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## Attitudes and practices of homeowners in the decision-making process for building energy renovation

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### Abstract

The most recent studies point out that building users play a critical role in the decision-making process for the energy renovation of buildings as well as in energy use during the building life-time occupancy. Nevertheless, this important player has been poorly considered in the policies implemented. The homeowner, whose role has been passively induced to renovate accordingly with impositions of the regulations, is calling for himself a more active participation in the renovation process. The social dimension of the building renovation has been ignored. This study aims to highlight the role of the homeowner in the decision-making for energy building renovation investigating his motivations, needs, attitudes and daily routines. A selected group of Portuguese homeowners were interviewed. Also in Portugal, homeowners' qualitative decisions and everyday life practices have a strong influence in the decision-making for building renovation.

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*Keywords:* Building Energy Renovation; Decision-making; Homeowners; Daily Practices

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### 1. Introduction

A variety of political measures have been put in place for some decades aiming to encourage the homeowners to make technical improvements in the built environment. Several ways of accomplishing this goal are being implemented but renovation is not a common practice today despite the efforts of the recast of the Energy Performance of Buildings Directive (EPBD) and the successful implementation of energy certifications systems [1]. There is something missing or not enough in the policies in progress. Tuominen et al. [2] identified barriers related to the decision-making process in buildings and among the players contributing to energy efficiency that can lead to

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inaction when no decision is reached. The focus today is on the individual that is fundamental for all the renovations process to start, the homeowner. Therefore, social practices theories are emerging with the goal of understanding the homeowner's behavior and everyday practices related with energy consumption in buildings. A number of studies argue that social science must be applied to define the policies that could encourage homeowners to energy renovate their buildings [1,3,4]. This new approach can signpost new product development focused on the homeowner's daily life expectations and perspectives. The social dimension of energy renovations has been neglected. On the whole, there is good evidence for having a closer look at how homeowners are crucial for the renovation of the existing housing stock. Recent studies demonstrate that homeowners can be the key group to accelerate the building energy efficiency rates [5,6,7]. The role of homeowners in the renovation decision-making has been seen by policy makers as passive in contrast with recent social science related studies whose results indicate the opposite. The social context should be an ingredient of the future policies to implement and bring together technical and social science [8]. This study explores the role of the homeowners in the building energy-related renovation and in the decision-making process. This research intends to understand why and how Portuguese homeowners use the energy renovation as a common practice and to what extent their needs, wishes and everyday practices come into play in the energy-related renovation of buildings. Recent highlights about social context of energy renovation in other countries were the starting point to define the background and research questions of the study.

## 2. Contextual background

Energy policy at EU level and consequently at national level has incentivized technological development focused on the project design and building solutions development. The idea of convincing the homeowners to renovate their houses mainly based on the argument of payback time and energy savings is being gradually left behind [3,9]. Policy measures assume that economic and rational decision is the critical aspect, although many studies are underlining that this message is clearly not reaching the homeowners [8]. The reasons for homeowners to renovate are assorted and include other arguments different from solely the economy of energy and money savings [8]. Energy efficiency is referred as not being the main renovation rationale but just an added additional benefit in the whole renovation [8]. As an example, the renovation of the kitchen and bathrooms are still the most common building renovation activities in most countries and they do not pay back [10,11]. A comprehensive renovation may, in many ways, not be economically viable but sometimes this is not the main concern for many homeowners. Risholt et al. [7] state that homeowners do not base their decision merely on quantitative basis but also in qualitative preferences. There are various homeowners aspirations, as for example, simply giving a new look to the old, a question of status, changing the lifestyle or even as simple as ambitioning the same solution as their neighbors, friends or family. The findings on this theme reveal that the adoption of renovation measures depends on a number of social and individual variables: aesthetics, convenience, comfort, social support and comparison, heritage values, time and money among others [12,13]. Their motivations are quite few times preceded by a combination of personal and circumstantial reasons. The way people decide is the result of a mixture of social expectations and cultural factors that need to be better understood by European and national policymakers. Homeowners' priorities for improving home qualities are important to the success of the energy renovation policy of dwellings because there are human factors and qualitative preferences that control the choice of homeowners [14]. Energy efficient renovations should not be partitioned off from other types of home improvements in which households are engaging as part of the current home life [15]. Other types of products for policies and for renovation practice development focused on both the social context and technical expert solutions needs to be explored [8]. The non-energy benefits must be demonstrated together with the energy benefits [8].

