

Making the home consume less – putting energy efficiency on the refurbishment agenda

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Abstract

Private home owners can reduce their energy use significantly and move towards a low carbon lifestyle by retrofitting their homes in an energy efficient standard. Despite high awareness for energy efficiency and rising energy prices, home owners only slowly take this opportunity to cut down their personal energy use and carbon emission significantly. In many cases, maintenance and repair activities only result in incremental improvements of energy efficiency. Thus, the dynamics of refurbishment seems to have a conservative bias. Against this background, we will present results from an empirical survey, focussing on home owners' maintenance and refurbishment decisions. Drawing on approaches from social-psychology, lifestyle analysis and evolutionary economics, we will explore the impact of attitudes, lifestyle orientations, cognitive frameworks and social resources on refurbishment decision especially on energy efficient ones and present a model integrating the most important driving factors.

Introduction

Space heating is by far the largest energy end-use in households in the EU-15 and a major source of CO₂ emissions (EEA 2005). Improving the energy efficiency of the housing stock is crucial to reduce energy consumption and to cut down CO₂-emissions. In Germany, energy consumption for heating in the residential sector fell by 2.4 percent from 1995 to 2006

(FSO 2008). This reduction is due to technical improvements and to changing heating practices: On the one hand, there are marked improvement in energy efficiency and improved buildings and heating systems. On the other hand, technical appliances allow users to control the heating system more effectively, resulting in a lowering of room temperature. At the same time, private home owners faced a dramatic rise in residential energy costs. Energy costs for heating, warm water generation and electricity raised up to 1,556 Euro per household in the year 2007.

Nevertheless, about 80 percent of the housing stock still is not fitted according to state-of-the-art technology. Although appropriate technology for refurbishment is available and economically viable, energy efficient modernisation of the building stock is going on very slowly. In Germany, the annual rate of energy efficient refurbishment is about one per cent a year (Kleemann and Hansen 2005). In many cases, energy efficiency measures are applied inefficiently. Studies have shown that in Germany on average just one third of the economic viable saving potential through modernization is being realised. This is far below of the goal of a three per cent annual refurbishment rate as it is suggested by the German Energy Agency (dena).

Within the last years, the German government launched several political initiatives and instruments addressing activities to improve the energy efficiency of the building stock. Despite these efforts, energy efficiency has only modestly increased. In particular, many private home owners appear to be reluctant to energy efficient modernisation. Against this background, the contribution will focus on the owners of private homes (i.e. single, semi detached and row houses). Drawing on own

empirical material, we will provide a multi-disciplinary conceptual framework to discuss the refurbishment decision and will then move on to explore some factors that shape decisions towards energy efficient refurbishment.

LOW CARBON REFURBISHMENT

In Germany about 75 percent of the end energy use of private households is used for space heating and the preparation of hot water. Private home owners can reduce the energy consumption and the related CO₂-emissions of their homes significantly by better insulating walls, roofs, windows, doors etc., increasing the heating system's efficiency or using renewable energy sources for heating and the preparation of hot water. Thus, energy efficient refurbishment offers for private home owners a viable perspective to adopt a low carbon lifestyle.

In recent years, private home owners have attracted growing attention in sustainable consumption research. Main focus was on marketing and acceptance of innovative technologies in the context of the construction of new buildings, in particular low energy homes (Belz et al. 2005; Ornetzeder and Rohrer 2007). Less attention has been paid to the issue of how private home owners improve the energy efficiency of the building stock. Only recently, the barriers and acceptance factors towards energy efficient modernisation have been taken more closely into consideration (Wittmann et al. 2006; Bartiaux et al. 2006).

Technical interventions to improve the energy efficiency of a building transform the options of energy use. They are connected to energy related consumption practices, like heating or cooling, which are closely linked to everyday life. "Ordinary consumption" (Gronow and Warde 2001) emerges at the interplay of socio-technical systems of provision and conventions. It is framed by routines, normalised expectations, personal values and attitudes as well as by the dictates of convention and public interests (Shove 2003, Spargaaren 2004).

