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Working Paper

A consumer decision-making process? Unfolding energy efficiency decisions of German owner-occupiers

HEMF Working Paper, No. 08/2017

Provided in Cooperation with:

University of Duisburg-Essen, Chair for Management Science and Energy Economics

Suggested Citation: Baginski, Jan Paul; Weber, Christoph (2017) : A consumer decision-making process? Unfolding energy efficiency decisions of German owner-occupiers, HEMF Working Paper, No. 08/2017, University of Duisburg-Essen, House of Energy Markets & Finance, Essen

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

HEMF Working Paper No. 08/2017

by

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and

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August 2017

UNIVERSITÄT
DUISBURG
ESSEN

Open-Minded

A Consumer Decision-making Process? Unfolding Energy Efficiency Decisions of German Owner-occupiers by Jan Paul Baginski and Christoph Weber

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 alleviate 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; energy efficiency policy

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1 Introduction

Housing is a sector with high priority in environmental policy. E.g., households contribute 26% to Germany's final energy demand and 11% to carbon dioxide emissions (BMWI 2016). Around 83% of consumed energy in households is used for space and water heating. Still gas, oil, and coal based systems plus district heating deliver almost 80% of the consumed energy (BMWI 2016). Renewable heating systems like wood pellet heating or heat pumps are only slowly gaining market shares (BDEW 2014).

The German government has the target to reduce primary energy demand in the building sector by 80% in 2050 (BMWI 2010). The objective is a climate neutral building stock in 2050, which presumes that the building energy demand is low and the remaining demand is supplied by renewable energy sources. Estimations claim that the annual refurbishment rate has to double from currently 1% to accomplish this climate-neutral building stock (UBA 2013). The long lifetime of buildings and building components implies that immediate action needs to be taken in order to reduce energy demand and to avoid lock-in into inefficient buildings and building technologies (Hecher et al. 2017). Two thirds of existing German buildings were built before the first guideline on energetic standards was established in 1977 and are rather inefficient (BMWI 2014). Efficiency standards are high today, but most regulations only apply for new buildings or in cases of extensive refurbishments (EnEV 2015). At the same time, the construction rate is rather low. This means the current building stock is likely to cover a large share of the residential buildings present in the year 2050. Thus, the refurbishment of existing buildings is an important lever for Germany's energy efficiency objectives.

Primary energy and carbon dioxide emission reductions for residential buildings rely on two pillars: First, reducing heat demand through building envelope refurbishments like thermal insulation of façades, roofs and ground floors as well as replacing windows; second, supplying the remaining heat demand with efficient and/or renewable heating technologies. Ideally, both pillars are pursued at the same time (Kastner, Stern 2015). If the potential of these pillars is unlocked, this can contribute significantly to reducing the energy impact of the residential building sector (Bauermann 2016). Various policy instruments based on regulating, incentivizing and informing/demonstrating are available to motivate building owners to improve the energy efficiency of their dwellings (Galvin 2014). Existing instruments include: energy audits and assessments, energy performance certificates or ratings at the point of sale, financial incentives and capital support (grants, subsidies, tax credits, low interest loans, third party financing), community or neighbourhood renovation schemes (collective procurement), marketing and information campaigns (Wilson et al. 2015). However, their success rate is rather low, as the refurbishment rate in Germany stagnates at 1% per year (UBA 2013).

Instruments are thus not sufficient or efficiently designed to facilitate a comprehensive uptake of energy efficient refurbishment measures.

Most introduced instruments and policies are influenced by the presupposition that homeowners are motivated to renovate to save energy and money, but are prevented from doing so by capital constraints and uncertainties regarding energy savings, profitability and contractors quality (Wilson et al. 2015). They mainly focus on the economic rationale as the decision to refurbish is interpreted as an investment decision (Kastner, Stern 2015). Policy makers have generally neglected behavioural determinants of individuals' decision-making such as motivations, attitudes and social norms (Claudy, O'Driscoll 2008). In order to design more effective policies that promote widespread refurbishment activities, it is fundamental to reproduce the, to this point underresearched, decision-making of homeowners (Aravena et al. 2016).

This paper tries to better describe and reproduce homeowners' decision-making process regarding energy efficient refurbishment measures. The decision is embedded in the context of consumer purchase decisions. The study focuses on single-family, detached or semi-detached owner-occupied houses. Their contribution to energy savings is crucial, as around 46% of the 40 million dwellings in Germany are owner-occupied, with single-family houses representing the largest share (Zensus 2011). Owner-occupiers are not only the independent decision maker, but also directly affected by their decisions' consequences.¹ Both aspects are to some extent a precondition for the suggested decision framework.

