domestic Product growth

The French economy has a high productivity, ensuring standards of living in line with the OECD average [26]. Moreover, from 2015 to end-2017, monetary policy, the global economic upturn and structural reforms have supported a gradual economic recovery.

GDP growth is expected to remain around 1.3% in 2019-20. The average household net-adjusted disposable income per capita is 29,000€ a year, lower than the OECD average of 30,700€ a year.

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However, economic growth slowed in 2018 and economic performance has decreased over the medium term. Indeed, global uncertainties and the effects of social troubles weighed on activity in 2018. This could have a negative impact on the GDP Growth.

Worrying rise of the Private Debt

In an environment of ultra-low interest rates, banks lend to a large number of French inhabitants. The indebtedness of French households and businesses relative to GDP is now the highest of the largest European countries: to 133.3% of GDP in France at the end of September 2018 (of which 59.2% for households and 74.1% for non-financial corporations). It has surpassed Spain's level and far exceeds the euro area average (118.6%), while remaining below the United Kingdom (153.1%) or United States (149%), according to figures released in early February 2018. [27]

According to a recent International Monetary Fund (IMF) study, a strong and rapid increase in private debt relative to a country's GDP has, subsequently, an amplifying effect on a recession, far more than public debt. This explains why analysts and regulators are following the subject very closely.

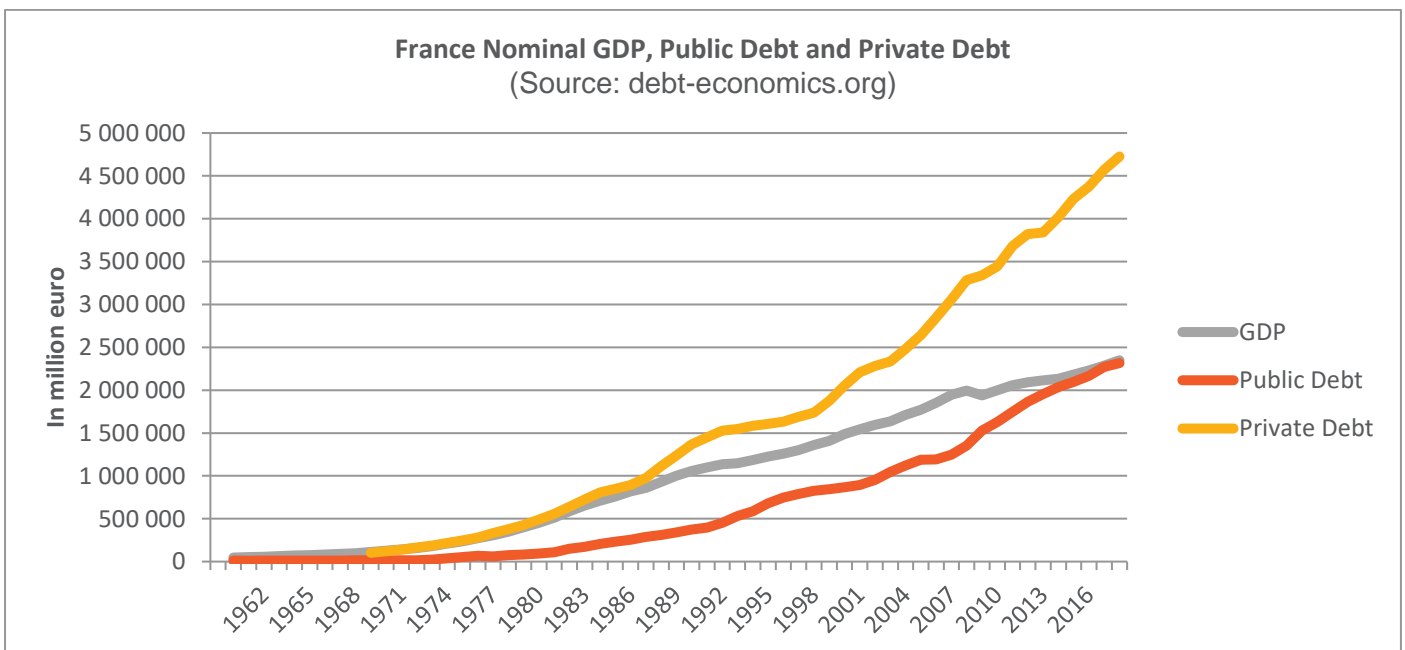


Figure 13 - Evolution of the GDP compare to Public debt and Private debt in France

Low employment rate

Employment rates remain low in international comparison despite a recent increase. About 65% of people aged 15 to 64 in France have a paid job, below the OECD employment average of 68%.

The employment rate is still one of the lowest among OECD countries, especially for the low-skilled, youngsters and older workers, despite its historically high level. Too many workers have skills that do not match labour market needs and educational outcomes are highly dependent on family background. Unequal access to training has made it difficult for the professional to hire young employees.

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If renovation activities became stronger it could have a positive impact on the employment rates and on the SMEs' activities.

Flexible labour market

Recent reforms promote a more flexible labour market, through lower uncertainty about layoff costs [28]. However, short-term contracts have rapidly increased. Containing the use of short-term contracts would require increasing the relative cost of short-term hiring and reforming the unemployment insurance system so that it does not encourage recurrent short-term employment periods and unemployment spells. The authorities foresee taking measures in this direction. Moreover, favouring workers' mobility should help match job offers with job seekers.

Strong health, social and environmental rankings

France has some good rankings on the OECD Better life impact [29].

In terms of health, life expectancy at birth in France is a little over 82 years, two years higher than the OECD average of 80 years.

The level of atmospheric PM2.5 – tiny air pollutant particles small enough to enter and cause damage to the lungs – is 1.34×10^{-8} kg/m³ almost in line with the OECD average of 13.9×10^{-8} kg/m³. However, despite a trend towards improving air quality over the last twenty years, the limit values are still not respected in several areas during pollution peak [30].

France also performs well in terms of water quality, as 82% of people say they are satisfied with the quality of their water, broadly in line with the OECD average of 81%.

France performs well regarding several aspects of work-life balance: fertility is above the OECD average; the employment rate of women aged from 25 to 54 is above the OECD average, and 78% of them work full-time; and despite a recent slight increase, at 10.8% the child poverty rate regarding children aged from 0 to 17 remains below the OECD average (13.9%). These positive outcomes go hand-in-hand with high investment in family policies across the different stages of childhood.

The French Government makes strong efforts to tackle sustainable development challenges.

Fiscal incentives

To promote energy renovation, several financial aids are available for individuals but also for social housing. The main fiscal incentives are:

For Individuals:

- Reduced VAT: renovation work done in old housing has reduced VAT rates under certain conditions. VAT at the reduced rate of 5.5% or at the intermediate rate of 10% is reserved for improvement, conversion, development and maintenance work on dwellings completed for more than two years.
- Eco-PTZ: zero-interest loan up to 30,000 euros to finance eco-renovation work. It is aimed at the owners, whether they live in the house or rent it out. The work must be carried out by recognized companies certified under a label called 'Reconnu Garant de l'Environnement' (RGE).

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- Created in 1995, this fiscal incentive is stable and secured in France. Some changes were introduced regarding allocation provisions, the last one in July 2019.
- Energy transition tax-credit (CITE): The tax credit for the energy transition makes it possible to deduct from the income tax 30% of the expenses incurred for certain works related to improvement of the energy performance. It concerned work performed between 2014 and 2019. This incentive should be updated and continued in 2020. Here again, the work must be carried out by recognized companies 'Reconnu Garant de l'Environnement' (RGE).
- One-euro insulation / Habiter mieux (Anah), Energy check.

For Social Landlords:

- Eco-PLS (Prêt Logement Social / Loan for Social building): Specific for landlords, this is a loan of € 9,000 to € 16,000 per unit, accessible to social landlords.

For Social Landlords and individuals:

- CEE (Certificats d'Economie d'Énergie) / White Certificates: Any person or legal person (associations, community, company) who will save energy will be issued a certain number of certificates based on kWh saved and may sell them to energy suppliers.

Fiscal incentives efficiency

The efficiency of all those incentives are regularly assessed to improve the overall scheme. The French government acknowledges that effort is still required to clarify those programs in 2019 that are not clearly understood and known by most of the population.

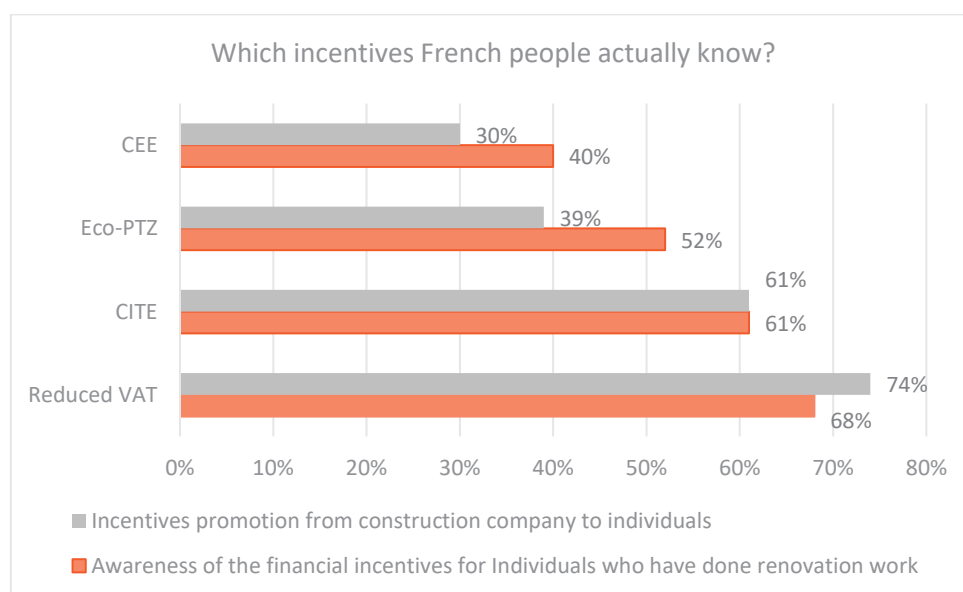


Figure 14 - Awareness and promotion of aid schemes with households in France. (Source: ADEME, Open 2015 [31])

Nearly half (44%) of the households that benefited from at least one financial incentive report that it allowed them to get the work done by a professional (most of them are eco-conditioned to the recourse of RGE certified-

Market & PESTLE Analysis

professionals) [32]. Anah's incentives have a more pronounced triggering effect than the others: 37% of the households that resorted to it declared that the aid made it possible to launch the project, compared to an average of 18% for the other incentives.

	CITE	Reduced VAT	CEE	Anah	Local incentives	All average
Get the work done by a professional	45%	45%	44%	47%	45%	44%
Conduct more renovation work	24%	17%	23%	29%	35%	19%
Starting the renovation project	19%	15%	23%	37%	33%	18%
Choose better quality products	18%	13%	19%	21%	20%	15%
No impact	25%	29%	24%	5%	8%	25%

Table 2 – Impact of financial incentives (Source: ADEME, TREMI 2017)

24% of households do not carry renovation works because their financial situation does not allow them to carry out renovation work. The study shows that more than 50% of households think their house does not need renovation works, which is not aligned with the status of the building stock.

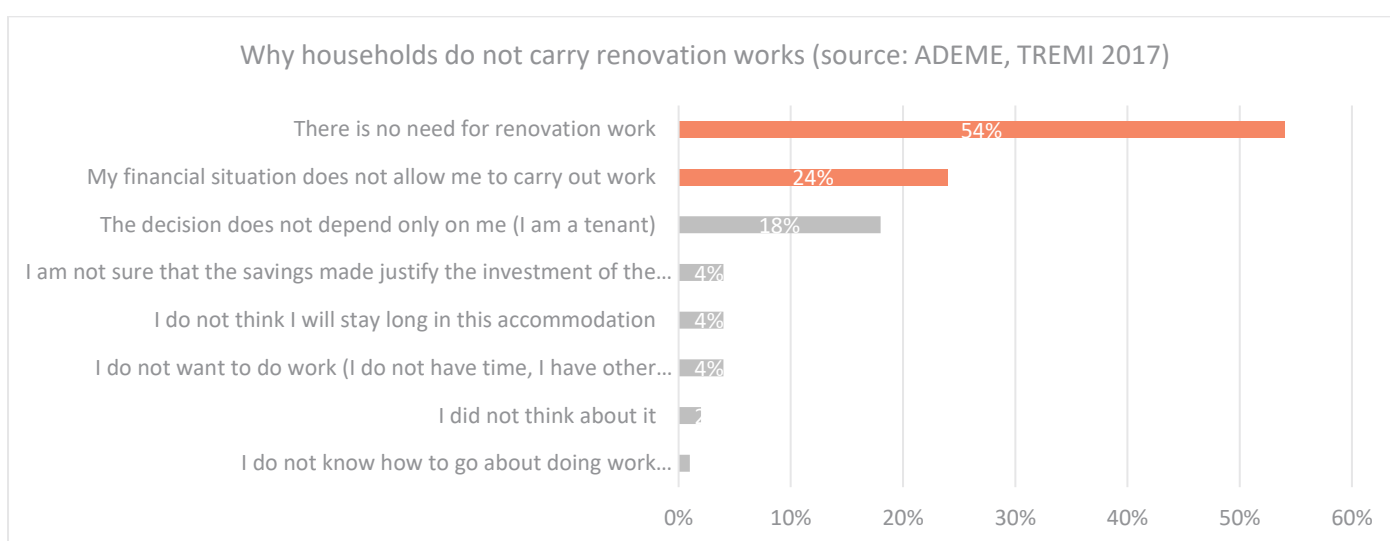


Figure 15 - Ranking of reasons why households do not carry renovation works

The results of the kiWih energy performance observatory [33] in 2018 show that for construction companies, the solutions already exist, and the question is to capitalize on the existing incentives and improve their efficiency. In addition, the survey highlights the need for communication with end-customers to raise awareness.

A major French economic newspaper Les Echos [34] states that “The public aid scheme is complicated. It combines subsidies, reduced VAT, zero-rate loan (Eco-PTZ), tax credit, and financial contribution from energy suppliers (CEE). This system has become unreadable, incoherent and costly, creating opportunity effects, and above all globally inefficient, without forgetting the "capture" of tax credits by suppliers, who take the opportunity to increase their prices”.

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Economic situation of the building renovation sector

Amount of activities

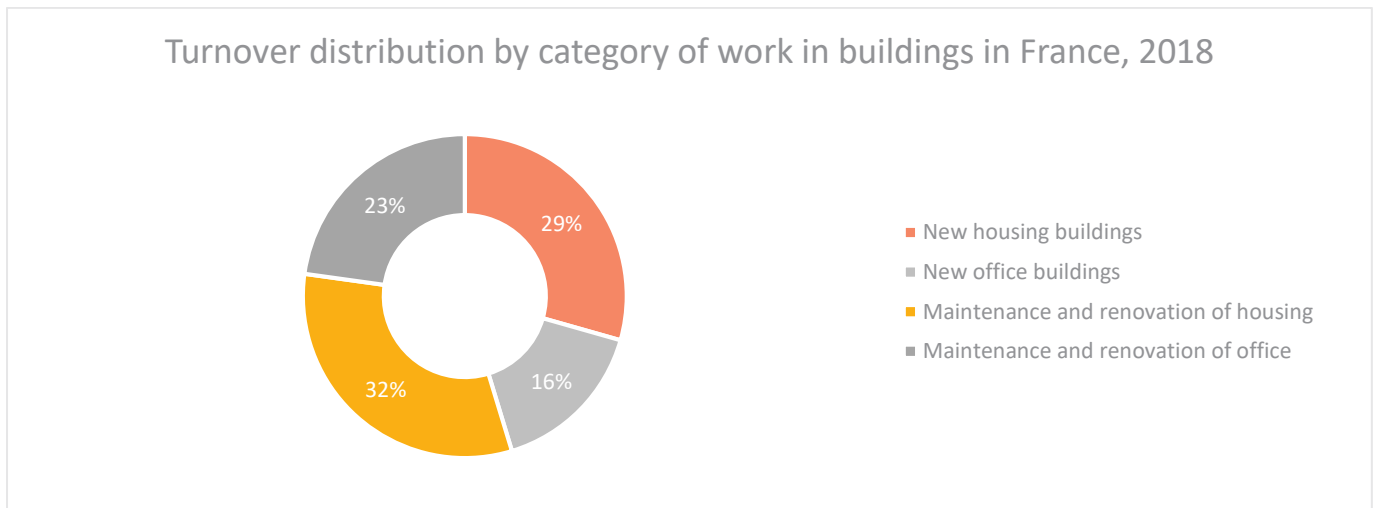


Figure 16 - French building activities turnover distribution in percentage of Euros (Source: AQC – 2018)

Maintenance and renovation work count for more than 50% of the turnover of all building's activities in France in 2018 [35]. Residential buildings account for 61% of the turnover building's activities.

ADEME TREMI study reveals that the amount of renovation activities had slightly increased in 2018 by 0,8% with a large disparity between housing and non-residential (i.e. respectively 1.5% vs 0.3% down). But the current pace of renovation activities is still too slow to reach the French government objectives (carbon neutral by 2050).

Renovation costs

The works carried out between 2014 and 2016 (at least one of which was completed in 2016) generated €59.3 billion of which 85% (€50.5 billion) is related to energy expenditure. The average cost per dwelling is €11,750. The renovation of the roof or attic represents the highest average expense (€6,400/unit), followed by openings (doors/windows) (€6,100/unit) [32].

Increase in renovation costs

An INSEE 2019 study [36] demonstrates that in Q1 2019, buildings' maintenance and improvement work price index (IPEA) went up (+0.7% after stability observed over the previous quarter). The growth was marked practically in all types of work, due in particular to rising raw material costs and annual price increases. Prices accelerated for joinery installation (+1.1% after +0.1%) and in other specialised construction activities (+0.9% after +0.1%). They rebounded when it comes to electrical installation (+0.8% after -0.6%).

Social factors

Various social factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in France are:

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- Social representation of climate change
- Changing lifestyles
- Web platform-based acceptance

Social representation of climate change

Over the last 15 years, ADEME has conducted an annual survey regarding Social representation of Climate change in France [37]. The results of 2018 survey reveal that the environment is not at the heart of French people concerns, only 8% judge that it is a top priority.

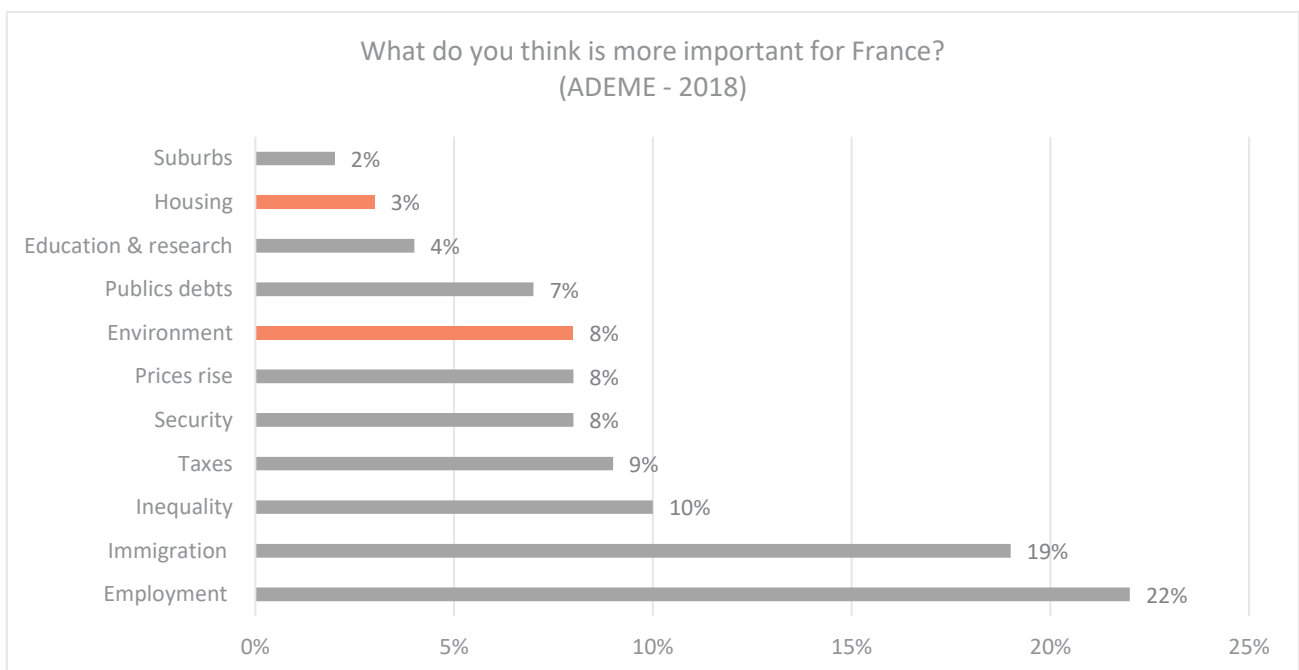


Figure 17 - Ranking of Frenchs' main concerns in 2018

Even if environment is not at the heart of French citizens 'priority, they mainly agree that media should speak more about that topic.

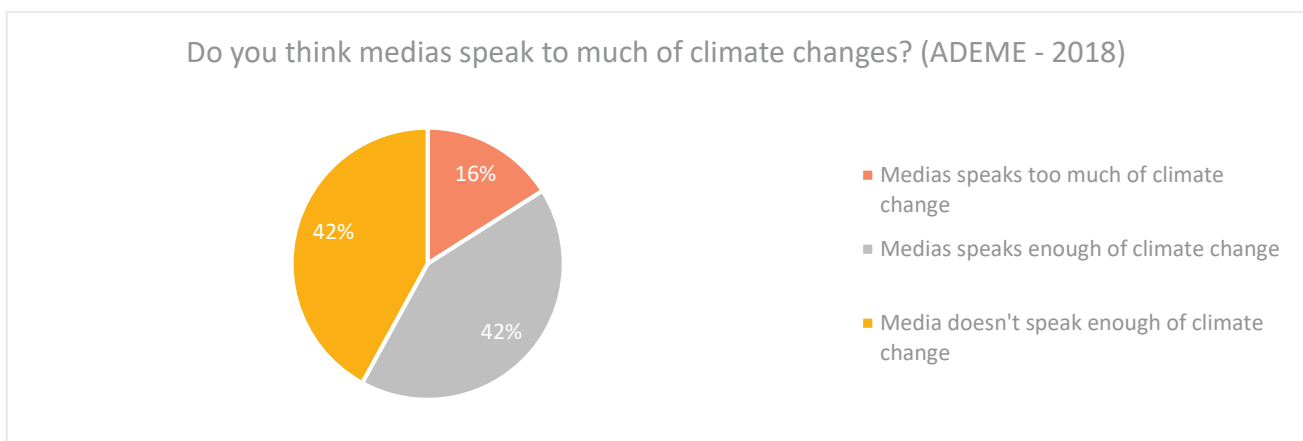


Figure 18 – Evaluation, by French people, of the quantity of information published by media regarding environment in 2018

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Having significant change in their way of life is the most important action that has to be done to tackle climate change, according to the survey.

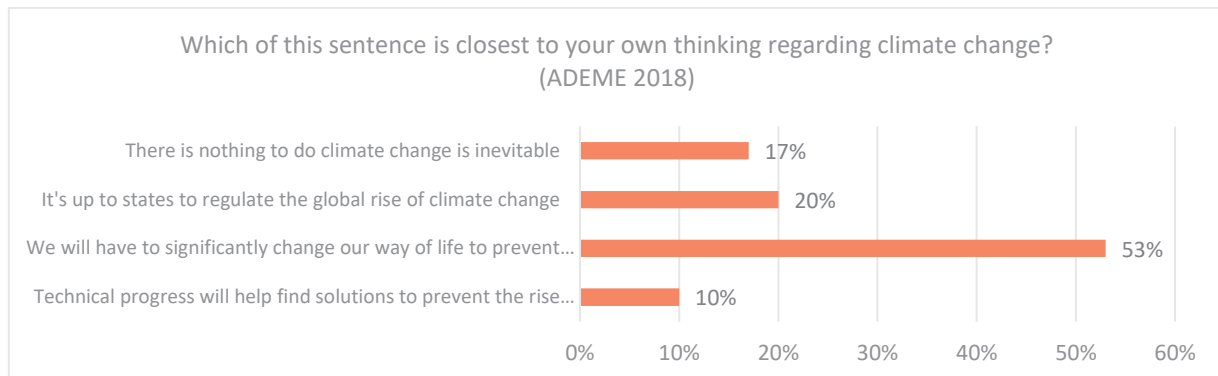


Figure 19 - Ranking of the kind of actions needed according to French opinion

Among the 90% of people who believe that it is possible to tackle climate change, 53% perceive it as a constraint rather than an opportunity. If it significantly acknowledged that changes in our way of life are necessary, 47% consider that the effort must be shared equally among all member of our society.

Changing lifestyles

Longer life expectancy

The number of elderly people is increasing. The demand for adapted housing (small, accessible, equipped to palliate the loss of autonomy) or medicalized, located in the city center, will increase, as well as the offer of 'Services à la personne' (i.e. home care services aiming at supporting ageing at home).

Family structure changes

Families in France are less stable: separations, stepfamilies, increased mobility, financial fragility. They will need smaller homes (single-parent families) or homes which can adapt to more flexible families (modular housing). Solidarity practices (family or not) will be generalized to cope with difficulties.