Unlike ordinary consumption practices, technical interventions to improve the energy efficiency of a building require important investments and have a time horizon of several years. Energy investment decisions, are typically connected to a building's refurbishment, but might also arise in the context of the change of a building's ownership. Therefore, they can be characterised as long-term investment decisions, occurring only very few times in a person's life (Kaenzig and Wuestenhagen 2006).

As a consequence, economic considerations play a more salient role than in ordinary consumption. However, this does not imply that energy investment decisions of private home owners can be understood according to a simple model of rational and utility maximising action. As Bizer et al. (2003) observe, the investment decisions of private home owners are shaped by a systematic bias towards short term investments and pay only little attention to long term economic benefits.

And it has also often been stated, that access to and the processing of information play a crucial role. Private home owners often have only poor knowledge on the costs of their actual energy consumption for space heating and warm water. Accordingly, they overestimate costs of improvement measures and underestimate the potential benefits of improving the energy efficiency of their homes (Reiß et al. 1999).

Following these considerations, we argue that radical changes in residential energy use occur as an outcome of a complex investment decision. This decision is shaped by the interplay of socio-technical, institutional, economic, cultural and social factors. Attempts to understand this decision have to take a complex interplay of technical factors, in particular the "windows of opportunity" caused by the life cycles of a building and its components, with economic considerations, socio-cultural norms and expectations, cognitive frameworks, lifestyle orientations as well as socio-demographic factors into account. Drawing on approaches from social-psychology, lifestyle analysis and evolutionary economics, we will explore the refurbishment decision and present a model integrating the most important driving factors.

Own conceptual approach

Steering consumer decisions is often guided by a simple heuristic: driving factors which impede or promote the desired behaviour are identified, in our case a low-carbon lifestyle, and then it is recommended to weaken the impeding and to improve the promoting factors. In a more elaborated approach, it is necessary to bring the presumed important factors in a theoretical order – some are important from a particular theoretical point of view while others are not.

Our most important theoretical references are amongst others

- lifestyle approaches in the sense that housing is a socially distinctive cultural practice being shaped by group specific values, beliefs and norms which are not simply symbolic derivatives of available resources and social positions (Berkling and Neckel 1990, Schneider and Spellerberg 1999),
- theories of planned behaviour in the sense that attitudes towards refurbishment and resources (money, knowledge) have an important influence on strategic consumption decisions (Fishbein and Ajzen 1975; Ajzen 1991; Ajzen 2005),
- behavioural economics in the sense that consumers normally behave not completely rational in the normative sense of microeconomic textbooks. Their decisions are framed by their attitudes and they use simple heuristics (see selected results below) to avoid an informational overload (Gigerenzer and Todd 1999).

Figure 1 gives an overview of our model. Linking these different theoretical threads, we follow a two level approach.

On a first level, we distinguish the social situation and lifestyle related values, beliefs, norms and attitudes which shape the relation of home owners to their dwellings in a general way. How people perceive and inhabit their homes varies significantly. The home, for example, can be a centre of family and social life, a shelter from the hectic pace of modern life, a preferred object of self-realization ("do-it-yourself") or an expression of one's social status. Unlike approaches from social psychology, we do not consider these factors as individual attributes, but understand them as social phenomena which can be examined and measured in terms of social groups or lifestyles (Hradil 1987). In this sense, housing practices are closely related to lifestyles. They represent habitualized sets of practices which correspond to specific lifestyle orientations (Schneider et Spellerberg 1999).