The remainder of this study is structured as follows. We identify a common model used in consumer theory, consider its use in explaining decisions on energy efficient refurbishments and review current literature (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

2.1 Consumer Decision-making

Research has produced many theories regarding human choice behaviour. They originate from three disciplines in particular: (Behavioural) economics, social psychology (environmental psychology) and sociology (Rennings et al. 2013). Consumer research merges approaches and methods of the three disciplines, to analyse purchase decisions. An effort continuum is used to cluster decisions, ranging from habitual decision-making to extended problem solving, where decision makers employ different approaches, depending on the deployed effort to

¹ Energy advisers focus on single-family, detached or semi-detached houses. Since energy advisers are our source of information, the research mainly applies to these homeowners.

reach a decision (Solomon et al. 2014, p. 146).² 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, p. 342). High perceived risk of a decision usually means higher involvement and is present if a purchase has potentially significant negative financial (financial losses), physical (discomfort) and/or social (embarrassment) consequences (Solomon et al. 2014, p. 148).

According to Solomon et al. 2006, p. 261, high cognitive effort and high involvement characterize extensive consumer decisions. This definition implicates that the decision maker is willing to or forced to become involved and to deal with the decision both cognitively and emotionally. The decision requires careful searching and processing of information and evaluation of options before making the final choice.

Extensive problem solving is found in innovative decision situations and for complicated, new, unknown or expensive products (Kroeber-Riel et al. 2011).³ Like cars or houses, energy efficient refurbishments rate as high-involvement purchases, as they meet several criteria that increase involvement (Kastner and Stern 2015), e.g., upfront costs are high and the functional principle is complex. Thus, the decision process is expected to be rather elaborate and imply extensive problem solving. Bodenstein et al. (1997) claim that environment-related consumer decisions involve an unusually high use of cognitive resources and need to be considered more in depth in consumer research due to their high ecological relevance. Following a common classification of business management decisions, the authors differentiate between strategic, administrative and operative environment-related consumer decisions. Especially the strategic consumer decision is interesting to our study and is characterized by three aspects: long planning horizon,⁴ high specific investment and high emotional involvement. Following the arguments above, strategic environment-related consumer decisions are associated with extensive problem solving. Moreover, strategic consumer decisions are made unfrequently, but shape an individual's ecological impact of the following years and decades. Bodenstein et al. 1997 present the purchase of car as an example of this type of environment-related consumer decision. The authors claim that the resulting environmental damages of the purchase decision can barely be reduced during the utilization phase.⁵

² Habitual decisions entail only little or no conscious effort and purchases are made rather automatically. Impulsive buying decisions are sudden purchases initiated on the spot when seeing merchandise. Decisions of moderate complexity, called limited problem solving, imply only moderate effort and are characterized by the use of proven decision criteria and heuristics.

³ Kroeber-Riel et al. 2011 suggest using the words *decision* and *problem solving* as synonyms.

⁴ Long planning horizon means on the one hand strategic decisions determine the fundamental path of the daily consume routines. On the other hand, they are long-term focused and hardly changeable on short notice.

⁵ Obviously driving less is an option.

We find that energy efficient refurbishment decisions can be subsumed under the definition of environment-related strategic consumer decisions associated with extensive problem solving. The refurbishment decision sets the boundaries for a building's energy performance in the subsequent utilization phase, i.e., the following years and decades due to the long lifetime of building components. The choice of the insulation level sets the boundaries for yearly heating energy demand and the choice of heating system determines the primary energy source and resulting CO₂-emissions. The household's environmental impact can a posteriori merely be influenced by energy saving behaviour (until the next energy efficiency improvement is implemented).

Unlike most studies in this field of research, we do not interpret the refurbishment decision of owner-occupiers as an ordinary business investment. Similar to an investment, the decision requires usually a high budget which is spent and cannot be used for a different purpose anymore nor reallocated later (sunk costs) (Bodenstein et al. 1997). However, unlike financial investments, the building is not only perceived as a (financial) asset and not primarily sought for to earn interest or to be resold under profit. 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; Jakob 2007; Offenberger 2016, p. 6; Wilson et al. 2015).⁶ The high degree of involvement that emerges from owner-occupiers' strong emotional bonds towards their building indicates a clear difference from financial investments. In addition, the daily utilization (living in the building) and experience of the consequences of energy efficient refurbishments constitutes a clear distinction against investments. The installation of thermal insulation or renewable heating systems shapes not only the asset "building" but also the home, thereby creating domesticity (Offenberger 2016, p. 45). Owner-occupiers evaluate the impact of energy efficient refurbishments by physical and emotional experiences and not only on by financial aspects.

