

## Project ECO-EMPLEO

Job creation in building  
renovation and energy  
efficiency improvement

Executive summary

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## 1. Introduction of the study

The study “Job creation in energy refurbishing of houses and buildings” was carried out by the foundation Conde del Valle de Salazar of the Technical University of Madrid in collaboration with the trade union confederation Comisiones Obreras and the Trade Union Institute of Work, environment and health (ISTAS). The project was co-financed by the European Social Fund within the framework of the programme “Empleaverde” managed by the Biodiversity Foundation that also acted as mediator. This study defines the profiles and characteristics of building and houses in Spain, it also offers a current perspective of energy refurbishing of buildings in terms technical, regulatory, human, management and financial aspects. It also draws a projection on job potential.

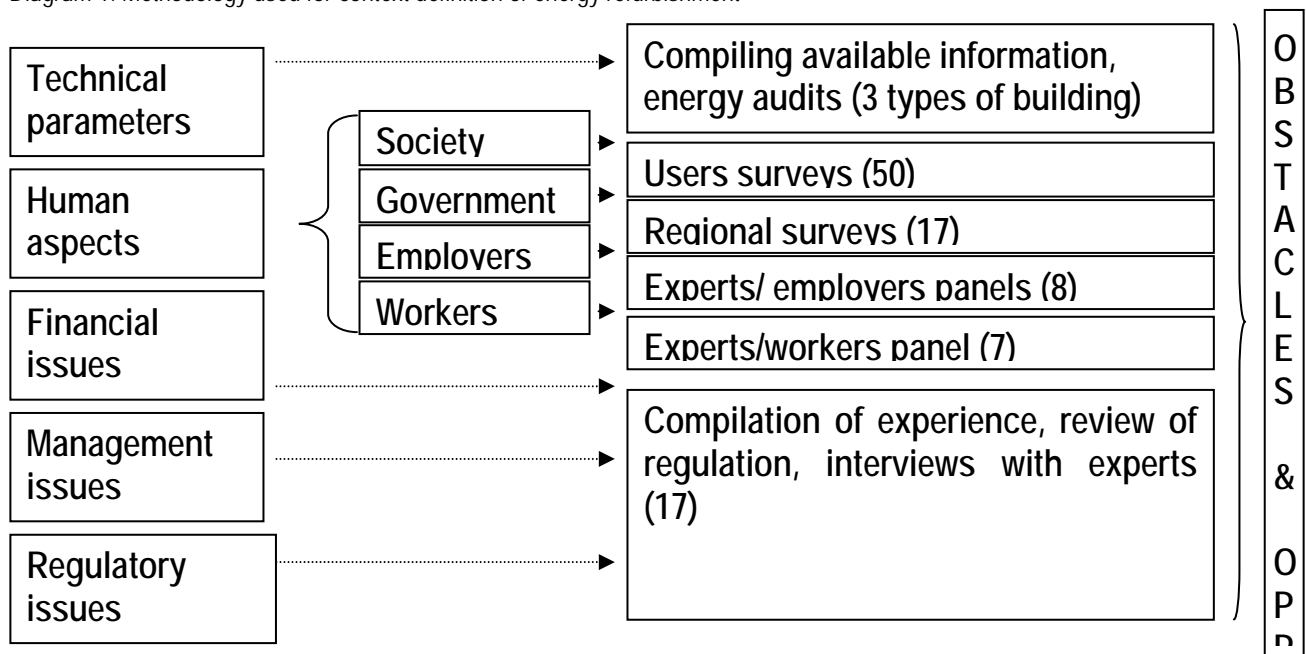
## 2. Aims of the study

The ultimate purpose of this study is to draw a quantitative and qualitative estimate on direct and indirect jobs to be created through the start of a set of actions for the energy rehabilitation of existing buildings. Several questions come up which need to be addressed: What is the general context of these actions? What measures will be implemented? On which buildings? What would be the motivation and the point of view of the groups involved (government, employers, workers, users, researchers and academics)? What are the main obstacle and opportunities? The first chapters of this study intend to answer all the questions taking into account the context and the current state of affairs. Only after addressing those questions it becomes possible to submit a proposal that include technical, economic, environmental and social aspects of energy refurbishing, and turning it into a potential source of jobs and energy saving.

### 3. Methodology

Each part of the study is consistent with one specific methodology. The definition of context was developed through an opinion survey with the user group, a survey in each regional territory, the arrangement of meetings with employers and workers, interviews with experts and energy audits as shown in the following graphic:

Diagram 1: Methodology used for context definition of energy refurbishment



Source: Own research

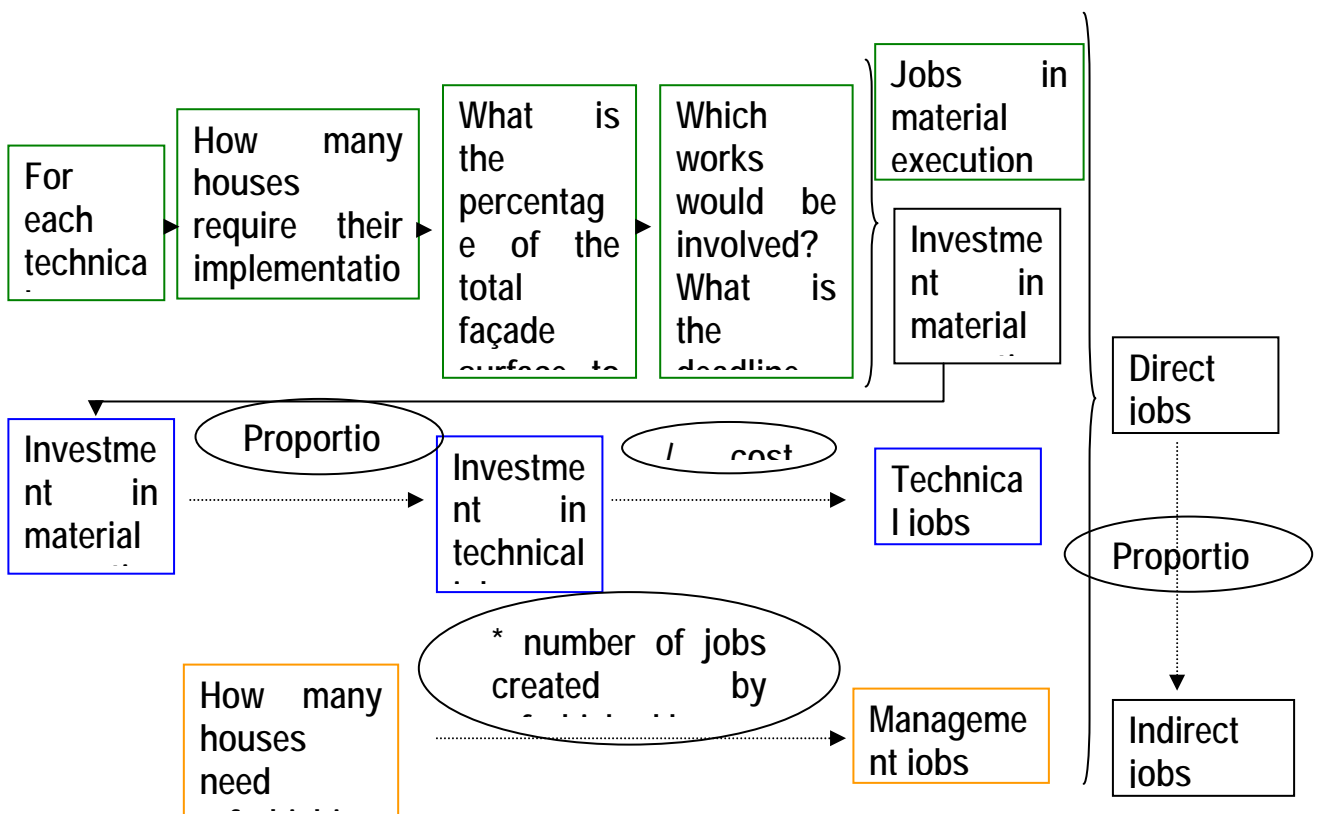
The methodology used to estimate the job potential is based on determining the main technical measures to be implemented and on estimates on the surface to be refurbished for each type of measure in Spain. These data and the pertaining information on costs and deadlines are used to calculate job potential and investment estimates.

This is a precise, innovative methodology. Current studies calculate job potential based only on the use of investment factors per invested million which makes impossible to segregate jobs by tasks.

Several panels were held to validate this work. Participants included experts, union representatives, employers and well-known specialists in energy renovation of buildings. These meetings allowed the validation of an initial hypothesis and provided complementary views.

The following diagram summarizes the methodology used in this study:

Diagram 2: Methodology used to calculate job potential

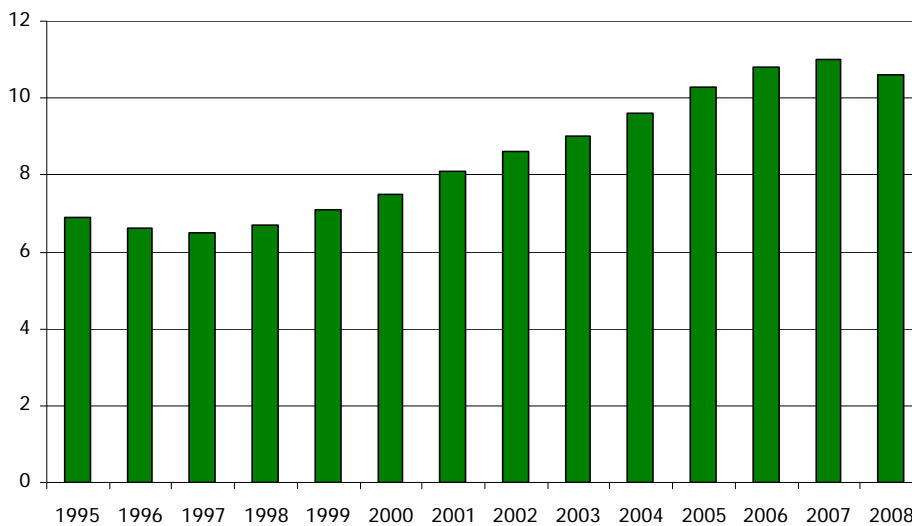


Source: Own research

## 4. Energy refurbishment of houses and buildings

The construction sector is one the driving forces of Spanish economy and subsequently a major job source. Construction amounts to 10% of Spanish GDP as shown in the following graphic:

Graphic 1: Evolution of the contribution of the construction sector to GDP (%) 1995-2008



Source: Statistical yearbook 2008 Ministry of Public Works

The “housing boom” period created an “oversized” construction sector which brought about several problems, among them, negative environmental effects and high unemployment rates as a result of the housing crisis in recent years .

Graphic 2: Evolution of employed, wage earners and unemployed personnel in the construction sector (thousands of workers) 1996-2008



Source: EPA (Ministry of Labour).

In such circumstances unions, employers, educational and research organizations, and the government have started to search for alternatives. Due to the great number of new houses built during the real estate speculation, the solution is obviously focused on refurbishment and renovation.

In the context of growing international concerns about climate change energy renovation of buildings through improved insulation on the basis of renewable energies and more efficient technology has become a leading trend, and represents one of the possible ways to promote new activities in the construction sector. Many advantages would stem from this approach. Firstly, it would reduce greenhouse gases emissions from houses, secondly it would help create a great number of jobs, and last but not least it would improve comfort and quality in houses.