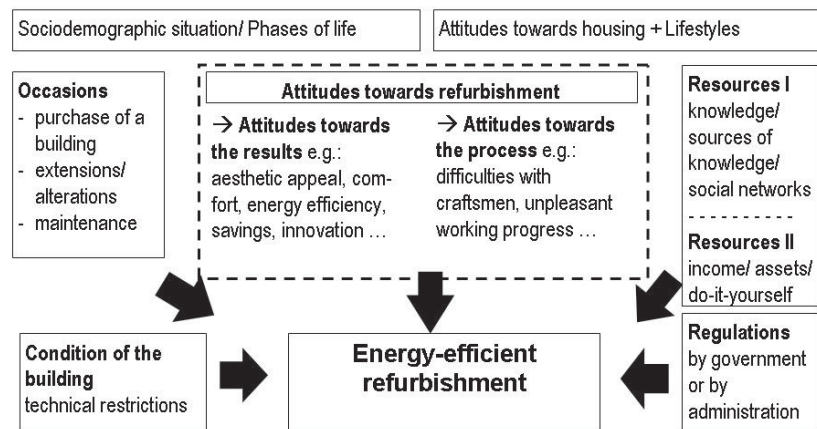


Figure 1: Model of the refurbishment decision

For example, home owners with a traditional lifestyles will be more likely to see their home as a centre of their social life than fun oriented lifestyles do. On the same level we distinguish social factors, like life stage, education, income or professional status. These factors define fundamental requirements to the housing situation. Putting social situation and lifestyle orientations together, we can identify typical groups of home owners. An example is the group of “best agers” (above 50, high income) with a positive attitude towards the environment and a negative attitude towards risk.

Modernizing the home usually is not a simple routine; it is rather a deliberate decision, because a home owner makes refurbishments only once or twice during his or her lifetime and a lot of own money is at stake. Therefore, an approach like the theory of planned behaviour which emphasizes this point seems to be appropriate to build a model for this type of decision and its outcome. Fortunately, this theory doesn't make any specific assumptions about decision rules and we are free to establish here what we detect in our empirical findings.

Therefore, on a second level, we situated another set of factors roughly following the ideas of Ajzen. The category “attitudes towards refurbishment” in our model refers to the category “attitudes towards behaviour” in Ajzens model. The categories “resources I”, and “resources II” refer to the category “perceived behavioural control” in Ajzens model; but it should be mentioned that the subcategories “knowledge” and “networks” have a strong link to the category “subjective norm” in Ajzens model. Unlike Ajzen we understand this category in a socially differentiated way and connect it to lifestyle orientations. Obviously, lifestyle orientations and general attitudes provide a background which influences the attitudes towards refurbishment. Moreover, factors like income, education or age influence the perception of resources or the perceived behavioural control of the home owners.

Since we know from consultants in this field that favourable occasions are important for refurbishment, especially for ecologically refurbishment activities, we integrate three boxes in our model, which address potential windows of opportunities. “Occasions” in the narrow sense of the word, address above all social or biographical opportunities, for example changing a job, purchasing a new house, or the birth of a child. Besides that, there are technical opportunities, for example if the heat-

ing system reaches the end of its lifespan. Such occasions are addressed by the category “condition of the building”. And finally, “regulations” can force home owners to replace some components or to renovate of their home.

In the following sections we will focus our considerations on three hypotheses:

First, since refurbishment, especially an ecological demanding refurbishment, is the outcome of a decision under uncertainty. In fact, there is no rational solution in an economic sense; and every calculation of a net present value or the length of amortisation of saving of energy by modernisation is based on speculative assumptions about energy prizes and energy saving effects of modernisation in the future. So we suppose that home owners use much simpler decision rules.

Second, we investigate the hypotheses that favourable/unfavourable occasions (in case of favourable occasion one might speak of a window of opportunity) are important for refurbishment activities.

Third, every outcome of a decision is framed by a decision context. This context is given by attitudes, by perceived resources, by social norms (social network) and by favourable/unfavourable occasions. Depending of this decision context, which partly can be assigned to life styles, different outcomes can be expected.

Empirical Design

The decision for refurbishment is a consideration process of different options regarding economical criteria and subjective perception of the situation. Aim of the empirical study [1] was therefore, to explore the situations of decision and to deduce hypothesis on promoting and inhibiting factors and barriers, on target group differentiation of private home owners, on influencing factors and phases of the decision process of energy efficient refurbishment. In addition a special view on gender specific perceptions shall be taken.

During this first explorative empirical step 44 in-depth interviews (face-to-face) with private home owners in four regions in Germany (Augsburg, Bremen, Berlin, Rhine-Main-Area) were conducted. The interviews were based on a problem centred interview guideline. The quota arrangement respected aspects like a wide sociodemographic range of the interviewees

concerning age, household size, children and gender. By this the life stages should be represented which possibly influence the needs on the home and priorities in home refurbishment decisions. Basically we differentiated between two groups:

- conventional refurbishers, who carried out functional or aesthetic repair at the building's envelope (walls, roof, windows etc.) or the heating system
- energy efficient refurbishers, who realised measures with high energy efficiency potential (e.g. wall or roof insulation, installation of solar heating collectors or triple glaze windows), which go beyond the standards of the German building directive.

