A Consumer Decision-making Process? Unfolding Energy Efficiency Decisions of German Owner-occupiers

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by

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Abstract

The German housing stock needs substantial energetic retrofit to meet carbon reduction targets. Various instruments are available to motivate building owners to improve the energy efficiency of their dwellings. These instruments mainly focus on the economic issue of funding and financing energy efficient refurbishments as the decision is interpreted as a rational choice of an investment. Their success is rather low as the refurbishment rate stagnates around 1% per year for more than a decade.

The objective of this study is to gain deeper insights into the decision-making of owner-occupiers regarding energy efficient refurbishments and to offer an adjusted framework to analyse the decision. A qualitative-explorative research approach is chosen, whereby in-depth interviews with independent energy advisers have been conducted.

Results point out that the decision of owner-occupiers towards energy efficient refurbishment measures qualifies as an extensive consumer decision rather than a pure investment decision. The refurbishment measure implies high cognitive as well as emotional involvement. Owner-occupiers use several criteria to evaluate refurbishments, which superpose monetary determinants. The standard process model of consumer decision-making, reaching from need recognition to post-purchase evaluation, qualifies for structuring the decision. It allows analysing drivers and barriers stepwise and deriving implications for activating homeowners and for promoting energy efficiency in each step. Current policies partly choose unrewarding argumentations to stimulate energy efficient refurbishments since they do not take all relevant factors of this consumer decision into account.

Keywords: Energy efficient refurbishments; decision-making process; consumer purchase decision

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1 Introduction

Housing is a sector with high priority in environmental policy. In the energy concept of 2010, the German government sets the target to reduce primary energy demand in buildings by 80% in 2050 to accomplish a “climate neutral” building stock (BMWI 2010). Two thirds of German residential buildings were erected before the first guideline on energetic standards was established in 1977 (BMWI 2014). The majority of these buildings is inefficient and has an energy demand way above current standards. At the same time, construction and demolition rates are quite low, leading to the presumption that today’s building stock is likely to cover a large share of the residential buildings in 2050. Thus, the refurbishment of existing buildings is an important lever for Germany’s energy efficiency objectives. It relies on two pillars: First, reduce heat demand through building envelope refurbishments like thermal insulation of façades, roofs and ground floors as well as replacing windows; second, supply remaining heat demand with efficient and/or renewable technologies. The long lifetime of building components implies that immediate action needs to be taken in order to avoid lock-in into inefficient buildings and building technologies (Hecher et al. 2017). Still, residential heating is dominated by fossil fuels, as oil, gas and district heating cover 80% of heating demand (BMWI 2018). Renewable heating systems like wood pellet heating or heat pumps are only slowly gaining market shares. In addition, the annual refurbishment rate stagnates at 1%. Estimations claim that the rate has to double to meet the envisaged climate neutral building stock in 2050 (UBA 2013). Various policy instruments are available to motivate building owners to reduce the environmental impact of their dwellings. These include: energy advice, energy performance certificates, financial incentives (grants, subsidies, tax credits, low interest loans, third party financing), community or neighbourhood renovation schemes (collective procurement), and marketing and information campaigns (Wilson et al. 2015). However, existing instruments do not succeed in facilitating a comprehensive uptake of energy efficient refurbishments.

Most introduced instruments and policies are influenced by the presupposition that homeowners are motivated to conduct energy efficiency measures (EEM) by the prospect to save energy costs, but are prevented from doing so by capital constraints and uncertainties regarding profitability (Wilson et al. 2015). They mainly focus on the economic rationale, arguing that homeowners perceive EEM as investments (Kastner and Stern 2015). The impact of non-economic factors on the decision is underestimated and uncared for in politics. Policy makers have generally neglected behavioural determinants of individuals’ decision-making such as motivations, attitudes and social norms (Claudy and O’Driscoll 2008). In order to design more effective policies that promote widespread energetic refurbishment activities, it is fundamental to reproduce the decision-making of homeowners (Aravena et al. 2016). Previous research on owner-occupiers’ decision to conduct EEM mainly follows four perspectives:
conventional and behavioural economics, technology adoption theory and attribute based decision-making, social and environmental psychology, and sociology (Wilson and Dowlatabadi 2007). Notwithstanding these approaches, the understanding of the decision-making appears to be unsatisfying (Wilson et al. 2015) and research still needs to be done (Kastner and Stern 2015). To our understanding, a consumer oriented perspective on EEM decision has not been taken so far. Also, most existing studies addressing refurbishment decisions wrongfully focus on one decision stage, not the entire process (Aravena et al. 2016). Hence, this study contributes to literature by associating the EEM decision with extensive problem solving prevalent in high-involvement purchases. The decision is framed in a consumer decision process model, which encompasses the stages: Need recognition, information search, evaluation of alternatives, choice and implementation, usage and assessment. With regard to these decision stages, we improve the understanding of homeowners’ decision-making and derive drivers and barriers as well as leverage points for policy interventions. The study is based on empirical findings gathered through interviews with energy advisers. The majority of EEM discussed with energy advisers in Germany are capital intensive, having a cost range of approximately 5,000 to 50,000 EUR. Energy advice focuses on owner-occupied single-family, detached or semi-detached houses. Around 46% of the 40 million dwellings in Germany are owner-occupied, with single-family houses representing the largest share (Zensus 2011). Their contribution to energy efficiency is crucial. Owner-occupiers are independent decision makers and are directly affected by their decisions’ consequences. Both aspects are to some extent a precondition for the suggested decision framework. Since energy advisers are the information source of the present study, results especially apply to the targeted homeowners.

The remainder of this study is structured as follows. We review relevant literature and propose the conceptualization of energy efficient refurbishments in the frame of a consumer decision process model (Chapter 2). In Chapter 3, the material and method of the own field study are described. Results are presented in Chapter 4 and implications derived in Chapter 5. Finally, a conclusion is given.