More connected lifestyle

Our buildings will be connected too, and we will communicate with them to control and regulate the consumption of water and energy. Housing will be able to react to our needs and requests.

As an example, France begins its nationwide smart meter rollout plan [38]. The objective is to reach 95% digital meter deployment by 2020. The smart meter is called Linky and it allows measurement and monitoring of electricity consumption online from a computer.

Market & PESTLE Analysis

Web platform-based acceptance

48% of inhabitants use internet to search for information regarding their DIY (Do It Yourself) or renovation project [39].

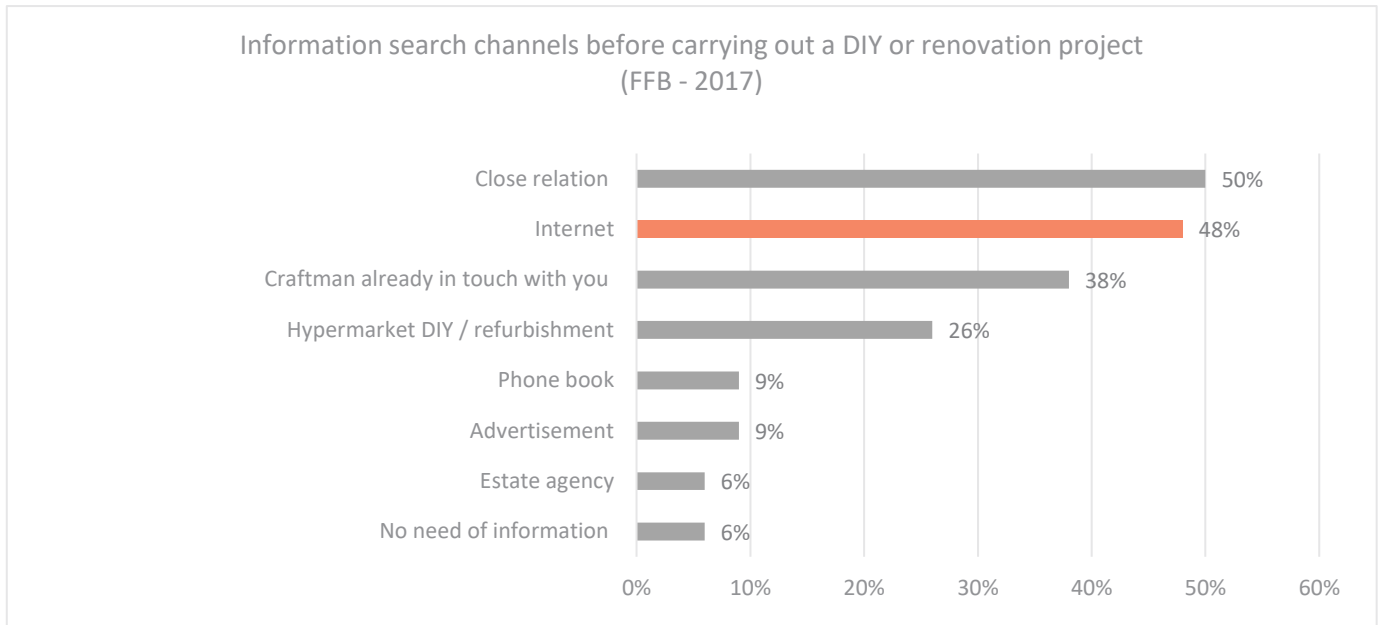


Figure 20 - Level of use of each information search channels used before carrying out a DIY or renovation project (in percentage)

On internet the information searched concerns prices and quality:

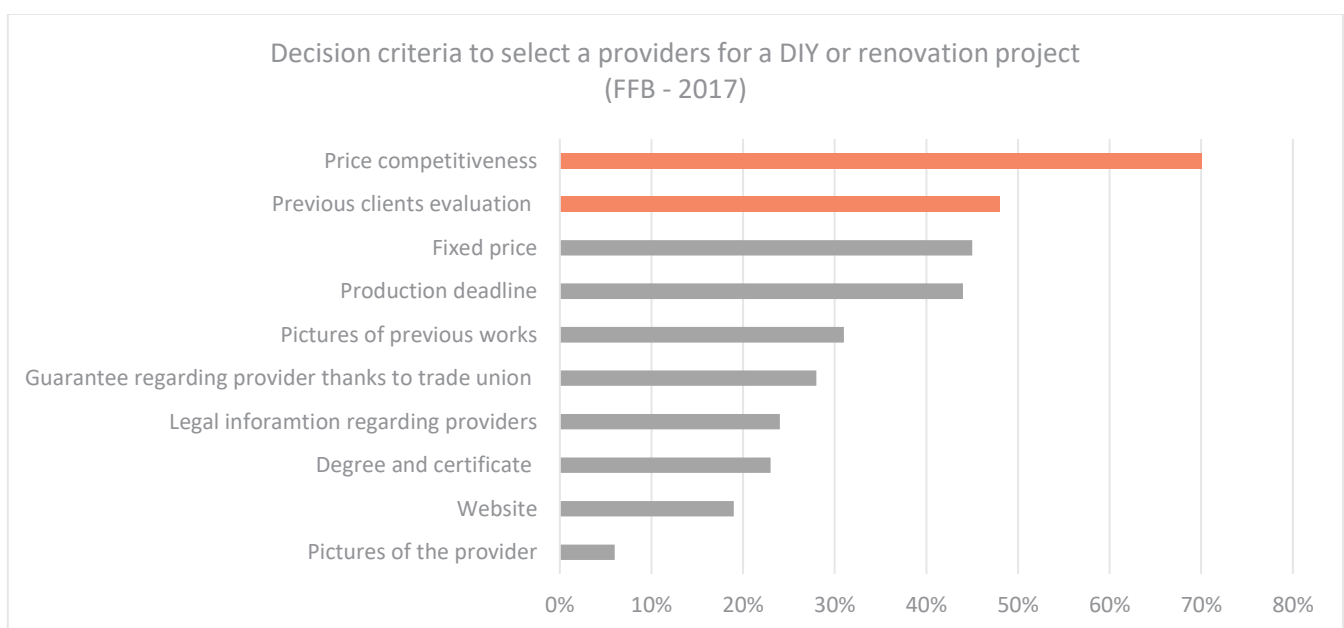


Figure 21 – Ranking of the decision criteria to select a provider for a DIY or renovation project

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Digital buildings platforms are in great development in France. Their development starts in 2011 and in 2017 a study conducted by the FFB (French Federation of Buildings) counts more than 150 platforms.

61% of French respondents know at least one of the proposed digital building platforms. But only 11% actually used them in their projects, mainly for repairing and maintenance.

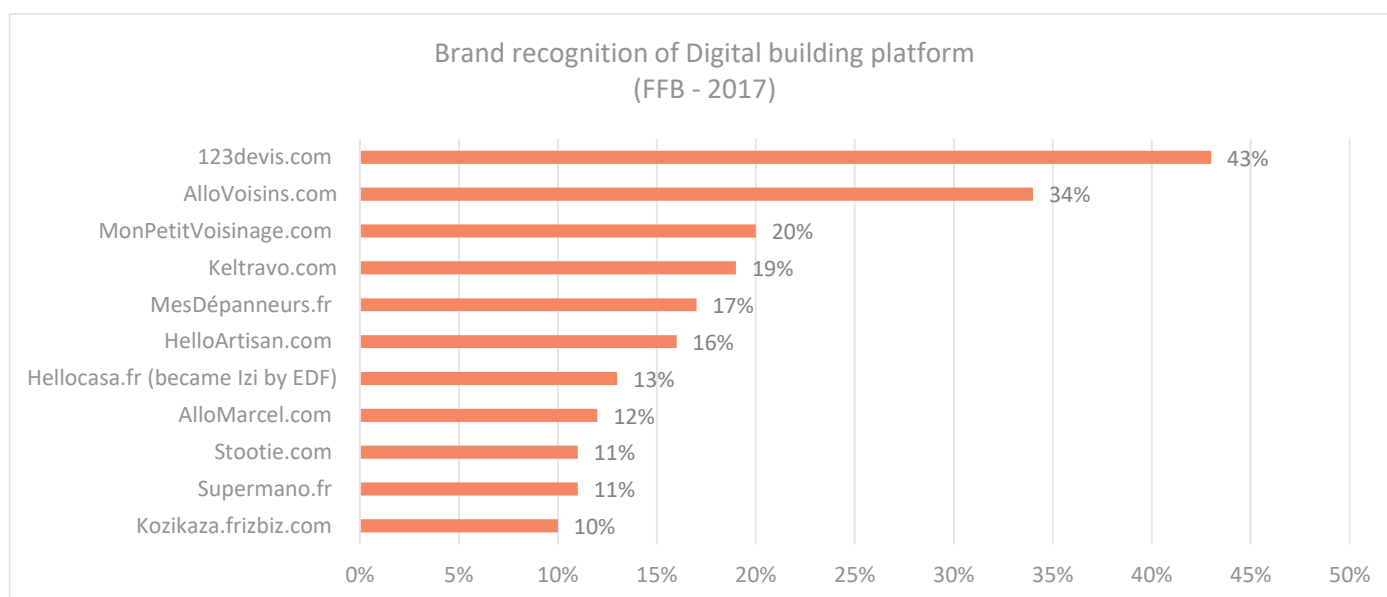


Figure 22 - Ranking of brand recognition of Digital building platform (in percentage)

Technological factors

Various technical factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in France are:

- Poorly qualified professional
- Quality mark for renovation
- Industry of the future
- Services platform and artificial intelligence

Poorly qualified professional

A survey initiated in 2008 by the Agence Qualité Construction (AQC) entitled 'Feedback from (experience) High-performance Buildings & Risks' reports that "the non-respect of the prescriptions [...], the speed of the evolutions of the techniques and the products, the lack of know-how or updating of the skills, the proliferation of the regulatory evolutions [...]" are the main causes of the difficulties in implementing quality energy renovations. Experts views agree on one point: renovation professionals are not able to keep up to date in terms of both business know-how and regulatory changes [40].

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Tackling the renovation challenges requires competent and well-trained professionals. Professional practices must evolve in the technical fields (insulation, ventilation, airtightness, installation of renewable energy systems) but also in global approaches [41]. Teachers and trainers also need to improve their skills to be able to spread good practice to students and construction stakeholders.

Quality (certification) mark for renovation

Quality ratings & labels in France are awarded by third-party and independent entities (including laboratories, certification organizations, inspection bodies) and, in many instances, submitted to the French Accreditation Committee (COFRAC) for final authorization. This includes for instance:

- Certification trademark HQE (High Environmental Quality) for tertiary buildings and NF Habitat HQE for residential buildings include the renovation activities.
- Label HPE renovation
- Label BBC-effinergie renovation
- Energy performance certificate (EPC)

Industry of the future

The study group Industry of the future launched by the president Emmanuel Macron has forecasted that four main technical solutions will be developed to support upskilling the construction sector [42]:

- BIM (Building Information Modelling)
- Augmented workers and equipment (AI help human decision making, augmented reality, connected workers)
- Augmented construction products (IoT, connected objects, green products)
- Big data

The cost of these innovations is still high, and their efficiency is not entirely proven yet. Moreover, this kind of innovations are only use in a few major tertiary buildings.

Services platform and artificial intelligence

The difficulty in standardizing a service is the main obstacle to the massive development of platforms for the construction sector. In other sectors, platforms rely heavily on the ability to offer a clear offer, defined upstream and not affected by external changes. Given the current state of technology, the renovation-related platforms focus on low-cost and low-complexity work.

However, the complexity of the work processed by the platforms could evolve with the introduction of artificial intelligence [43].

Legal factors

Various legal factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in France are:

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- Thermal regulation for existing buildings
- Energy Performance Contracts
- The Tertiary Decree
- Insulation obligation
- Energy study obligation
- Construction products reuse

Thermal regulation for existing buildings

Since 1st January 2018 and the enforcement of a decree released on 22nd March 2017, new requirements concerning the thermal characteristics as well as the energy performance of existing buildings have been introduced and must be implemented in case of energy renovation works. This new thermal regulation, 'RT Existant 2018', applies to renovation of existing buildings.

The regulatory measures are different depending on the importance of the work undertaken by the client [44]:

- The renovation called "global" defines an overall performance objective for the renovated building, to be justified by a regulatory calculation.
- For all other renovation cases, in the event of installation or replacement of a building element (insulation or window installation, boiler change), the regulation defines a minimum performance for the replaced element or installed. To carry the works, owners must use products with energy and thermal performances complying with the new minimum values introduced within the decree of 22nd March 2017.

Energy Performance Contracts

An EPC is defined as a contract between the owner of a building and a facility management company to improve energy efficiency. The aim is to ensure a reduction in the energy consumption of the building in comparison with an initial reference situation that has been measured. The EPC distinguishes itself from other energy services by coupling an investment aimed at improving the energy efficiency of a building and a guarantee on a reduction in energy consumption. In 60% of the EPCs implemented in France [45], the nature of the works carried out within the contract is only focused on the energy systems, while coupling energy systems and interventions on the buildings accounts for about 30% of the cases. The remaining 10% for system optimization and operation is probably not representative of reality.

The Tertiary Decree

The tertiary decree [46] from the Elan law has been published in the Official Journal of 25 July 2019. The targets are to reduce the final energy consumption for all buildings subject to the obligation of at least 40% in 2030, 50% in 2040 and 60% in 2050 compared to 2010. The buildings concerned are those with an area of more than 1,000 m². The decree will be completed by an implementing decree containing the energy performance thresholds, a user guide and the structuring of a database where the owners or users will have to report each year on their level of consumption.

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Insulation obligation

Since 1 January 2017, a decree implementing the Energy Transition Act has made it necessary to achieve thermal insulation for major renovation works such as façade renovation, roof repairs and the development of a room in habitable room.

In the event of non-compliance with the insulation requirement, the judicial authority could take action against the beneficiaries of the works, the architects, the contractors or any other person responsible for the execution of work. The company which execute the work has to give advice to the owner and inform him about the obligation of renovation [47].

Energy study obligation

Multi-family residential with a collective heating or cooling system must carry an energy audit. This energy study takes either the form of an energy audit or the form of a collective energy performance assessment (EPC). This choice depends on the size of the multi-family building. For buildings with more than 50 lots, only those with a building permit filed before June 1, 2001 are affected [48].

Construction products reuse

Renovation of buildings coupled with circular economy will implies the reuse of construction products. This good-practice is far from being developed in France in particular because of regulatory and insurance-related barriers. It will first be necessary to put in place the necessary elements to supervise the reuse practices and to ensure confidence between all actors [49].

Once such framework is in place, it will also be necessary to develop the offer (identify re-use possibilities and identify re-useable deposits), connect the re-use actors and facilitate the logistic organisation of materials and products (platforms for re-use, storage or distribution). Reuse can then find its place in public or private contract markets, for rehabilitation operations, or even new construction, housing or offices.

Environmental factors

Various environmental factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in France are:

- Old building stock with high energy consumption
- Adaptability to climate change impacts

Old building stock with energy consumption

The French history explains the diversity of residential buildings stock and its specification.

- Collective housing period before 1949: Town, suburban or working-class buildings (especially in big cities)
- Single-detached houses pre-1949 period: Suburban flats between the two wars
- Collective housing period 1949 -1974: Big and small collectives
- Single-family dwellings period 1949 -1974: Suburban post-war flats

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This diversity makes it more difficult to standardize energy renovation.

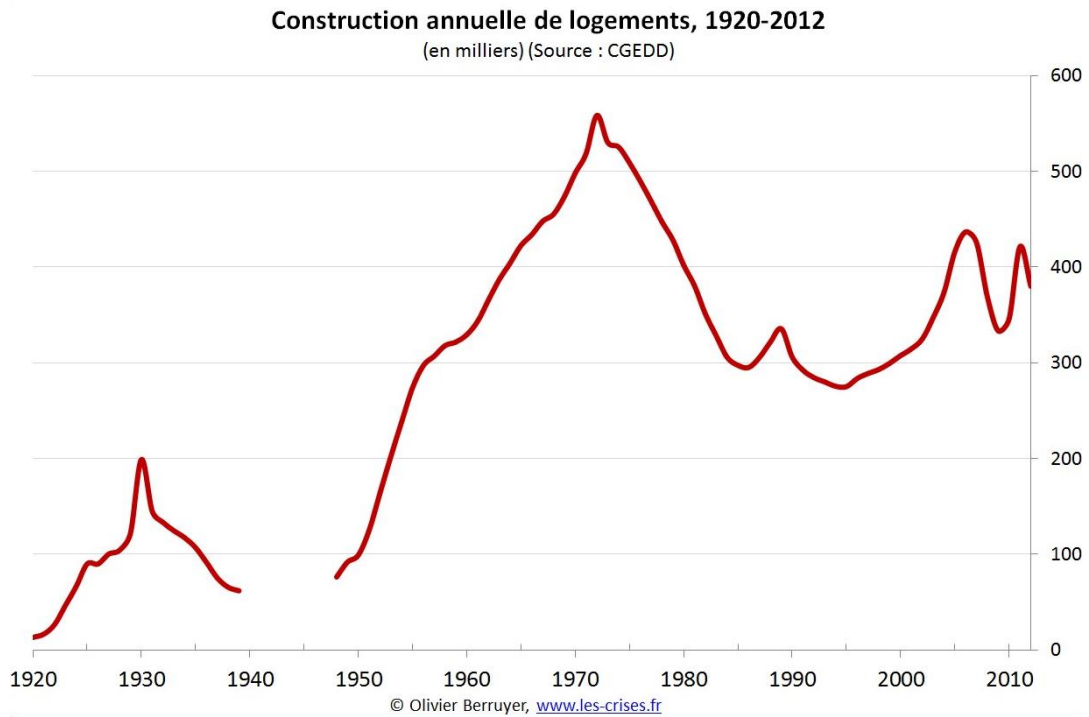


Figure 23 – History of annual construction rates in France (Source: Les Crises [50])

The energy consumption of existing buildings also depends on their period of construction.

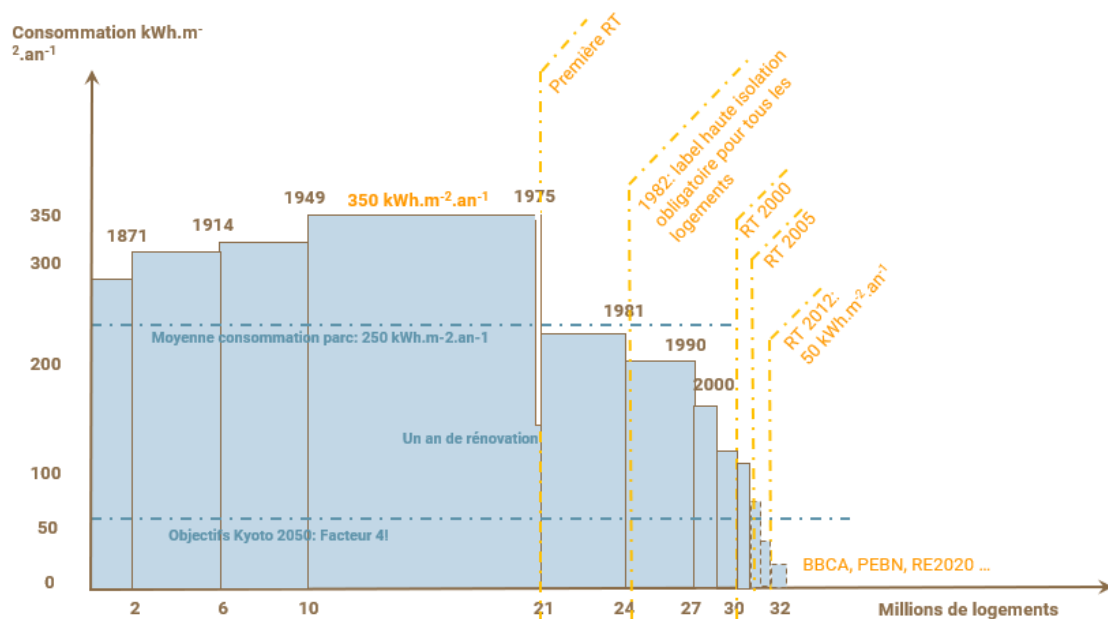


Figure 24 - Energy consumption of the buildings related to their construction period (Source: CSTB)

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Adaptability to climate change impacts

The building sector is closely related to climate change as it is one of its heavy contributors and will shortly face its consequences.

In France, the building sector consumes nearly half of the energy and emits more than 20% of the greenhouse gases responsible for climate change. Energy demand related to air-conditioning is forecasted to be multiplied by three by 2030 [51].

The impact of buildings on the environment begins with the manufacture of building products and goes to the end of their life, with their demolition and recycling of materials. The eco-design of materials and the practice of the circular economy must be generalized to limit the impact of the construction sector on the environment.

It is necessary to adapt buildings to more extreme weather conditions, for example the increase in the number of hot days, but also with more floods, storms, heavy rainfall or droughts (resulting in phases of swelling / shrinking of clays weakening foundations and underground networks).

2.3. Ireland

Building stock characteristics

Ireland experienced considerable construction growth in the early 2000's, which halted upon the economic crisis of 2007-2008. Therefore, the proportion of Ireland's housing stock constructed post-2000 (over 25%) is significant, as compared with other EU countries [9]. The Irish housing stock mainly consists of single-family dwellings (over 80%) [52]. An analysis of Ireland's housing stock reveals that approximately 42% are detached properties, of which 83% are rurally located [53].

Up until now, Irish residential buildings have been primarily constructed using stone, concrete and timber. Until the 1930's, residential buildings in Ireland were constructed primarily with stone and solid brick wall [54]. The following 20 years saw buildings typically constructed with mass concrete. Residential buildings started to be constructed using hollow concrete blocks and cavity walls using concrete blocks from the 1950's onwards. Hollow concrete blocks continued to be used for constructing residential buildings up until the early 1990's. Timber framed houses started to become more commonplace from the mid 1990's. Post-1990, cavity walls remain the primary method for constructing walls for Irish residential buildings [54].

Figure 25 shows the proportion of the building stock of various construction type, per dwelling type from the years 1990-2019. This figure was based on the SEAI's National BER research tool database [55]. It must be noted that there are some limitations to this data, such as a large proportion of unspecified construction types, as indicated. Moreover, 300mm cavity wall was the only option given for cavity wall construction, whereas, it is not to be assumed that every cavity wall is of 300mm.

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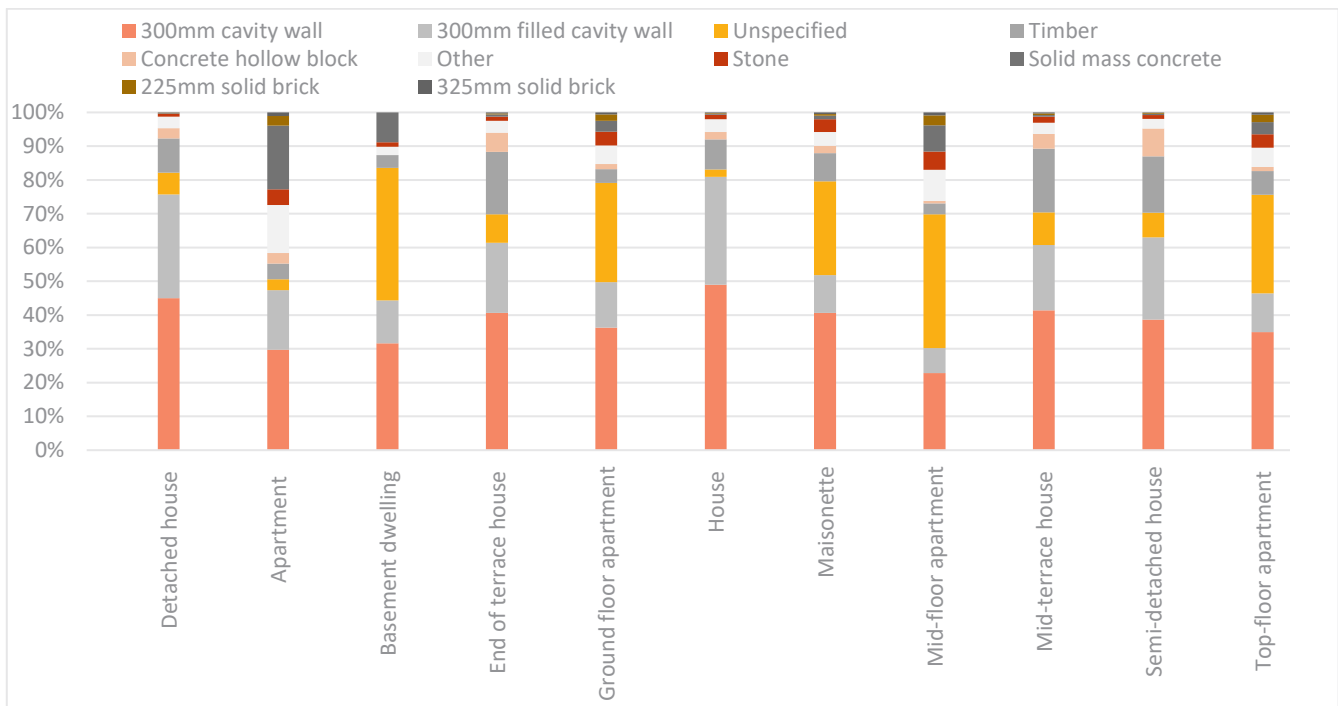


Figure 25-Construction type of post-1990 dwellings in Ireland. (Source: Adapted from [55])

However, unlike the earliest methods for constructing walls and other building elements (ground floor, roof, windows and doors) in Irish construction practices, building elements are now required to meet specific thermal fabric efficiency standards, as per specified in Part L of the Irish building regulations [56]. Irish buildings are now being designed and constructed to tighter building standards and codes to combat their energy demand and carbon emissions. The earliest building energy efficiency standards were published in Ireland in 1991, with the current regulations coming into effect on the 1st of November 2019 [56]. However, approximately 50% of the Irish housing stock was built prior to 1979 [57]. Thus, a significant proportion of the housing stock was built prior to the introduction and implementation of the minimum standards for insulation, building and energy efficiency regulations [57].