For analysing the purchase of high-involvement products, consumer research most frequently applies structural models (Kroeber-Riel et al. 2011). These models may be traced back to Howard, Sheth (1969). The consumer decision process model (CDP) by Blackwell et al. (2006) represents a common structural model (Figure 1).

⁶ 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.

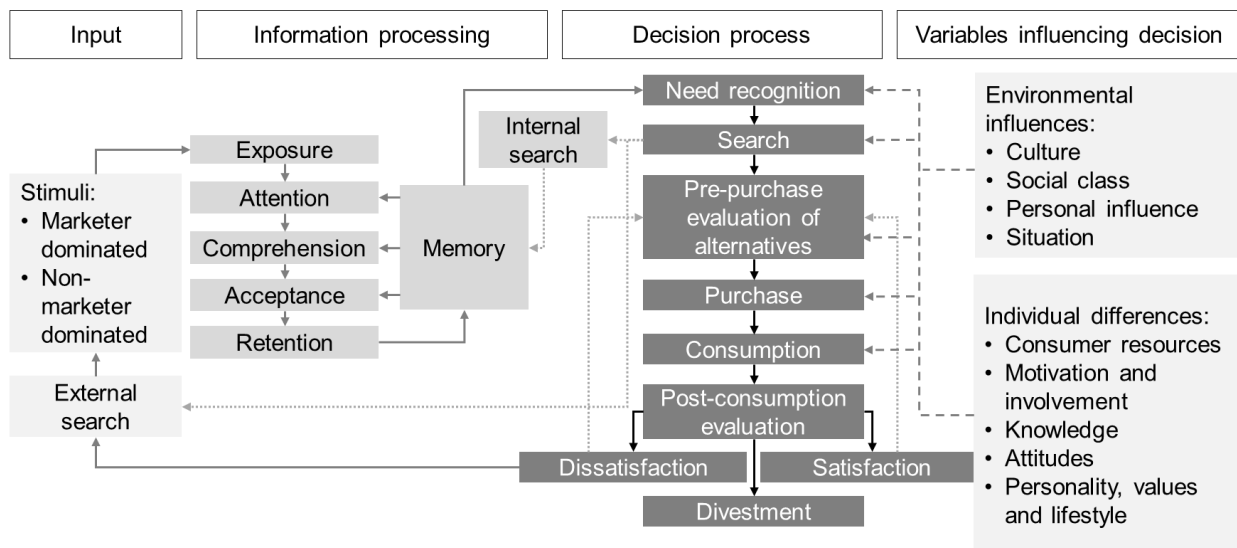


Figure 1 Consumer decision process model; own illustration based on Blackwell et al. (2006)

In a schematic format, the CDP model captures the activities that occur when decisions are made and shows 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 product communication and sales strategies.

According to Wilson (2007), in an applied field like energy efficiency, theories of decision-making have two functions. The first is to explain behaviour and identify important drivers for interventions to target. The second is to provide a framework for empirical research on the impact of these interventions. Kollmuss, Agyman (2002) argue that the question of what shapes pro-environmental behaviour is such a complex one that it can hardly be visualized through one single framework. However, we find that the CDP model, illustrated in Figure 1 provides an appropriate frame to analyse the entire decision-making process regarding energy efficient refurbishments. 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.⁷ Rogers (2003) points out that technology adoption research must consider the decision as a process rather than as a fixed choice at a certain point. Lane and Potter (2007) emphasise the importance of examining the total process of consideration, adoption, use, consolidation and/or rejection when identifying the factors that drive consumers to purchase low carbon products (in their study cleaner vehicles in the UK). The decision steps of the CDP model relevant to our study are briefly described in Table 1 and resumed in Chapter 4. In extensive consumer decisions, the information search and processing phase is most important, as

⁷ Different terms are also used and stages are sometimes consolidated leading to five or six decision stages.

consumers devote considerable time and effort to analyse alternatives (Kroeber-Riel et al. 2011).