2 Background

Numerous conceptual and empirical studies have analysed decisions on energy efficient refurbishments. They agree that owner-occupiers’ decision-making not only includes monetary factors, such as upfront costs or annual energy cost savings, but also non-monetary factors, such as social norms, status, environmental benignity and indoor comfort. Table 1 gives a concise overview of literature findings on homeowners’ motives and barriers.
Table 1 Motives and barriers when evaluating energy efficient refurbishments (Friege and Chappin (2014); Kastner and Stern (2015); Wilson et al. (2015))

<table>
<thead>
<tr>
<th>Motives and Drivers</th>
<th>Barriers and Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic</strong></td>
<td>Residents may</td>
</tr>
<tr>
<td>An energy efficient refurbishment</td>
<td>• drop option due to high upfront costs</td>
</tr>
<tr>
<td>• is profitable</td>
<td>• lack necessary financial resources</td>
</tr>
<tr>
<td>• increases home’s value</td>
<td>• be reluctant to raise a (further) loan</td>
</tr>
<tr>
<td>• reduces energy bills</td>
<td>• be uncertain about pay-back period and energy cost savings</td>
</tr>
<tr>
<td>• provides security against volatile prices, future supply problems and dependency on classic suppliers</td>
<td>• utilizes funding</td>
</tr>
<tr>
<td>• utilizes funding</td>
<td>• increase thermal comfort, convenience, and status</td>
</tr>
<tr>
<td><strong>Non-economic</strong></td>
<td></td>
</tr>
<tr>
<td>• increases thermal comfort, convenience, and status</td>
<td>• think no refurbishment is needed and are satisfied with the home’s current state</td>
</tr>
<tr>
<td>• embellishes the building appearance</td>
<td>• find the retrofit process too complicated and have no interest to deal with it</td>
</tr>
<tr>
<td>• reduces energy demand, environmental impact, and greenhouse gas emissions</td>
<td>• be concerned about the quality of options and the work of craftsmen</td>
</tr>
<tr>
<td>• increases resilience against climate change</td>
<td>• fear increased risk of mould and dampness</td>
</tr>
<tr>
<td>• falls together with necessary maintenance</td>
<td>• argue the right time has not come and fear that refurbishment causes dirt and stress</td>
</tr>
</tbody>
</table>

Although non-economic decision determinants have been established in recent research, approaches to explain EEM decisions still focus on monetary determinants (Zundel and Stieß 2011). Wilson et al. (2014) emphasize that non-monetary determinants are systematically understudied in the area of energetic refurbishments. Klockner and Nayum (2016) conclude that this might bias research findings toward overemphasizing economic determinants. Notably, Zundel and Stieß (2011) propose that most homeowners do not regard energy efficient refurbishment measures solely as an investment but rather as a consumer good. They refer to Gram-Hanssen et al. (2007) who argue that energy efficient refurbishment measures are strongly linked to feelings of convenience and comfort and deliver not only economic profit but also other useful features. Unlike investments, the building is not only perceived as a financial asset and not primarily sought for to earn interest. Owner-occupiers see their building as a home, the focal point of private life and a place to feel comfortable and safe (Gram-Hanssen et al. 2007; Wilson et al. 2015). The installation of thermal insulation or renewable heating systems shapes not only the asset “building” but also creates domesticity (Offenberger 2016). The daily utilization (living in the building) and experience of EEM consequences

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1 The construction of home as a sanctuary is expressed in phrases like “my home is my castle”. Saunders and Williams (1988) discuss the perspective on home in contrast to house.
distinguishes them from investment decisions. Following these arguments, we propose that it may be rewarding to analyse EEM decisions as consumer purchase decisions. In consumer research, an effort continuum is used to cluster purchase decisions, ranging from habitual decision-making to extended problem solving. The level of effort consumers put into decisions depends on the level of involvement (Kroeber-Riel et al. 2011). Involvement is induced by a person’s high perceived relevance of an object, based on inherent needs, values and interests (Zaichkowsky 1985). High perceived risk usually means higher involvement and is present if a purchase has potentially significant negative financial (losses), physical (discomfort) and/or social (embarrassment) consequences (Solomon et al. 2014). High-involvement purchases force the decision maker to deal with the purchase both cognitively and emotionally. The decision requires careful information searching and processing as well as evaluating options before making a final choice. EEM, similar to cars or kitchens, rate as high-involvement purchases, as they meet several criteria that increase involvement (Kastner and Stern 2015). They constitute complicated, unknown, expensive and often innovative products for homeowners. Hence, the decision-making is elaborate and implies extensive problem solving. In addition, EEM decisions have a high ecological relevance, which, due to the long lifetime of building components, shape a household’s ecological impact of the following decades. The choice of the insulation level sets boundaries for heating energy demand and the heating system choice determines the primary energy source and resulting CO2-emissions. Environmental impacts of these decisions can a posteriori merely be reduced by energy saving behaviour in the utilization phase. Bodenstein et al. (1997) claims that environment-related consumer decisions of this type involve an unusually high use of cognitive resources and characterizes strategic consumer decisions by three aspects: long planning horizon, high specific investment and high emotional involvement. Subsequently, we subsume EEM decisions under the definition of environment-related strategic consumer decisions associated with extensive problem solving.

For analysing the purchase of high-involvement products, consumer research most frequently applies structural models (Kroeber-Riel et al. 2011), which may be traced back to Howard and Sheth (1969). These models align a decision process according to several decision stages. The application of decision stages has been carried out by some environment-related decision studies. Lane and Potter (2007) examine the total process of consideration, adoption, use, consolidation and/or rejection for low carbon vehicles. Following Rogers' innovation diffusion model Rogers (2003), Nair et al. (2010b) use a three step model of decision-making to evaluate Swedish homeowners’ adoption of building envelope components. The decision process starts with homeowners’ need for a new building envelope component, leading to information collection and finally the selection of a component. A similar approach is used by Hecher et al. (2017) to analyse the triggers for homeowners’ heating
system choice in Austria. Klockner and Nayum (2016) structure EEM decisions into four stages, which are referred to as “not being in decision mode” (mind-set in the pre-decision phase), “deciding what to do” (people consider alternatives and explore options), “deciding how to do it” (planning gets more concrete and an alternative is prioritized) and “deciding how to implement” (implementation arrangements are made). In these studies, the decision process ends with the implementation, adoption or non-adopter of a refurbishment measure. We see the termination at this decision stage as a weakness since the utilization phase is neglected. A different approach, which in our view (partially) overcomes this weakness is made by Aravena et al. (2016). They study motives of Irish households at three different stages of the EEM decision-making process: (ex ante) motivations for the application of grants; motivations during the adoption of measures; and (ex-post) motivations governing further refurbishment decisions.