This chapter is obviously focused on energy refurbishment, although in fact it is difficult to separate it from other types of renovation works (Table 1: ). Actions to enhance energy aspects also involve improvement of accessibility, safety, etc. i.e. they



imply a complete renovation process. We consider that such a comprehensive intervention is essential to grant adequate living conditions in buildings and houses.

Table 1: Renovation possibilities

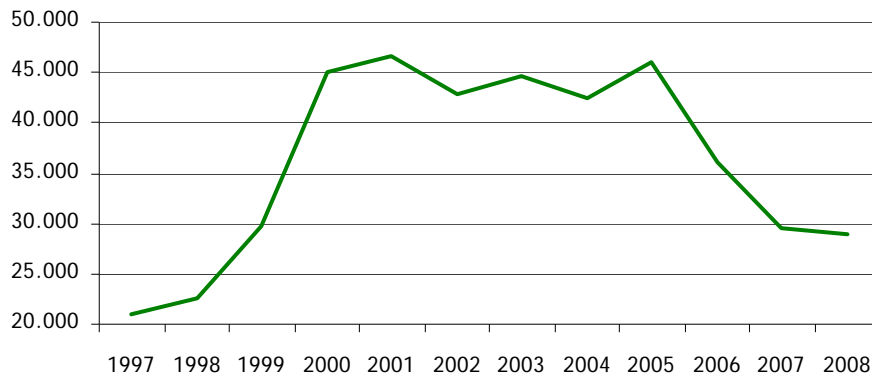
Enhancement of framework structure
Enhancement or maintenance of building systems
Improvement of distribution
Improvement of internal conditions: heating/air conditioning, lighting, acoustic and air quality
Enhancement, maintenance or substitution of facilities
Improvement of accessibility

Source: Own research

The road to ambitious renovation projects in Spain is far-reaching. New buildings account for most of the activity in this sector. The number of new building projects authorized in 2008 represented 88% of total building activity, whereas in 2006/2007 it reached around 95%.

The evolution of the number of works since the final years of the last decade has been fairly irregular. It is consistent with the sector's take off with minor fluctuations since 2000. It falls abruptly in the most intense period of urban development and it continues to decrease, although less sharply, in 2008 as part of the general decline of the sector.

Graphic 3: Evolution of renovation/refurbishment projects authorization 1997-2008.



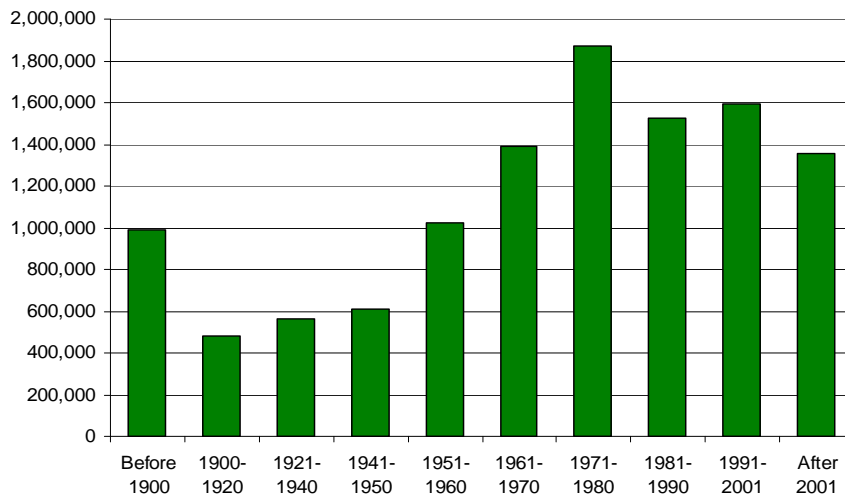
Source: Construction statistics (INE)

Renovation has been a secondary activity so far. The current circumstances require a considerable increase of building renovation works and more specifically of refurbishment projects associated to energy efficiency. The construction sectors needs to reorient its activity towards building renovation.

## 4.1. Manifest inefficiency of buildings

With over 25 million houses, of which one third are second homes or vacant properties, and with a construction rate that exceeds housing needs, Spain presents a relatively new, inefficient and oversized housing capacity.

Graphic 2: Family houses by year of construction. Spain, 2001.



Source: 2001 Census (INE).

The economic model based on the spread of the construction industry developed in the last decades has left an imprint of unplanned development and unlimited consumption of resources that require an intervention

House projects built before 1979 (70 %) - date on which came into effect the Basic Regulation for Thermal conditions in Buildings (NBE-CT-79) – did not have any insulation to improve energy efficiency. Houses built between 1980-2006 include certain improvements, whereas buildings completed after 2006 were projected and built according the Basic Rule for Energy Saving approved by the Building Technical Council (CTE-HE-06), i.e. insulation and conditioning were taken into account and some measures are introduced to improve energy efficiency.

That is why we regard residential buildings built before 1979 as a priority group in comprehensive energy refurbishment projects.

Buildings chosen within the given time period require certain comments. Those completed before the 1970s construction boom although included in the priority group were built according to local construction and architectural characteristics, which means that solutions, materials and locations were chosen taking into account climate and external conditions. Even though these buildings might present a series of structural deficiencies we do not consider them a priority in terms of energy renovation.

Another aspect to be taken into account is that houses built during the 1990s construction boom might not really have better thermal conditions even though they are supposed to comply with the Basic Rule for Energy Saving (NBT CT-79). The accelerated pace of construction, the poor quality of building materials and the lack of qualification of some operators have caused in some cases significant energy deficiencies. This period of expansion in the construction sector occurred simultaneously with the development of more specialized air conditioning technologies and the introduction of unnecessary equipment to compensate for the low quality of construction. Many of these buildings have oversized, inefficient and energy-consuming air conditioning and heating equipment.