Table 1 Consumer decision-making process (Blackwell et al. 2006, Solomon et al. 2014)

Stage of the decision process	Description
Problem recognition	Problem or need recognition occurs when an individual perceives an important difference between the actual and a desired state of affairs.
Information search and processing	Information search may be internal (retrieving knowledge from memory) or external (collecting information from peers, family, reference groups and the marketplace).
Pre-purchase evaluation	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.
Purchase and consumption	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.
Post-purchase evaluation	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.

Homeowners try to make reasoned decisions in order to achieve certain outcomes, but are subject to personal and contextual influences (Wilson et al. 2015). For consumer decisions, these influences are depicted on the right side of Figure 1. Although no reference to the CDP model is made, environmental influences or contextual influences (e.g., building condition, energy prices, investment costs, norms) as well as individual differences or personal influences (e.g., age and income, lifestyle, attitudes towards energy use, knowledge) have been regularly addressed in the literature (for example in Aravena et al. (2016); Jakob (2007), Klockner, Nayum (2016); Michelsen, Madlener (2013); Nair et al. (2010a); Stieß, Dunkelberg (2013); Zundel and Stieß (2011)). These studies primarily use quantitative methods and focus on the explanation of observed or stated preferences. They often involve the pre-and post-purchase evaluation stages. The remaining stages of the decision-making process, as well as the emerging of need recognition (left side of Figure 1) have been addressed rather rarely. Literature findings related to our research are summarized in the next section.

2.2 Research on Energy Efficient Refurbishment Decisions

Research on owner-occupiers' decisions to conduct energy efficient refurbishment measures mainly follows four perspectives: conventional and behavioural economics, technology adoption theory and attribute based decision-making, social and environmental psychology, and sociology (Wilson, Dowlatabadi 2007). To our understanding, a marketing oriented consumer research perspective has not been taken so far. One explanation may be the presupposition that energy efficient refurbishments are mainly seen as investments by homeowners and approaches to explain these decisions focus on monetary determinants (Zundel, Stieß 2011). Wilson et al. (2014) emphasize in their literature review that non-monetary determinants are systematically understudied in the area of energetic refurbishments. Klockner and Nayum (2016) conclude that this fact might bias research findings toward overemphasizing economic determinants. Only Zundel and Stieß (2011) propose that most homeowners do not regard energy efficient refurbishment measures solely as an investment but also 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. Stieß, Dunkelberg (2013) make an attempt to bring previous findings together and merge them into one conceptual model. Their model introduces attitudinal components of the decision maker, like the attitude towards energy efficiency measures, as well as outcome expectations as decision determinants.

Numerous conceptual and empirical studies agree that owner-occupiers' evaluation of energy efficient refurbishments 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 2 summarizes the results of three literature review papers on homeowners' motives and barriers.

Table 2 Motives and barriers when evaluating energy efficient refurbishments (Friege, Chappin (2014); Kastner, Stern (2015); Wilson et al. (2015))

	Motives (also Drivers)	Barriers (also Constraints)
	An energy efficient refurbishment	Residents may
Economic	<ul style="list-style-type: none"> • is profitable • is cost attractive • increases the home's value • reduces energy bills • provide security against volatile prices • utilizes funding 	<ul style="list-style-type: none"> • drop option due to high upfront costs • lack necessary financial resources • be reluctant to raise a (further) loan • uncertain about pay-back period of saved energy costs / the profitability
Non-economic	<ul style="list-style-type: none"> • increases thermal comfort, convenience, and status • embellishes the building appearance • reduces energy demand, environmental impact, and greenhouse gas emissions • reduces risk for future supply problems and dependency on classic suppliers • increases resilience against climate change • falls together with necessary maintenance 	<ul style="list-style-type: none"> • think no (further) refurbishment is needed or are satisfied with the current state of their homes • think the right time has not come, have no interest to deal with that topic and collect information • find the retrofit process to complicated • be concerned about the quality of options and the work of craftsmen • fear increased risk of mould and dampness • be worried that a refurbishment causes dirt and stress

Wilson et al. (2015) claim that most studies wrongfully treat the refurbishment decision statically, as a discrete event or point in time. Correspondingly, studies usually only focus on one decision stage, not the entire process (Aravena et al. 2016). Nonetheless, some recent studies have produced similar ideas and approaches to our study and some findings are depicted in the following paragraphs.