The works should have been conducted during the past three years to guarantee that the interview partners are able to describe precisely the process in retrospection. The interviews were conducted in summer 2008; they lasted approximately between 60 and 90 minutes.

The interview topics, respectively the interview guideline were as follows:

- social situation/context and life world background
- characterisation of the house, attitudes towards the house, decisions, in-house efforts
- preconditional situation and type of refurbishments
- motives and alliances
- objectives of the measures, background motives and decision process
- barriers and obstacles for energy efficient works
- knowledge on energy consumption of house, saving potentials, regulations
- information usage, role of social networks, knowledge of energy consultation offers, professional consultancy
- financing measures
- perception of energy efficiency discussion
- individual evaluation and contentment of accomplished measures.

The computer aided analysis of the qualitative data (database) makes it possible to interpret the results horizontally (between different cases in one topic) and vertically (in one case over all topics).

Selected Results

In the following section, we will present the most important findings of the empirical inquiry. Main emphasis is given to selected factors of decision model which is outlined above. We will first highlight some characteristic traits of the investment decision from an economic point of view and will then discuss the role of the decision context and the motivational background as well as some implicit, but critical barriers for energy efficient refurbishment.

CHARACTERISATION OF INVESTMENT DECISION

The empirical findings support the initial hypothesis that the way of how private home owners make refurbishment decisions differs considerably from an orthodox model of rational economic choice. Most home owners do not think about refurbishment in terms of an economic investment, whose benefits can be calculated in monetary terms. It is a surprising result that even decisions for a comprehensive energy efficient refurbishment with an investment of 50,000 Euro and more in many cases are not based on an evaluation of economic efficiency in the strict sense. They are rather outcomes of a process in which home owners are weighing costs and benefits in terms of objective criteria and immaterial improvements of the personal quality of life. How these qualities are conceived and valued depends from a variety of factors. In this regard, the specific needs of the actual social situation, but also lifestyle specific orientations play an important role.

Another characteristic of the investment behaviour is that some, but not all, home owners are reluctant to obtain a loan in order to finance their refurbishment. As a consequence, the limit for investment is restricted to the amount of money which is available at the time the decision is made.

If we want to understand this behaviour properly, we have to keep in mind that investment decisions related to the improvement of the energy efficiency of homes are made in a state of uncertainty. Nobody can predict exactly the development of energy prices, not even the so called experts. Moreover, deciding which kind of energy saving investment should be chosen is a difficult task, because there are many technical options with different outcomes. Therefore, it is not very surprising that home owners do not behave rational in the sense that they calculate life cycle costs of their options and choose the option which pays for itself first.

Surprisingly, in our sample even ecologically interested people only have broad ideas about the size of their energy consumption. Consequently, many people do not calculate even roughly the amount of energy savings owing to their energy investment decisions. For most energetic modernizers it was most important to use less energy in the future, unless they could not estimate the amount of energy saved. But most of them were convinced that the additional costs would pay in the long run. However, there were others who carried out energy efficient improvements, although they were convinced that these investments would not pay off in monetary terms at all.

We found that many home owners use simple heuristics instead of calculations of economic efficiency: An example is the idea that against the background of increasing energy prices, it would be useful to invest in refurbishment which could save energy on the condition that they would not have to regret their investment, even if the prizes did not increase. Another simple and widespread heuristic is the idea that one should handle energy saving measures as a side effect of necessary repairing measures. For example, if the roof has to be restored, an improvement in insulation will come into consideration when the additional costs are only marginal.

This kind of caution goes in line with the often observed preference for present over future. Therefore, home owners tend to act like consumers in general: They choose options which pay back in the present and cost in the future over options which cost in the present and pay back in the future, even if both

options have the same time of amortisation (Kahneman et al. 1991). On conditions of certainty, this behaviour seems to be a reasonable strategy, but very often, the decisions are made not even on the basis of costs and pay backs but only on the basis of liquidity considerations. Putting it in a general rule, one might say: if something needs to be repaired and you have a little bit of extra money you can also improve the energy efficiency of your home.