It can be concluded that considering that the total amount of buildings built before 2001 was of 9,284, 513 (Source: 2001 Census INE), that the residential sector accounts for 92.77% and our intervention aims at covering 67.79 % of housing buildings. The proposal for this kind of actions will be carried out in 5,839,035 buildings which imply renovating 62 % of Spanish buildings existing in 2001).

According to census data and using the same criteria (residential sector before 1979) there are 14,593, 609 whose renovation is a priority. 27% of them are single family homes and 73% home multiple families. 58% of existing houses in 2008 (70% of houses in 2001 according to census data).

## 4.2. The multiple obstacles to building refurbishment

There is a first series of obstacles related to current regulation. Spain is adapting its legislation on buildings energy efficiency to the framework of European policies. The main elements of this new regulation are the Technical Code for Buildings (CTE), as a regulatory framework and the National Housing and Renovation Plan (2009-2012), as intervention programme.

Adaptation to European legislation in Spain is a slow process; a good proof of this was Brussels' warning to the Spanish government on compliance with Directive 2002/91/CE on certification, as well as the inspection system for heating and air conditioning systems which are mandatory since January 4<sup>th</sup> 2009. The delay in the adaptation process is due largely to the necessary transfer of national legislation to a complicated grid of regional regulatory systems.

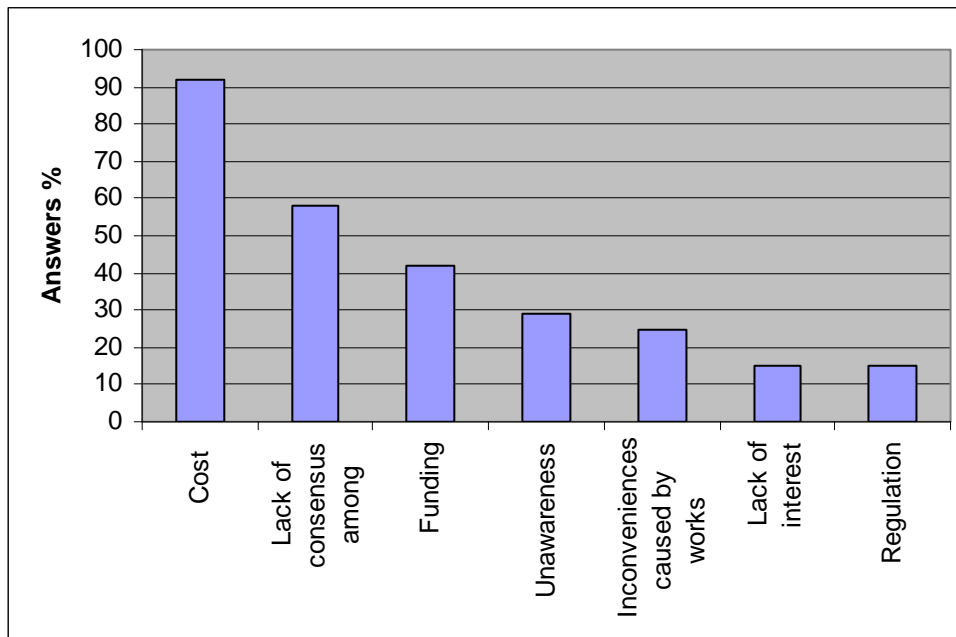
Another significant aspect is that the development of national and regional legislation is basically focused on new works and projects, far beyond relative development of renovation projects for existing buildings. This will imply a significant delay in the implementation of renovation measures in the next years. The particular nature of renovation projects requires specific rules and regulation that allow an adequate management within a consolidated urban environment. Besides, current legislation is not only unspecific but in many cases restrictive to renovation projects. There are regulatory and competence restrictions, legal gaps, overlapping and restrained regulations that affect any renovation effort. In terms of the goals set in the strategies, they seem to be clearly insufficient: most regions set their renovation goals focused for a reduced number of buildings. At this pace the full renovation of existing buildings would take years.

We consider that in general terms we are in the initial stage or even in a previous stage to a real change in the building and housing models, an early phase of territorial planning and urban functionality design.

The different agents covered by this study and involved in the renovation process have complained about the barriers they find to develop renovation projects.

For users these obstacles are mostly financial, social and cultural issues: lack of interest and awareness is one of the obstacles that must be necessary to overcome. Surveys also indicate that costs and funding are the primary concerns when implementing energy renovation measures.