Following Rogers' innovation diffusion model, Nair et al. (2010b) introduce a three step model of decision-making in Swedish homeowners' adoption of building envelope components. In the first stage, homeowners develop a "need for a new building envelope component". Three possible situations to recognise a need are alleged, with the components' age being the driving factor: the physical condition, the thermal performance or the aesthetic value. Aesthetic aspects are limited to visible components such as windows, roofs and facades, in contrast to, e.g., basement ceilings. Furthermore, perceived high costs of energy as well as environmental concern may induce owner-occupiers to consider energy efficiency measures. In the second stage of the model, potential adopters address multiple sources to collect information. The third stage constitutes the selection of a building envelope component.

Owner-occupiers compare alternatives based on their perception of the (to them) relevant attributes and likely choose the alternative with the most perceived advantages. A similar approach is used by Hecher et al. (2017) to analyse private homeowners' heating system choice in Austria. Their focal interests are the triggers behind the adoption of new heating systems.

Klockner, Nayum (2016) develop an approach on the basis of a survey among Norwegian households. Their structuring of energy efficient refurbishment decisions follows a stage-model of self-regulated behaviour change by Bamberg (2013). The four introduced stages 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 all of the presented models, the decision process ends with the decision, namely the adoption and implementation or non-adoption of a refurbishment measure. We see the termination at the decision stage as a weakness since the utilization phase of energy efficient refurbishments is neglected. A different approach, which in our view (partially) overcomes this weakness is made by Aravena et al. (2016). In their article on Irish households' decision-making regarding energy efficiency measures, they study motivations at three different stages of the decision process: (ex ante) motivations for the application of grants, motivations during the adoption of measures and (ex-post) motivations governing further refurbishment decisions. To our knowledge, it is the sole study which examines post-purchase influences on future energy efficient refurbishment decisions. This includes satisfaction or dissatisfaction with non-economic and economic experiences obtained in prior energy efficient refurbishments decisions, conducted by themselves, friends or relatives.

Notwithstanding new approaches, the understanding of the decision-making appears to be unsatisfying ((Kastner, Matthies 2016); Wilson et al. 2015). Kastner, Stern (2015) claim that this research field does not evidence accumulated knowledge and that much research still needs to be done. To our understanding, owner-occupiers' all-encompassing decision-making process to undertake energy efficiency retrofits has not been analysed in depth and research lacks a marketing oriented consumer perspective, which encompasses the entire decision-making process. This study tries to fill this gap by associating the energetic refurbishment decision with extensive problem solving and unfolding the decision with the help of the CDP model. This transfer represents a significant step in order to understand owner-occupiers' decisions and underlying motives to conduct energetic refurbishment measures. It allows policies to be better targeted and provides a framework to explain the impact of these policies. It contributes to this journal's publications on ongoing debates about energy efficiency research and policy implications.

3 Methodological Approach

For gaining a thorough understanding of the decision-making process when conducting energetic refurbishment measures, we choose a qualitative-explorative research approach. Its objective is to understand the experiences of the participants and to identify underlying reasons (Maxwell 2005). Such 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). It thus complements and deepens the majority of prior studies, which rely on quantitative approaches.

There are yet two challenges when it comes to interviewing households themselves on their energy efficiency refurbishment decisions: the first one is recruitment. Since owner-occupiers will on average engage only every twenty to hundred years into such measures⁸, 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). Lane, Potter (2007) conclude that what consumers report as concerns or intentions has often little relation to what they actually do. In pro-environmental behaviour studies, this is commonly described as the attitude action gap (Kollmuss, Agyman 2002). In addition, consumers tend to change their evaluation of a product after the purchase (post-purchase dissonance), especially in high-involvement purchases (Solomon et al. 2006, p.148). Hence, owner-occupiers may stress rather rational criteria (e.g., energy cost savings) in order to explain and justify their decisions.

Therefore, energy advisers have been selected as the information source for the study at hand in order to get a rather unbiased view of owner-occupiers' decision-making.⁹ The advisers have accumulated knowledge through multiple consultations, which is advantageous for this explorative research in order to get valuable and detailed insights with a limited number of interviews. During the consultation process, advisers reason with homeowners in person and gain direct insight into the considerations, motivations and barriers before, during and after

⁸ 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.