In order to cope with a broad range of stages in the decision process, we base our analysis of EEM decisions on a general consumer decision process (CDP) model. The CDP model by Blackwell et al. (2006) represents a widely used structural model and captures the activities that occur when consumers make decisions in a schematic format (cf. Figure 1).² It depicts how different internal and external forces interact and how they affect consumers’ reasoning, evaluating and acting (Blackwell et al. 2006). It helps marketers to analyse how individuals make purchase decisions and to guide communication and sales strategies. When consumers engage in extended problem solving, they usually complete the entire decision-making process: Need recognition, search for information, pre-purchase evaluation, purchase, consumption, post-consumption evaluation, and divestment.³ The objective of our research is then to develop a version of this CDP model that is specifically adapted to describe homeowners’ decision making for EEM decisions and thus captures the key findings of our empirical analysis.

² The first edition was already published in 1968 (Blackwell et al. 1968). We present the CDP model version illustrated in the 2005 edition.
³ Stages are sometimes consolidated leading to five or six decision stages. The steps relevant to our study are briefly described in Table 2 in the appendix.
3 Methodological Approach

Research on eco-conscious strategic consumer decisions has to build on qualitative surveys in order to comply with the diversity and inconsistency of actions and subjective setting of consumer priorities (Bodenstein et al. 1997). For gaining a thorough understanding of homeowners’ decision-making process when conducting EEM, we choose a qualitative research approach. Its objective is to understand the experiences of the participants and to identify underlying reasons (Maxwell 2005). Our approach is based on interviews and complements prior studies, which mainly rely on quantitative approaches.

There are yet two challenges when it comes to interviewing households themselves on their EEM decisions: the first one is recruitment. Since owner-occupiers will on average engage only every twenty to hundred years into extensive EEM⁴, random sampling of households will lead by construction to very low relevant interviewees. Even if recruitment is managed in a more efficient and still non-biasing way, the response rate may turn out to be low due to lack of time etc. The second issue with direct interviews is potential bias: As owner-occupiers are highly involved in the decision, usually lack relevant technical and economical knowledge and are subject to social desirability effects, answers would possibly be biased (Rennings et al. 2013). In pro-environmental behaviour studies, this is commonly described as the attitude action gap (Kollmuss and Agyman 2002). Therefore, energy advisers are selected as the information source for this study. Energy advisers have accumulated knowledge through multiple consultations. This is advantageous for this explorative research, since we can get valuable and detailed insights with a limited number of interviews. Also, as we only interview

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⁴ The lower bound is derived from the average lifetime of heating systems as the most short-lived equipment in that field. The upper bound corresponds to the inverse of the observed refurbishment rate.
supplier-independent advisers, we get a rather unbiased view of owner-occupiers’ decision-making. Advisers reason with homeowners in person and gain direct insight into the considerations, motivations and barriers before, during and after the uptake of energy saving measures. Advice services differ in their duration, depth of analysis and setting (stationary or on-site). Throughout, key elements are the evaluation of the current building status, identification of potential EEM and quantifications of energy savings. In addition, profitability calculations and implementation concepts are assessed. Individual energy consulting is likely to provide the most reliable information in refurbishment decisions (Kastner and Stern 2015). Eventual deficits in knowledge about the outcome of EEM are reduced and make the decision for homeowners more manageable. Consultations generally lead to an investment in more ambitious and qualitatively better EEM (Stieß and Dunkelberg 2013).

During the empirical study, twelve interviews with energy advisers in North-Rhine Westphalia (Germany) were conducted between September and December 2016. Advisers were selected based on their long-time experience, academic background and gender, following purposeful sampling (Patton 2015) (cf. Table 3 Appendix). To get heterogeneous information, we sampled advisers who offer (currently or in the past) initial energy advice, detailed energy advice and door-to-door advice. A semi structured interview guide was prepared, to have a framework of selected themes to be explored, while allowing for new aspects to be brought up during the interviews (cf. Table 4, Appendix). Besides initial questions regarding the adviser, his background and his common advice practice and concluding remarks, where advisers could address unresolved issues, we grouped the interview questions into five subthemes: occasions for energy advice and EEM in general, home-owners decision process and the role of energy advice, motives and barriers for EEM, the role of profitability, the relation of energy advice and implementation of EEM. Within these topics, we altered questions depending on the individual course of conversation. The interviews took 50 minutes on average, were recorded and transcribed. Thereby the interviewed advisers were made anonymous. Subsequently, we used the software MAXQDA for qualitative content analysis and abductive coding of the interview transcripts (Kuckartz 2009). We designed a code system to structure the high complexity and specificity of individual statements. The codes basically comply with the above mentioned subthemes, but entail several subcategories. Remarks were allocated to one or more subcategories. Then, similar remarks within subcategories were aggregated to meaningful propositions and general conclusions from the interviews were drawn and formulated.

As the study is based on a limited number of interviews, the results are not expected to be representative of all EEM decisions throughout Germany. Certain analytical generalizations

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5 Supplier independent energy advice is subsidized in Germany, e.g. by the BAFA.
can nevertheless be generated from qualitative studies (Maxwell 2005). Notably, results have to be regarded in the specific context of energy advice in Germany, where only a small share of homeowners frequents energy advice when conducting EEM (Gossen and Nischan 2014). Arguments for not deploying an adviser are seemingly sufficient knowledge about energy saving potentials and measures, as well as lacking trust in the objectivity of energy advice. Thus, a selection bias might be present, as advisers experience is only based on homeowners who consulted them. Also, advisers’ statements might be influenced by self-serving bias, which represents a limitation to the chosen approach.

4 Key Results

The analysis of the interview transcripts indicates that homeowners consider EEM as consumer durables as opposed to investments. EEM rather compete with amenity renovations like a new driveway, new furniture or a new bathroom than with investments. For example, homeowners do not consider spending their money on stocks instead of insulating the roof.