From as early as 1999, Ireland's housing stock has been identified, as among the least energy efficient in Northern Europe [58]. This, however, is no longer the case, with more recent studies indicating a reduction in household energy consumption since 2008 [58] [59]. Nonetheless, Ireland's stock is considered to be highly carbon intensive, emitting almost 60% more CO₂ than other EU countries [53]. There are various influencing factors with significant impact on such. Firstly, the number of persons per dwelling has been identified as an influencing factor [53]. On average, as of 2016, the average number of persons per dwelling in Ireland was 2.7, rated as the second highest in Europe [53]. Other factors include the large floor areas and number of rooms of Irish dwellings. Ireland is among the European countries with the largest number of rooms per dwelling [57]. The pervasiveness of detached dwellings in the Irish landscape is another contributor [57]. Such dwellings have higher surface area to volume ratios, thus, a greater heat loss potential than other dwelling types of the same period. Moreover, such dwellings required longer heating periods, and thus, have a stronger association with fuel poverty [57]. Additionally, the extensive use of oil, gas and solid fuels for heating in the Irish building stock, further exasperates the carbon intensity of the stock [60].

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The Central Statistics Office (CSO) reported in 2019, that of the BER certificates produced (i.e energy performance certificate), the most common rating achieved in domestic dwellings are C3-BER rating (>200 kWh/m²/yr) and D1-BER rating (>225 kWh/m²/yr), with a total of 53% of ratings having D1-BER ratings or worse (i.e. ≥ 225 kWh/m²/yr). Conversely, only 11% of homes produced a B1-BER to B3-BER rating (i.e. (75-125 kWh/m²/yr), while only 3% were A-Rated (i.e. ≤ 50 kWh/m²/yr) [61]. In other words, a significant proportion of homes are currently failing to achieve the cost-optimal energy efficiency standard of 125 kWh/m²/yr, which is the required standard housing in Ireland must meet if it undergoes major retrofit works. Housing is considered to have undergone a major retrofit if work is carried out on more than 25% of the building surface area [56].

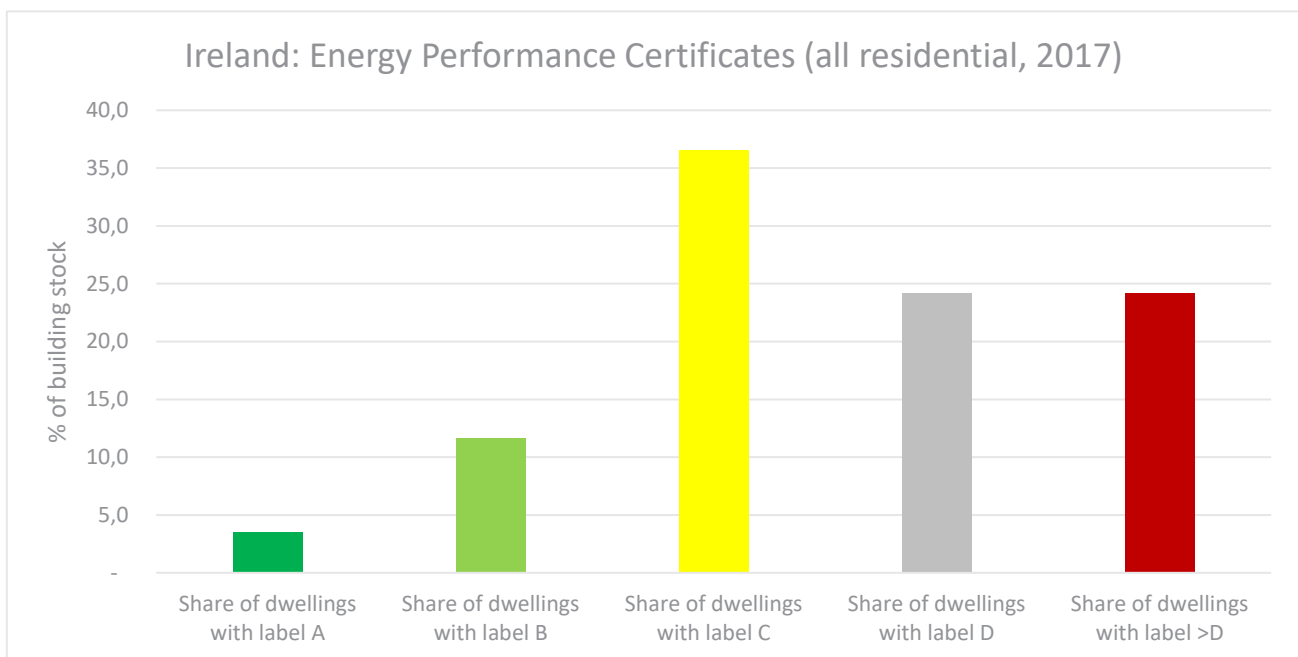


Figure 26 – Ireland: Energy Performance Certificates (2017, all residential buildings) (Source: BPIE)

With regards to retrofitting the Irish building stock, the initial focus should be on building fabric upgrades, with the aim to achieve the best possible energy efficiency standards, and consequently, reduce energy demand, maintain comfort, and allow consumers to achieve energy savings [62]. Secondly, attention should be given to fuel switching, given the reliance of dwellings on oil, gas and solid fuels [63]. In particular, the reliance of rural dwellings, on oil fired boilers for space and water heating needs [63].

Fuel or energy poverty is considered the most significant negative social impact resulting from the inefficiency of the domestic sector [64]. The primary effects of fuel poverty include welfare losses and adverse impact on occupant physical and mental health [65]. A relationship exists between fuel poverty, thermal comfort and the level of cold strain resulting from an inadequately heated home. Currently in Ireland, over 20% of households experience energy poverty [66].

In Ireland, TURNKEY RETROFIT will primarily focus on accelerating the rate of energy renovation and the ‘depth’ of energy efficiency upgrades by addressing various barriers to renovation, including making energy renovation desirable and easier, upskilling the industry, enhancing cross sector engagement and mobilising private investment. Considerable potential and scope for deep renovations for existing dwellings exists, given its centrality to the

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achievement of Ireland’s energy targets. Moreover, renovation of the thermally substandard, inefficient and carbon intensive stock is considered to have immense potential impact within Ireland. The potential impact is three-fold; in terms of (i) the energy saving potential; (ii) CO₂ emission reductions; (iii) energy poverty alleviations, given the unacceptably high number of households affected by energy poverty.

Summary of the factors and their impact

A summary of the factors identified and their impact on the business opportunities required to run and upscale the TURNKEY RETROFIT service in Ireland is given in Table 3. Reasoning for the assessed impact of the factors is detailed in the following sections. The scale for the impact assessment is:

- Very negative (--)
- Negative (-)
- Positive (+)
- Very positive (++)

	(--)	(-)	(+)	(++)
Political	The short and long-term impacts of Brexit negotiations	The government’s role & competing priorities Lack of compliance with commitments in the fight against climate change	Policy and public measures in place	
Economic	Household spending in the Irish renovation sector High upfront costs for homeowners and developers	Decrease in GDP Increases in inflation Economic uncertainty with regard to Brexit negotiations Decreased Consumer Sentiment Index (CSI) High household debt Uncertainty as to the future of fiscal incentives	The availability of financing and grant supports	
Social	Lack of awareness and knowledge	Split incentives and stressed rental market conditions	The effect on property value Minimum standards for rental sector	

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	(- -)	(-)	(+)	(+ +)
			Tenants' willingness-to-pay The use of digital platforms Climate change perspectives	
Technological		Lack of professionals skilled in energy renovations The use of advanced measures and auditing deficiencies Fragmented value chain	Innovation, research and development	5G technology
Legal			Review of building regulations	
Environmental		Environmental awareness	Old building stock with high energy consumption	

Table 3 – Summary of the factors identified and their impact on the business opportunities required to run and upscale the TURNKEY RETROFIT service in Ireland

Description of the factors

Political factors

In a political context, factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in Ireland are:

- The impacts of Brexit negotiations
- Government policy, public measures and funding
- The Government's lack of compliance with climate change commitments
- The Government's competing priorities

The impacts of Brexit negotiations

Amendments to Directive 2012/27/EU and Regulation (EU) 2018/1999.

Given the recent uncertainty with regards to the BREXIT negotiations for the UK's impending exit from the European Union, the European Parliament issued a decision on amending the 'Energy Efficiency Directive (EED)', (Directive 2012/27/EU on Energy Efficiency and Regulation (EU) 2018/1999), on the governance of the energy union and

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climate action (Council Decision 2019/504/EU). Article 3 (5) of Directive 2012/27/EU, requires all EU Member States (MS) to set indicative national energy efficiency contributions towards the energy efficiency targets of the Union, of at least 32.5% for 2030. In setting those contributions, the MS must consider the EU's 2030 energy consumption in terms of primary and/or final energy.

The UK's proposed withdrawal from the EU means that the projected energy consumption figures for the EU in 2030 must be amended to reflect the 27 MS of the EU, known as the 'EU-27'. For the EU-28, 2030 targets show that primary energy consumption should equal 1,273 Mtoe, while the final energy consumption should equal 956 Mtoe (Council Decision 2019/504/EU). The equivalent projections for the EU-27 show that primary energy consumption should be equal to 1,128 Mtoe and final energy consumption should equal 846 Mtoe (Council Decision 2019/504/EU). Despite the overall decrease in energy reduction targets for the EU-27, the exit of the UK from the EU means that the 2030 energy reduction target for each country will increase. Thus, the figures for energy consumption levels in 2030 must be amended. In Article 3 of Directive 2012/27/EU, paragraph five, the same has been amended. The amendments hold that all Member States should introduce the energy reduction contributions as part of their integrated national energy and climate plans (Council Decision 2019/504/EU).

As a result of this amendment, Ireland is now under increasing pressure to meet their energy reduction targets. As a result, this may positively affect the area of energy renovation within Ireland, in terms of increased government investment to achieve these stricter energy reduction targets. Conversely, such targets may increase pressure on retrofit design, in terms of the design of optimal retrofit solutions that consistently achieve actual rather than theoretical performance energy improvements. Altogether, Brexit is considered to have some impact on the area of energy renovation in the near future.

Effect of Brexit on energy prices

The discussion around Brexit, and more importantly, the likelihood of a 'hard Brexit' has increasingly included a discussion on the effect of such on Ireland's energy prices. Ultimately, it is held that in the event of a hard Brexit, householders and businesses alike, are increasingly likely to be faced with higher energy prices than before [67].

Electricity prices, in particular, are set to rise [68]. This is largely because, in the event of a hard Brexit, Ireland will be cut off from trading with other EU MS in the electricity market, as no direct connection between Ireland and the European mainland exists. Thus, Ireland will fail to lower energy prices and increase energy integration as intended through joining the European Integrated Single Electricity Market (I-SEM) [68] [69].

Ireland depends heavily on coal, oil and gas imports from the UK for household fuel [67]. In fact, approximately 85% of Ireland's gas supply is sourced in the UK [69]. Thus, the fear of security of supply is another key challenge. EU directives, such as the EU Security of Gas Supply Regulation (EU 994/2010), ensures that MSs maintain a solidarity, sharing energy resources to avert energy crises in any one MS. The results of energy stress tests in 2014 implemented as part of the Energy Security Strategy showed that Ireland was among the countries least likely to face insufficient gas supply, due to gas availability in the UK [69]. However, Ireland is poorly interconnected with other MS leaving the country increasingly vulnerable to energy crises from supply disruption post-Brexit [69].

Ireland's lack of self-sufficiency in terms of supplying its energy needs is therefore undeniable. Thus, the likelihood of tariffs on imports (particularly gas imports) from the UK, is increasingly likely [68]. Moreover, reductions or complete

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cut-offs in supply from the UK could also occur. Both situations will undoubtedly have influence on energy prices, with the likely outcome being that energy prices will increase [68].

Given the already high instances (over 20%) of energy poverty in Ireland [66], an increase in energy prices could potentially have a negative impact on householders on a national basis, in terms of the affordability of warmth in their homes. Furthermore, this may have a significant impact on the area of energy renovation, making it progressively more important to achieve real energy consumption cost savings, and subsequently, alleviate energy poverty.

While the effect of Brexit on energy prices in Ireland is discussed, there is an apparent consensus between Ireland and the UK that their energy relationship should be maintained [68]. Thus far, however, provisions for do not seem to be in place. Moreover, the maintenance of such a relationship will require full co-operation amongst the UK, Irish and European Government alike. However, there have been considerable tensions between such parties to date. Therefore, the risk associated with these discussed challenges, increases with the likelihood of an acrimonious Brexit occurring.

The authors of this report suggest that increases in energy price may affect the TURNKEY RETROFIT service, in several ways. Firstly, increases in energy prices may result in an increased demand for more cost-effective energy saving options, in an aim to reduce household spending on energy. Thus, this may increase householder interest in energy efficiency retrofit (and services such as the TURNKEY RETROFIT service), as householders strive to reduce energy consumptions and garner cost savings.

Secondly, relative fuel cost has been shown to be an important attribute in terms of a consumer's decision to choose renewable heat technologies, such as heat pumps, solar thermal and bioenergy [70]. Given that renewable heat technologies typically reduce fuel costs, renewable options will be favoured and adopted, as long as the cost reductions cover the initial installation costs [70]. In fact, the SEAI demonstrated this influence on fossil fuel price changes on heat technology uptake, by investigating demand for renewables at various fossil fuel price levels, finding that an increase in fossil fuel prices, resulted in a more favourable environment for renewable heat technologies, whereas lower fossil fuel prices, resulted in a less favourable environment for renewable heat technologies [70]. Thus, it is suggested that increases in energy prices could subsequently result in increased interest and adoption of renewable technologies, and thus, their implementation as part of a TURNKEY RETROFIT service.

Finally, increases in energy prices may make it increasingly expensive for Irish householders to heat their homes, thus, having repercussions in terms of energy poverty and health impacts. As a result, the need for retrofit services to alleviate fuel poverty and health implications may become increasingly important. However, increases in energy prices shall undoubtedly have impacts on the general economy, and may also impact on individual disposable income, thus, their ability to invest in retrofit services. However, one can only speculate as to the effect of such at this stage.

Government policy, public measures and funding

It is highly relevant to consider the government policies and funding, and the characteristics, strengths and weaknesses of the current model of public supports for renovation uptake in Ireland when creating the business model for the TURNKEY RETROFIT service in Ireland. Such supports will have significant influence on demand and supply of the service.

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In their study, Zuhaib et al. (2017) found many Irish retrofit professionals highlighted the government's role, as a key factor affecting their practices [58]. More specifically, they indicated the government's role in policy loopholes, funding supports, and the retrofit approach as key issues.

Government Policies

Article 24 of the Energy Efficiency Directive requires that Ireland implement various National Energy Efficiency Action Plans (NEEAPs), which outline Ireland's energy reduction targets. In 2009 Ireland set a target to improve Ireland's energy efficiency by 20% by the year 2020, requiring energy savings of 31,925 GWh [71]. The fourth NEEAP, published in 2017, outlines the progress towards Ireland's 2020 targets, and highlights the measures required to maximise the progress towards this target, building on the predecessor plans [71].

Significant progress has been made towards the 2020 energy savings target. Despite the progress, the projected 2020 energy savings is expected to be 25,904 GWh. This would result in an achievement of approximately 16.23%, compared with the target of 20% target. The gap in the energy saving targets occurred despite the publication of several policy and plan documents including the (i) White Paper 'Ireland's Transition to a Low Carbon Energy Future 2015-2030' [72]; (ii) Climate Action and Low Carbon Development Act (2015) [73]; (iii) National Mitigation Plan [74]; (iv) The Public Sector Energy Efficiency Strategy [75]; (v) Ireland's Long Term Renovation Strategy 2017-2020 [62]; (vi) 'Project Ireland 2040' National Development Plan 2018-2027 [76]; (vii) the National Energy Efficiency Action Plan [71] and (viii) the Climate Action Plan 2019 [77].

Ireland's Climate Action Plan (2019) [77] is the most recent policy plan document published. It recognises the impacts of climate disruption on Ireland's economy, society, environment and natural resources. The plan also recognises that the impact of Greenhouse Gas (GHG) emissions is accelerating, the opportunity window for action is closing, and Ireland is all in all off course in terms of its mitigation targets [77]. As such, the Plan outlines actions for the coming years that will address this issue. The Plan also aims to make Ireland a leader in terms of responding to climate disruption [77].

In particular, the Climate Action Plan outlines sectoral actions for the achievement of its goals. The actions in relation to the building sector which may influence the implementation of the TURNKEY RETROFIT service include:

The introduction of stricter requirements for new builds and substantial refurbishment.

- Policy for the upgrade of approximately 500,000 existing dwellings to at least a B2 BER, and the installation of approximately 400,000 heat pumps by 2030.
- The creation of a 'one-stop-shop' supply chain and model to group home retrofits for funding and delivery.

The Climate Action Plan also proposes that the Minister for Communications, Climate Action and Environment introduces a new Climate Action (Amendment) Bill [77].

The Climate Action Plan also specifically refers to the establishment of 'one stop shop' retrofit delivery structures as future actions to be taken [77].

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Government funding

SEAI Schemes

Domestic support schemes aimed at achieving energy improvements in the domestic sector were designed and introduced by the SEAI as household supports for those wishing to achieve consumption reductions and cost savings [62]. Between 2000 and 2016, 375,000 homes received government grants for energy efficiency measures [53].

The grant programmes established by the SEAI for private homes and social housing, include the Better Energy Homes, Better Energy Warmer Homes, Better Energy Communities and Social Housing Upgrades. Moreover, two pilot grant schemes were established in 2017, namely the (i) Warmth and Wellbeing Pilot Scheme, and the (ii) Deep Retrofit Pilot [78].

The Warmth and Wellbeing Pilot Scheme is delivered by the SEAI and the Health Service Executive (HSE), which aims at bringing comprehensive energy upgrades to elderly persons and children with certain clinical conditions, namely, those living with chronic respiratory conditions [79]. The Deep Retrofit Pilot Scheme aimed at exploring ways for homeowners to overcome the various barriers to deep retrofit. This scheme however has since closed [80].

Of the schemes mentioned, the Better Energy Homes Scheme, Warmer Homes Scheme, and Better Energy Communities are ongoing. Such schemes are expected to achieve final energy savings of 1,324 GWh, 347 GWh, and 543 GWh, respectively, by 2020 [71]. The now closed Warmth and Wellbeing Pilot scheme and Deep Retrofit Pilot are expected to have achieved 23GWh and 18 GWh final energy savings, respectively, by 2020 [71].

While the aforementioned schemes exist, the current annual retrofit activity in Ireland is considered to be exceedingly limited, at approximately 23,000, primarily shallow, retrofits per annum [77]. In recognition of this, the Climate Action Plan 2019 emphasizes the need for increased retrofit activity within the Built Environment. As such, the Climate Action Plan 2019 has set ambitious targets including the completion of 500,000 energy efficient retrofits to a B2 Building Energy Rating (BER) or cost-optimal equivalent by 2030, at a rate of 50,000 per year [77]. A combination of new funding options, and a grouped approach to housing retrofits are considered key for achieving such. Moreover, the Climate Action Plan highlights a new delivery structure for retrofitting as critical to success [77].

Ireland's 2020 Budget

Ireland's 2020 Budget outlines funding to be allocated to home upgrades in 2020, particularly focused at targeting the most vulnerable [81]. In this respect, €20 million is being allocated for the delivery of a new model for group housing upgrades, targeted at the Midlands in particular. Additionally, a total of €52.8 million is being made available through the Warmer Homes Scheme, for the retrofitting of homes of those living in or at risk of energy poverty. €13 million of this funding is being taken from ring-fenced revenue from the €6 increase in carbon tax as per the 2020 Budget. This is the largest ever allocation for the Warmer Homes Scheme, being twice the initial allocation for 2019 [81].

Lack of compliance with climate change commitments

Ireland ranked 28th out of 29 countries in terms of the actions taken to fight climate change in 2018, due to national opposition to climate action [82]. Moreover, Ireland ranked 22nd out of the EU-28 for overall renewable energy share, and 26th out of the EU-28 for progress towards to overall 2020 renewable energy target [83].

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Ireland is on track to miss the 2020 targets set [82] [83], and is largely off course for the achievement of its unambitious 2030 emissions targets [82]. Thus, it is considered that Ireland has the most challenging emissions reductions targets in the entire EU [84]. SEAI reports that accelerated and significant effort is required should Ireland come close to meeting such targets. Otherwise, Ireland will face non-compliance costs annually, in the range of €500 million [82].

Ireland's exceedingly poor performance in this regard questions the seriousness, leadership and ability of the Irish government, in terms of climate action. Such is reflected in Ireland's failure to join the progressive group of EU MS advocating increased climate ambition [82]. Moreover, the Irish government were consistently found looking for loopholes to dilute EU 2030 legislation on climate and energy [82].

The Irish government's competing priorities

The government's awareness of the importance of climate change and energy efficiency is clear, and reflected in the establishment of the aforementioned policy, funding and public measures. However, it is not the only government priority, and moreover, may not necessarily be the priority at the fore.

Studying the 'Project Ireland 2040' National Development Plan 2017-2028 [76] gives some insight into the competing priorities which exist. Ten national strategic outcomes and investment priorities are outlined in the document, of which climate action is one. In addition, the document highlights government challenges which form the context of the national planning framework and the strategic investment priorities. Such challenges include demographic changes, cross-border and Brexit, housing and sustainable employment [76].

The 2020 Budget expenditure allocations provides further insight into government priorities and competition across various government departments. Specifically, the budget states that supporting the Health sector is a key priority for the Government, reflected in an increase of expenditure of 6.3%, over €1 billion from 2019 [85]. Similarly, the Department of Housing, Planning and Local Government an 8% increase in current expenditure in 2020, while the Department of Children and Youth Affairs received an expenditure increase of over 6%. The Department of Communications, Climate Action and Environment however, received an expenditure increase of 1.8% [85].

The factor identified as having the most negative impact is the uncertainty surrounding Brexit including its effect on Ireland's obligations under the EED, Irish energy prices and the Irish consumer. The government's role, including their policy responsibility, the public measures and government funding in place to support the uptake of retrofit in Ireland are crucial to the creation of the business model for the TURNKEY RETROFIT service. The presence of various policies and public measures to support the uptake of renovation in Ireland is identified as a factor with potential positive effect on the TURNKEY RETROFIT project. However, given the state of retrofit uptake in Ireland, and the failure of the government to meet their 2020 climate action targets, one questions the adequacy of the government's policy, funding and efforts to date. Thus, the lack of compliance in the fight against climate change has been identified as a factor to negatively affect the TURNKEY RETROFIT service. Moreover, the presence of competing government priorities is considered as another factor which could negatively affect the TURNKEY RETROFIT service. However, should the government fully invest in the implementation of the long-term strategies and plans, this could present significant opportunity for the TURNKEY RETROFIT service to be implemented in Ireland.

Market & PESTLE Analysis

Economic factors

Various economic factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in Ireland are:

- The general economic situation
- Spending in the Irish renovation sector
- Uncertainty as to the future of fiscal incentives
- The high costs for homeowners and developers
- The availability of financing and grant supports

The general economic situation

In 2018, the real Gross Domestic Product (GDP) in Ireland grew by approximately 8.2%, with growth in 2019 being at approximately 5.5% [86]. Despite these substantial growth rates, economic forecasts post the reveal of the Ireland's 2020 budget suggest that this growth is to decrease to 0.7% in 2020 in the event of a no-deal Brexit [86]. This moderation in GDP is largely a result of (i) recent slowdown in global growth and world trade, (ii) a less benign external environment, and (iii) the continued uncertainties as to trade policies, given the current Brexit negotiations, and possibility of 'no-deal Brexit' [87]. Furthermore, the inflation rate in Ireland reached a six year high of 1.1% in June of 2019, with projections for further increases and wage pressures into 2020 [88]. As a result, consumer buying power is expected to decrease.

The Irish government deficit position turned from a slight deficit of 0.3% in 2017, to a balance deficit of 0% in 2018, as a result of buoyant corporate tax revenues and a generally strong economic position [87]. This balance is expected to remain unchanged, with projections of a surplus possible, that is, given a no-policy change assumption. Additionally, the general public (government) debt ratio declined to approximately 64.8% of GDP in 2018 and is expected to fall further to 61.3% and 55.9% of GDP, in 2019 and 2020, respectively [87]. Again, these projections rely on a continued stability in economic growth in the medium-term, and positive balances. Despite these projections, however, some risk to the fiscal outlook exist due to the various economic outlook uncertainties, the possibility of no-deal Brexit, and the sustainability of the current level of government revenues, in terms of corporate tax revenues in particular [87].