⁹ Energy advisers break down national political targets to residential buildings with individual owners. Their advice is an important instrument to encourage the diffusion of energy efficiency and to increase the refurbishment rate. Hence, supplier independent energy advice is subsidized in Germany. The energy advice market is heterogeneous encompassing several actors and various forms of advice. Advice services notably differ in their duration, depth of analysis and setting (stationary or on-site). Key elements are always the evaluation of the current status, identification of energy efficiency measures and quantifications of energy savings. In addition profitability calculations and implementation concepts are assessed.

the uptake of energy saving measures. Their advice reduces uncertainty of expected energy cost savings and reinforces attitudes towards the outcomes (Wilson et al. 2015).

During this explorative empirical study, twelve qualitative interviews with energy advisers in cities of North-Rhine Westphalia (Germany) have been conducted.¹⁰ We have selected experts based on the criteria of their long-time experience in this field, academic background and gender, following purposeful sampling (Patton 2015). In addition, we differentiated advisers in relation to their main form of advice being either initial energy advice, detailed energy advice or door-to-door advice to get a heterogeneous sample. We have asked them to describe motives, beliefs and barriers of homeowners based on their day-to-day experience. We have continued with the acquisition of new interview partners until no substantially new insights were generated. The interviews took 50 minutes on average. The interviews were recorded and transcribed and in the analysis, the interviewed are made anonymous and their names are changed. Subsequently, we have used the software MAXQDA for qualitative content analysis and abductive coding (Kuckartz 2009) to structure the high complexity and specificity of the individual statements. As the study is based on qualitative methods and the number of interviews is limited, the results are not expected to be representative of all energetic refurbishment decisions in residential buildings throughout Germany. Certain analytical generalizations can nevertheless be generated from the study (Maxwell 2005).

4 Key Results

The analysis of the interview transcripts indicates that owner-occupiers consider energy efficient refurbishment measures as consumer durables rather than investments. Advisers state that homeowners rather consider spending money on a new driveway, new furniture or a new bathroom (amenity renovations) instead of spending it on energy efficient refurbishments. We did not observe comparisons of return on capital for instance between purchasing stocks and insulating the roof. This matches the finding of Zundel, Stieß (2011) (see Chapter 2.2) that homeowners do not regard energy efficient refurbishment measures solely as investments but also as a consumer good. Hence, owner-occupiers are likely to evaluate energy efficiency renovations like other consumer goods. The subsequent empirical results of our study are therefore structured according to the decision stages of the CDP model (Figure 1), which is well established to describe and analyse consumer decisions. We furthermore put them into context by referring for each decision stage first to results established by others that are relevant here and either validated, extended or disproved by our own findings.

¹⁰ Aachen, Alsdorf, Bonn, Duisburg, Düsseldorf, Gelsenkirchen, Hamm, Münster, Oberhausen.

4.1 Problem Recognition

The starting point of each refurbishment decision is the consumer'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, p. 71)

Many owner-occupiers regard their homes as ideal and do not perceive a demand for alterations (Zundel, Stieß 2011). Misperception respectively ignorance of the current energy demand and a low salience of energy costs is common (Wilson et al. 2015). 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 and are unaware that thermal properties of the 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, Nayum 2016).

Our research adds the following findings. In case no extraordinary event occurs, the actual state of affairs does neither require nor provoke changes. There is no need, time or willingness to think about energy efficient refurbishments and apathy or phlegm regarding the buildings heat demand is observable. Homeowners do not concern themselves with energy consumption. If anything, they know their monthly payment, but not their yearly energy demand. If the current heating system is reliable, worked for the last decades and warms up the house owner-occupiers trust in this system (the default option is favoured)¹¹ and are not willing to change a running system. Bad press or hearsay from neighbours, whose new heating system failed, supports the trust in old systems. Similar, if the home has served for the last decades, homeowners trust that it will function in the future. For some homeowners, it is emotionally difficult to alter their houses and they perceive change as hurtful. They are deeply rooted in their homes and tend to favour the status quo.

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 the residents to reduce energy consumption. Advisers state that in recent years, the issue of high energy costs as a reason for energetic refurbishments ceased to persist. However, the annual billing is still raising somewhat the attention level. Notably after cold winters with potentially subsequent payments, high heating costs are mentioned as a reason to frequent energy advisers. Hence, extra energy payments can cause problem recognition.