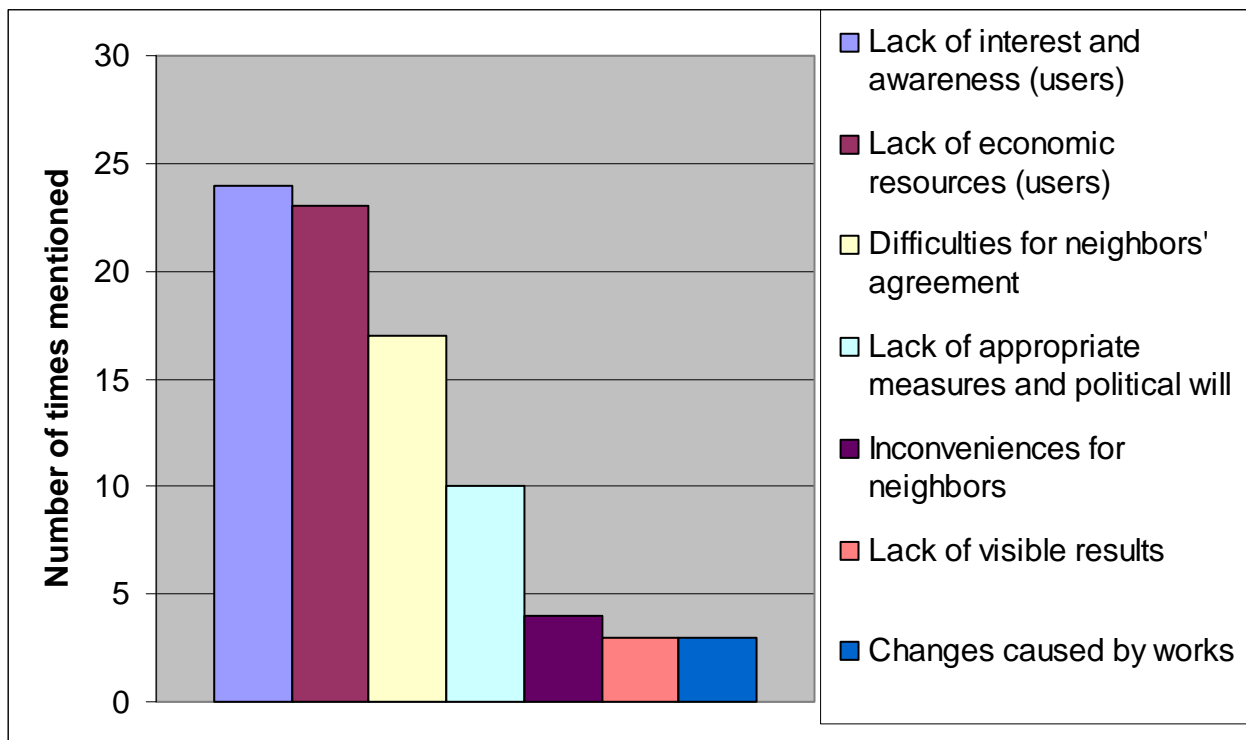
Graphic 5: Main obstacles for users



Source: Users survey

Civil servants also point at difficulties related to the lack of human and economic resources.

Graphic 3: Main obstacles



Source: Own research based on survey information

Employers, especially in big construction companies, are currently very interested in business opportunities of renovation and energy refurbishment, but the current circumstances, mostly lack of regulation and a framework for funding of full scale renovation projects, restrict almost any initiative. Financial institutions are in the same situation, they need a legal framework to ensure their participation. Small and medium-sized companies have an even greater dependence on the regulatory framework (due to the structure of the sector and to subcontracting by bigger companies).

It is observed that from both conceptual and technical points of view, renovation will require a full scale training programme for workers. The shift to a new model (from new works to renovation) must be an opportunity to solve the problems derived from the old

approach of the sector such as the poor quality of construction due largely to the lack of specialized labour force and job insecurity.

There are also important limitations regarding funding and economic issues. It exists a significant scattering of public subsidies which complicates support by those funds. In transition periods as the one we are going through now, when it becomes necessary to improve technology and when users are not fully aware, it is important to promote changes through subsidies, especially in cases related to common interests like the issue at hand.

In our view existing subsidies are not a sufficient incentive to produce a real change. In neighbouring countries those subsidies are more significant and Spain should least come closer to that level. With a more consolidated public opinion and technology, the amount of subsidies could be gradually reduced. Banks and financial institutions are neither fully aware, nor prepare to finance renovation projects.

There are also organizational barriers at both micro and macro levels. From the very early stages of management it is important to take into account that renovation differs from new construction projects. One of the main elements of that difference resides in the fact that neighbours must be consulted. The management of works is considered an essential part of a process that grants a successful intervention. The presence of users in the building during works notably affects the planning. Performance is affected and this alteration has an undeniable influence on the organization and normal development of works. It is important to consider who will be in charge of management: Will such management require a specialized profile? Are the existing profiles adequate? What is the extent of management tasks? Management would obviously become a new research priority in this sector.

From the “macro” point of view, there is not a clear model reached by consensus about how to organize a nationwide process of renovation that include all involved agents and funding methods.

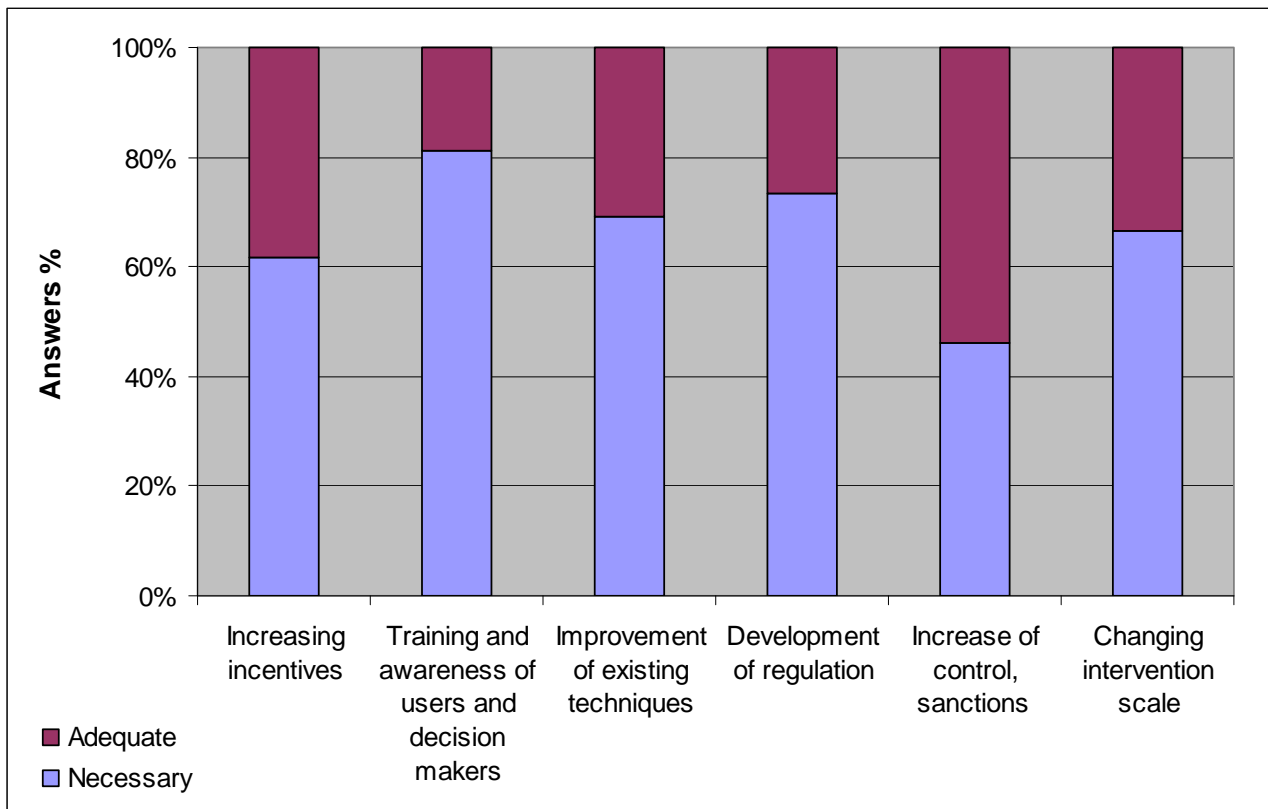
To achieve a favourable context it is essential to overcome those barriers and government experts agree upon a series of changes like:

- need to increase incentives



- training and awareness of users and decision-makers
- need for improvement of existing technology
- development of regulation
- increased control and implementation of sanctions
- changes in the scale of intervention

Graphic 4: Main challenges

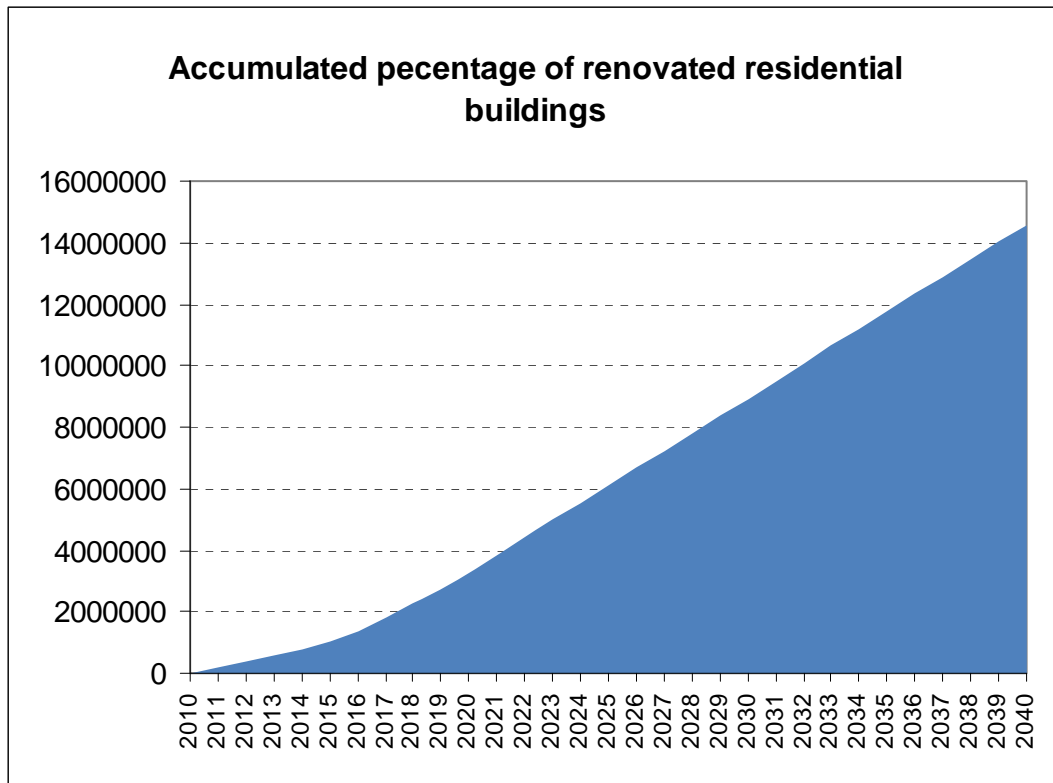


Source: Based on self-developed survey

## 5. Buildings renovation potential

Addressing the context appropriately, by clearing up the obstacles mentioned above, would provide a high social and environmental potential. That potential was calculated for this study to focus on a specific programme adapted to this report. In the period of full activity the project expects to refurbish 565,000 houses per year, reaching an accumulated percentage of 58% of existing buildings by 2040.

Graphic 5: Percentage of renovated buildings



Source: Own research

The programme is based on the implementation of 8 priority measures that include insulation projects and incorporate the use of renewable energies:

- Introduction or enhancement of thermal insulation of façades
- Introduction or enhancement of thermal insulation and waterproof sealing of buildings surfaces
- Introduction or enhancement of thermal insulation and solar protection factors of glass surfaces (façade openings)
- Enhancement of watertightness, conductivity and thermal break of wooden elements in façades
- Introduction or enhancement of control elements, filtering and solar protection in façade openings
- Substitution of non renewable fuels (and/or systems) and introduction of renewable energies (solar thermal, biomass, geothermal) for heating systems and hot water supply
- Introduction of improvement of energy efficiency of equipment and facilities
- Introduction of renewable energies (photovoltaic solar panels, air generators) for the production of electricity

Based on conservative estimates, which means these would be minimum figures, full activity could create 105,000 stable jobs. Jobs would be mostly distributed in material execution and management tasks. This programme would also generate many indirect jobs in the manufacture sector, as well as management and energy sector jobs.