From a theoretical point of view, such simple rules are very important, because the outcome of decisions which are based on these simple heuristics is often different from the postulated outcome of decisions of a perfectly informed economic rationalist (Kahneman 2002; Dawney and Shah 2005). We suppose that these rules have to be in line with the biographical situation of the homeowners and their lifestyle.

One might formulate this idea in a more general hypothesis, i.e. that all actors tend to be consistent in their subjective cognitions (Festinger 1957). Hence, decisions about refurbishment have to be consistent with the way home owners perceive their situation and their lifestyle orientation. The outcome of a refurbishment decision is strongly linked to the decision context which is shaped by the biographical situation, the type of situation and the motivational background of the refurbishment decision. Some of these critical factors will be discussed in the following sections of the paper.

DECISION CONTEXT

Referring to the elements of our model the decision context can be distinguished in *social* and *technical* opportunities. Under *social occasions* all situations resulting from changes in biographical or professional life can be subsumed, like birth of a child /expanding the family, changing jobs, purchasing a house or going into retirement. From the interviews the hypothesis was supported that life stage and different starting points shape the decision context. *Technical occasions* refer to the age and the status of the house, they are related to the different life spans of a building's components (heating, roof covering etc.) or to measures being necessary because of regulations. In our analysis we found that these two types of opportunity are often intermingled.

As *social occasions* we identified in our empirical material for example younger purchasers of a second-hand house with the aim to reach a bigger living space and higher standard. They are dominantly couples around their thirties having created or expanded their family or having moved because of a new job. The purchase of such a property leads often to very far reaching renovations of the home (*technical occasion*) and has a large potential for energy efficient improvements.

Another important *social occasion* is the pre-retirement phase, but it is showing the complex situation of allocating financial resources: Several studies confirm (Bizer et al. 2003; Krémer et al. 2005) that in Germany private home-owners are a majority in the age group of 60 plus (55%). In our interview material we found that the biographical situation of the home owners (retirement phase) influences the willingness for and ability of financial investments (own life expectancy). Additionally the homes of these owners were built during the 1960s and 1970s and are now reaching the end of their maintenance cycle (*technical occasion*). Taking this into consideration, there is only a narrow window of opportunity for an economically vi-

able energy-related refurbishment, depending on the age of the building (maintenance cycle) and the home owner's perception of his or her future perspective.

Putting social and technical occasions together, we could deduce different categories of renovation processes form the empirical material, which influence the degree of energy efficiency of refurbishment:

1. Purchase or inheritance
2. Extensions or alterations
3. Maintenance and upkeep

These categories integrate to a certain degree the *social and technical occasions* and can be seen as a higher or lower likelihood of an energy efficient refurbishment:

Ad 1: We found that in many cases a general renovation is carried out before the owners move into a house which is recently purchased or inherited (social occasion). This includes a basic renewal of a heating system and functional parts like windows as it is difficult to realise such measures later under running use (technical occasion). Modern standards which include mainly partly energy efficient measures are common practice. In some cases, measures with a high energy efficient standard like insulation of external walls and roof are realised in a second step. In some cases we observed that inheritance can make it difficult for the new owners to find optimal solutions for refurbishment. The perception of the home is strongly shaped by emotional aspects and a desire to change the character of the home and to appropriate it to one's own wishes. This falls sometimes back to the energy efficient standards of the conducted measures, because priority is given to suboptimal solutions.

Ad 2: In this category we found a higher readiness to take more extensive measures with a more future oriented focus. Professional planning and delegated undertaking are more often found. In the focus of such measures is the adaptation of the home to the specific needs of the inhabitants depending of their life phase (e.g. home office, roof extension, age-based adaptation; technical occasion). Often these measures are at least partly energy efficient and oriented at energy efficiency standards. Young families and golden greys are often open for optimal energy efficient solutions. Couples in the post-family phase have often more time and financial resources to do bigger steps. For lower income groups not only step wise works but also in-house effort makes it more likely that energy efficiently sophisticated measures can be realised.