The net disposable household income in Ireland is approximately €23,000, below the OECD average of €30,700 [89]. Ireland's household debt to gross income is approximately 133%, the 7th highest in the EU [90]. According to the KBC Bank, the Irish Consumer Sentiment Index (CSI) fell to approximately 75.3, as of September 2019, from 77.2 in the previous month [91]. This was the third straight month of decline reported, and the weakest recorded since November 2013. Ultimately, this is a result of consumers downgrading their expectations for personal finances, as the chaos of Brexit negotiations result in consumers being increasingly nervous about the future outlook for the Irish economy in general [91]. Four of the main index components declined, namely general economic outlook, unemployment outlook, household finances in the past twelve months, and household finances over the next 12 months. Consumer Confidence in Ireland averaged at 88.1 Index Points from 1996 to 2019, with an all-time high of 130.90 in 2000, and a low of 39.60 in July 2008 [91]. The Figure 27 shows the average historical CSI for Ireland from October 2018 to September 2019.

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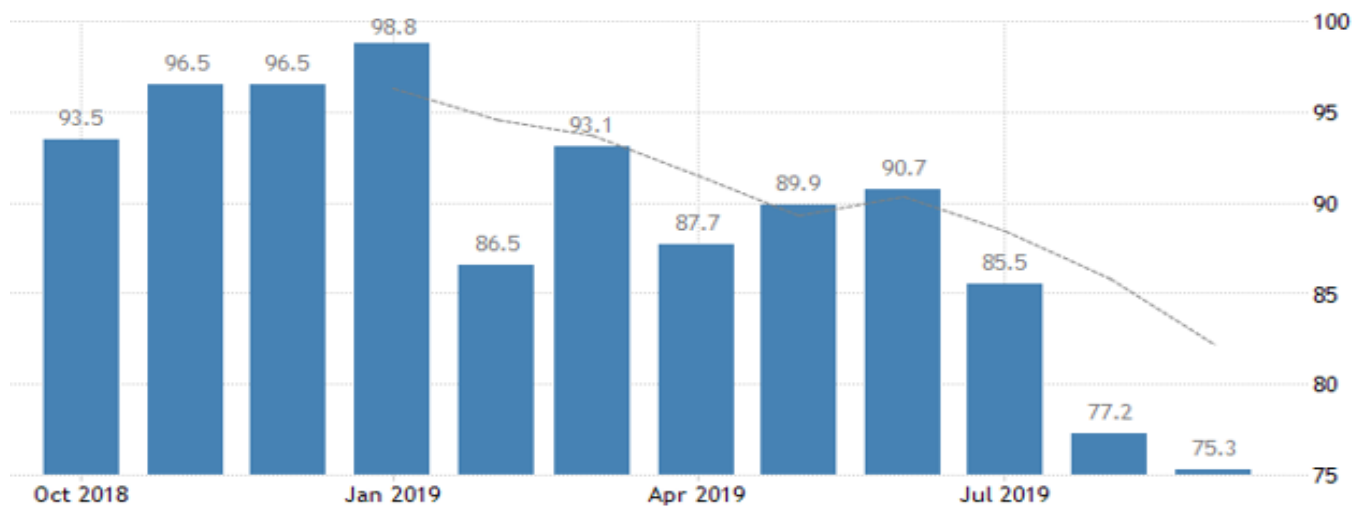


Figure 27 - Average CSI in Ireland from October 2018 to September 2019 (Source: [91])

While such weaknesses have been discussed, there are some strengths noted. Employment and investment in construction is expected to underpin the domestic economy. Employment experienced considerable increases in 2018, and is expected to increase further, albeit at a more moderate pace [87]. Additionally, the projections show that the average compensation per employee increased by 2.9% in 2018, with further accelerations projected for the forecast period 2019-2020, strengthening householder disposable income [87].

In terms of the TURNKEY RETROFIT service, the general economic situation is considered to potentially have negative impact. This is due to the fact that increases in inflation, coupled with lower household incomes, increased household debt to income ratios, and decreased CSI, reflect poorly on the consumers ability to invest in retrofit. Additionally, concerns with regards to the effects of Brexit negotiations on Ireland's economy also threaten the ability for widescale implementation of retrofit, in terms of the government's allocations of funding of such.

Spending in the Irish renovation sector

Ireland has the third lowest renovation spending in the EU, of under 0.5% of the household's disposable income [9]. Moreover, between 2010 and 2016, Ireland experienced a decrease of approximately 0.24% in renovation spending as a percentage of disposable household income [9].

Saheb (2016) found that Ireland's residential energy renovation market segment accounted for under 1% of the energy renovation market across all EUROCONSTRUCT countries assessed (Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Poland, Portugal, Slovakia, Spain, Sweden, The Netherlands and the UK) [13].

Uncertainty as to the future of fiscal incentives

Fiscal measures supporting energy efficiency play a significant role in incentivising renovation works. In their early study, Clinch and Healy (2000) found that government provided tax relief on the costs of retrofitting was a key potential instrument to correct market failure within domestic energy efficiency in Ireland. Ireland is one out of just four MS which offer such measures [9].

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The Home Renovation Incentive (HRI) provides tax relief in the form of tax credits at 13.5% of the expenditure incurred on renovation, repair or improvements on a private residence, if the value of the works exceeds €4,405 excluding VAT [9]. There is significant doubt, however, as to the future of the provision of such fiscal measures in Ireland. As of the 2019 budget, there is no mention as to the extension of the scheme, or the introduction of alternative fiscal measures in Ireland. The Accelerated Capital Allowances (ACA) for Energy Efficient Equipment is another fiscal support, which allowed companies to claim 100% of the capital cost of certain energy efficiency plant and machinery against corporate tax [92].

While grant schemes do exist and are successful in Ireland, tax-free opportunities on energy products remain to be explored. Taxation forms a significant barrier to retrofit uptake, given the taxes householders pay on costs often outweigh the energy savings generated [93].

The high costs for homeowners and developers

Often the most important barrier affecting homeowner motivation for retrofit is the associated high costs. The importance of cost has been consistently highlighted as a major barrier to investment in retrofit projects and the selection of energy efficiency measures [58]. The SEAI found that a lack of sufficient funds was one of the key reasons as to homeowners are unwilling to invest in various retrofit measures or packages [94]. Moreover, the payback period of their investment is another key driver in a homeowner's willingness-to-pay [94]. In a study by Zuhaib et al (2017), approximately 90% of building professional respondents to a survey reported that 'cost involved' was the driving factor for their retrofit planning choices.

Although clearly not the only barrier, lack of sufficient funds is one of the key reasons why consumers in the residential sector are not willing to invest in various energy efficiency measures and packages. For example, there is a general lack of motivation for the implementation of deep building envelope retrofits, largely due to cost factors [58]. Similarly, Collins and Curtis (2017) found that retrofit packages involving attic and cavity insulation are often the most popular and less likely to be abandoned. Generally, such packages are low-cost and low-disruption. However, more comprehensive packages or 'deeper' retrofits are more likely to be abandoned, given that they are more expensive, generally more disruptive, and associated with longer payback periods [95]. This is further exasperated by the fact that there is a clear lack of development of low-cost technologies and solutions in the Irish retrofit industry [58].

Figure 28 gives the average costs for standard and advanced retrofit packages in Ireland. The average costs are taken from the TABULA project [54], which provides a breakdown on residential building typology in Ireland and average costs to retrofit the typology. The standard package achieves a BER ranging from B1-C2 depending on the construction period of the building. The advanced retrofit packages achieve a BER ranging from A2-B2. A BER label is the Irish residential building energy performance certificate. While these figures are based on data from 2014, much has not changed in terms of the cost, with it being accepted that the average cost of a deep retrofit being between €30,000 and €40,000 [96]. As such, a major challenge within an economic context is the considerably high upfront costs associated with retrofit works.

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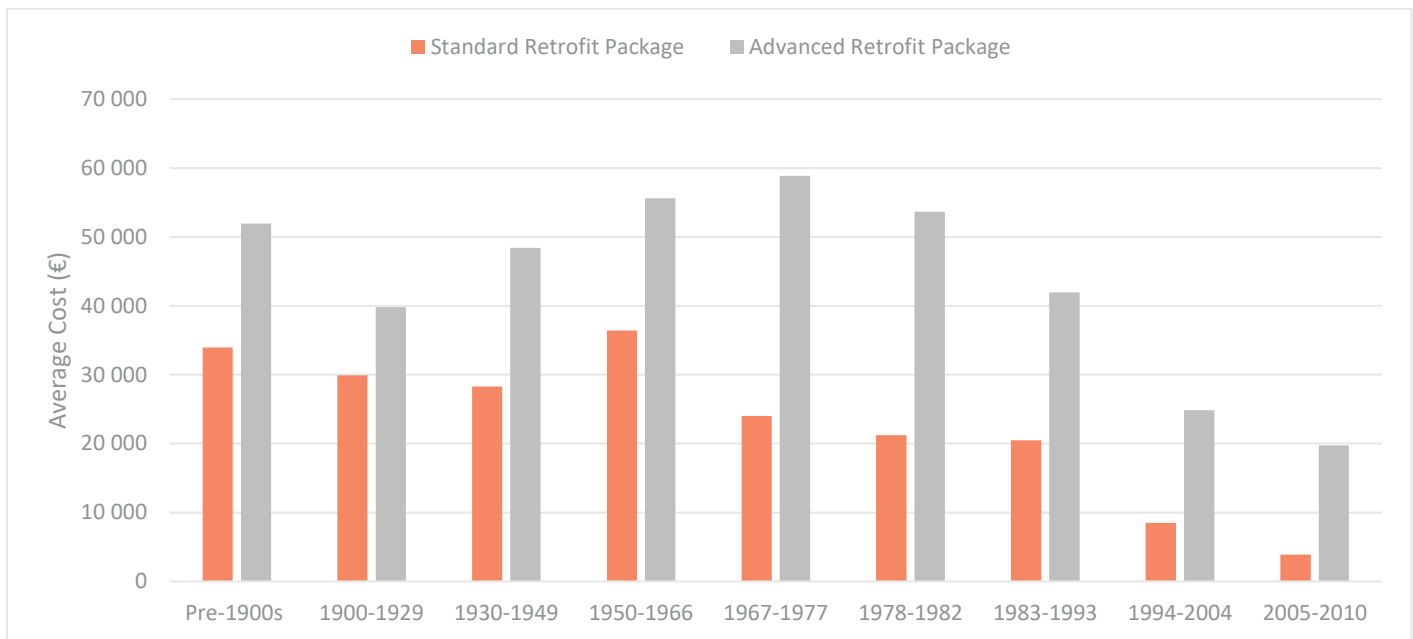


Figure 28 - Average cost of retrofitting Irish dwellings (Source: Adapted from [54])

The availability of financing and grant supports

Financing measures are often included as energy efficiency policy measures. Moreover, such financing measures are critical for improving the energy performance of existing buildings [9]. In Ireland, the financing measures in place with regards to retrofit include grants and loans. Financing models are also being trialed and piloted through the Better Energy Finance (BEF) Initiative run by SEAI [97].

Grants

The grants available in Ireland introduced by SEAI include the (i) Better Energy Home scheme; (ii) the Better Energy Warmer Home scheme; (iii) the Better Energy Community Scheme and the (iv) Social Housing Upgrade scheme. Under these schemes, homeowners, elderly persons, and those experiencing fuel poverty, can avail of grants to fund thermal fabric, heating system and renewable technology upgrades. Additionally, the SEAI introduced two pilot grant schemes in 2017, to include (i) the Warmth and well-being scheme and (ii) the Deep Retrofit Pilot Scheme. The SEAI offer various levels of funding for the installation of various retrofit measures. These include (i) insulation grants; (ii) Heat Pump System grants; (iii) Heating Controls Grants; (iv) Solar Water Heating Grants; (v) Solar Electricity Grants. Table 4 summarises the level of funding available for various retrofit measures under the SEAI schemes [98].

SEAI Grant	Details of Grant	Funding Available
Insulation Grant	Attic Insulation	€400
	Cavity wall insulation	€400
	Internal Insulation (Dry Lining)	€1,600-2,400
	External Wall Insulation	€2,750-6,000

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SEAI Grant	Details of Grant	Funding Available
Heat Pump System	Air to Water	€3,500
	Ground Source to Water	€3,500
	Exhaust Air to Water	€3,500
	Water to Water	€3,500
	Air to Air	€600
Heating Controls Grant	Heating Controls upgrade	€700
Solar Water Heating grant	Solar Water Heating grant	€1,200
Solar Electricity Grant	Solar panel installation	Up to €3,800

Table 4 - Summary of SEAI grant schemes (Source: [98])

While grant schemes are available to landlords, the take-up of such schemes has been considerably low [62]. Considering this, as of Ireland's Long-Term National Renovation Strategy, it is proposed to introduce minimum energy efficiency standards in the rented sector from 2020 onwards, as was the case in other countries such as the UK and New Zealand.

In addition to the grant schemes, the Energy Efficiency Fund launched in Ireland in 2014, which offers financing for innovative projects which focus on energy efficiency across all Irish private and public buildings and infrastructure. The fund invests also in building retrofit projects including replacing and upgrading energy systems [99].

However, while such schemes exist, some have pointed to the inadequacy of such. In their study, Zuhaib et al. (2017) found that grant supports in Ireland are limited and require new or reformed models if retrofit uptake by householders is to accelerate. Zuhaib et al.'s (2017) study revealed an evident absence of government incentives for the achievement of higher energy efficiency goals. Furthermore, the aforementioned SEAI Deep Retrofit Pilot scheme is now discontinued since 2018, with no additional funding at present.

Energy efficient or 'green mortgages'

The emergence of the Energy Efficient Mortgage Initiative has provided a mortgage framework which offers homebuyers more favourable borrowing rates on mortgages, in return for purchasing energy efficient homes or implementing energy renovations [100]. Offer of such is still in its emergent phase in Ireland; however, the propagation of such will surely negate some of the current awareness issues discussed above and promote recognition within the real estate market of the benefits of building energy efficiency.

While financing measures exist in Ireland, difficulties remain as to attaining funding from financial entities. Zuhaib et al.'s (2017) study highlighted that financial institutions must support retrofits and reinforced the importance of specific financing schemes in increasing retrofit uptake in Ireland. In addition to the lack of funding structures, some point to the complexity of funding structures as key barriers with regards to retrofit uptake. In particular, complex funding structures were highlighted as a key driver for the abandonment of retrofit projects under the Better Energy Home scheme by Irish householders [95].

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Consumer research conducted by the SEAI in 2015 found that borrowing, even at a more affordable rate, will not necessarily provide the primary motivation to act [62]. Rather, the financing package would simply act as the enabler after a householder has made the decision to improve their homes energy efficiency [62].

The research showed that alternative funding options must be found. Ultimately, the Exchequer is unable to grant aid at the scale of renovation required to support the decarbonisation of buildings [62].

The economic factors identified which most negatively impact TURNKEY RETROFIT service are the level of householder spending in the Irish renovation sector and the high upfront costs for homeowners and developers. The factors identified as having negative impact on the TURNKEY RETROFIT service are the general economic situation, which is experiencing moderation in growth, the presence risks to the fiscal outlook, and significant uncertainty with regards to the Brexit negotiations. Additionally, while Ireland was one of few Member States to offer fiscal incentives for energy renovation, the future of such incentives is uncertain, given the closure of the HRI. Thus, uncertainty as to the future of such incentives has been identified as another negatively impacting factor. However, there are several finance and grant support available for energy renovation, particularly in the residential sector, which present opportunities for the TURNKEY RETROFIT service.

Social factors

Various social factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in Ireland are:

- Awareness and knowledge
- Climate change perspectives
- Nature of occupancy
- The effect on property value
- The use of digital platforms

Awareness and knowledge

Collins and Curtis (2017) noted that key barriers to retrofit implementation in the Irish context were behavioural, rational and cognitive limitations which influence a householder's understanding of retrofit benefits [95]. More particularly, a lack of investment in retrofitting, particularly for Irish homeowners, is consistently correlated to a lack of awareness and knowledge as to not only the benefits of retrofitting but also as to the various opportunities and initiatives in place for the completion of retrofit projects [9], [93], [101]. Such is central to encouraging homeowner's interest in undertaking retrofit [94].

This lack of awareness and knowledge is also a direct result of insufficient motivational information to Irish homeowners [94]. Another frequently cited barrier to investment is a lack of trust with regards to the information available [95] [101]. Moreover, the confidence a homeowner has in the offering provided is another barrier [94]. Thus, it is suggested that homeowners will become more engaged with the provision of information from the outset, from a reliable source believed to be acting in their best interest and providing impartial advice [94]. In addition,

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informed decision making and awareness among occupants, users and owners is essential to increase the knowledge level and propagates the benefits of retrofits [102].

The literature frequently finds that householders rarely invest in energy efficiency measures on the basis of energy efficiency improvements alone, instead valuing the economic cost savings, along with other benefits such as comfort improvements, health and well-being benefits and poverty alleviations [95] [101]. Thus, one could suggest that not only a lack of awareness, but a lack of an energy efficiency culture is another key challenge. To deal with such, it is vital that energy efficiency upgrades are encouraged through the promotion of the co-benefits of retrofit, within not only an environmental, but economic and social context.

Ultimately, in Ireland, there is significant room for a study on understanding the knowledge extent of homeowners in terms of energy retrofitting, and what they understand the associated benefits to be [101]. Subsequently, getting the appropriate information to the right consumer at the right time is critical for incentivising uptake [94]. Not only this, but more needs to be done to understand the different consumer drivers for energy efficiency in the residential sector [94]. For example, some might be motivated by cost, some by comfort and value improvements, or some by aspirational factors such as sustainability, the environment and the future [94]. Additionally, other consumers may be motivated to retrofit, in an aim to change their energy use behaviours, however, currently, there is no evidence to back this up. Given that householders may be motivated differently, specific attention must be given to the development of targeted actions toward each consumer segment [94].

Climate change perspectives

In a survey conducted by European Social Survey, the public attitudes towards climate change were gathered under 'Public Attitudes to Climate Change, Security and Energy Preferences', across 23 European countries [103]. This survey revealed that most Europeans agree that climate is changing, and that climate change is caused by human activity. Thus, the survey revealed that the climate change reality and the human effect on climate change is widely acknowledged [103]. The survey noted however, that there were considerable differences across countries as to the percentage of people worried about climate change [103].

The results for Ireland are presented in Figure 29. The survey of over 2,700 Irish respondents revealed that as of 2016, 9% of respondents were 'not at all worried' about climate change, while a further 23% of respondents were 'not very worried' about climate change. The remaining 68% of respondents were somewhat worried to extremely worried. While those not concerned with climate change are the minority, it must be noted that 32% of respondents is a considerable percentage. Furthermore, out of the twenty-three countries, Ireland ranked 8th highest in terms of the percentage of respondents not worried about climate change [103].

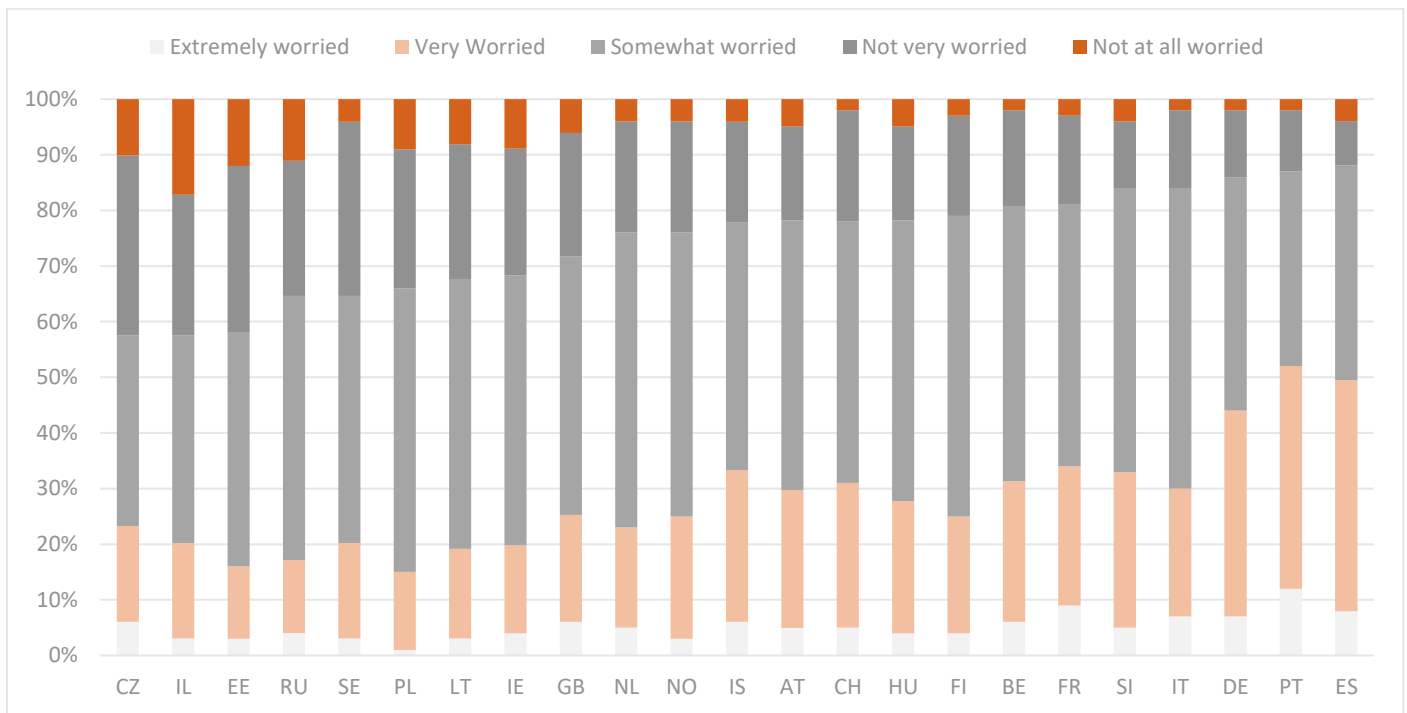


Figure 29 - Concern for climate change (%) (Source: [103])

Recent research, however, would suggest that there has been an increasing concern with climate change in Ireland from 2017 to 2019. A Eurobarometer survey of 1,067 Irish people in 2019 revealed that there is increasing concern regarding climate change, with 75% of the survey respondents believing climate change to be a ‘very serious’ problem (an increase of 7% from a previous survey in 2017) [104]. Additionally, more than one quarter of respondents believed it to be the most serious problem in the world (an increase of 13% from a previous survey in 2017) [104]. The survey results are displayed and compared with the EU-28 average in Figure 30.

The European Social Survey also analysed the public’s efficacy beliefs and climate policy measures [103]. Irish respondents maintained a general pessimistic view towards efficacy, with 50% believing that large-scale collective action is unlikely to tackle climate change. In addition, Irish respondents believe it is unlikely that the government will take action to tackle climate change (42%) [103].

The pessimism among Irish respondents is significant. The results suggest that people find it difficult to remain optimistic about the efficacy of the government in the mitigation of climate change. Thus, if people believe that at an institutional level nothing is being done, or that the collective action is too enormous to be likely, they will believe their individual actions are futile [103]. Thus, this may result in the proliferation of a disincentive towards individual action. Additionally, people remain in hope that the government will reduce climate change, while doubting that they are working efficiently. Thus, these results suggest a deficiency in the current climate change mitigation measures [103].

While the European Social Survey results suggest a general pessimism toward collective and institutional efficacy alike, the results of the Eurobarometer survey suggest that as of 2019, approximately 62% of Irish respondents had personally taken actions to fight climate change in the past six months, an increase of 12% since 2017 [104]. Furthermore, when given specific examples of climate actions, 96% of those surveyed reported personally taking

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actions to fight climate change [104]. Such actions cited include low level actions such as trying to reduce waste and separating it for recycling, and cutting down consumption of disposable items, to higher level actions such as installing solar panels in the home or buying a low energy home [104]. It must be noted, however, that such samples may not be representative of the entire Irish population.