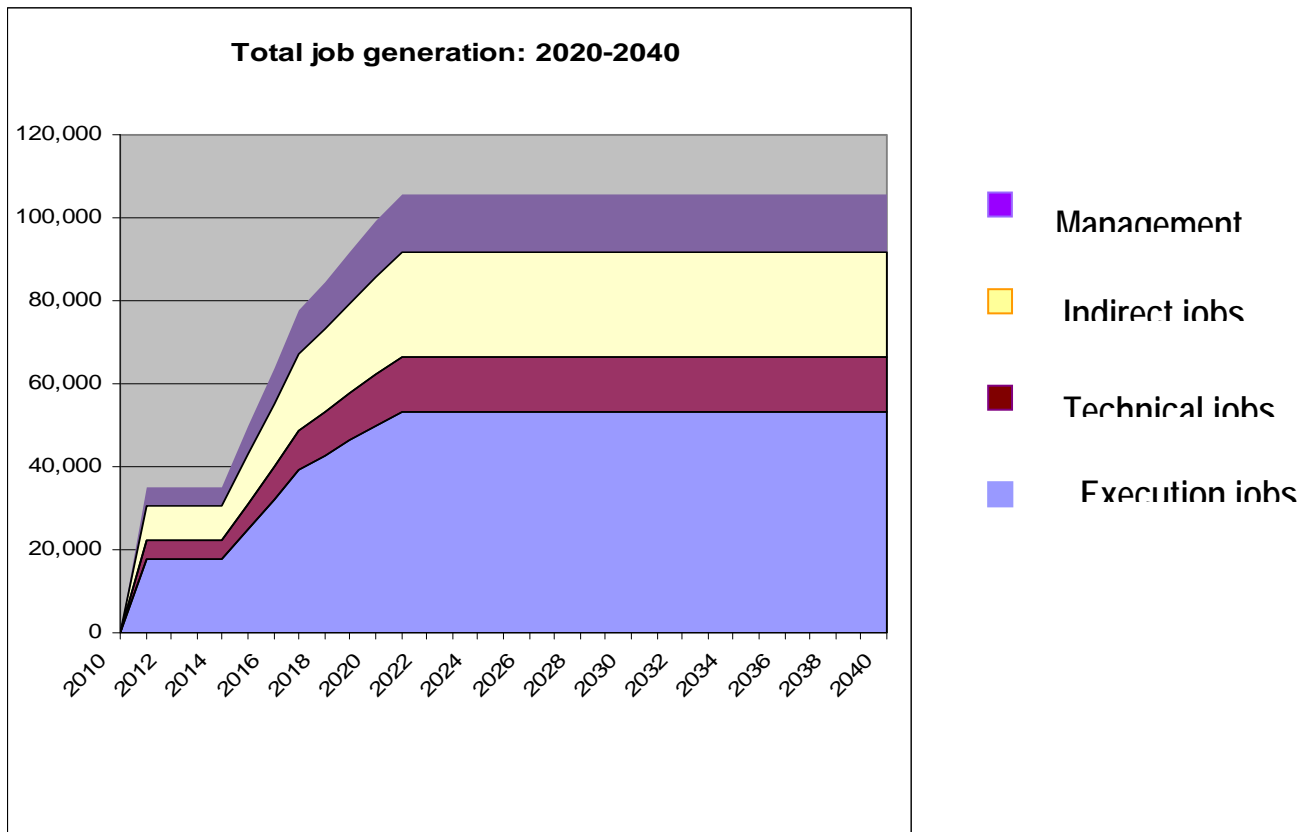
If the building energy renovation programme presented in this study is implemented, the jobs created between 2020 and 2040 would be the result of adding up direct jobs (execution, technical and management) and indirect ones. The following table summarizes the results:

Table 2: Total jobs

	2011-2014	2015	2016	2017	2018	2019	2020	2021-2040
Material execution jobs	17,790	24,906	32,022	39,138	42,696	46,254	49,813	53,371
Technical jobs	4,381	6,133	7,886	9,638	10,514	11,390	12,267	13,143
Management jobs	4,712	7,036	8,795	10,366	11,308	12,250	13,507	14,135
Direct jobs	26,883	38,076	48,703	59,142	64,519	69,895	75,586	80,649
Indirect jobs	8,369	11,854	15,163	18,413	20,087	21,761	23,532	25,108
<b>Total jobs</b>	<b>35,252</b>	<b>49,930</b>	<b>63,866</b>	<b>77,555</b>	<b>84,606</b>	<b>91,656</b>	<b>99,118</b>	<b>105,757</b>

Source: Own research

Graphic 6: Total job generation



Source: Own research

It is important to note that beyond qualitative potential renovation there can be a great opportunity for the qualitative improvement of jobs in the sector. This requires an extensive training programme to adapt workers' expertise in terms conceptual and technical levels. New specific professional profiles are required for renovation processes, especially for management jobs.

The estimated investment to start the programme amounts to 12.5 billion euros per year starting in 2020 in the full development stage. The effort will prove worthwhile and

countries that bid for energy efficiency will have a significant technological head start in the future.

Regarding the environmental potential, the programme is estimated to save some 600,000 barrels of final energy oil and the equivalent to 300 million tons of CO<sub>2</sub>, a huge potential that would allow a proportional reduction of Spain's energy dependence and of costs associated with European and international commitments in terms of reduction of greenhouse emissions.