Our findings are summarized in a modified version of the CDP model given in Figure 2. This developed CDP model for the context of EEM decisions differs from the original CDP (cf. Figure 1) as e.g. stimuli (triggers & occasions) and individual differences are specified. In addition, the decision stages are concentrated and supplement by the stage “backtrack”, implying that homeowners can withdraw from the decision-making and postpone or dismiss the implementation. In the next sub-sections, findings are presented in detail and structured according to the decision stages (cf. Figure 2). Further, we put our findings into context by referring for each decision stage to results established by others that are relevant here and either validated, extended or disproved by our own findings.

Figure 2: Consumer decision process model for energy efficiency measures (EEM)
4.1 Stimuli and Problem Recognition

The starting point of each EEM decision is the homeowner’s recognition of a need or problem. It occurs when “… an individual senses a difference between what he or she perceives to be ideal versus the actual state of affairs.” (Blackwell et al. 2006) In general, need recognition is hardly achieved and constitutes the first barrier for EEM. Many owner-occupiers regard their homes as ideal and do not perceive a demand for alterations (Zundel and Stieß 2011). Misperception or ignorance of the current energy demand and a low salience of energy costs is common (Wilson et al. 2015; Hille 2016). Energy is usually taken for granted and merely reaches consumers upon receiving the energy bill (Hille 2016). A segment of homeowners is not aware of the condition of their home’s insulation or that thermal properties of existing insulation have deteriorated (Nair et al. 2010b). Moreover, procrastination tendencies are obvious, as owner-occupiers tend to argue that the right time to refurbish has not come (Klockner and Nayum 2016).

Our research agrees that in case no extraordinary event occurs, the actual state of affairs does neither require nor provoke changes. If the current heating system has worked for the last decade and has warmed the house, owner-occupiers trust in the old system. Homeowners are deeply rooted in their houses and for some, it is emotionally difficult to alter their homes. There is no need to think about EEM and apathy regarding heat consumption is observable. Even though energy prices have increased over time and maintaining a warm house has become more expensive, it is often not putting enough pressure on homeowners to consider reducing energy consumption. Advisers state that in recent years, the issue of high energy costs as a reason for EEM ceased to persist. However, the annual billing is still raising somewhat the attention level. Notably, cold winters with potentially subsequent payments induce problem recognition and are a reason to consult energy advisers.

Studies agree, that EEM decisions are likely to be launched in the course of replacing broken or worn components and after a change of owner (Stieß and Dunkelberg 2013). Nair et al. (2010b) allege three possible triggers: a components’ ageing (the physical condition, the thermal performance or aesthetic aspects6), the awareness of high energy costs and environmental concern. Hecher et al. (2017) distinguish between problem situations (e.g., technical defects) and opportunity situations (e.g., the replacement of a heating system in the course of refurbishment measures on the building envelope). Referring to problem situations, Wilson et al. (2015) use the term ‘salient events’, which serve as triggers for EEM.

Our findings underpin that the sheer need to replace a building component, which no longer performs adequately, is the dominant reason to conduct EEM. The decision process

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6 Aesthetic aspects are limited to visible components such as windows, roofs and facades, in contrast to, basement ceilings or heating boilers.
literally starts with problem recognition, where deficiencies range from a sordid façade over mould, damp walls and draughts to faulty heating systems. In terms of actually implementing EEM, this kind of need recognition is the most promising, as residents no longer want to bear the situation and thus, a decision and implementation is forced. In contrast, opportunity situations implicate free will and a voluntary decision. A scheduled retrofit is the best opportunity for EEM. All advisers claim that tiling a roof without insulating it is a waste of this opportunity. If owner-occupiers do not integrate thermal insulation, a cost effective occasion vanishes. Another opportunity situation is a planned addition or alteration to the building. These situations are rare, but provide points of leverage for cost-effective refurbishments and thus have to be harnessed consequently. We find that changing living situations are another reason to reflect on EEM. Wilson et al. (2015) also identify transition periods in a household lifecycle as possible triggers. Our results point to two major transition periods. The first encompasses people who recently bought or inherited a house. Usually young couples or families who move into their first own property are thinking about what can or has to be done to guarantee a comfortable home and what budget is available. In principle, a turnover offers the occasion to assess the quality of a building. Here lies a huge potential as new owners are usually planning on living in the building for the next decades. If it is achieved that a complex planning of EEM is done and a refurbishment roadmap is developed, EEMs are likely to be implemented. New owners often want to modify the entire building but due to time or budget constraints rather plan to do it in consecutive steps. This stepwise refurbishment plan is financially and socially more compatible. They start with the most important and postpone further measures. Concerning energy savings, this group is promising, as the outreach (of energy advice) is the greatest since the entire building is considered and a final energy reduction target is set. Yet, if a building is inherited, obvious construction defects are often neglected or accepted. The heir knows that the building served for the last decades and is positive that it can be lived in in the future. Thus, heritage can become an impediment to problem recognition. The second group that considers EEM are settled homeowners (roughly between 55 and 70 years). They have lived in their home for a long time, are financially well off and are eager to prepare the house for retirement. In comparison to younger homeowners, they are often only planning single measures. With reduced living expectations, the willingness to accept long amortisation times reduces. Thus, the energy saving potential in this group is usually smaller. Discussions, e.g., by Thøgersen and Crompton (2009), have questioned whether spillover of pro-environmental consumer behaviour is observable. Our findings suggest, that there are rare occasions where homeowners follow the EEM uptake of neighbours. Family members and other social influences can put the idea of EEM into motion. However, refurbishments do not go viral through a neighbourhood.