Another interesting issue building found in recent studies is that the homeowner sometimes desires to have power over some tasks of the renovation process, thus personalizing their house. According to Nair et al. [16] homeowners tend to adopt building envelope measures if they replaced one building envelope component themselves in the past or made a investment on the past. Personal involvement of the homeowners in the decision-making should be considered just in the beginning of the building renovation practice, if they request to. Quite a few homeowners even want to do some works of the renovation for the reason that they are as interested in the process itself as they are in the final result [5,8]. Galvin et al. [5] calls them the homeowner-retrofitters and says they exert some bottom-up influence in the social-technical system. The DIY products are presented as a kind of possibility to consider in the

future, giving the people who want it the possibility to put a personal mark on their renovated building and not be submitted to mandatory technical solutions or already existing solutions suggested by the energy adviser. It is another way of promoting building energy renovation getting the homeowner involved in the improvement of something that is their own.

Another important aspect is that homeowners are not isolated individuals but bring with them established know-how and routines that have to be considered [1]. Private homeowners identify the renovation need and decide upon it based on their needs, desires and capabilities. Gram-Hanssen et al. [12] refers that homeowners are seen as a part of a social group whose practices influence the individual behavior. They interpret or reject new information on the basis of their previous knowledge and in the context of their social network even if they trust the energy expert adviser. The promotion and the difficulties in the acceptance of knowledge depend on the surrounding social network [12]. These knowledge networks include family members, friends and colleagues which many times include professionals and craftsmen. This knowledge transfer is made by informal conversations and in some cases consultation of craftsmen. These social knowledge networks are responsible for conveying trust and confidence to homeowners as a complement to technical issues [1]. These networks are decisive for the decision-making process. Nevertheless, the homeowner's social network know-how is fragmented between different players, especially the group of craftsmen that do not feel themselves as energy practitioners in the energy renovation process [1]. Better and trustable exchanges of advice, networks of knowledge or practical help about energy-related renovations are needed [1]. Consequently, reducing the energy use in buildings also becomes a social and not only a technical-economical problem [17]. In a holistically approach perspective, the entire society must change and not only those who are directly related to the building design and construction. Bartiaux et al. [1] consider that energy renovation must be socially contextualized.

A better information and dissemination model is also accepted as being one of the most successful approaches to reach better results. Personalized communication and personal contact have been found particularly effective in the decision-making process linked to opportunities and tailored to the circumstances of the household [8,18,19]. Judson et al. [3] consider that the information should be tailored to the household context. In consequence, social skills need to be part of the training of energy advisers. The energy adviser must be capable of classifying and understanding the type of homeowner and capture his motivations, desires and what is important to the homeowner [9]. After this, advisers should be educated to give more eclectically advice to homeowners based on visual and style arguments among other rationales and not only on technical and economic issues. Gram-Hanssen [8] proposes that the energy performance certificates could evolve to more appealing tools, closer to a personalized homeowner-guide which could bring to light other sides of energy renovation more related to visual aspects, for example. He also remarks that increased knowledge on all benefits of energy efficiency and better channels of energy advice are needed.

Thus, there is a gap between policy aims and the practices of the daily life of homeowners [3]. Building renovation must be seen as a social practice and must be related with other social practices that interact with it [3]. Neglecting this in the policies and in their operational programs will in fact result in their continuing limited impacts. Policy makers need to engage more positively with the homeowners who expect to invest large amounts of money in energy renovation [20]. Homeowners are seen by policy-makers and energy advisors as professionals' investors who are available to spend a reasonable quantity of money to renovate even if they are not pay-baked and also as non-experts in their own domains [10]. This idea must be changed. Neither the indoor lifestyle nor the financial situation is being taken into account in the policies formulation and consequently in the regulations. Policies assume that people live accordingly with the assumptions considered in the regulations and they invest comfortably and easily if they need any repair in the building, but this is not a fact in the majority of cases.

Minor energy renovations and step-by-step renovations are discouraged and some regulations even do not permit that [10]. By other means, the reality and particularities of the existing residential buildings are far from being reached by the regulations that remain too inflexible. Regulations on these matters are far from suiting actual buildings and their owners [10]. Step wise renovations could be more appropriate to the nature of each building. The latest empirical results address that the base line for starting a renovation process settles not only in the building conditions but in different energy users' profiles, individual expectations and everyday life factors [10].