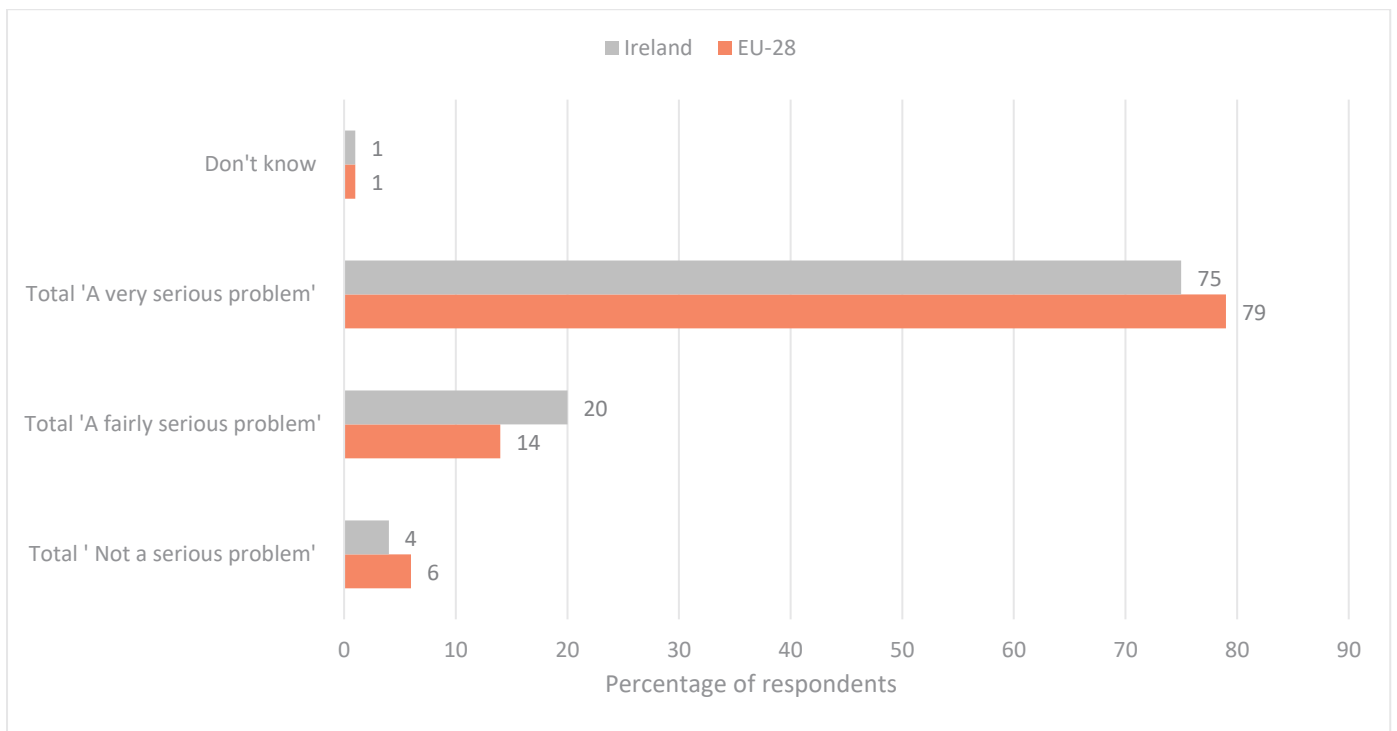


Figure 30 - Summary of EUROBAROMETER survey results (Source: [105])

Nature of occupancy

Figure 31 gives the nature of occupancy for Irish housing units according to the 2016 Irish census [105]. 36% of housing units are owner occupied without a loan or mortgage, 32% of housing units are owner occupied with a loan or mortgage, 18% of housing units are rented from a private landlord and 8% of housing units are rented from a local authority.

Of the housing units which are owner occupied without a loan or mortgage, 87% having owners who are more than 49 years old. Of the housing units which are owner occupied with a loan or mortgage, 67% are 49 years old or younger. There is no data available (to the authors of this report) that shows a relationship between householders that decide to undertake a retrofit and whether they own their house with or without a loan or mortgage. People who have a loan or mortgage to pay for their home may prefer to pay off their loan or mortgage instead of investing in an energy efficiency retrofit of their home.

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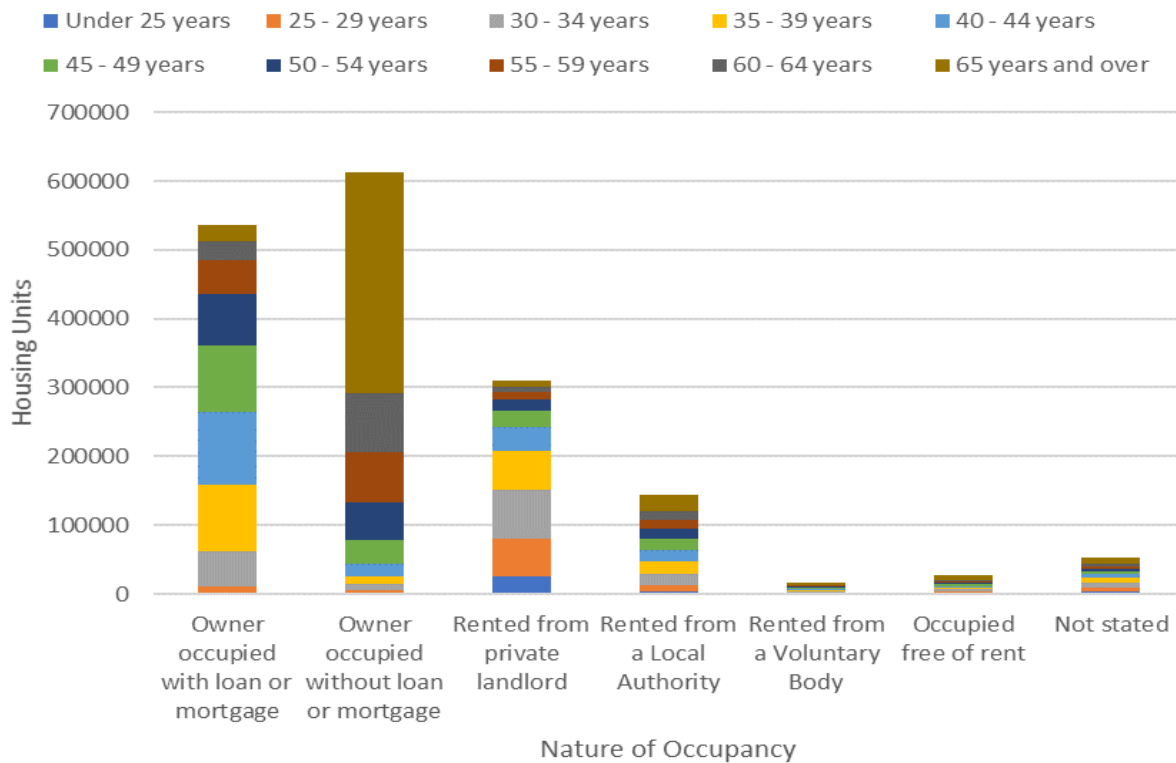


Figure 31 - Nature of occupancy of housing units in Ireland (Source: [106])

The rental residential property market in Ireland consists of approximately 36% of tenure status in urban towns and cities [107]. Moreover, there are upward growth trends in terms of rented accommodation in Ireland [53].

In Ireland, the energy performance certificate database of residential buildings is publicly available [108]. From this database, it is clear to see that the distribution of Building Energy Ratings (BERs) for private rental dwellings are heavily skewed toward less efficient grades [109]. According to the IGBC, approximately 20% of rented dwellings have a BER of F or G, compared to the overall housing stock where 15% have the same rating [107]. Moreover, over 55% of private rented dwellings have a BER rating of D or lower [107].

From the BER ratings of the rental sector, it is clear that potential exists to improve the energy efficiency of the rental stock [109]. Moreover, from a social perspective, it can be implied that those people living in rented properties are at a significantly higher risk of fuel poverty, than people living in owner occupied or local authority homes. Therefore, the rental sector is an important area to tackle in terms of energy poverty alleviations [107].

While the potential is clear, one must consider and understand the level of incentive required from the landlord perspective to improve the energy efficiency of their properties [109]. In terms of the profile of landlords in Ireland, the Irish property sector is comprised of a large number of small landlords [107]. Additionally, 86% of landlords own only two properties or less, with 70% managing only one tenancy [107].

The split incentive existing between tenants and landlords is considered the most acute, and persistent barriers to the potential of building energy efficiency [107]. This situation is one in which the landlord responsible for meeting the cost of works, but only receiving a benefit when the work increases the rental or resale value of the property. On

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the other hand, the tenant receives the benefit of reducing energy bills. However, they are unlikely to invest in the work without certainty that their savings will outweigh their investment over the course of their tenancy in the property [107].

The split-incentive has been high on the EU agenda for the past 15 years [107]. Article 19 (1) (a) of the Energy Efficiency Directive (EED) and Energy Performance of Buildings Directive (EPBD) refer to this barrier directly. Article 19 (1) (a) states that MS shall evaluate and take appropriate measures as regards to the split of incentives between the owner and the tenant of a building, with a view to ensuring that parties are not deterred from making efficiency-improving investments, by the fact that they will not individually receive the full benefits from them (Directive 2012/27/EU) Article 2a (d) of the EPBD recast holds that the long-term renovation strategy must include an overview of the policies and actions which target split incentive dilemmas [107]. As such, Ireland's Long-Term Renovation Strategy [62], suggests planned measures for the rental sector, including the introduction of minimum standards for energy efficiency in the rented sector for 2020 [62].

The requirement that rental properties must possess a BER provides those looking to rent the opportunity to identify the energy performance of buildings which would otherwise be unknown. The idea is that if consumers value energy efficiency, whether this be for comfort gains, monetary savings, environmental concerns or otherwise, this should increase the demand for more efficient properties [107].

Improved energy efficiency (in the form of improved energy performance certificates) has been shown to attract a price premium in many rental markets [109]. A study conducted in 2013 found that with each decline in energy efficiency rating, comes a decline in rental price of 0.5% [107]. Moreover, A rated properties receive a rental price premium of just under 2%, relative to D rated properties [107]. Thus, this provides an incentive for landlords to improve their property energy efficiency [109].

A study conducted in 2018 showed that half of Irish rental tenants are willing to pay more for properties with higher energy efficiency levels [107]. Tenants in Ireland are willing to pay an average of €47 for each grade improvement of BER in their accommodation [109]. However, this study revealed that this falls to €38 where tenants are more informed as to what their BER ratings mean. Thus, it is suggested that in the absence of information, rental tenants overvalue energy efficiency labels [109]. The study revealed that more informed tenants value the non-monetary benefits of retrofit works, such as health and comfort improvements [109].

Difficulties, however, arise depending on rental market conditions. For example, in stressed rental market conditions (such as those in Ireland in 2013-2016), whereby demand is growing faster than supply, rent prices are forced upward. In these conditions, landlords may be disincentivised to invest in retrofitting, given that landlords rental income will increase regardless of the condition of the accommodation. Thus, they will not be incentivised to improve their living standards [109]. Similarly, upward rental pressures will result in downward pressures on the willingness to pay of rental tenants, given that higher rental costs reduce the tenant's ability to afford improved energy efficiency within their budget constraint. Thus, this will reduce the standard of living accepted by renters [109].

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The effect on property value

A discussed benefit of retrofit is the increase in building market value which results from energy efficiency measure (EEM) implementation [95]. Clinch and Healy (2000) found that the sales value of a house should reflect the monetary value of EEMs, when the housing market is working effectively, and when the public is aware of the benefits of EEMs [93]. Increasingly in Ireland, the sales value of properties being affected by the BER [58] [94]. Moreover, homeowners are increasingly placing high value on BERs with prospective homeowners frequently checking BERs before purchasing [94].

The use of digital platforms

Across the EU, several countries have made significant strides in terms of improving their digital performance. Ireland belongs to the high performing cluster of countries in terms of increased digitalisation and an advanced digital economy, ranking sixth in the EU in terms of the Digital Economy and Society Index of 2018 [110].

In Ireland, approximately 92% of households have 4G coverage, with approximately 93% of Irish consumers owning a smartphone, and approximately 97% of Irish consumers having access to some form of smart device [110]. This is extremely important in terms of demand, as most smart device users are currently using digital platforms [111]. It must be noted however, that smartphone ownership will not guarantee householders will feel comfortable using a smart device for the TURNKEY RETROFIT service.

Ireland is ranked third in the EU in terms of the integration of digital technologies across businesses and e-commerce in particular [110]. However, in general, construction sectors remain relatively impervious to digital integration [110]. Nonetheless, there is tremendous incentive in the industry for the development of solutions that transform project delivery and productivity [112]. Thus, there has been a notable shift towards the implementation of digital solutions within this sector. For example, in 2017, the National BIM Council of Ireland produced its Digital Roadmap 2021 for the construction industry [113]. This shift towards digital integration works in favour of the implementation of a digital platform as part of the TURNKEY RETROFIT service.

Some digital platforms presently exist in Ireland for the provision of retrofit packages. Examples include ProEnergy Homes, House2Home and SuperHomes Ireland. ProEnergy Homes is a credit union initiative supported by the SEAI, in association with Retrofit Energy Ireland Ltd, which aims to make warmer, healthier, energy efficient homes more affordable. The digital platform for retrofit applications consists of a questionnaire which asks the applicant to answer three questions related to their property, namely, the type of property, the estimated annual spend on heating, and the current property heating system [114]. House2Home aims to provide a complete solution for retrofitting. The digital platform consists of an online contact form which asks the interested person to detail what they are interested in, by giving pre-defined choices in a drop-down menu. Additionally, the form asks whether the house was constructed prior to 2006. Additionally, contact details and a freephone number are provided [115]. SuperHomes Ireland offers a 'one stop shop' solution for energy retrofit projects, with an aim to retrofitting homes to an 'A' BER standard. Their digital platform includes an online application process which requires the applicant to answer 45 questions related to the occupants, the dwelling itself, any EEMs they currently have, want or need as part of the retrofit, their motivations or demotivation for retrofit, their expected costs, savings and payback, and any information on their financial plan for the retrofit works [116].

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The social factor with the potential to most negatively impact the TURNKEY RETROFIT project is the lack of awareness and knowledge among Irish homeowners as to the benefits of energy retrofit projects, and the various supports in place for the completion of retrofit projects. This awareness gap translates into a lack of engagement with energy retrofitting among Irish homeowners. Significant room exists to properly inform and educate homeowners in Ireland to drive uptake of retrofitting. Thus, a key consideration for the TURNKEY RETROFIT service is how to properly inform and engage homeowners with the service and translate the benefits of such projects to them. In addition, the presence of split incentives and the effect of stressed rental market conditions have been identified as factors which negatively impact the uptake of retrofitting in this sector in particular.

On the other hand, factors identified such as the use of digital technologies in Ireland, the changing perspectives on climate change, rental tenant's willingness-to-pay and the introduction of minimum BER standards in the rental sector, have the potential to positively influence the business model of the TURNKEY RETROFIT service.

Technological factors

Various technical factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in Ireland are:

- The use of advanced measures and auditing practices
- The skills and qualifications of professionals in the energy renovation sector
- Fragmented value chain
- Innovation, research and development
- 5G technology

The use of advanced measures and auditing practices

In the Irish retrofit industry, there is insufficient use of new analysis and modelling tools, with a lack of use of new measurement and verification techniques [58]. Moreover, Zuhaib et al. (2017) found that low-quality auditing practices are prevalent. In gauging the most frequently used audit practices before and after building retrofits, Zuhaib et al. (2017) found that 80% of respondents recorded visual inspection as standard practice. Such practice, however, is not effective in assessing retrofits. Only 30% of respondents used air-tightness test as an audit procedure, yet this is generally standard practice in Ireland. Moreover, just 22% of respondents reported the use of infra-red imaging to detect thermal bridging, heat losses and air-leakages as an audit practice. Thus, such improper and inadequate auditing practices impedes on the opportunities for energy efficiency improvements in buildings [58]. In addition, measurement and verification is further complicated by the fact that homeowners often express a lack of desire to record data and monitor for such [58].

The skills and qualifications of professionals in the energy renovation sector

The National Status Quo study conducted under the BUILDUP Skills initiative found that by 2020, over 3 million workers across Europe will need to increase their skills within the building sector in relation to energy efficiency and renewable energy systems [9]. Thus, specific and dedicated training of professionals in the industry is pivotal to delivering effective energy efficiency retrofits for buildings [9].

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In the Irish context, the lack of skilled installers to implement renovation services and the presence of non-qualified companies providing services with a lack of quality, are key barriers to be taken into consideration [58] [117]. In their study, Zuhaib et al. (2017) found that approximately 40% of professionals surveyed reported a lack of skilled workers in the Irish retrofit industry as a key barrier. Moreover, this lack of skills is associated with incoherent advice, poor quality, and a general loss of confidence in energy renovation in general, as building and health problems emerge from inappropriate upgrading works [117].

In Ireland, approximately 60,000 to 100,000 building construction workers were identified in the Build Up Skills Ireland (BUSI) Status Quo Report as having considerable gaps in their construction knowledge, and, within the areas of energy efficiency [118]. In order to facilitate successful renovation in Ireland, upskilling of construction workers is vital [119]. Generally, better trained construction workers and professionals are better able to advise end-users at key points [63]. Moreover, better quality will be incorporated into the renovation process.

The Irish Green Building Council (IGBC) recommended that basic building physics, traditional building standards, risk evaluation, Building Information Modelling (BIM) and consumer interaction, be integrated into all professional and vocational pathways [63]. Additionally, upskilling in BIM and IT will enable the development of efficient administrative processes [119]. Education institutes, trade associations and manufacturers all have a vital role in such [63].

To address these needs, several actions have been undertaken in Ireland [119]. For example, the Department of Education and Skills has provided funding for initiatives such as the Springboard initiative of 2011. Springboard provided opportunities for construction sector firms to partner with education and training providers, including a broad choice of courses in areas such as IT, BIM and 'green' construction to name a few. The Construction Industry Federation (CIF) is also playing an active role in the area of upskilling [119]. Moreover, the IGBC suggests the introduction of skill cards and a mandatory live register, of construction workers and professionals alike, will allow end users to easily identify such upskilled workers [63].

In the area of energy efficiency, upskilling programmes such as the BUILD UP Skills Initiative (BUS) and QUALIBUILD project, have been introduced [58]. The BUS Initiative is a strategic initiative started under the Intelligent Energy Europe (IEE) programme. The initiative aimed to enhance the skills of both on-site workers and craftsmen in the sector, in terms of energy efficiency and renewable energy sources, in order to meet the 2020 objectives. It also aimed at increasing the number of skilled workers in these fields [120]. The Build Up Skills Initiative has been continued via the construction skills strand of the EU 2020 research and innovation programme (H2020 EE4 Construction Skills), under which 5 projects were supported for further development with regards to multi-country qualification and training schemes [120].

As a follow up to the Build Up Skills Initiative in Ireland, the QualiBuild project was introduced. This project primarily focused on three areas, namely the upskilling of construction workers knowledge in energy efficiency and construction techniques; the upskilling of trainers, and the development and piloting of a register of skills for construction workers [118]. The project pilot aimed to train 100 trainers and 200 construction workers via the Foundation Energy Skills (FES) course. As of the completion of the QualiBuild project piloting from 2014-2016 saw the successful training of 57 out of 85 trainers registered for the program, and 195 out of the 232 participants registered for the FES course [118]. A sustainable funding model is needed for national roll out and train the 60,000 to 100,000 construction workers currently employed in the sector. Moreover, it is estimated that a realistic national

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roll-out would require approximately 33 courses a year over 6 years, at 11 courses per trainer, in order to achieve the target of 80,000 trained construction workers [118].

In the context of TURNKEY RETROFIT, this lack of skills in the Irish retrofit industry could be a considerable negative factor. Therefore, it is vital to ensure that those undertaking the works, possess the awareness, knowledge, understanding and competency required for high-quality renovations.

Fragmented value supply chain

Various studies have indicated that retrofit value supply chains are highly fragmented between various actors, to include SMEs, designers, developers, construction workers, clients and policy makers [58] [121]. This fragmentation gives rise to issues such as cost escalations, knowledge gaps and a lack of project management, which are considered important barriers to advanced energy renovations [121]. Therefore, successful market development of energy efficient integrated renovations relies heavily on reformulation of the associated renovation process and better supply chain collaboration [121].

In an Irish context, unaligned value supply chains, poor interaction among professionals, and fragmented services have deterred standardisation within the retrofit industry [58]. The value supply chain is further weakened by the aforementioned skills gaps, and a lack of integrated one-stop-shop solutions [58]. Therefore, there is a need to identify the value chain in the Irish context and align the value supply chains to the current demands of highly efficient buildings [58].

Innovation, research and development

According to the European Innovation Scoreboard 2017, Ireland is classified a Strong Innovator [119]. Moreover, Ireland's energy transition is expected to have a positive impact on innovation, economic activity and employment by investment encouragement in the products, services and technologies required for a low carbon future [72].

The Irish Government's Construction 2020 strategy proposed the development of a public sector pilot 'Market-Led Clustering Programme' to stimulate collaboration between the Irish construction sector, other industry sectors, and the research community, to contribute to national level policy goals, in terms of climate change in particular [119].

In general, Government funding for research and development in energy has been consistently high since 2005, even increasing in more recent years [72]. Moreover, the Irish research community consists of world-class centres of energy research excellence, which have had significant success in EU funding programmes [72]. Moreover, under the Action Plan for Jobs in Ireland, an interdepartmental committee was established to focus on positioning Ireland as Europe's Energy Innovation Hub. Additionally, the Energy Research Strategy Group (ERSG) has identified areas of research and the requirements for ensuring continued world class energy research in Ireland [72].

The White Paper on Ireland's Transition to a Low Carbon Energy Future 2015-2030 continues to support Ireland's energy research sector, with the establishment of policies that facilitate the identification and prioritisation of novel concepts and technologies that enable Ireland's transition [72]. The energy research strategy shall be overseen and aligned with energy policy and the EU strategy, maximising Ireland's potential to secure EU Horizon 2020 funding. Finally, jobs and local economic activity shall be supported by working with national, regional and local economic development agencies, attracting energy business, and helping existing businesses to embrace new technologies [72].

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The SEAI National Energy Research Development and Demonstration Funding Programme is part of the SEAI's central role in bringing about a low carbon economy through measures and activities focused on the transition to a more sustainable energy future [122]. The objectives of the programme include accelerating the development and deployment of competitive energy-related products, processes, and systems in the Irish market place; supporting solutions to overcome technical and other energy market uptake barriers; to grow Ireland's national capacity to access, develop and apply international class RD&D; and to guide and support policy makers and public bodies through results, outcomes and learnings from supported projects [122].

The funding programme supports innovation and actions to assist in the delivery of the NEEAP, and the National Renewable Energy Action Plan (NREAP), the National Mitigation Plan, the Department of Communications, Climate Action and Environment Energy White Paper, and Ireland's National Energy and Climate Plan [122].

As part of the call for the 2018 Funding Programme, certain topics directly related to the built environment were included. These were 'Topic 6: The In Use Factor: Comparison of the certified versus operational performance of energy efficiency technologies', and 'Topic 11: The Operational Performance of "A" rated Energy Buildings' [122].

As part of the call for the 2019 Funding Programme, topics directly related to the built environment included, 'Topic 13: Changing energy behaviours in the field: Measuring the impact of behaviour change strategies/interventions on changing energy related behaviours in Ireland'; 'Topic 14: Energy profiles in non-domestic buildings', and 'Topic 15: Internal environmental data in non-domestic buildings' [123].

Such Funding Programmes for RD&D, in particular those related to the built environment, reflects positively on the current nature of RD&D investment, and of the future potential investment in the areas of energy efficiency in the built environment in Ireland.

5G technology

According to the fourth quarterly 5G Observatory Report (July 2019), licenses for 5G technology in Ireland started in January of 2019, lasting till 2032 [124]. Thus far, the 5G roll out in Ireland has already began, with several providers switching to 5G in various cities including Dublin, Cork, Limerick, Galway and Waterford.

Given that TURNKEY RETROFIT service is proposed to be offered and supported through a digital platform, 5th generation technology will have an important role, allowing faster user access and large volume data storage, automation and digitalisation of the services provided, and the possibility for the generation of new services, such as virtual customer service.

The technological factors identified as having negative impact on the TURNKEY RETROFIT service in Ireland are the skill shortages (and the effect of such) which exist among Irish construction industry professionals, and the lack of use of advanced measures and auditing procedures. While the skills shortages among the construction industry is considered a significant barrier, it is considered only to have a negative impact as opposed to a very negative impact, given that there are increasing numbers of training programmes available within the area of energy retrofitting. However, there are significant opportunities in terms of research and development and innovation in the Irish market, and in the roll out of 5G technologies, which would support a project such as TURNKEY RETROFIT including the support of the proposed digital platform services. Thus, such factors are considered to have a positive, and very positive impact, respectively, on the TURNKEY RETROFIT service.

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Legal factors

The principal legal factor identified that impacts on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in Ireland is:

- The Review of the Irish Building Regulations for the Conservation of Fuel and Energy to incorporate requirements of the Recast Directive 2010/31/EU

Review of the Irish Building Regulations for the Conservation of Fuel and Energy to incorporate requirements of the Recast Directive 2010/31/EU.

Part L of the Irish Building Regulations has been subject to considerable review, with the Building Regulations (Part L Amendment) 2017 signed into law to set higher building energy performance standards. Furthermore, the current 2019 regulations provide for the requirements of Articles 2-9 of the EU Energy Performance of Buildings Directive- EPBD (recast) (2010/31/EU of 19 May 2010).

The changes in the Irish Building Regulations apply to any relevant works from the 1st November 2019 onwards. Buildings must achieve cost-optimal performance when in excess of 25% of the building surface area undergoes major renovation works. This cost-optimal performance level is 125 kWh/m²/year, as calculated in the Dwelling Energy Assessment Procedure (DEAP).

The introduction of higher building energy performance standards as per the review of the Irish building regulations is considered to have a positive impact on the TURNKEY RETROFIT project, in that renovations conducted to comply with these regulations are likely to produce better energy performance. As a result, the potential of the TURNKEY RETROFIT project in this context can be demonstrated, as an incentive for the replication and scaling of the project.