4.2 Information Search and Evaluation of Alternatives
Once problem recognition occurs, consumers begin searching for information, internally and/or externally. External sources are mass media or interpersonal channels such as neighbours, friends or energy advisers. The search can either be passive, by simply becoming more receptive to information or active, by engaging in search behaviours. In extensive consumer decisions, the information search and processing phase is most important, as consumers devote considerable time and effort to analyse alternatives (Kroeber-Riel et al. 2011). Homeowners make the decisions to refurbish rarely in their biography and generally cannot rely on internal information. Further, technical and financial details of EEM tend to overwhelm them, leaving them uncertain about what to do. As a consequence, EEM decisions usually involve an external search with interpersonal sources being most important (Nair et al. 2010a). Our findings indicate that it is of utmost importance for owner-occupiers to understand that what they are planning is reasonable and useful. They cannot filter contradicting information and are suspicious about non-personal information sources. Driven by critical media messages, homeowners are bewildered, have doubts and objections. Also, they demand reassurance whether statements of, e.g., the heating installer, are correct, and thus consult independent energy advisers. In the category of passive information, our results suggest that the exposure to thermography pictures helps to raise attention, even if the consecutive stages of the decision process do not follow immediately. The graphical, colourful results are appealing, easy to interpret and can be used as an eye-catcher before an active information search starts.

Independently from the information source, owner-occupiers are looking for information regarding their subjective evaluation criteria, “the standards and specifications used to compare different products” (Blackwell et al. 2006). Depending on the kind of trigger, Hecher et al. (2017) find that economic factors are important in opportunity situations. However, operational convenience, thermal comfort and aesthetic aspects are important as well (cf. Friege and Chappin 2014; Zundel and Stieß 2011). In line with Nair et al. (2010a), Aravena et al. (2016) find that individuals prioritise reducing energy bills over environmental benefits. In the same vein, Organ et al. (2013) conclude that environmental benefits may be a by-product rather than the fundamental motivation for EEM. Hence, environmental consequences are only relevant for individuals with pro-environmental value orientation (Kastner and Matthies 2016) and environmentally concerned homeowners have a higher propensity to implement EEM (Martinsson et al. 2011). Notably, EEM decisions are not driven by one motive, but by an alliance of motives (Stieß and Dunkelberg 2013).

Our empirical results agree that in most refurbishment decisions monetary aspects are essential determinants. However, the main concern is not profitability but financial feasibility.\footnote{This dichotomy has been analyzed deeper as we asked what kind of profitability calculations homeowners or advisers conduct and what individual owner-occupiers understand by profitability.}
Homeowners’ objective is not to choose the alternative with the highest rate of return (or net present value), as it would be with an investment. Considerations focus on which alternative is affordable. Thus, upfront costs outweigh profitability reflections. Especially concerning extensive measures, financial feasibility is the main barrier to EEM. This is aggravated by the fact that homeowners are often not willing to take a loan, even not subsidised low-interest credits. In view of budget restrictions, owner-occupiers rarely conduct comprehensive refurbishments but rather implement single measures. Hence, a promising strategy are stepwise refurbishments: Start with the most important measure and postpone the rest, while keeping the final efficiency standard in mind.

Even if profitability calculations are considered, owner-occupiers tend to be demoralized and overwhelmed by “long” payback periods above 15 years. Given that some building components have a lifetime of 40 years, amortisation times of over 20 years should be acceptable. However, this does not fit into manageable timeframes for homeowners, who like to hear about 3 or 4 years amortisation time. In addition, especially older homeowners fear that they are not much longer able to get on in the house. This uncertainty (of having to sell the house and not being able to profit from a refurbishment) often keeps them from undertaking EEM. Hence, the conservation of value is subordinate, with the exception of a planned inheritance. Yet, a refurbishment is cumbersome, implies dirt and often means too much stress for elderly homeowners.\(^8\)

The majority of homeowners perceives the prospect that less gas or oil is burned after conducting an EEM as saving money. We agree with previous studies (cf. (Aravena et al. 2016), that homeowners rarely reflect on reduced CO2-emissions or environmental benefits and at most, perceive it as a nice co-benefit. Nonetheless, some owner-occupiers are ecologically motivated (often reflected in their entire lifestyle). Ideas to do something pro-environmental are however often shrinking to affordable measures (“backtrack” in Figure 2). Here, homeowners are willing and ready to use wood pellet or solar systems, but financial restrictions prevent them from actually adopting and they stick to conventional technologies. For homeowners, who are not motivated by prospective energy cost savings or environmental benignity, other aspects have the potential to increase the willingness to spend money on EEM (given their financial capability). First, comfort losses like air draught, problems with cold indoor temperatures or enhanced demand for thermal comfort favour the implementation of EEM. Second, visibility of refurbishment activities (e.g., new windows or solar systems), which embellish the building’s appearance or symbolise wealth, support the adoption of EEM. Third, advis

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\(^8\) Wilson et al. (2015) argues the anticipated ‘hassle factor’ of having home life disrupted, while the renovation takes place, is a barrier.
interest in and fascination with new technology is a factor that can upstage monetary aspects in the adoption decision. In this context, one energy adviser claims: "We have to retreat from the cost-benefit discussion of thermal insulation. The focus should not only be on the cost side and on how do I benefit financially. Because thermal insulation has many other benefits which could be stressed instead and pushed forward." (Interview 11) Owner-occupiers regard these non-monetary criteria, which have the potential to upstage financial aspects and foster the diffusion of EEM.

4.3 Choice and Implementation

After opting for a specific EEM, homeowners still need to choose how to implement. With other products, the purchase is influenced by sales persons and point-of-purchase advertising (Blackwell et al. 2006). Consumers sometimes buy something quite different from what they intended or decide not to buy at all, because of what happens during the purchase stage. In the case of refurbishments, mainly artisans and to some extent energy advisers influence the final choice and implementation. Our empirical investigations suggest that homeowners have already made a decision or more specifically, have chosen a certain EEM before approaching energy advisers. They usually seek validation and wish to rationalize prefabricated decisions. Notably, energy advisers struggle to persuade owner-occupiers of alternative, more adequate measures, as they are often not responsive to rational arguments: "It principally is an emotional decision and the energy adviser is frequented in order to check, whether the decision is actually reasonable. But after the possible rational input, the decision is again made emotionally." (Interview 2) Concealed beneath rational criteria, the decision is influenced by emotions, individual dispositions, and rather taken with gut instinct. Sunikka-Blank and Galvin (2016) conclude that there is logic behind homeowners' decision-making, but it is not necessarily economically rational. Our findings reveal that only after the EEM decision is made, homeowners ask whether receiving a grant is an option, implying free-rider behaviour. Here, funding does not trigger the EEM decision, but is willingly embraced later on. However, application procedures for some funds are complicated and time-consuming, which prevents homeowners from using them. The implementation of EMM can still be hampered by lacking access to competent or trustworthy contractors (Weiss et al. 2012). Our findings support that EEM decisions can still be retracted, if no qualified or willing artisan is available. In addition, mistrust regarding artisans or the perception to overpay for mediocre quality can impede the implementation.