### 3. Methodology

The research questions were raised following recent findings. What kind of renovation activities have been made by Portuguese homeowners until now? What kind of motivations do they have to renovate or not renovate? Are there social practices and social networks that could help to make the energy renovation a more frequent action or is this a sole practice? To what extent can the renovation be viewed as a practice? Are the EPC (Energy Performance Certificate) and the technical solutions proposed by the energy adviser contributing to that? This study intends to be mainly a qualitative research work rather than a quantitative one.

To address these questions, 18 qualitative interviews were made in Portugal to homeowners conducted at the their homes. First, some testing in-depth interviews were made to 3 homeowners and then extended to the others. These interviews are also part of a broader literature review that provides contextual knowledge on users' practices and energy-related policies for the renovation of buildings. The qualitative interviews were conducted and analyzed following qualitative social science standard [21]. An interview guide was accomplished and included the research questions. The limited number of interviewed householders, as a qualitative research study, leads to some attention to the output of the results, since they probably cannot represent all the cases. The authors intend to achieve a more in-depth knowledge but consciously accepting that the findings can be limited to the cases found in the interviews. The selected groups of house owners interviewed covers: who has bought a house recently, who has contracted an energy assessment for planning energy-related renovation (or had an Energy Performance Certificate (EPC) done in their home) and who has implemented low energy measures. Following the considerations of Mills et al. [22], a high-school diploma has no significant impact on household knowledge of energy use relative to no high-school degree however, when the most educated member of the household has a university degree the knowledge increase. For that reason, the informants selected all have an wide range of educational levels to be considered sufficient knowledgeable about the renovation practice to transmit their testimony and experience. The informants all have educational levels to be considered sufficiently knowledgeable about the renovation practice to transmit their experience.

### 4. Results

#### 4.1. Overview

A particularity of the Portuguese existing residential building context is that the houses are mainly owner-occupied. For this reason, it is important to understand the expectations and daily practices of homeowners that are simultaneously householders because they are able to feel the house where they live in a particular way, as a personal project for life. The empirical results of the research into the role of Portuguese homeowners in the process to renovate their building will be presented.

#### 4.2. What kind of renovations householders are doing

The non-related energy renovations made by most of the respondents were bathrooms and kitchens, even before the end of service lifetime of the equipment had been reached. The renovation activities that give a new aesthetic and functionality to the home demonstrate to be the priority compared with solutions that save energy. The aesthetics solutions seem to be an ambition of people even if there is no granted payback or savings.

According to the interviews, the most frequent energy renovation activities and the first to be adopted were: installing more efficient heating systems; insulating the attic and replacing window frames. Comparing with other studies, these renovation actions are rather the same in almost all the countries, being these, in general, the first activities of energy-related renovations. The first priority in the renovation activities is normally the indoor followed by actions in the building envelope. The renovation of the domestic hot water or air heating systems is one of the first indoor actions. Another frequent action is installing a biomass fireplace stove to heat the indoor air of the room where a previous open fireplace exists. Replacing the windows and installing roof insulation are normally the first renovation activities in the building envelope. The wall insulation is gradually growing in the preferences of homeowners, especially the use of External Thermal Insulation Composite System (ETICS).

The adoption of energy related renovation activities is tendentiously linked to the adoption of major building renovations [23] but some informants recognized that they missed those occasions and did not undertake investments for the reduction of energy consumption.

#### *4.3. Why householders renovate their buildings*

The informants that have already made some energy renovations refer two different contextual bases for motivations. First, the energy renovation occurs in the following sequence of a renovation for necessity of maintenance, some damage repair or bad functionality of the building components. Some examples are the replacement of the roof tiles or the heating system. They refer that the idea of going forward with the additional low energy renovations sometimes come to light right in the beginning or even during the renovation process. Some homeowners also focus directly on the energy-related renovations made because of building problems related to that, like condensation in the frames or glass, the existence of thermal bridges or to improve thermal comfort. Thus, the motivation for these interventions was based on a need.