Environmental factors

The principal environmental factor identified that impacts on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in Ireland is:

- Environmental awareness

Environmental awareness

Retrofit benefits are largely categorised as economic, social and environmental. However, Collins and Curtis (2017) found that in the Irish context, the decision to invest in retrofit implementation is primarily concerned with economic considerations, such as the investment cost and gains in energy savings, followed by social benefits, usually in terms of comfort improvements. Generally, householders do not prioritise environmental aspects [95]. Thus, there exists an environmental unconsciousness among householders with regards to retrofit projects.

In fact, research conducted by McDonnell and Sinnott (2010) found that even the most environmentally concerned and informed consumers are reluctant to undertake energy efficiency measures in their home, given the other inherent barriers of retrofit implementation [125]. Moreover, Collins and Curtis (2017) found that in Ireland, those

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using environmental concern as their motivation for retrofitting, were more likely to abandon applications under the BEH scheme than others [95]. In Ireland, the lack of environmental awareness is further exasperated by a common lack of understanding among householders about their energy use and the potential savings that could result [125]. Thus, more needs to be done to educate and make the Irish consumer more aware.

Despite the fact that the Irish policy framework points to the actions in place for climate change mitigation, there are several environmental factors set to negatively impact not only the likes of the TURNKEY RETROFIT project, but Ireland's climate action efforts and realisation of EU targets in general. A lack of environmental awareness is prevalent among the Irish citizen, with Irish householders being less concerned with environmental considerations in a renovation context, than economic or social considerations. Moreover, the environmental consciousness of the Irish government is questioned given the lack of compliance of their commitments in the fight against climate change, as previously discussed in the section of Political factors. Thus, environmental awareness is considered to have a negative impact on the uptake, scaling and replication of TURNKEY RETROFIT.

2.4. Spain

Building stock characteristics

Spain had a boom in construction between the 1950s and the 1980s, due to a period of prosperity and rural migration. According to the results of the SECH-SPAHOUSEC project [126], buildings from this period represent 60% of the total stock in Spain. The Spanish building stock mainly consists of multifamily buildings (70%) which are usually located in high density urban areas, which represent 53% of the residential energy consumption [10]. A considerable portion of the single-family houses was built in the last 30 years under strict building requirements, whereas the share is much lower for multifamily buildings. Most of the buildings (around 80%) are owned by the occupants of the building.

- Total building stock built before 1980, which is the priority target of the TURNKEY RETROFIT service: 13,750,000 dwellings.

Consequently, the most representative building typology in Spain will be characterized by the multifamily blocks constructed between 1941-1980, with poor quality and highly energy inefficient.

The potential energy savings are therefore considerable. The common characteristics of multi-family buildings are those listed in the Table 5.

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Common characteristics	Average dwelling size: 70m ²
	Ground floor and three or four floors
	Pitched roof with ceramic tiles
	Double brick façade without insulation
	Mortar-based envelope, without balconies nor verandas
	Basic windows with aluminium frame, single glazing and without air tightness
	Inefficient heating systems, based mainly on electricity or gas, and recurrent problems with heating, insulation and indoor environment
	Water heating and cooking is provided by gas boilers
	Cooling is rarely integrated, especially in the northern region

Table 5 – Common characteristics of multi-family buildings in Spain

Energy consumption in these buildings is largely higher than in newly built buildings. Smart metering and on-site energy generation are rarely present.

A deep renovation of these buildings could have a major impact due to their high replication potential, vast energy and CO₂ savings, and large number of affected dwellings or families (including many families living in energy poverty [127]). The most pressing renovation needs are related to façades and roofs, as well as renovation of the ventilation system. In addition to these energy-related actions there is also a need to improve accessibility and to update the draining systems. Furthermore, the average energy performance level of residential buildings in Spain is as follows: Around 85% of buildings have an EPC grading of D or worse, in other words highly energy inefficient.

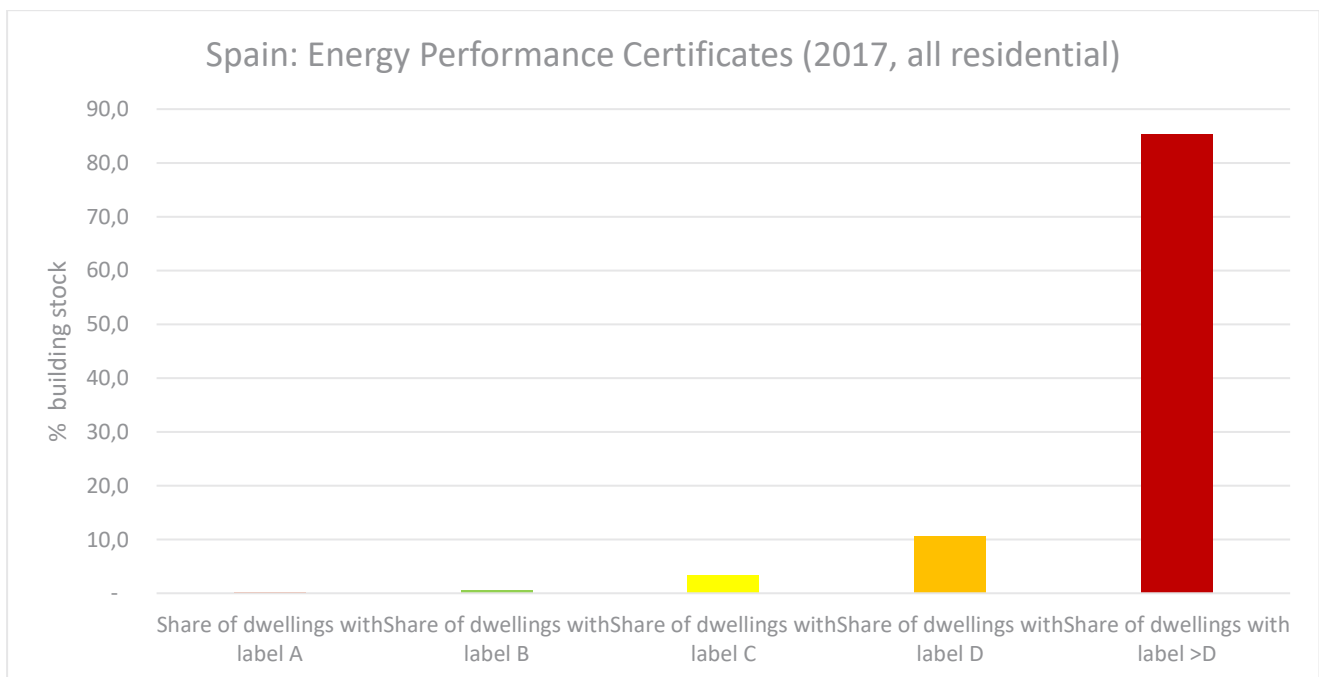


Figure 32 – Spain: Energy Performance Certificates (2017, all residential) (Source: BPIE)

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Summary of the factors and their impact

A summary of the factors identified and their impact on the business opportunities required to run and upscale the TURNKEY RETROFIT service in Spain is given in Table 6. Reasoning for the assessed impact of the factors is detailed in the following sections. The scale for the impact assessment is:

- Very negative (--)
- Negative (-)
- Positive (+)
- Very positive (++)

	(- -)	(-)	(+)	(+ +)
Political	Political instability	<p>Insufficient and fragmented public support measures for the energy renovation of buildings</p> <p>Decisions on urbanistic and dwelling matters are taken by the autonomous regional governments</p>	Strategic framework for boosting the energetic renovation of the buildings sector Urban Agenda 2030-2050 and the Long-Term Strategy for energy renovation in the building sector in Spain	Favourable future scenario
Economic	Absence of strong fiscal incentives	<p>General economic situation</p> <p>Economic situation in the renovation sector</p>		
Social	Lack of culture in favour of energy renovation	General distrust of citizens towards the workers in the renovation and refurbishment sector	<p>Increase in the value of sustainable dwellings</p> <p>New digital possibilities for businesses</p>	
Technological	Workers lack technological skills	Distrust of the clients (e.g. communities of dwellers in residential buildings) in new and untested technological products or solutions	Upcoming boost to R&D&i focused on energy renovation (buildings)	<p>Existence of a market for products and solutions for energy renovation</p> <p>5G Technology</p>

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	(- -)	(-)	(+)	(+ +)
Legal	Devaluation of the building's Energy Performance Certificates		Compulsory "Libro del Edificio" (Building Book) but only for new buildings	More demanding regulatory framework: "Código Técnico de Edificación" (Technical Building Code) & DB-HE update <Energy Saving>
Environmental	Lack of compliance on climate change-related commitments		Increase in environmental sustainability Old building stock with high energy consumption	Future stricter strategic framework for Energy and Climate

Table 6 – Summary of the factors identified and their impact on the business opportunities required to run and upscale the TURNKEY RETROFIT service in Spain

Description of the factors

Political factors

In a political context, factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in Spain are:

- Political instability
- Strategic framework to boost energy renovation in the building sector
- Competences in terms of Urbanism and Residential Buildings transferred to Regional Governments
- Public measures to support energy renovation of buildings (residential sector)
- Favourable future scenario

Political/Government instability

The Spanish Government suffered a sudden change in July 2018 after seven years of being governed by a conservative government. The Spanish president lost a motion of censure against him and was forced to resign because of a corruption scandal in his party. It was the leader of the Spanish Socialist Workers Party (PSOE) who replaced him until April of this year 2019, the date on which the general elections took place as scheduled.

After these elections, Spain continued with a Provisional Government, given the difficulties of the socialist party (the election winner) to come to an agreement with the other political parties, which it needs support from, in order to form a stable and coherent government. Finally, it could not come to an agreement, so in November 2019 there have been new elections. Today, the government has not yet been constituted.

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This political uncertainty has caused a delay in policy implementation and budgets assignment. In this particular case, depending on the political parties that finally come together to form a government, there could be either a continuation on how energy renovation is addressed in the residential building sector in Spain or a potential significant change in strategies, regulations and priorities.

Strategic framework to boost energy renovation in the building sector

In Spain, we have the Spanish Urban Agenda ('Agenda Urbana Española 2030 – 2050' [128]) which is a strategic document, non-regulatory in nature, which complies with the criteria set in the Agenda 2030, the New Urban Agenda of the United Nations and the Urban Agenda for the European Union, and which aims at achieving sustainability in the policies for urban development.

Drawn up by the Ministry of Public Works, its main objective is to achieve cities based on sustainable and energy-efficient construction and renovation and, where possible, self-sufficient with net balance. It focuses on renovation because:

- The building sector in Spain has an approximate weight of the 30% of final energy consumption; and, in particular, residential buildings account for 18.5%. Of the 25 million residential homes that constitute the building stock of Spain, 55% are over 40 years old and were built without any insulation, 24 million have energy performance certificate below category C⁸, only 7% will meet the 2006 regulation and only 1% are within the limits set by the current regulation. According to the IDAE, Institute for Diversification and Energy Saving ('Instituto para la Diversificación y Ahorro de la Energía') the stock of dwellings in worst conditions is around 2 million in number. As a result, buildings represent one of the highest potentials for savings, in terms of cost and energy efficiency [129].
- At a social level, the gradual retrofit of the building stock has to contribute to the elimination of energy poverty in Spanish cities⁹; combining renovation and efficiency in energy consumption activities with the availability of social rates that are suited to the income level and specific characteristics of each family.
- The renovation sector is also a key source of jobs that can aid in the professional retraining of many workers and thus the economic recovery for many families.

In this document, it is included as one of the proposals to give a determined impulse to the integral rehabilitation, improve the energetic and acoustic behavior of houses and buildings.

The Ministry of Public Works developed the National Renovation Strategy for the energy renovation in the building sector in Spain (ERESEE 2014)¹⁰ [130], in compliance with article 4 of the Directive 2012/27/UE, with regards to Energy Efficiency. The strategy was updated¹¹ in 2017 'Update of the long-term strategy for energy renovation in the

⁸ According to the Energetic Classification Scale (A, B, C, D, E, F y G)

⁹ According to the document on Energetic Poverty in Spain 2018 [130], there are a total of 6,8 million people, equivalent to 15% of the population in our country, who suffer inadequate temperatures in their homes or lag behind with their utility bills, or both.

¹⁰ The external evaluation that the Joint Research Centre undertook at the ERESEE 2014 was very good: not only is it between group of 10 "completely compliant", but it is also the best valued of the 31 strategies which were reviewed, obtaining a score of 21 points out of a total of 25

¹¹ It centred on the analysis of the impact of the currently adopted measures to boost energy efficiency in buildings

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building sector in Spain (ERESEE 2017)' [131] is still in force. The strategy will have to be updated in 2020 again, including new requirements specified by the amended EPBD.

It is an important starting point for boosting the energy renovation of the Spanish (residential and non-residential) building sector, as well as the roadmap to guide different agents that participate in renovation processes, each in the context of their own activities. The strategy had originally aimed at the renovation of 250,000 buildings per year (private dwellings), starting with those with serious structural and energetic problems, so that the most deteriorated stock could be renovated within 8 years, however data from the Ministry of Public Works indicates that even though there has been an increase in the number of renovated buildings in recent years, reaching an average of 25,000 buildings per year, which is very far from the original objective.

Competences in terms of Urbanism and Residential Buildings transferred to Regional Governments

The Paris agreements, signed by the European Union, set objectives for the reduction of energy consumption¹² which force the Spanish public administration (as well as the regional and local administrations) to fix dates for reaching those objectives in terms of energy renovation that international agreements set out.

In Spain, the competences in terms of Urbanism and Residential Buildings are the sole responsibility of regional governments and, therefore, they are in charge of the strategic planning of urban renovation and retrofitting, within the Spanish legal framework 2015, related to the law on territory and retrofitting [132]. In general, it is clear that the strategies have weaknesses (especially with specific objectives, strategic actions, and a corresponding action plan) [133], while they do general objectives and offer subsidies. There are good exceptions, such as in the case of the region of Cataluña, which has its own ECREE strategy ('Estrategia de Cataluña para la Rehabilitación Energética de Edificios') or the region of the Basque Country which has a Roadmap for Sustainable Construction ('Bultzatu 2025').

In conclusion, there is a strategic framework in Spain to boost the energy renovation of the building sector, which can favour the delivery of TURNKEY RETROFIT services. The framework focuses on the importance of comprehensive and exhaustive rehabilitation which improves both energetic and acoustic performances. Even though it has led to a sustainable growth of 3% in the sector in recent years, it still has more untapped potential.

Additionally, since the Urban and Residential Building competences are transferred to regional governments, depending on their strategies and plans, as well as on the corresponding budgets, the TURNKEY RETROFIT service could have more success in those where the level of requirement is higher.

Public measures to support energy renovation of buildings (residential sector)

The main public measures in terms of subsidies that the Government provides include:

- State Housing Plan 2018-2021 ('Plan estatal de vivienda 2018-2021'). Royal Legislative Decree 106/2018. Ministry of Public Works.

This is a Plan with no strategic vision and a key element in the Spanish residential buildings investment, which mixes subsidies for retrofitting with those for promoting rental of residential properties or other

¹² At least 40% reduction of greenhouse-effect gas emissions (in relation to the levels of 1990); at least 27% of the renewable energy quotas; at least 27% improvement in energy efficiency (objectives that must be achieved by 2030)

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financial support measures for those in danger of eviction. As a whole, they insist on promoting building maintenance, energy efficiency improvements and the introduction of measures for the disabled. The Budget for the period 2018-2021 is €1,443 million, a 62.46% increase with respect to the previous period (2013-2016).

The plan has several programmes, but the two following ones are the ones related to renovation:

- a) Program to promote the improvement of energy efficiency and sustainability in housing of the State Housing Plan 2018-2021 ('Programa de fomento de la mejora de la eficiencia energética y sostenibilidad en viviendas del Plan estatal de vivienda 2018-2021'). Budget: €101.32 million [134].

These are related to works on residential buildings aimed at improving energy efficiency and sustainability. These subsidies are compatible with the Ministry of Works programme for the conservation and the improvement in access in buildings. In multi-family buildings and in single-family housing, the aim is to reach a percentage reduction in annual energy use (cooling and heating) depending on the climate zone from: 35% for climate zones D and E, 25% for climate zone C, and 20% for climate zones α , A and B. In the last case, as an alternative, it can be also admitted the consumption of non-renewable primary energy consumption of 30% as a minimum. It will be required to justify these consumptions, both in terms of demand as well as in terms of consumption, in the energy performance certification.

- b) Promotion of conservation, improvement of security of use and accessibility in housing of the State Housing Plan 2018-2021 ('Fomento de la conservación, de la mejora de la seguridad de utilización y de la accesibilidad en viviendas del Plan estatal de vivienda 2018-2021').

They financially support the execution of construction work for the conservation, the improvement of safety of use and the universal access to the disabled in buildings, both for multifamily residential and single-family use, either in urban or rural environments as well as in any homes within residential buildings.

- 'PAREER II: The Aid Program for Energy Rehabilitation of existing Buildings'. IDAE - Institute for Diversification and Energy Saving - Ministry for the ecological transition.

The subsidies programme aimed at addressing energy renovation of buildings in Spain. The objective of the actions eligible for support is to achieve the reduction of CO₂ emissions and final energy consumption of the buildings, via an improvement in the energy efficiency, in such a way that the target buildings improve, at least, one letter in their energetic classification¹³. Budget (PAREER I, PAREER II) €404 million (for the 2014-2020 period) [134].

The types of eligible actions include those that lead to reduction of CO₂ emissions and final energy consumption of the buildings, by means of one or several of the following:

¹³ According to the Energetic Classification Scale (A, B, C, D, E, F y G)

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- Energy efficiency improvement of the thermal building envelope
- Improvement in the energy efficiency of thermal and light installations of the building
- Substitution of conventional energy for solar thermal energy
- Substitution of conventional energy for geothermal energy

The support consists of a financial contribution which can be improved with an additional subsidy which depends on the following 3 criteria: social, energy efficiency (in terms of improving two energy performance certificate rating, energetic classification or in terms of reaching the “A” or “B” energy performance certificate), comprehensive action (i.e. combining at least two types of eligible actions). In addition, the recipient can also apply for a loan up to a total of 90% of the eligible cost, in that which is not covered by the direct financial contribution.

The ratio of investment per application received was €200,000 and the average subsidy was of €120,000 per application and with respect to the type of action, the thermal envelope is the action which has received the most economic support (86%).

In both cases, the majority of regional governments have already signed this year 2019 their respective agreements with the Ministry of Public Works and IDAE. But the budgets are still considered small and cause inequalities between the different autonomous regions.

All the public support measures that exist for boosting energy renovation in existing buildings can favour the TURNKEY RETROFIT service business opportunity.

Weaknesses of the current model:

- It does not have enough resources and, in addition, sometimes the financial contributions are not compatible with one another (i.e. only one can be received), even though their aim is the same.
- Is focused on the subsidy as the main instrument, without taking into account other tools and initiatives that are already in place in other European countries¹⁴.
- The financial support lines for renovation compete with other resources, i.e. with those for rental of buildings or for people in danger of eviction, which shows that the prioritization by the government for renovation is unclear.
- There is a lack of coordination of the resources from the Ministry of Public Works, Energetic Transition and FEDER funding, which hinders growth in terms of economic impact and resulting building energy efficiency coming from renovations, which finally end up being viewed as anecdotic actions.
- The retrofit of residential buildings is seriously affected by the timescales of the subsidies, where the period of time for presentation (or justification) of the subsidy applications is followed by long periods without access to any subsidies.
- The competences in Urban and Residential buildings are exclusively in the hands of the Regional governments, so that each one can decide what to do and which measures to take, which in turn leads to a lack of alignment between regions, unsuitable measures.

¹⁴ For example, fiscal incentives, green mortgages, energetic passports, etc.

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It will be highly relevant to take into account the characteristics of the current model of public support measures when defining the business model for the TURNKEY RETROFIT service in Spain, as they will significantly influence the demand and supply of the service.

Favourable future scenario

As explained in Chapter 2, the Member States will adopt all the necessary legal, regulatory and administrative provisions in order to meet the current Directive before March 10th 2020¹⁵.

The Spanish strategy will be updated next year (ERESEE 2020) and it still unclear what it will look like in terms of the objectives and measures to achieve them. The strategy has the potential to boost energy renovation of buildings in Spain, which would represent a major opportunity for the TURNKEY RETROFIT service.

In addition, several agents and organisations within the sector are promoting the initiative known as, 'Pasaporte Energético' (Energetic Passport). This Spanish initiative is an adaptation of the one existing in Germany, Belgium (Flanders) and France [135]. Until now, this is only a proposal that has been presented to IDAE and could end up, for example, within the 'Libro del Edificio' (or Building Book, a document which exists for new buildings), and that consists in facilitating and financing the actions related to gradual retrofit of residential buildings with a minimum age by means of a step-by-step action in a timescale of years. In this way, the timescales for the construction works would not constitute a major problem as they would be supported by a specific funding programme with a longer timescale. It would include comprehensive energy renovation projects (thermal insulation improvement of facades, thermal insulation of roofing and flooring, building enclosure elements, as well as, the improvement or substitution of heating and cooling systems, generation of hot water and ventilation for the heating system) and that also achieves a reduction in the global annual energy consumption demand related to building heating and cooling referred to the energetic certification of at least 60% in buildings in climate zones D and E in accordance with the Technical Building Code ('Código Técnico de la Edificación' [136]), and 50% in buildings in climate zone C. On the other hand, it is also noteworthy to mention that in the Energy Efficiency Directive 2018/2002, revision 2012/27/EU, it indicates that if the renovation requires a change in the installations, it will be compulsory to install devices which can be read remotely.

This type of initiatives will represent an important boost to the TURNKEY RETROFIT service.

Economic factors

Various economic factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in Spain are:

- General economic situation
- Fiscal incentives
- Economic situation of the building renovation sector

¹⁵ BPIE has developed "A guide to implement the Energy performance of buildings directive (2018/844)"

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General economic situation

After having decreased in 2012 and 2013, Spanish GDP grew by 1.4% in 2014 and more than 3% in 2015, 2016 and 2017. In 2018, the GDP increased by 2.6% with respect to 2017 [137]. Despite the economic growth in the last years, some important factors are putting pressure on the Spanish economy, such as an unbalanced national budget, with a high fiscal deficit (2.6 % of GDP in 2018) and public debt (97.2% in 2018), and pensions growing at a very low rate, which decreases the consumer confidence index. This index, in 2018 has dropped 11.6 points with respect to the 2017 register due to a drop in the citizens' expectations related to the economy and current situation.

Towards the end of 2018, the Bank of Spain published a new report that stated that the Spanish economy would continue in a growth phase within the following months. However, the rate will be lower, so that the GDP will be 2% in 2020. A decrease in GDP growth will affect, without any doubt, the Spanish families' budget, which could clearly influence the decision of whether to undertake energy renovation projects in their homes.

The result of the last survey by the Centre for Sociological Research ('Centro de Investigaciones Sociológicas') [138] points out that 50.2% of those surveyed¹⁶ described the economic situation in their home as 'making ends meet', while 13.8% describe that it is extremely difficult to make ends meet or even that they have gone into debt.

Even so, a growth in private consumption is expected in the next year, albeit it being lower than in 2018. For the time being, in the first trimester of 2019, a significant strength has been noted, with a backdrop of high employment creation being maintained, an increase in the buying power as a result of a decrease in inflation (attributed, in part, to the fall in crude oil prices), the budget boost to household income (mainly in the second half of 2018) and the decrease in savings rate.

In general, the majority of Spanish organisations agrees with the declaration that the rate of growth of the Spanish economy will not be as high as was expected at the start of 2019, but nevertheless this does not mean that our country has entered into an economic downturn.

Fiscal incentives

In Spain the national regulation of the IRPF (Personal Income Tax or 'Renta de las Personas Físicas') does not predict the possibility of introducing any type of discount to renovation, refurbishment or home improvement works, even if they aim at improving energy efficiency. Notwithstanding, they are available in some autonomous regions in relation to building projects for the main residence.

There are no allowances on the IBI (Real State Tax or 'Impuesto sobre Bienes Inmuebles') for those who have undertaken any building projects or actions that have led to energy efficiency improvements; there are no allowances either in the ICIO (Tax on Buildings, Installations and Works or 'Impuesto de Construcciones, Instalaciones y Obras') in favour of those buildings, installations or works that lead to energy efficiency.

The absence of fiscal incentives can have a negative impact on the TURNKEY RETROFIT service.

¹⁶ The base of the survey is 2.500 people

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Economic situation of the building renovation sector

The renovation sector, as a whole, maintains a stable rate of growth of ca. 3% [139]

The business volume for residential buildings in 2017 was of €44,294 million, of which 55% corresponded to the renovation and conservation (highlighted in red in the Figure 33), and 45% to the construction of new buildings. Figure 34 shows how in the last 3 years the % has been decreasing. There is no data to indicate the exact business volume corresponding to renovation works aiming at improving energy efficiency, or which have been performed in an integrated service provided through one-stop-shops.