4.4 Usage and Assessment

After the purchase, consumers utilize a product and assess the outcome: “Satisfaction occurs when consumers’ expectations are matched by perceived performance. When experiences and performance fall short of expectations, dissatisfaction occurs.” (Blackwell et al. 2006, p.
It is important to ensure homeowners’ satisfaction with the overall process of implementing EEM, including information search, advice services, artisans and post purchase experiences. Unlike investments, thermally insulated building envelope components or efficient heating systems are consumer goods, which deliver a range of useful services (Gram-Hanssen et al. 2007; Zundel and Stieß 2011; Wilson et al. 2015). Owner-occupiers experience the manifold effects and evaluate convenience, comfort and lower energy costs during utilization. For adopters of EEM compared to non-adopters, Aravena et al. (2016) find the increase in comfort is significantly more important in the ex post evaluation. In addition, the authors find that households who experienced energy savings as a consequence of implementing EEM, are more likely to undertake further measures. Homeowners store the outcome of EEM in memory and a positive outcome is necessary to ensure further adoptions. If the assessment turns out positive, the message is likely to be propagated, which might trigger refurbishment activities of others. Yet, if unsuitable measures are taken or measures are implemented badly, dissatisfaction occurs, evokes reservations towards EEM and obstructs activities of others. Therefore it is crucial to reach owner-occupiers early enough in the decision-making process to ensure that gainful measures are conducted. Our findings add, that small, low-cost measures that achieve energy savings or comfort gains might be a promising starting point for more extensive EEM. However, retrofitters often miss to quantify achieved energy and cost savings. E.g., no heat meter is installed with a solar thermal system and it is not possible to evaluate performance. Here lies a large potential to enhance satisfaction, for instance through visualisation of achieved savings or follow up advice including before/after comparisons. With big-ticket items like EEM, consumers often have second guesses regarding the product, which can be subsumed under post purchase regret or cognitive dissonance. In response, a successful strategy to ensure customer satisfaction is the provision of additional information, e.g., toll-free numbers to answer questions, brochures or follow up phone calls.

5 Implications for Efficiency Policy

In the marketing of consumer goods, retailers and manufacturers only succeed when strategic efforts are addressing all stages of the consumer decision process (Blackwell et al. 2006). Hence strategies aiming to facilitate EEM should also consider the decision stages. The specific design of marketing measures or policy interventions is beyond the objective of this study, but is an important area for future research. Nonetheless, from our empirical findings, we derive some tentative recommendations for policy makers to guide promotion and communication strategies for EEM.

Most public policies are trying to influence consumers at the purchase stage through monetary incentives. At this stage, costs and budget constraints are often the limiting factor for undertaking EEM. Hence, we agree on the importance of reducing investment costs, which
can be done through subsidies or reduced-interest loans, as it is already common in Germany. However, prior to that, a broader need recognition is required to enable and accelerate the diffusion of EEM. We limit our recommendations to the decision stage of need recognition, as it is identified as a main barrier to EEM uptake. In marketing, there are two strategies to tackle this problem. First, innovations and product improvements can raise consumers' awareness of unperceived needs. Improving energy efficient products reduces barriers to implement them, as advantages prevail and costs decrease. Also, the level of awareness itself influences adoption of innovative products (Rogers 2003). Several EEM are market-ready but might still not have reached owner-occupiers’ awareness. More attention to the availability and positive consequences of innovative heating systems or efficient building components should be attracted. The communication and advertising could include success stories of individual homeowners to illustrate the benefits. Unfortunately, current German energy policy (information campaigns, funding brochures) focusses on profitability and has largely ignored other benefits of EEM such as increased thermal comfort. Advisers already advertise EEM via comfort aspects and retreat from focussing only on financial aspects. Aravena et al. (2016) confirm that policies stressing comfort gains may be more efficient than those highlighting financial aspects. Hence, to encourage consumers to conduct EEM, it might be rewarding for policies to pay greater attention to increased thermal comfort or reduced environmental impact.

Second, consumers’ recognition of their undesirable current state may induce problem recognition. Notably, awareness of (relatively) high energy bills or a household’s high environmental impact could be enhanced. Concerning low heating energy prices, a first best instrument to internalize external effects of heating energy use, are CO2-prices (e.g. through a tax or certificates). Higher energy prices would raise consumers’ awareness and induce need recognition. Regarding environmental damage, it is possible to change a consumer’s environmental judgement of his current state through social influence (comparison, persuasion). Earlier findings by Hansen and Schrader (1997) or Bodenstein et al. (1997) claim that an awareness that a business as usual attitude aggravates climate change has to be created and greater information efforts are necessary to engender pressure. Campaigns about the possible harmful effects of current behaviours could translate into more eco-friendly decisions (Hille 2016). If owner-occupiers perceive using more energy than necessary as socially wrong, this feeling might internally drive need recognition (Klockner and Nayum 2016). Information strategies should increase homeowners’ awareness of their “invisible” energy use and concomitant environmental impact. Special campaigns, such as door-to-door energy advice or neighbourhood approaches including thermographic pictures succeed in raising problem recognition. Hence, to activate potential renovators, the supply of out-reach

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9 This idea was raised by the interviewed advisers, but e.g. also promoted in the project InnovationCity Ruhr (http://www.icruhr.de), where it was found to be effective for activating EEM (Tappeser and
consulting through energy advisors should be enforced and local craftsmen, chimney sweeps or plumbers could be harnessed for the communication of possible EEM. Wilson et al. (2015) suggest that policies should promote the bundling of EEM into other types of home renovations (amenity renovations). Our results add that a chance to get a ‘foot in the door’ with elderly people is the implementation of barrier-free options in combination with energy efficiency (e.g. new doors). This opens up opportunities for policy approaches advertising bundled renovations. In the long term, a stronger pro-environmental value orientation may be created early on with broad educational measures in school. Another approach is to generate a broad agreement that EEM connote improved status (similar to other consumer goods like new kitchens). This may motivate owner-occupiers to spend money on energy efficiency and facilitate a broader uptake.