Many said that they were motivated by the aspiration related to aesthetics, a new lifestyle, status or prestige. Some refer that they saw their neighbor doing some renovation and this was a motivation for them. The motivation for these interventions was a desire without any argument related to savings or payback. Some aesthetic renovations bring along energy improvements but it was an additional benefit and not the initial main goal. Hauge et al. [24] says there is a lack of research on aesthetic aspects of the energy efficient buildings and the findings in this study confirm that the aesthetics issue is preponderant for the process to begin, only then leading to further energy efficient renovations.

The energy efficiency and environmental concerns were perceived as important by some householders but they assume that it is not the main concern.

Regarding whether the daily routines influence the renovations as a practice or not, the data collected showed how some interventions were motivated by the desire to change some everyday routines and practices. For example, some new requirements of thermal comfort such as the increase of the number of family members living in the house, creating conditions for ageing or an intention of more social activity. The renovation practices can respond to maintain the current daily routine but also to the wish for changing the way home is used. From the analysis to the data, energy efficient requirements are weighted by the householder based on his daily experience level before and during the renovation process. Technical solutions solely do not convince the homeowners although some participants referred that some of them can be an attractive to implement.

Some of the homeowners consider that they sometimes receive different advice from different sources which contribute to a confusion and indecision about the approach to take and decay in the trust worth. .

Almost all refer that the economic aspects are fundamental. The budget for renovation was limited in the majority of cases, so they planned to make step-by-step renovations and for that reason they defined priorities. This factor overruled other motivations such as aesthetic and environmental considerations. Nevertheless, in the majority of the cases, the participants refer that are not used to make payback calculations and they are not comfortable with these economic matters.

For some informants, the activity of renovating is seen as an uninteresting duty and a process that will affect the normal everyday life of the family. They do not want to get through this. These are reluctant to put the renovation process into action.

#### *4.4. How households process the renovation steps*

What was found is that people carried step-by-step renovations during the lifetime occupancy of the home. This depends on the time and money available at the moment, the right circumstances and an ambition to take forward this sort of work. The renovation seems to be a continuous process during lifetime. Some homeowners see this enterprise as a task that they enjoy working on. They like the process as they like the result of it. The study also demonstrates that people who buy the houses did not make the energy renovations previously but rather year after year as a continuous activity. Those who did not make until now intend to do the same.

The homeowners who have contracted an energy assessment or an energy certificate stated that they intend to look for more information and are open to advice in order to get new solutions. They have an idea of technical solutions to implement together with the economic calculations to support their decision and they are convinced of the benefits of energy efficiency. They also want to be involved in one or more of these phases, the planning, design and execution. This kind of conscientious and versatile homeowner is not the typical homeowner. The greatest part of homeowners did not consider the EPC when planning their renovations because it is not, up till now, a common practice. The typical is the one who sees the energy certificate as a bureaucratic paper and the one who ordered the certificate because it was mandatory in case of a deep renovation. Notice the EPC is mandatory in Portugal in residential buildings when they are sold, rented out or constructed. Those who contracted an adviser also did so because they have friends or family that have already some experience in the field and gave those good references and an adviser contact. But the majority of the homeowners interviewed did not contract the service of an energy adviser when they decided to make improvements. They contacted directly a contractor or builder, or even a craftsman, many times recommended by family and friends. Sometimes, this professional is also someone who they already knew previously. This kind of homeowner is generally more uninformed or more confident on their previous knowledge or on the social network around. The ones who have recently acquired a home have access to an EPC but they did not pay much attention to the measures or they do not remember all of them in detail. Nevertheless, the majority of homeowners seem to have a positive attitude towards the energy advisers and the ones who contracted these professionals assume that the energy efficient solutions ended up being more comprehensive. In the other hand, the energy advisers are not trained to give other kinds of information besides the technical aspects and the economic viability of the solutions. The informants confirm that the information received was of this nature.

The study also reveals that they rely on the advice of professionals but mainly of builders or craftsmen. These professionals have a strong influence on the decision of homeowners about the building solutions implemented. Generally the homeowners trust the advice of these professionals and do not contract the services of an energy adviser or energy-related architect or engineer. Many of them do not have the idea that there are energy advisers or they think they exist but they have the specific task of elaborating an EPC. Only some respondents said "if we can have an advising service from a craftsman, why pay for an additional service of advice?" The homeowners still see this service as an additional cost. The aware and informed homeowners can contract these specialized services but they are the exception.