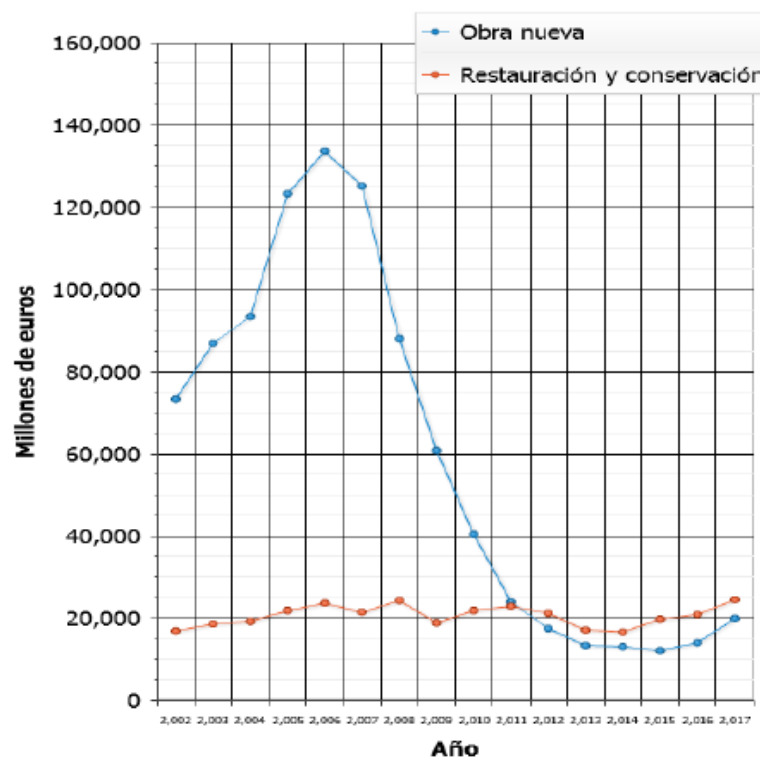


Figure 33 – Business volume for residential buildings (million €) (Source: [140])

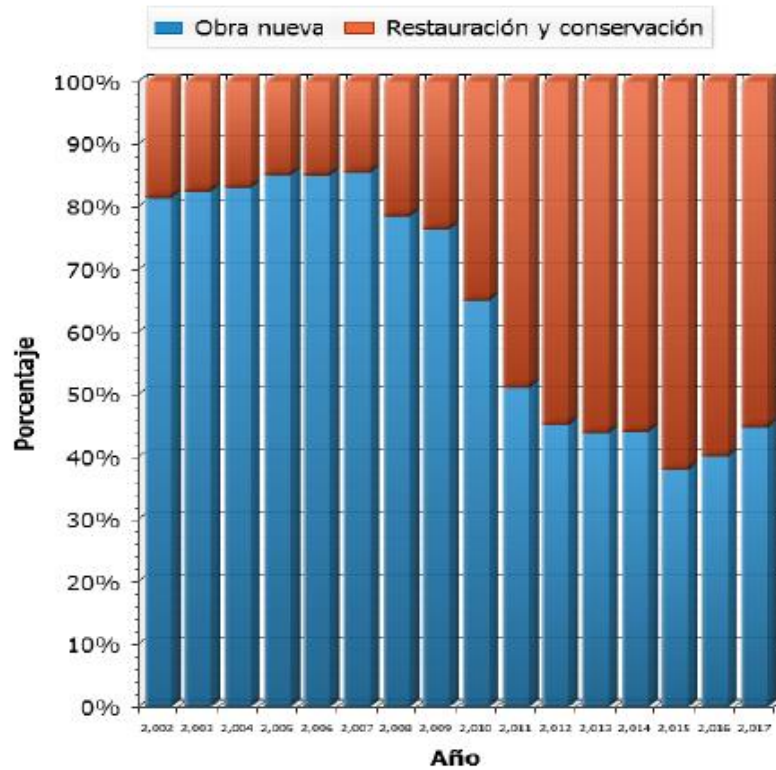


Figure 34 – Business volume for residential buildings (%) (Source: [140])

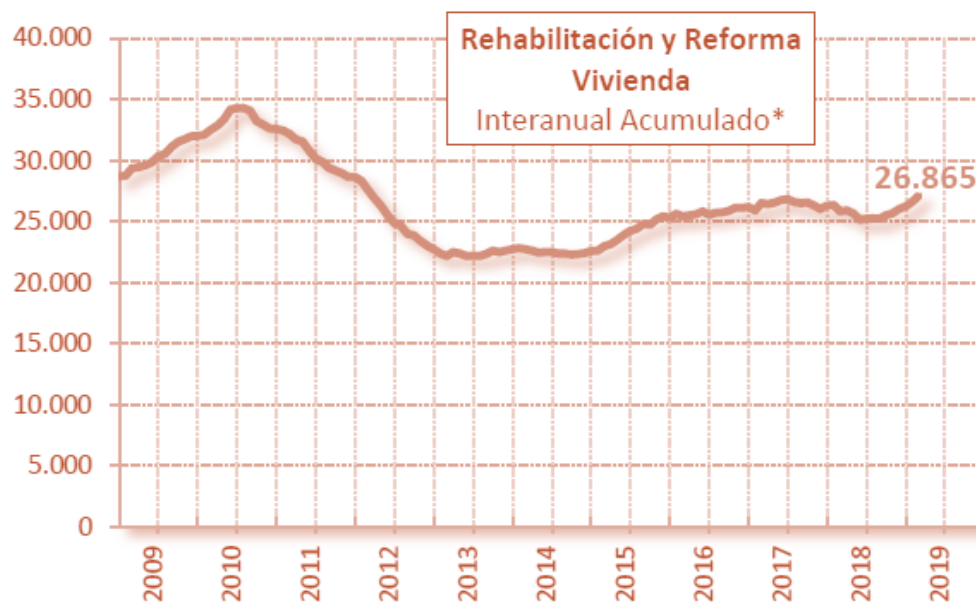


Figure 35 – Dwelling renovation, cumulative year-on-year (April 2018 - March 2019) (Source: [141])

In Spain, the number of active companies [142] that take part in the building energy renovation processes are the following, and are grouped in terms of their main activity:

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- Architecture: 15,699
- Certified Passive House Designer: 618 (11% of the world total)
- Energy services providers: 1,642
- Building construction or renovation: 95,980
- Engineering bureau involved in building construction or renovation: 28,934
- Construction product manufacturers: 81,843
- Construction product distributors: 13,398

And finally, the EU average of renovation spending as percentage of total household disposable income in 2010 was 0.8%. This value has remained stable during the next years, having the same average share during the next 5 years [143]. Renovation spending increased between the years 2010 and 2016, in only half of EU Member States [143]. Spain has a renovation spending close to the European average.

Social factors

Various social factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in Ireland are:

- Lack of culture in favour of energy renovation
- Increase in value of sustainable buildings
- General distrust of citizens towards professionals in the renovation and refurbishment sector
- New digital possibilities for business

Lack of culture in favour of energy renovation

Both the renovation with exclusively private funding, as well as that assisted by the different public support initiatives, is not getting the desired response, largely due to the lack of awareness and culture in favour of renovation, which does exist in other European countries [130]. To this, we should also add that there is a lack of knowledge of the benefits resulting from the investment required. The benefits of energy renovation of buildings should be explained with data including payback periods and reduction of energy bills [144]. On one hand, the payback period is greater than 10 years and, on the other, there is a lack of public access databases that show the advantages in energy performance of the renovated buildings. In addition, there is little available information on how to undertake a comprehensive renovation of this type. All of this contributes to a lack of culture in this subject.

When a renovation project is undertaken in a building, owners are more worried about issues like accessibility (lifts, ramps, etc.), comfort (e.g. in terms of humidity problems) or the building aesthetics, which are some of the main reasons that lead to their decision to go ahead with the building renovation work [144]. Energy efficiency and the building performance tend to be secondary aspects.

Both the Ministry of Public Works and the IDAE have started, in recent years, to develop actions to promote awareness in the general public on the importance of renovation, mainly focusing on economic savings and on energy efficiency improvement; for example, campaigns to raise awareness such as 'If you improve your building,

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you improve your life' ('Si mejoras tu edificio, mejoras tu vida'), publication of several guides, dissemination of good practices and pilot projects, etc. But a lot remains to be done in this field.

Additionally, there are also studies that show that the renovations that have been undertaken, for instance, in Euskadi's building stock (one of the autonomous regions with the oldest buildings, but where many more resources are being dedicated to their renovation) have a limited scope and lack a comprehensive vision [145]. The majority are limited to basic elements of habitability or maintenance but lack the comprehensive vision which results in a less effective transformation of the performance of the Basque building stock.

The result of the last survey by the CIS¹⁷ [138] is as follows:

- 64% of people who were surveyed do not believe that they need to undertake any renovations to their residential building.
- 70% do not consider undertaking any renovation works in their building in the next 12 months.
- The remaining 30% plan to renovate façades, roofs, lifts or stairs (but not in a comprehensive manner).

The lack of culture regarding energy renovation in Spanish society is a factor that can have a negative impact on the TURNKEY RETROFIT service as it is directly related to the demand for the service. Fortunately, the growing environmental awareness in Spain [146] together with high running costs in inefficient buildings are prompting more and more homeowners to wonder about energy efficiency of their buildings, so that the situation is likely to change.

Increase in value of sustainable buildings

The commitment to energy efficiency in buildings is starting to attract interest in other sector, among them, the real estate sector. Any property that, after renovation, meets a set of criteria that guarantee energy consumption 80% lower than a traditional equivalent property, 40% lower water demand and 7-8% lower running and maintenance costs, will see an increase in its appraisal value of up to 25% due to the quality improvement in the building itself [147].

Recently, a trend in 'green mortgages' began, which is a type of financial support that helps to buy, build or renovate buildings which are energy efficiency (mainly those with A, B or C energy classifications) by means of preferential conditions: more attractive interest rates, lower differentials, lower commissions, less strict requirements in terms of legal bindings.

Even though the offer and demand in Spain is still emerging, since only a few banking institutions grant this type of mortgage and since the new mortgage regulation still does not include them, the spread of this product will help raise environmental awareness in society in the context of buildings.

General distrust of citizens towards professionals in the renovation and refurbishment sector

In general, the renovation sector is not perceived as a professional and trustworthy sector. Additionally, it is not deemed as an attractive future employer by younger generations, which in turn is leading to less qualified professionals in the sector.

¹⁷ The base of the survey is 2,500 people

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New digital possibilities for business

Digital platforms constitute for the business sector a powerful tool for value creation as advertising media, sales channel and for internationalisation [148].

The growing digitalisation of Spanish society and the increasing use of smart phones (where 92% of the Spanish population now own a phone with internet connection [149]) is key from the demand point of view, as many citizens are already users of digital platforms currently available for many purposes.

In Spain, in the construction sector, there are different types of management platforms for work demand [150].

- Option 1. On-demand payment platform
The platform puts the customer in contact with potential suppliers during the bidding phase. But it does not offer any added value.
- Option 2. Platform of payment by demand + % on the sale
It's an evolution of the first choice. It puts the customer in contact with potential suppliers during the bidding phase and from the platform a minimum follow-up is made. But it does not advise, it does not select professionals for each type of work; the added value is lower.
- Option 3. Platform of Advice + % on the sale
This type of platform includes advice to the client, both technical and financing, accompanying the entire sales process.

The TURNKEY RETROFIT service will deliver services through the digital platform, which is considered initially as differential added value. We must consider carefully its exact purpose (Why do we need it?) and its scale according to the needs so far identified.

Technological factors

Various technical factors identified that impact on business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in Spain are:

- Existence in the market of products and solutions for energy renovation
- Distrust of the clients (community of owners in multifamily buildings) in untested technological products and solutions
- Next boost to R&D&i focused on energy efficiency (in buildings)
- Professionals in the sector poorly qualified in technological solutions for energy renovation
- 5G Technology

Existence in the market of products and solutions for energy renovation

The construction sector is taking great strides with respect to innovation. A good example are the technological advances in energy efficiency in buildings (mainly by the use of advanced materials that improve thermal insulation in buildings, 3D printing and additive manufacturing processes for energy renovation). The objective is to achieve more energy efficient and environmentally friendly buildings with minimum consumption.

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In Spain, there are different guides in the market, which can be accessed on-line, launched from both the public and private sectors and that identify the wide range of constructive solutions for energy renovation of buildings. An example is the:

- 'Guía Técnica para la Rehabilitación de la Envolvente Térmica de los Edificios' (*Technical guide for the energy renovation of building envelopes*), which focuses mainly in improving thermal insulation [129] or
- The guide 'Rehabilitación exprés para hogares vulnerables. Soluciones de bajo coste' (*Fast renovation for vulnerable homes. Low cost solutions*) published by the Naturgy Foundation, which aims to advance towards improvements in terms of thermal wellbeing conditions and in the assessment of energy consumption in the climate control system of homes inhabited by residents in the poverty line or with energy vulnerability, and also aims to provide low cost solutions, which can be quickly and easily implemented and which provide the necessary climate comfort for the residents of these homes [151].

Distrust of the clients (community of owners in multifamily buildings) in untested technological products and solutions

When energy efficient solutions are selected, "proven solutions" [144] are required. The investment is high, and the investors don't want to take any risk. Therefore, well-known solutions, with proven performance, locally available and with maintenance and warranty service are requested. State of the art solutions are not accepted by the market. The commitment of the technology provider is considered very important moreover with innovative solutions to be implemented.

Next boost to R&D&i focused on energy efficiency (in buildings)

As is described in the draft document Integrated Plan for Energy and Climate 2021-2030 ('Plan Integrado de Energía y Clima 2021-2030') the objective in Spain with regards to R&D&i is to invest annually and continuously at least 2.5% of our GDP during the next 40 years, independently of economic cycles. From that investment, one significant part will be dedicated to the fight against climate change and the de-carbonisation of the economy¹⁸. Energy efficiency affects various areas, among them construction which will also be supported in order to develop new active and passive solutions for comprehensive (or deep) energy renovation of buildings.

On the other hand, in order to boost the development and implementation of innovative solutions, the Public Administrations are already introducing the Innovative Public Procurement¹⁹. At the start, it was mainly boosted via regional governments for specific economic sectors: This is the case of Galicia and Cataluña for the Health sector and also via the Ministry of Defence; but there are also tenders being published, albeit occasionally, aimed at promoting innovation in energy renovation.

¹⁸ It will be included in the future Spanish Science and Technology Strategy for the 2021-2027 period and will constitute a change from the current national R&D&i planning structure as nowadays all the funding calls are evaluated and awarded strictly using criteria of excellence without defining the level of funding for specific sectors or challenges, for this reason, at present there is no data available on how much is invested each year in Spain in R&D in this specific area.

¹⁹ The Innovative Public Procurement is an administrative action to promote innovation oriented to the potential development of new innovative markets from the demand side, through the instrument of public procurement.

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Among many examples, it is worth pointing out the city of Sestao in the Basque Country and its urban renovation association SestaoBerri that participated in 2016 in the EU project PAPIRUS [152]. Sestao Berri's PAPIRUS tender was focused on improving the new building's envelope thermal properties by reducing energy losses through vertical building opaque envelope as well as heat losses in winter and unwanted heat gains in summer through the windows.

Solutions would have to avoid thermal bridges in pillars, slab surfaces, shutter mechanisms, etc. and provide a Thermal transmittance of $U \leq 0.18 \text{ W/m}^2\cdot\text{K}$ for the opaque envelope and $1.94 \text{ W/m}^2\cdot\text{K}$ for windows among other requirements such as installation easiness process and maintenance.

Both contracts awarded in the frame of the PAPIRUS tender fulfilled those demands by far.

With respect to regulations, the new law *Ley 9/2017 (LCSP)* related to public sector contracts came into place in March 2018, where EU Parliament and Council Directives 2014/23/UE y 2014/24/UE have been transposed to the Spanish legal system. Said law establishes the incorporation of more complex and detailed criteria for the selection and procurement of public contracts. According to the LCSP, the criteria for awarding a public contract must be based on the "best price-quality ratio" replacing the "most advantageous economic offer". The "best price-quality" will be determined based on economic and qualitative criteria, where the buyer can also include any environmental and/or social qualitative criteria related to the contact objective. In addition, the new LCSP introduces the concept of different players can associate with the aim of innovating (i.e. "association for innovation") within the new contract procurement processes.

Professionals in the sector poorly-qualified in technological solutions for energy renovation

In Spain, the so-called "brick crisis" ("crisis del ladrillo") brought as a consequence the almost complete disappearance of the professional vocation in terms of the skills and trades related to construction. Furthermore, sadly, there is still a professional and social disregard for people working in this sector [153].

Both from the conceptual and technical point of views, the renovation will require the launch of a wide-ranging training plan for the workers. This change in model in going from new construction to renovation that is desirable can help to solve problems in the old model of the construction sector, such as low quality in buildings due to the lack of specialised construction workers [154].

When there is no knowledge or specialization, they tend to use the same solutions. Solutions they know and feel comfortable with. So, when a new solution is proposed, the construction planning is usually delayed, and training of professionals is needed during the renovation process. Research projects also allow for training of the construction professionals in new products and techniques, but the impact is very low.

There is room for integrated (or comprehensive) renovation services such as TURNKEY RETROFIT in Spain provided that the companies carrying out the work are qualified, and the renovation process is clarified.

5G Technology

As was planned in the 'National Plan 5G' document drafted by the MEE or Ministry of Economy and Enterprises ('Ministerio de Economía y Empresa'), the deployment of the new network has already began in Spain, from 2018 until 2020, when it is expected to be ready to take off and to constitute an important technology for the future. To date, there are 15 Spanish cities that can benefit from this technology, which will revolutionise communications and

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have a huge impact in the way people and companies live and work. This fifth-generation communication technology goes beyond mobility and will open a wide range of new possibilities, allowing for things to happen that are currently impossible. These advantages are based on a wider bandwidth for the same physical territory, higher speeds and less latency. These three advances combined will lead to great technological and business innovations.

Since TURNKEY RETROFIT service will be offered and supported through a digital platform, this technology will play an important role, as it will allow (faster) user access and the storage of a large volume of data by the user, the automation and digitalisation of the services provided, as well as the generation of new services such as, for example, a virtual customer service, etc.

Legal factors

Various legal factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in Spain are:

- More demanding regulatory framework
- Devaluation of the Building Energy Efficiency Certificates
- Compulsory Building Book ('Libro del Edificio') only for new buildings

More demanding regulatory framework

The different public administrations have made a considerable effort in recent years to boost regulatory measures that facilitate the launch of the renovation sector.

Law 8/2013 dated 26th June, on Renovation, Regeneration and Urban renewal ('Rehabilitación, Regeneración y Renovación urbana') must be highlighted. It sets out the mechanisms that contribute to promoting quality, sustainability and competitiveness, both in the building and in the soil itself, and bring closer the national regulatory framework to the European one, mainly in relation to the objectives on energy efficiency and savings. In 2015, it was merged with the Law of Soil 2008 ('Ley de Suelo de 2008 -Real Decreto Legislativo 7/2015', 30th October). At the autonomous region level, there are many that have approved specific legislation on renovation, or that have modified the legislation to adapt to the requirements of the national law.

This Law:

- Demanded the use of the Spanish Building Technical Code in the projects undertaken on existing buildings, solving a series of problems related to the application of this norm in the renovation projects, which had been expressed for some time by the main agents in the sector.

At the same time, the updating of the Basic Document on Energy Saving ('Documento Básico DB-HE Ahorro de Energía'), of the Spanish Building Technical Code, approved by the Order FOM/588/2017, on 15th June, includes the criteria for energy efficiency in the renovation of existing buildings, and also considers the procedure for verification of meeting the requirement, and criteria for setting the scope of the renovation.

This new DB-HE document updates the requirements to drive the new buildings and the renovation of existing ones towards a set of parameters for high energy efficiency and a very low energy demand.

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Specifically, some of the changes include:

- The minimum values of energy efficiency are reviewed. For example, the limit on primary non-renewable energy consumption is reduced to 38% in multifamily buildings and to 60% in single family in the worst areas in winter.
- With regards to renewable energy usage, it is required that it supplies 50% of the primary energy consumption in extreme conditions.
- It is proposed that a reduction in the final energy consumption and in primary energy by means of the mechanical systems: heat generation, cooling and ACS.
- More strict requirements are included for cases of renovation in different climate zones.
- The obligation to use specific renewable energy sources, such as solar thermal or photovoltaic solar, is eliminated. This change opens the range of options to use other technologies and renewable energy sources.
- A new parameter is now considered: the global thermal coefficient limit for heat transfer through the thermal envelope (k), which sets fixed values for the thermal conductivity of the envelope, the solar control and the air permeability. Specific values of “k” (thermal conductivity) will be demanded for both new buildings and renovated buildings, etc.

The application of all the above requires an adaptation effort from all the agents involved in construction, as well as dissemination work so that society can understand that the compliance to these new recommendations, along with their related added costs, represent a direct benefit to the end user and to society ensuring that our planet continues to be habitable.

- This law also introduced the Report for the Evaluation of Buildings (‘Informe de Evaluación de los Edificios’ - IEE), as an instrument, which could initially be for information purposes, but which can also play an important role as catalyst in the energy renovation building projects. This report has as an objective to prove the situation that buildings, with relation to their state of conservation (‘Estado de conservación’ - ITE), are in compliance to current regulations in terms of universal access (to the disabled) and in terms of the degree of energy efficiency (including the Certificate of Energy Efficiency of the Building, with the content and by means of the procedure established by the regulation), which makes it a diagnostic instrument of great importance for the future design of policies in the renovation, specifically, and in general in construction in Spain.

It is compulsory in nature for residential buildings which are over 50 years old and it is compulsory to apply for public support to undertake the conservation, accessibility and energy efficiency building projects.

In the case that in the IEE, deficiencies are detected in the state of conservation of the building, the Administration can enforce actions aimed at resolving them, as in Spain the owners have the obligation of conserving the buildings [155]. When the deficiencies in conservation are detected in a given dwelling, usually they are in the facades and in the roofing. The compulsory execution of conservation projects, if they are considered to be “important renovations”, could also entail the legal requirement of improving energy efficiency. When the deficiencies are minor (<25% of the total thermal envelop surface), the report will be the instrument that generates synergies between the building projects and an improvement, in this case voluntary,

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of the energy efficiency. In the Royal Decree 235/2013, 5th April, where the basic procedure for the energetic classification of buildings is approved, it forces the inclusion of the certificate, as well as a document with recommendations, which the owners will take into account when they must undertake any compulsory renovation works to address the deficiencies detected in the state of conservation of facades and roofing. It represents a unique opportunity for them to consider the need to follow the recommendations of the Energetic Certification and execute voluntarily and in a simultaneous manner the works related to the envelope's energy renovation.

According to the report from the GTR, an adequate deployment of the IEE would demonstrate to what extent the building stock needs relatively urgent renovations in their structural elements, tightness (air and water), envelopes, accessibility, or in the heating and cooling systems, most specifically those in the most vulnerable or poor quarters and in the homes most seriously affected by the economic crisis.

The regulatory framework, today, with the updating of the DB-HE includes the requirements to drive the renovation towards parameters of high energy efficiency and a very low energy demand, can be a boost for the TURNKEY RETROFIT service, if it can offer owners a set of technological solutions that allow them to achieve those parameters. Furthermore, it is expected that it will offer a tool for calculating the energy savings, which will be crucial so that the owner can take the right decisions.

Devaluation of the Building Energy Efficiency Certificates (i.e. Energy Performance Certificates)

Both the technical staff that execute the project as well as the owners that apply for the Energy Performance Certificate must take this document very seriously. Nowadays, many consider it a mere formality to apply for the public support or to sell or rent a dwelling, thus underestimating the value it has and looking for the service provider that can do it most quickly and cheaply, as the content of the certificate is not valued.

The regulations related to the Energy Certificate (Royal Legislative Decree 235/2013), indicate what type of professionals can undertake these energy certifications. They define them as competent technical staff with the necessary academic qualifications that allows them to draft the project itself and guide the works, according to the Law: 'Ley de Ordenación de la Edificación'. Architects and Technical Architects the Senior Engineers of certain specialties.

This factor can have a very negative impact in the TURNKEY RETROFIT service, as if the energetic diagnostic is considered a mere formality and is not valued, the client demanding the service will not want to pay for it.

Compulsory Building Book ('Libro del Edificio') only for new buildings

The lack of regulations regarding the need for existing buildings to have what is called a 'Libro del Edificio' (or Building Book), as in the case of new buildings, is an obstacle in getting to know the different renovations that have been already undertaken previously, the IIE, certificates, previous other works, etc. as well as the monitoring of maintenance activities that have taken place.

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Environmental factors

Various environmental factors identified that impact on the business opportunities required to run, replicate and upscale the TURNKEY RETROFIT service in Spain are:

- Future more demanding strategic framework for Energy and Climate
- Increase in environmental awareness
- Old building stock with high energy consumption
- Lack of compliance with the commitments in the fight against climate change

Future more demanding strategic framework for Energy and Climate

Renovation is considered as one of the main solutions to counter climate change as buildings are one of the main causes of greenhouse gas emissions, where they can contribute to almost 40% [135].

At present, IDAE is drafting the new document National Comprehensive Plan for Energy and Climate 2021-2030 ('Plan Nacional Integrado de Energía y Clima (PNIEC) 2021- 2030'). In it, the objectives are set out for the decrease in the GHG emissions, the introduction of renewable energies and energy efficiency. The proposed actions are also set out and the roadmap which, according to the models used, is deemed as the most appropriate and efficient, maximising opportunities and benefits for the economy, job creation, health and the environment; minimising costs and respecting the needs of adaptation of the more CO₂ intensive sectors. This document is a programme that will need to be presented to the European Commission for its evaluation and that will be debated between all the different agents in Spain throughout 2019.