6 Conclusions

Widespread energy efficient refurbishment activities are necessary to reduce building energy demand and achieve German carbon reduction targets. Immediate action is needed to avoid lock-in into inefficient buildings and technologies. German politics have tried to motivate individual homeowners to improve energy efficiency of their dwellings, but existing instruments fail to accomplish a widespread adoption of efficiency measures. Hence, a better understanding of the complex decision-making is required. A qualitative research approach was chosen to comply with the diversity and inconsistency of homeowners’ decision-making. Guided interviews with energy advisers were conducted, transcribed and analysed. Against the background of recent studies and our own empirical findings, we find that EEM decisions are not sufficiently explained when treated as ordinary investments. An improved understanding can be reached with the definition of environment-related strategic consumer decisions (Bodenstein et al. 1997), associated with extensive problem solving (Kroeber-Riel et al. 2011).

Kollmuss and Agyman (2002) argue that the question of what shapes pro-environmental behaviour is so complex that it can hardly be visualized through one single model. Yet, we find that the here proposed consumer decision process model (cf. Figure 2) provides an appropriate framework to explain and analyse homeowners’ decision-making. It considers the entire decision-making process including problem recognition, information search and evaluation of alternatives, choice and implementation, usage and assessment. Also, the CDP

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Fromm 2018. In neighbourhood activities, a neighbourhood (300 – 500 households) with a low refurbishment rate and high potential is chosen. In addition, areas with changing owners are picked as low hanging fruits. The residents get a letter from the mayor or another highly renowned person of the city, telling them about the campaign including pictures of the advisers to raise trust. This appeal is supported by public address though media, e.g. newspaper articles. Residents can then approach the organizer to schedule an energy advice service. In addition to the public advertisement, the energy advice is further promoted by a price reduction (by 50%) compared to regular advice costs.
model encompasses the internal information processing, occasions and triggers, environmental influences and individual differences.

Since need recognition is a precursor to action, it is essential to understand what triggers off or prevents owner-occupiers to undertake EEM. For two major reasons, need recognition is a serious impediment for energy efficiency. First, salience of energy expenditures is rather low, because of low energy prices and the only yearly recurring energy bill. Second, owner-occupiers regard their homes as ideal and resilient. As a consequence, they are at ease with domestic energy consumption and do not demand any changes. Notably, unless they face ‘salient events’, the decision-making processes is hardly ever initiated. These events emerge in technical failures, structural deterioration or biographical changes. Subsequently homeowners search for adequate EEM and evaluate alternatives. Within monetary decision determinants, upfront costs are crucial and profitability is secondary. Yet, non-monetary criteria have the potential to upstage monetary aspects and increase the willingness to spend money on EEM. These are, amongst others, enhanced comfort, reduced environmental impact or the use of innovative technologies. Strategies aiming to facilitate energy efficient refurbishments should henceforth consider the entire decision-making process and be targeted accordingly. With regards to evaluative criteria, policies paying greater attention to increased thermal comfort instead of profitability might be more rewarding in incentivizing EEM.

More research is needed to improve and redevelop policy interventions to promote EEM and thus, alleviate climate change. Our results provide first important implications. However, it is essential to acknowledge the limitations of the current study. Primarily, it cannot be concluded from the rather small sample (12 interviews) that every owner-occupier completes the decision-making process when adopting or not adopting EEM. Further, results have to be regarded in the specific context of energy advice in Germany, where only a small share of homeowners frequents energy advisers. The handling of EEM decisions as a consumer purchase decision in future studies, questioning directly owner-occupiers is advisable to test the robustness of our findings.


Rennings, Klaus; Brohmann, Bettina; Nentwich, Julia; Schleich, Joachim; Traber, Thure; Wüstenhagen, Rolf (Eds.) (2013): Sustainable Energy Consumption in Residential Buildings. Heidelberg: Physica-Verlag HD; Imprint: Physica (ZEW Economic Studies, 44).


### Table 2 Consumer decision-making process (Blackwell et al. 2006, Solomon et al. 2014)

<table>
<thead>
<tr>
<th>Stage of the decision process</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem recognition</td>
<td>Problem or need recognition occurs when an individual perceives an important difference between the actual and a desired state of affairs.</td>
</tr>
<tr>
<td>Information search and processing</td>
<td>Information search may be internal (retrieving knowledge from memory) or external (collecting information from peers, family, reference groups and the marketplace).</td>
</tr>
<tr>
<td>Pre-purchase evaluation</td>
<td>Consumers employ different evaluative criteria (standards and specifications used to compare alternative options), that are important to them and decide which options are feasible. They narrow down the field of alternatives before they finally resolve to buy one of them.</td>
</tr>
<tr>
<td>Purchase and consumption</td>
<td>The act of purchasing involves what and where to buy. After the purchase, consumers can use the product immediately or delayed. The correct use of the product influences the satisfaction and how likely consumers are to buy a similar product in the future.</td>
</tr>
<tr>
<td>Post-purchase evaluation</td>
<td>The buying and consumption experience generates satisfaction or dissatisfaction. The outcome is significant as consumers store their evaluations in memory and refer to them in future decisions.</td>
</tr>
</tbody>
</table>
Table 3 List of interviewed energy advisers