The interviewees recognized that they support their decisions upon a previous consultation of the knowledge network around them and upon information collected on the internet. They recognize that they already have some previous know-how about the solutions to implement sustained by a background of previous experiences, informal conversations and social network opinions. Some of these homeowners recognize that have made their own research to help support their final decision.

#### *4.5. Who execute the renovations*

Who made the renovations is another interesting aspect extracted from the informants' opinions. In most cases, the contractor was someone they already knew or recommended by friends or family. The craftsmen involved were many times from the social network, family and friends. In some few cases it was the house owners who did some works themselves supported by craftsmen, but these DIY tasks are more common in the non-related energy renovations. The DIY homeowners recognized that they consulted craftsmen for advice on particular tasks. Some refer that some of the solutions recommended by craftsmen were not the most suitable and they had problems after that which had to be repaired. Craftsmen could play an important role, but due to their lack of knowledge, they can be a barrier to energy efficiency.

The informants who intend or have decided to start renovation stated that they have in mind to auscultate the social network around them. The option can be between the ones they have already known or whose contact they have.

In Portugal, this type of service for energy efficient renovations is fragmented through different actors, each of them working independently and giving no-convergent advice. Therefore, many solutions recommended are in conflict sometimes. The one-stop-shop model or the local advice desks could be good instruments to achieve more successful interventions.

## 5. Conclusions

Established technical mandatory measures and using energy and payback arguments are gradually demonstrating to have limited action in many European countries, including in Portugal. Conceptualizing building renovations as a social practice enables a deeper understanding of social-technical issues associated with buildings [3]. The objectives of this study were to assess the attitude and practices of Portuguese homeowners towards energy-related renovations and its influence in the decision-making process.

First, the householders start by typical renovations tasks and usually do it step by step along the building occupancy lifetime. Some of those preferred renovation works do not payback. They were strongly motivated by a householder's desire.

The aesthetics and the lifestyle issues as homeowner's arguments for non-related energy renovation reveal to be central. This motivation can be the starting point for homeowners doing energy renovations. The need for repair can also precipitate and stimulate the decision upon low energy renovation.

The results show that also in Portugal the building renovation is influenced by needs, wishes and social practices of householders and depend on how this is negotiated at the family level. The energy renovation is usually motivated by a combination of personal and contextual reasons conducted by homeowner's usual daily life and by expectations for the future. The findings point towards the fact that energy renovation is molded by homeowners' skills, know-how and common practices and less, than would be expected, by the energy and money savings or by environmental arguments. The rational decision-making is not decisive when the homeowners decide to renovate. This is only one of the aspects for the homeowner's decision that becomes more crucial in the cases where people have limited budgets. The purpose of changing the nature of some daily practices can be an incentive itself to energy renovate in the future and in many cases the energy renovation actions came as an addition to other non-energy renovation. The concern for the family comfort and more conditions for socializing are important aspects.

The study also highlights the crucial importance of the social network in the decision-making process, or to be exact, in the renovation steps process and in the choices of the practitioners to do the work. Households trust in family and friends opinion and in craftsmen for support their decision. The majority contact directly these latter professionals without asking for information from an energy adviser or energy-related architect or engineer. They felt they are paying for an unnecessary service. Craftsmen can be a barrier to energy renovation because they reveal lack of knowledge when they suggest the building renovation solutions. There are reports about bad quality solutions that came from this sort of interventions.

Different types of homeowners' attitude towards the energy-renovation practice were perceived. The strategies need to be directed to these different householders' profiles. The most conscious and informed ones tend to search for more information than the received from the social network and generally they know about the existence of the energy adviser. Normally this type of homeowner wants to have an active role during some or all phases of the renovation process.

Last but not least, the EPC seems to have a moderate role in conditioned the homeowners' choices. When there is an EPC for the house, homeowners do not pay the right attention to the recommended measures contained in this document.

The knowledge gained in this study shed more light on the fact that in Portugal, as in other countries, the qualitative factors influence the homeowner's decision-making for building renovation, namely human, personal and contextual factors. The rise of new policies centered on the social dimension of renovation is fundamental. Reducing energy use in buildings requires policies also focused on the social context of renovation in contrast with the predominant approaches which rely mainly on technical improvements for buildings. In addition, this study strengthens that a very comparable behavior between diverse countries' homeowners exists although the social and economical differences. Policy measures need to be put forward to enforce the role of homeowners in renovation of buildings process.

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