Ad 3: A real long term concept of refurbishment does not exist; the refurbishment decision is rather a reaction to occurring and needed repairs (e.g. painting of facade, replacing a window, repair of a part of the heating). Each measure is more or less conducted in routines, often the well known craftsmen are assigned and the financial effort is kept as low as possible. Mostly this type does not lead to an energy efficient upgrading of the building. In some cases incremental improvements are realised. Our observation is that mostly older age groups tend to this type of refurbishment.

LIFESTYLES AND MOTIVATIONAL BACKGROUND

In most cases, refurbishment is not a response to an urgent need. Even in most cases where maintenance and upkeep is at stake, there is a considerable scope of decision. Whether an old heating system has to be replaced or a façade needs to be painted, is not determined by technical reasons alone. Most of the maintenance or refurbishment measures have a time window of half a decade or more. Whether this work is carried out and when this is done, has much to do with the individual values and preferences of the home owner. Looking closer at this decision context, we find a complex interplay of pragmatic and straightforward goals and a motivational background which is shaped by attitudes and lifestyle orientations. In this regard, some important distinctions between conventional and energy efficient refurbishers can be made.

Conventional modernisers are mostly committed to functionality and optics and their decision is often characterised by a strong cost element. Outdated or defective appliances are removed and damaged parts of the house are restored in order to safeguard the quality of the home for further personal use. Refurbishment might also be the outcome from the desire to reduce maintenance cost or efforts. Improvements are made, but they refer basically to adapting the home to contemporary technical standards. In most cases, energy issues are not on the maintenance agenda. Many conventional refurbishers are simply not aware that they are wasting energy. They are convinced that they already do a lot and don't see a need to invest in energy efficient improvements of their home. More sophisticated measures, like improved insulation, highly efficient heating systems or the installation of solar collectors are rejected. They are seen as expensive and not profitable expenditures or considered as technically immature. As the empirical survey shows, in particular home owners with traditional lifestyles can be found in this category.

Unsurprisingly, *energy efficient refurbishers* are more keen to consume less energy and to reduce energy costs. However, despite the sharp increase in energy costs in the past years, we found that this desire alone seems not to be strong enough to lead to a decision towards more sophisticated solutions and to pay for their additional costs. In most cases, energy efficient refurbishment is an outcome of more complex motivational alliances.

On the one hand, some home owners reduce energy use or turn to renewable resources, like wood, solar or geothermal energy, because they want to protect the climate or to become independent from fossil fuels. In these cases, the decision context is shaped by a cognitive framework of climate change and carbon reduction. Home owners within this group are strongly committed to environmental sustainability and a low carbon lifestyle. They carry out a comprehensive energy efficient refurbishment; because they want to reduce their carbon emissions significantly. However, the spread of these motives is very limited and only effective with the already "convinced".

On the other hand, energy efficient refurbishment can be an outcome of motives and goals which are not directly linked to environmental sustainability and a low-carbon lifestyle. Here, we found that the readiness to invest in energy efficient refurbishment is supported by motives like the desire to improve the living quality and the comfort of the home, a fascination to use innovative technologies, a strong aspiration towards pres-

tige and to adopting a pioneering role. Energy efficiency is seen as a positive value, however, in most cases it is not a priority issue: Energy efficiency is rather considered as an additional benefit and the selection of measures results from a pragmatic compromise between various goals or concessions to limited financial resources.

Among older age groups, the motive of provision comes into play. In some cases, home owners carried out energy efficient measures, like wall and roof insulation, because they wanted to be less vulnerable to rising energy prices or because they wished to prevent greater refurbishment work in later years. However, the implication of this motive is arbitrary: On the one hand, we found that more comprehensive energy efficient refurbishment can be promoted, if energy issues can be included into the agenda. On the other hand, in some cases we found trade-offs with other measures related to age-dependending adaptation of the home. And finally, the time window for this work is limited to home owners between about 55 and the end of the 60s.

IMPLICIT BARRIERS AND OBSTACLES

Obviously, a commitment to energy efficiency or a low carbon lifestyle doesn't guarantee that finally an energy efficient refurbishment is carried out. The reasons why this intention may fail are legion. Besides obvious factors like limited financial resources as well as building or legal restrictions we found that the gathering and processing of knowledge (in our model "resources I") may act as crucial barriers on an implicit or tacit level:

At first we discovered in the interviews the aspect of information overload and lack of knowledge which information is trustworthy. The energetic performance of a building is an outcome of various technical components. To understand and assess this performance properly requires technical knowledge far beyond the experience of everyday life. Many interviewees found it difficult to gather reliable and useful information. In particular, home owners who are not very keen with technical issues do not find easy access to reliable knowledge. Information is provided from many sources, but it is difficult to evaluate its quality.