Other positive impacts are also expected although not fully accounted in this study:

environmental improvements:

reduced consumption of fossil fuels

reduction of transport processes

reduced waste generation and soil depletion

social advantages:

improvement of habitability and comfort

consolidation of social networks

improved job quality and occupational safety

professional qualification of workers

economic advantages:

savings derived from the reduction of energy consumption and emissions

intensification of business activity

as the promotion of research and innovation in new materials and renewable energies

The final balance is obviously positive and favourable to the start of full scale building renovation processes. We also consider that this potential is highly sustainable given the new perspectives on energy saving and production that will have a permanent status, supported by technical improvement and innovation. This will ensure a continuation of renovation processes. Houses are built once but they can be renovated and refurbished several times through their useful life cycle.

Another significant issue to be taken into account is the high potential for electricity production from renewable sources in buildings and the opportunity offered by

renovation processes for the implementation of those systems for self-consumption. This is not only attractive from an economic point of view, but also from a conceptual perspective since their implementation implies a change in the electricity production model. Although renewable micro-generation technologies (photovoltaic, mini wind, micro-generation) are fully developed today and their relatively simple operation makes them similar to common devices as lifts or boilers for heating systems, the complicated management scheme established by authorities make them unfit for domestic use or the tertiary sector due to the fact that they are classified as an economic activity and are therefore, subject to the same requirements as any power station regardless of their size.

A change in regulation should allow the direct connection to the electricity grid of any renewable energy based equipment that do not exceed the buildings limit power since such equipment is perfectly fit to work within that power limit. The additional use of a meter to obtain “net measurements” could benefit users that would offer their power surplus to the distributing company in the sector. That would represent a considerable economic saving for all and would definitely promote the take-off and regular use of these solutions that benefit consumers, electricity companies and society in general.

## 6. Prospects, responses and initiatives

An important search for solutions is currently under way, many of them approved by consensus, other still under discussion. It is important to point out the existing trends and the questions they raise. The following table is a brief summary of the situation:

Table 3: Renovation trends

Questions	Trends
To which extent can citizens be required to implement renovation measures in their houses? What is the role to be played by citizens and how can that participation develop?	Mandatory vs. social participation
What is the adequate scale of intervention? What regulatory and financial modifications	Scale of intervention

are required for effective action on a given scale of intervention?	
What level of industrialization will be developed for renovation processes?	Industrialization of renovation processes

Source: Own research

### 6.1. Mandatory approach vs. social participation

As it can be observed, the regulatory framework may be an important restraint for renovation processes. Horizontal property laws, for example, leave the decision making on renovation in the hands of a reduced number of users. Such an important issue as the energy renovation of buildings and houses should not be left in the hands of a few. Most agents suggest a legal redefinition of the necessary factors for this activity.

In concurrence with measures taken to grant that change there should be a definition of social participation processes. Social involvement in the transformation of living spaces has been seriously reduced in the last decades of accelerated construction. Users have less capability to act on their environment and decision making often occurs far from living spaces. The change we want to bring on through renovation also aims at revitalizing citizens' participation.

Citizens' involvement implies many advantages. Renovation would improve their living spaces, promote social and environmental protection, but it also presents a major difficulty, it demands significant awareness and training efforts that will only have medium and long term effects. It also requires efforts in search of new involvement methods, trust in citizens' decision making and their capability to submit proposals. It is basically a process that shifts the responsibility from current decision makers to citizens. This is a complicated process that might be easily sidestepped but experiences in this field prove a positive impact in the long run.

### 6.2. Scale of intervention

The current financial framework supports some renovation projects in an isolate manner. Users may obtain certain funds for specific measures, like changing windows



or boilers. This trend could be used as a transition or an element to raise awareness, but it will not by itself promote an ambitious renovation of building and houses.

Recent studies and experiences, as well as the international seminar SBMAD10 held this year in Madrid, promote the renovation of entire neighbourhoods. This trend has important advantages compared to previous one: it has a greater environmental impact, it allows saving costs and it is more interesting for the business sector. There is a general consensus in the sector to orient future activity toward this type of renovation.

### 6.3. Degree of industrialization

Regarding the degree of industrialization of energy renovation, we should note that although we do not fully reject the implementation of regular solutions in some cases, they would be an “easy” short term way to cut costs and might imply certain risks, mostly due to the fact that this model basically reproduces the trends of the previous cycle applied to renovation. It would be easier to forgo social participation, solutions might be uniformly designed, it would promote a certain monopolization by some companies and the industrialisation of renovation processes.

We seek an intervention model that would allow responses adapted to each situation and project, in which all companies, small and big, would have a share in a balanced situation, a model promoting citizens’ participation. Renovation can become a reason to really change the model and introduce new approaches in the sector. In our view responses that offer quick, uniform solutions to housing and building problems might ignore the current opportunity to change the construction model. Unfortunately, reflections on the change of model often arrive late, in moments when a quick response is necessary, and there is a high risk of choosing short term measures over reflection and long term action.

## 7. Main challenges

From the previous observations we can outline a series of main challenges:

- Adjusting the regulatory, financial, human and technical context for an ambitious nationwide project of building and houses renovation
- Drawing up a new action plan adjusted to current challenges that define ambitious goals, adequate volume of public resources to carry out the plan. Studying methods for funding and cooperation with private companies
- Reassess the concept of renovation to “increase the value of houses”: buildings and houses, as any other asset degrade with time and require continuous renovation, which is not only a way to save money in the long term, but also a way to have a more comfortable, profitable and socially valuable house on a reduced investment.
- Shifting from the concept of users who are just consumers to users who become producers/consumers of energy based on renewable sources.
- Achieving social involvement, i.e. going from passive to active users by bringing decision making closer to living spaces with a real involvement of citizens.
- Opening a new phase in the history of construction through a fundamental change in the sector in terms of the very conception of architecture and habitability.

We therefore suggest:

- Developing specific regulation on building renovation and the definition of a consensus-based funding model
- Designing and developing a broad scale training programme
- Designing and developing an awareness programme