By 2050, the aim is to reach climatic neutrality along with a 90% reduction in our GHG emissions and in accordance to the EU strategy.

PNIEC supports measures such as energy renovation of the existing building stock, while pointing out that cities and governments must be very important and active agents for change. The objectives for 2030 which will be included and are in accordance to ERESEE 2020, related to energy renovation of building, are as follows (Figure 36):

- Improvement in energy efficiency (thermal envelope), throughout the next 10 years, of a total of 1,200,000 residential dwellings.
- Improvement in energy efficiency (heating and cooling system renovations) of 300,000 residential dwellings/year.

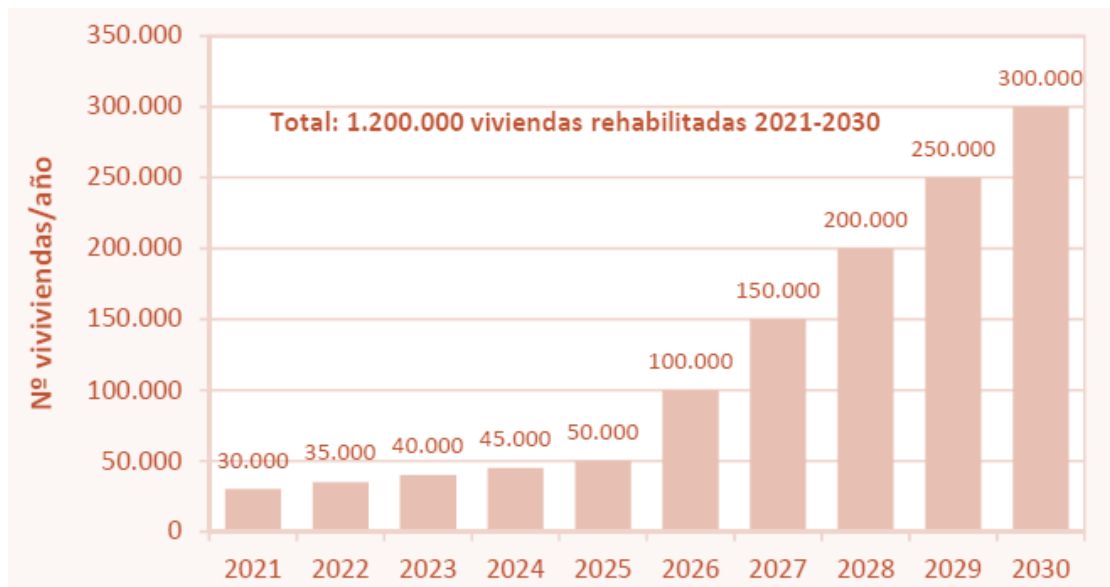


Figure 36 – Current prediction of energy renovated residential buildings 2021-2030 (Source: [156])

The renovation should allow improvements in the energetic classification of the building. The basis for the public support will be the 'Certificate of Energy Efficiency of the Building', which must include a description of the energy characteristics of the building as a starting point for its energy efficiency diagnostic. This certificate will contain information about all the elements eligible for intervention from an energy efficiency point of view (thermal envelope, heating system, cooling system, hot water production, lighting and other control and management systems), as well as information about the normal running and occupancy conditions, thermal comfort conditions and indoor air quality, among others. The certificate must include recommendations regarding the improvement of optimum and cost-effective levels of the energy efficiency of the building or a part of it; it can also include an estimation of the return on investment timescale during the building's service life.

The measure aims to achieve 4,755.9 ktep in final energy savings accumulated during the 2021– 2030 period.

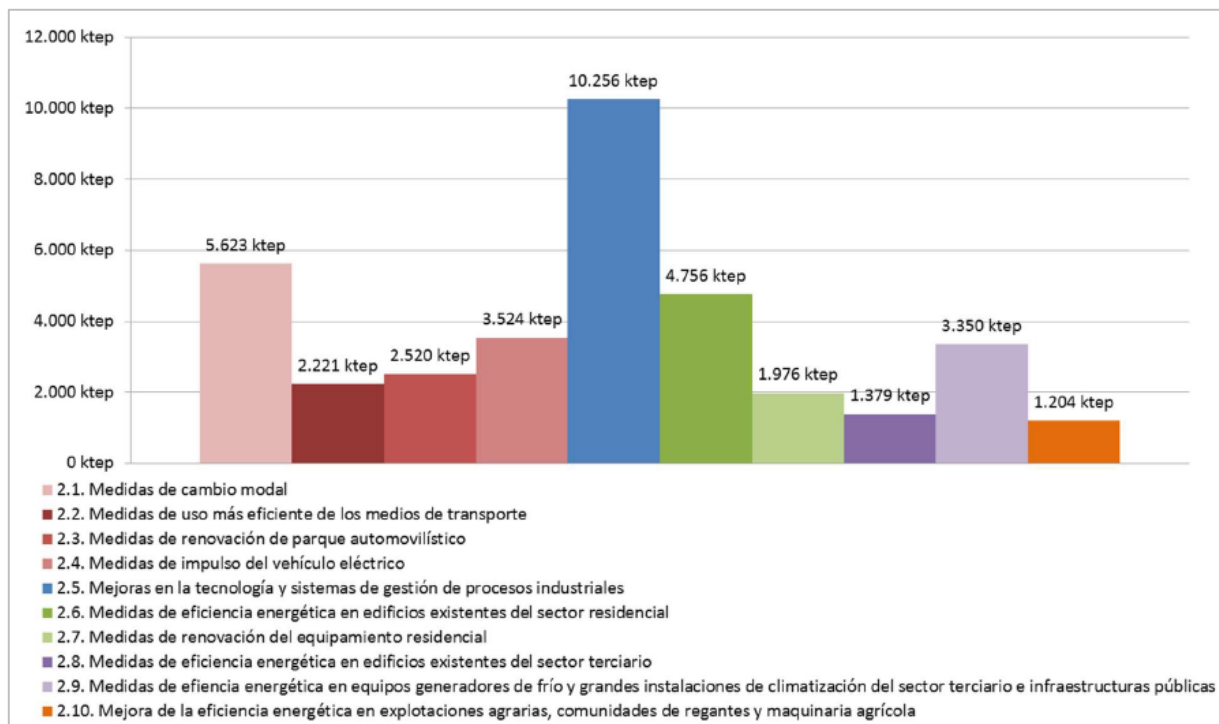


Figure 37 – Final energy savings accumulated by measures in Spain 2021-2030 (ktep) (Source: [156])

The estimated public support for the deployment of this measure in the 2021-2030 period is worth €5,509 million which, mostly, will come from the European structural and investment funds corresponding to the new financial framework and that will allow the mobilisation of a volume of investment of €22,431 million in total for this specific time period.

It is expected that putting this measure in place, as will be described in the ERESEE 2020, could be in the future a boost for the TURNKEY RETROFIT service. Additionally, even though the Plan prioritises the investments in the thermal envelope, the public support will be linked to social criteria, the achievement of high levels of energy efficiency classification (or improvement by at least two or more rating letters) and to the execution of comprehensive renovation projects that impact, simultaneously, on the envelope and on the thermal installations (or systems) of the building.

Increase in environmental awareness

As pointed out previously in the section on Social Factors, the growing environmental awareness²⁰ in Spain together with high running costs in inefficient buildings prompted more and more homeowners to wonder about the energy efficiency of their buildings.

²⁰ 56% say they would be willing to pay more taxes to finance policies to combat climate change

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Old building stock with high energy consumption

As mentioned in the chapter 'Building stock characteristics' approximately 60% of the built stock in Spain is prior to 1980 and 21% is over 50 years old. Almost 58% of its buildings were built prior to the first regulation that introduced minimum energy efficiency criteria in Spain (the basic building standard NBE-CT-79 on thermal conditions of buildings).

Lack of compliance with the commitments in the fight against climate change

The fact that Spain is ranked in the 16th position in a list of 29 countries (with regards to where they stand on fighting climate change), that only 35% of the objectives have been achieved or that Brussels recently warned on the need to take more drastic measures against pollution, are all signs that the Spanish government does not take this problem sufficiently seriously. This, in turn, introduces a general uncertainty about the government's leadership and, more specifically, about the requirement level in the future deployment of the National Comprehensive Plan for Energy and Climate 2021-2030.

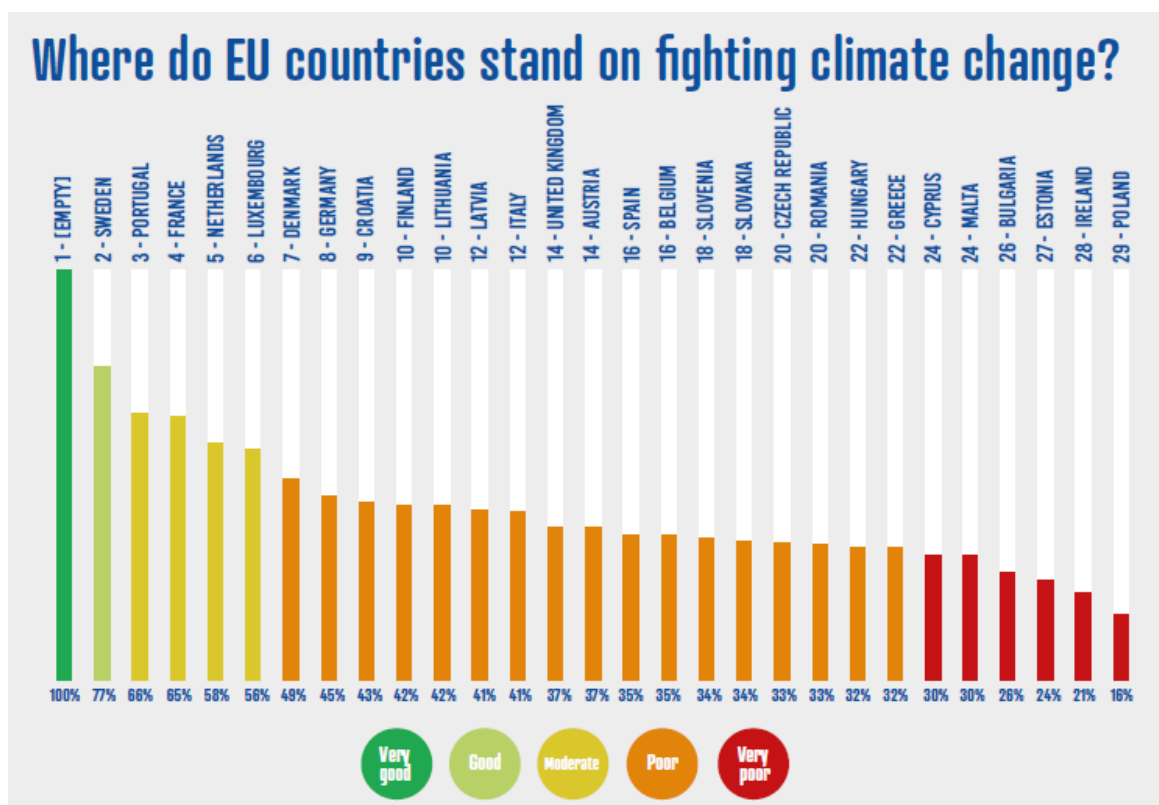


Figure 38 – Where do EU countries stand on fighting climate change (Source: [157])

CONCLUSIONS

The PESTLE analyses carried out in each target country have made it possible to obtain information about the context, including the identification and analysis of external factors that may influence the implementation process. As already mentioned, although most of them cannot be controlled or modified, it is important to understand their implications.

Table 7 summarizes the factors identified in France, Ireland and Spain as well as their impact on the business opportunities required to run and upscale the TURNKEY RETROFIT service.

	FRANCE	IRELAND	SPAIN
Political	<p>Stable and favorable policy towards energy efficiency (+)</p> <p>French regions have launched innovative policies to increase rate and depth (+)</p> <p>Policy low efficiency (-)</p>	<p>Policy and public measures in place (+)</p> <p>The government's role & competing priorities (-)</p> <p>Lack of compliance with commitments in the fight against climate change (-)</p> <p>The short and long-term impacts of Brexit negotiations (- -)</p>	<p>Favorable future scenario (+ +)</p> <p>Strategic framework for boosting the energetic renovation of the buildings sector Urban Agenda 2030-2050 and the Long-Term Strategy for energy renovation in the building sector in Spain (+)</p> <p>Insufficient and fragmented public support measures for the energy renovation of buildings (-)</p> <p>Decisions on urbanistic and dwelling matters are taken by the autonomous regional governments (-)</p> <p>Political instability (- -)</p>
Economic	<p>Strong health, social and environmental rankings (+)</p> <p>Low employment rate (-)</p> <p>Fiscal incentives low efficiency (-)</p> <p>Worrying rise of the Private Debt (- -)</p>	<p>The availability of financing and grant supports (+)</p> <p>Decrease in GDP (-)</p> <p>Increases in inflation (-)</p> <p>Economic uncertainty with regard to Brexit negotiations (-)</p> <p>Decreased Consumer Sentiment Index (CSI) (-)</p> <p>High household debt (-)</p> <p>Uncertainty as to the future of fiscal incentives (-)</p> <p>Householder spending in the Irish renovation sector (- -)</p> <p>High upfront costs for homeowners and developers (- -)</p>	<p>Economic situation in the renovation sector (-)</p> <p>General economic situation (-)</p> <p>Absence of strong fiscal incentives (- -)</p>

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	FRANCE	IRELAND	SPAIN
Social	<p>Growing concern and awareness of climate change (+)</p> <p>French people are not ready to use services based entirely on web platform (-)</p>	<p>The effect on property value (+)</p> <p>Minimum standards for rental sector (+)</p> <p>Tenants' willingness-to-pay (+)</p> <p>The use of digital platforms (+)</p> <p>Climate change perspectives (+)</p> <p>Split incentives and stressed rental market conditions (-)</p> <p>Awareness and knowledge (- -)</p>	<p>Increase in the value of sustainable dwellings (+)</p> <p>New digital possibilities for business (+)</p> <p>General distrust of citizens towards the workers in the renovation and refurbishment sector (-)</p> <p>Lack of culture in favour of energy renovation (- -)</p>
Technological	<p>Quality (certification) mark for renovation (+)</p> <p>Lack of highly qualified (-)</p>	<p>5G technology (+ +)</p> <p>Innovation, research and development (+)</p> <p>Lack of professionals skilled in energy renovations (-)</p> <p>The use of advanced measures and auditing deficiencies (-)</p> <p>Fragmented value chain (-)</p>	<p>5G Technology (+ +)</p> <p>Existence of a market for products and solutions for energy renovation (+ +)</p> <p>Upcoming boost to R&D&i focused on energy renovation (buildings) (+)</p> <p>Distrust of the clients (e.g. communities of dwellers in residential buildings) in new and untested technological products or solutions (-)</p> <p>Workers in the sector are not highly skilled in the technological solutions for energy renovation (- -)</p>
Legal	<p>Thermal regulation for existing buildings (+ +)</p> <p>Construction products reuse (+)</p>	<p>Review of building regulations (+)</p>	<p>More demanding regulatory framework: "Código Técnico de Edificación" (Technical Building Code) & DB-HE update (Energy Saving) (+ +)</p> <p>Compulsory "Libro del Edificio" (Building Book) but only for new buildings (+)</p> <p>Devaluation of the building's Energy Performance Certificates (- -)</p>
Environmental	<p>Old building stock with high energy consumption (+)</p> <p>Adaptability to climate change impacts (+)</p>	<p>Old building stock with high energy consumption (+)</p> <p>Environmental awareness (-)</p>	<p>Future stricter strategic framework for Energy and Climate (+ +)</p> <p>Old building stock with high energy consumption (+)</p>

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	FRANCE	IRELAND	SPAIN
	Adverse impact of renovations: embedded energy, material (- -)		Increase in environmental sustainability (+) Lack of compliance on climate change- related commitments (- -)

Table 7 – Summary of the factors identified and their impact on the business opportunities required to run and upscale the TURNKEY RETROFIT service in France, Ireland and Spain

As can be seen in Table 7 one of the main factors that will directly influence the success of the TURNKEY RETROFIT service is the political framework adopted by the country to boost energy renovation in the building sector. But, as described in this report, it is not enough to establish ambitious long-term renovation strategies; it is also necessary to prioritize and to work on facilitating its implementation.

French government launched the “Plan de renovation énergétique du bâtiment” (PREB). The plan will dedicate €14 billion over a five-year period to finance the renovation of 500,000 housing units per year. The Irish Government Climate Action Plan 2019 has set ambitious targets, including the completion of 500,000 energy efficient retrofits to a B2-BER or better, at a rate of 50,000 per year, by 2030. In Spain, the Long-Term Strategy for the energy renovation in the building sector had originally aimed at the renovation of 250,000 buildings per year (private dwellings), starting with those with serious structural and energetic problems; and now the IDAE is drafting the National Comprehensive Plan for Energy and Climate 2021-2030 and has set the objective of the improvement in energy efficiency (thermal envelope), throughout the next 10 years, of a total of 1,200,000 residential dwellings.

The reality is that the targets are not being met: in Ireland the current rate is 23,000, primarily shallow retrofits per year; in Spain 25,000 per year. Nor is it achieved in France, although in this case, experts count around 300,000 renovation, but there is not proper counting or observatory of the renovation done.

There is no doubt that these ambitious goals offer a great opportunity for a service like the TURNKEY RETROFIT. But in order to achieve this, political stability in the country is crucial. While in France the political situation is stable, in Ireland it will be necessary to wait for the short and long-term impacts of Brexit negotiations, and in the Spanish case, a stable government is urgently needed to allow long-term policies and strategies to be implemented. As important as the political stability is that the government has clear political priorities. In the case of Ireland and Spain, the same Government who has set their ambitious targets in the Climate Action Plans, has also failed to meet climate mitigation targets thus far. And last, but not least, it will be important to have instruments, fiscal measures, etc. that facilitate the achievement of these objectives to allow the renovation rate to be increased. In France, Ireland and Spain exist the availability of financing and grant supports, but they can be improved. For example, in Spain there are subsidies but there are almost no fiscal incentives.

Another factor that may facilitate the implementation of the TURNKEY RETROFIT service is to have more strict regulations. In France, since the 1st January 2018, new requirements concerning the thermal characteristics as well as the energy performance of existing buildings have been introduced and must be implemented in case of energy renovation works. This new thermal regulation, ‘RT Existant 2018’, applies to renovation of existing buildings and

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could have a significant impact on renovation activities. In Ireland, Part L of the 'Irish Building Regulations' has been subject to considerable review, with the 'Building Regulations' (Part L Amendment) 2017 signed into law to set higher building energy performance standards. Buildings must achieve cost-optimal performance when more of 25% of the building surface area undergoes major renovation works. In Spain, the updating of the Basic Document on Energy Saving of the 'Spanish Building Technical Code', approved by the Order FOM/588/2017, on 15th June, includes the criteria for energy efficiency in the renovation of existing buildings, and also considers the procedure to verify the meeting of the requirement, and criteria for setting the scope of the renovation. This new DB-HE document updates the requirements to drive the new buildings and the renovation of existing ones towards a set of parameters for high energy efficiency and a very low energy demand.

These regulations, which include requirements to direct renovations towards high energy efficiency parameters and a very low energy demand, can be a good impulse for the TURNKEY RETROFIT service, if it can offer the owners a set of technological solutions that allow them to achieve those parameters.

Two factors have been identified, shared in the 3 countries, which could negatively influence the implementation the TURNKEY RETROFIT service. One of them, is that professionals in the sector are poorly qualified in technological solutions for energy renovation. Facing the renovation challenges requires competent and well-trained professionals. Professional practices must evolve in the technical fields (insulation, ventilation, airtightness, installation of renewable energy systems) but also in global approaches. As described above, the construction sector is taking great strides with respect to innovation. But there are technological solutions that are not implemented because there is no knowledge or specialization, so professionals tend to use the usual solutions. Therefore, there is room for integrated renovation services such as TURNKEY RETROFIT if the companies performing the work are qualified.

And the other, the lack of culture in favor of energy, combined with a lack of knowledge about the return on the investment they will get (benefits of energy saving measures), may influence directly the demand for the service. The fact that the payback period for the money invested is longer than 10 years, or the lack of public access databases that demonstrate the energy performance of renovated buildings and information on how to carry out a deep renovation, feed this lack of culture. When a renovation project is undertaken in a building, owners are more worried about issues like accessibility, comfort or the building aesthetics, which are usually the main reasons that lead to their decision to go ahead with the building renovation work. Energy efficiency and the building performance tend to be secondary aspects.

Other factors that highlight its possible negative impact are the following:

- In France, the worrying rises of the private debt. The indebtedness of French households and businesses relative to GDP is now the highest of the largest European countries: to 133.3% of GDP in France at the end of September 2018 (of which 59.2% for households and 74.1% % for non-financial corporations). Far exceeds the euro area average (118.6%).
- In Ireland, householder spending in the Irish renovation sector (Ireland's residential energy renovation market segment accounted for under 1% of the energy renovation market across all EUROCONSTRUCT countries assessed; Spain (4%), France (15%)) and the high upfront costs for homeowners and developers (the average cost of a deep retrofit being between €30,000 and €40,000).

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- In Spain, the devaluation of the building's Energy Performance Certificates (i.e. Energy Performance Certificates). Both the technical staff that execute the project as well as the owners that apply for the Energy Performance Certificate must take this document very seriously. Nowadays, many consider it a mere formality to apply for the public support or to sell or rent a dwelling, thus underestimating the value it has and looking for the service provider that can do it most quickly and cheaply, as the content of the certificate is not valued. This factor can have a very negative impact in the TURNKEY RETROFIT service, as if the energetic diagnostic is considered a mere formality and is not valued, the client demanding the service will not want to pay for it.

And finally, it is also important to mention the following factors that may positively affect the implementation of the TURNKEY RETROFIT service:

- In France, existence of quality (certification) mark for renovation which are awarded by third-party and independent entities (including laboratories, certification organizations, inspection bodies) and, in many instances, submitted to the French Accreditation Committee (COFRAC) for final authorization.
- Increasingly in Ireland, the sales value of properties being affected by the BER (Building Energy Rating). Moreover, homeowners are increasingly placing high value on BERs with prospective homeowners frequently checking BERs before purchasing. This is an important factor that could contribute to increasing the demand for the service.
- In Spain, several agents and organizations within the sector are promoting initiatives that could represent an important boost to the TURNKEY RETROFIT service. This Spanish initiative called 'Pasaporte Energético' (Energetic Passport), is an adaptation of the one existing in Germany, Belgium (Flanders) and France. Unfortunately, until now, this is only a proposal that has been presented to IDAE; it is understood that it will resume when there is governmental stability.

The need to scale up energy renovation activities offers a market opportunity for TURNKEY RETROFIT service. In the three target countries, renovation activities are likely to increase in the coming years, due to political commitments, a desired increased awareness (especially regarding climate, environment and health) and a greater application of new technological solutions. However, as mentioned above, the success of the TURNKEY RETROFIT service will depend to some extent on Member States adopting ambitious long-term renewal strategies, transposing them into their policies and facilitating their implementation.

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ACRONYMS AND ABBREVIATIONS

ACA	Accelerated Capital Allowance
ADEME	Agence de l'environnement et de la maîtrise de l'énergie
Anah	Agence Nationale de l'habitat
AQC	Agence Qualité Construction
BEF	Better Energy Finance
BER	Building Energy Rating (Sustainable Energy Authority of Ireland)
BIM	Building Information Modelling
BPIE	Buildings Performance Institute Europe
BUSI	Build Up Skills Initiative
CIF	Construction Industry Federation
CSI	Consumer Sentiment Index
CSO	Central Statistics Office
CSTB	Centre Scientifique et Technique du Bâtiment
DB-HE	Basic Document on Energy Saving
DCCAE	Department of Communications, Climate Action and Environment
DEAP	Dwelling Energy Assessment Procedure
EC	European Commission
EED	Energy Efficiency Directive
EEM	Energy Efficiency Measure
EPBD	Energy Performance of Buildings Directive
EPC	Energy performance certificate
EU	European Union
FFB	French Federation of Buildings
GDP	Gross Domestic Product
GG	Greenhouse Gas
GWh	Giga-Watt hours
GTR	Grupo de Trabajo de Rehabilitación (Green Building Council España)
H2020	Horizon 2020
HRI	Home Renovation Incentive
HSE	Health Service Executive
IDAE	Instituto para la Diversificación y ahorro de la Energía

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IEE	Intelligent Energy Europe
IGBC	Irish Green Building Council
IMF	International Monetary Fund
INSEE	L'Institut national de la statistique et des études économiques
ITE	Inspección Técnica de Edificios
MS	Member States
NEEAP	National Energy Efficiency Action Plan
NREAP	National Renewable Energy Action Plan
NUIG	National University of Ireland Galway
OECD	Organization for Economic Cooperation and development
OSS	One-stop-shops
PREB	Plan de renovation énergétique du bâtiment
QA	Quality Assurance
R2M	R2M Solution SRL
R&D&i	Research, development and innovation
RGE	Reconnu Garant de l'Environnement'
SEAI	Sustainable Energy Authority of Ireland
SPPEH	Service Public de la Performance Énergétique de l'habitat
TECNALIA	Fundación TECNALIA Research & Innovation
TURNKEY RETROFIT	Turnkey solution for home retrofitting
UK	United Kingdom