Due to the deficiency of available/perceived information social networks strongly influence decisions. Conflicting recommendations, prejudices and clichés as well as self-styled "advisors" in the social environment can make the planning and decision process a thorny task. Facing these difficulties, some home owners turn to the known craftsman or ask persons in their personal environment for advice. Those who are more risk adverse will opt for conventional solutions in order to avoid wrong decisions.

A third field of obstacles becomes visible in our data by regarding the interaction and responsibilities with the partner but also with other family members and friends. Gender specific structures of the division of labour and division of responsibilities play an important role. In most families or couples, smaller technical works in the house are carried out by men. In particular, among older couples mostly men decide about technical solutions using basically technical criteria whereas women would be more open for future oriented solutions. Or older women being responsible on their own for the property are frequently more risk adverse and hesitate to use innovative technologies. They hesitate to think about energy efficient op-

tions and give priority to functional or optical improvements. But it is also obvious that gender and professional background interact. In particular, women with higher education with a responsible position manage the refurbishment of their home as a project and delegate the task of gathering information to experts like architects, energy advisors or craftsmen.

Outlook

Summing up, we can conclude that energy efficient refurbishment offers a way to a low carbon lifestyle, but in many cases improvements are only made incrementally. To put it in plain words, the technically viable potential of carbon emission reduction in the housing stock will be fully realized only in a very limited number of cases and situations. Nevertheless, there is a considerable number of home owners who take refurbishment as a chance to adopt a low carbon lifestyle. In particular, a transfer of ownership provides an excellent window of opportunity to make decisive improvements in energy efficiency, albeit there is no guarantee that a comprehensive energy efficient refurbishment is carried out. It is promising that a low carbon lifestyle is not limited to committed environmentalists, but is also fuelled by motives like comfort or the use of innovative technologies. There is not only one single lifestyle striving to reduce carbon emissions, but there are several ones which have a propensity to do so: Living in a low carbon home offers comfort and prestige - and helps to cut down one's energy costs.

Obviously, these findings have far reaching implications for the design of strategies and instruments to promote energy efficiency in the housing stock. Although it is not possible to discuss these implications here in greater detail, we would like to add some preliminary remarks. It is important to acknowledge that due to biographical reasons a large number of home owners is not very likely to invest in energy efficient refurbishment. This might be unpleasant news, in particular in Germany, where large sums of public funding are spent in order to promote energy efficient refurbishment. And, as these barriers are not due to a lack of financial resources, they can hardly be overcome by financial incentives alone. Moreover, many home owners use heuristics and decision rules that are not in line with conventional cost benefit assessment. Keeping in mind that loans at reduced fees are the most important financial instrument in Germany to promote energy efficiency, these instruments are likely to fail the decision context of many home owners. In many cases, for example, not repayable subsidies might be more effective than loans at reduced fees. Another conclusion refers to energy advice. We found that energy advisory schemes at least in Germany are strongly based on standardized assumptions of "orthodox" cost benefit calculations in order to compare and prioritize different refurbishment measures. It might be more effective, if these procedures could be adapted to different decision contexts and criteria.

Therefore, strategies to promote energy efficiency in the housing stock should not depart from a too simplistic assumption that more money will automatically lead to more efficiency and less carbon emission. What is rather needed are differentiated and target group related approaches which address different levels of refurbishment ("top refurbishment" vs. "incremental refurbishment"). Strategies to promote energy efficiency need a long time perspective and should be based on a coherent set

of instruments, including financial incentives, independent and professional energy advice, marketing campaigns and regulatory instruments. How these strategies can be designed is the object of further research. Based on the findings of the empirical inquiry a systematic assessment of refurbishment related instruments in Germany will be carried out as next step of the ENEF-Haus research project in order to develop recommendations for target group specific approaches.

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Endnotes

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