<table>
<thead>
<tr>
<th>Interview</th>
<th>Qualification</th>
<th>Gender</th>
<th>Main Occupation</th>
<th>Time of occupation</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Architect</td>
<td>F</td>
<td>Employed (consumer organisation)</td>
<td>About 20 years</td>
<td>Düsseldorf</td>
</tr>
<tr>
<td>02</td>
<td>Civil engineer</td>
<td>M</td>
<td>Employed (consumer organisation)</td>
<td>About 15 years</td>
<td>Oberhausen</td>
</tr>
<tr>
<td>03</td>
<td>Architect</td>
<td>M</td>
<td>Employed (consumer organisation)</td>
<td>About 20 years</td>
<td>Alsdorf</td>
</tr>
<tr>
<td>04</td>
<td>Architect</td>
<td>F</td>
<td>Employed (consumer organisation)</td>
<td>About 10 years</td>
<td>Aachen</td>
</tr>
<tr>
<td>05</td>
<td>Architect</td>
<td>M</td>
<td>Employed (business)</td>
<td>About 10 years</td>
<td>Hamm</td>
</tr>
<tr>
<td>06</td>
<td>Architect</td>
<td>F</td>
<td>Employed (business)</td>
<td>About 5 years</td>
<td>Hamm</td>
</tr>
<tr>
<td>07</td>
<td>Architect</td>
<td>F</td>
<td>Self-employed</td>
<td>About 10 years</td>
<td>Münster</td>
</tr>
<tr>
<td>08</td>
<td>Architect</td>
<td>M</td>
<td>Self-employed</td>
<td>About 10 years</td>
<td>Münster</td>
</tr>
<tr>
<td>09</td>
<td>Architect</td>
<td>M</td>
<td>Self-employed</td>
<td>About 10 years</td>
<td>Gelsenkirchen</td>
</tr>
<tr>
<td>10</td>
<td>Carpenter</td>
<td>M</td>
<td>Self-employed</td>
<td>About 10 years</td>
<td>Düsseldorf</td>
</tr>
<tr>
<td>11</td>
<td>Chemist</td>
<td>M</td>
<td>Employed (consumer organisation)</td>
<td>About 15 years</td>
<td>Bonn</td>
</tr>
<tr>
<td>12</td>
<td>Physicist</td>
<td>M</td>
<td>Self-employed</td>
<td>About 5 years</td>
<td>Duisburg</td>
</tr>
</tbody>
</table>
Table 4 Interview guide (translated; original guideline and interviews were conducted in German)

<table>
<thead>
<tr>
<th>Topic/subtopic</th>
<th>Main questions</th>
<th>Follow-up questions/information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductory Words</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Questions</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Topic/subtopic</strong></td>
<td><strong>Main questions</strong></td>
<td><strong>Follow-up questions/information</strong></td>
</tr>
<tr>
<td>Introduction of interviewee</td>
<td>• Please introduce yourself and tell me how you became an energy consultant?</td>
<td>• Personal information</td>
</tr>
<tr>
<td>Information on adviser</td>
<td>• Please describe how a consultation process usually works - from the first contact to the end of the process.</td>
<td>• Qualification</td>
</tr>
<tr>
<td>and advice process</td>
<td></td>
<td>• How long have you worked as an energy adviser?</td>
</tr>
<tr>
<td>Information on advice-seeker</td>
<td>• Which persons make use of your consultations?</td>
<td>• How many consultations have you performed?</td>
</tr>
<tr>
<td>Interest in energy advice</td>
<td>• How do you rate the interest in or the demand for energy advice and its development in recent years?</td>
<td>• Which type of advice do you mainly conduct?</td>
</tr>
<tr>
<td>Cost of different advice types</td>
<td>• Do you think that the cost of counselling is a problem?</td>
<td>• How many inquiries do you get per week?</td>
</tr>
<tr>
<td>Occasions for energy advice</td>
<td>• When or on what occasion do people come to your consultation?</td>
<td>• <strong>How does the making contact proceed?</strong></td>
</tr>
<tr>
<td>Social influences</td>
<td>• Do any recommendations from neighbours or neighbours’ refurbishments play a role in getting in touch?</td>
<td>• Building types</td>
</tr>
<tr>
<td>General decision-making</td>
<td>• Describe the general decision-making process of refurbishing households from your experience.</td>
<td>• Homeowners, owner-occupiers, landlords</td>
</tr>
<tr>
<td>Advice in the decision-making</td>
<td>• In your estimation, do consultations directly initiate energetic renovations or are consultations more likely to redevelop the outcome of a decision already made?</td>
<td>• Education, income, age</td>
</tr>
<tr>
<td>Decision-making process of retrofitters</td>
<td>• When in this process do people seek advice?</td>
<td>• What do you estimate: What percentage of building owners in your “advice area” know about the possibility of energy consulting?</td>
</tr>
<tr>
<td></td>
<td>• So do the deliberations rather extend already planned activities, change the ranking or set new priorities?</td>
<td>• What percentage of all retrofitters engage an energy consultant?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• What role does the promotion of counselling play?</td>
</tr>
</tbody>
</table>
## Motives and Barriers

**Reasons for seeking advice**

**Important topics**

**Motives**

- Which topics play the biggest role for advice-seekers during the counselling process or which questions are most frequently asked?

- In your experience, is there a ranking of motives and if so, what are the top five motives?

**Barriers**

- How would you describe the decision-making behaviour? Do rational factors or emotional factors prevail?

**Rational or emotional**

- Which motives are (in your opinion) behind the decision to refurbish?

- What are the barriers to refurbishments and what are people’s fears and concerns?

- What formulations bear fruit?

## The role of profitability

**Advice-seekers awareness**

- What do the advice-seekers understand by cost-effectiveness of refurbishment measures?

- How do you present profitability of measures in the consultation and why?

**Presentation of profitability in advice**

- What is your general assessment of the cost-effectiveness of energy-saving measures and which factors have a particularly strong impact on profitability?

**Assessment of profitability**

- Which figures are important to advice-seekers?

- In your experience, what measures are profitable (in which building types and ages)?

## Relation between advice and implementation

**Realisation after advice**

- To what extent do you accompany the implementation after the consultation and are you aware of whether and which measures are implemented?

- In your judgement, what is preventing advice-seekers from implementing certain measures, or which proposals for measures are being rejected?

- Do advice-seekers see your work sceptical or do they face you with trust?

**Rejection of certain measures**

- Are recommended measures implemented or is the advice only used for information?

**Criticism of advice**

- In how many cases does advice lead to refurbishment?

- To what extent is the decision dependent on whether or which measures advice-seekers have considered in advance of the consultation?

## Final remarks

Are there any things we have not talked about yet that you still consider important?
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