In general, need recognition is however hardly achieved and constitutes the first barrier for energy efficient refurbishments. For a refurbishment decision process to start, an out of the

¹¹ Heinzle 2013 finds that any change from the status quo requires the individual to invest time and effort and many people are reluctant to do that, especially when faced with a complex decision-making process, they tend to either avoid the decision or delay it.

ordinary trigger is needed. The decision is likely to be launched in the course of replacing broken or worn components or after a change of owner (Stieß, Dunkelberg 2013). Hecher et al. (2017) distinguish between problem situations (e.g., technical defects, breakdown of a boiler) and opportunity situations (e.g., the replacement of a heating system in the course of refurbishment measures on the building envelope or in response to subsidies), that lead to need recognition for a new heating system. Referring to problem situations Wilson et al. (2015) use the term 'salient events' and claim that salient events serve as trigger points for energy efficient refurbishments.

Our own research agrees with these findings and adds the following. The sheer need to overhaul or replace one or several building components, which no longer perform adequately (problem situation), is the dominant reason to frequent energy advisers and trigger for energetic refurbishments. The decision process literally starts with problem recognition. Deficiencies range from a sordid façade over mould, damp walls, draughts and condensations to faulty heating systems.¹² In terms of actually implementing efficiency measures, this kind of problem 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 the decision is voluntary. There is consensus that a scheduled general retrofit is the most practical and best occasion for an energy efficient refurbishment. Owner-occupiers are well aware when they retrofit the façade that it is a once in a lifetime thing. All advisers claim that tiling a roof without insulating it is a waste of an opportunity. If owner-occupiers do not integrate thermal insulation, this cost effective opportunity 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 (opportunity) occasion for reflecting on energy efficient refurbishment measures. Wilson et al. (2015) as well identify transition periods in the household lifecycle as possible triggers. Our results point to two major groups or transition periods. The first group 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 to take action. In principle, a turnover offers the occasion to assess the quality of a building and the opportunity for energy efficient refurbishments. 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 the energy efficient refurbishment is done and a refurbishment

¹² If homeowners know their heating system (with the shortest expected operational life span of 20 years among all building components) has to be replaced soon, or have been informed by the chimney sweeper to do so, the thinking process starts and they begin to gather information.

roadmap is developed, energetic refurbishment measures 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.

If a building is inherited, obvious construction defects are neglected or accepted which would very likely be fixed in the case of an alien person buying the building. The heir knows that the building served well 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 energetic refurbishments are settled homeowners (roughly between 55 and 70 years). They have lived in their home for a long time, are financially well off and want to spend money on their home. They 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.

Recent discussions ,e.g., Thøgersen, Crompton (2009), have questioned whether spillover of pro-environmental consumer behaviour is observable. We have asked advisers whether they experienced the need for energy advice as a result from social contagion. Advisers usually do not observe that households motivate each other. It sometimes happens that neighbours follow if one person does something visible to his house or that individuals seek energy advice due to family members spreading information about their own participation in energy consulting. Social influences can put the idea of energy efficient refurbishments into motion. However, refurbishments do not go viral or spread like a wildfire through a neighbourhood.

Our findings further indicate that financial grants are primarily considered in the stage of information search, but can also raise need recognition.¹³ New norms and obligations to upgrade to a certain standard are not found to induce problem recognition, since they usually do not apply for existing buildings. They are rather the frame that refurbishment measures or new constructions need to comply with.

Energy advice is usually not the trigger for the decision-making process. Nonetheless, some activities succeed in raising problem recognition. These are out of the ordinary occasions, like special campaigns, such as door-to-door energy advice or neighbourhood

¹³ In the case of KfW grants, a special expert is needed to certify the planning and implementation of a measure. In this process, an energy adviser is frequented. Usually, a specific measure is already planned.

approaches as well as thermography actions.¹⁴ On the one hand, those campaigns activate residents who do not consider a refurbishment by themselves and who do not think about the energy topic at all. On the other hand, the number of free riders is rather high and the degree of implementation is small.¹⁵ Costs of these campaigns are considerable and the achievements are hardly measurable.

4.2 Information Search and Processing

Once problem recognition occurs, consumers begin searching for information on solutions to satisfy their needs. The search may be internal or external (cf. Chapter 2.1). It can either be passive, by simply becoming more receptive to information or active, by engaging in search behaviour, such as researching on the internet etc. The length and depth of search is determined by variables such as personality, social class, income, size of purchase, past experiences, prior product perceptions and customer satisfaction (Blackwell et al. 2006, p. 79). External sources are mass media and interpersonal channels such as neighbours, friends or energy advisers.

When owner-occupiers have recognised a need, they are often uncertain about what to do and how to do it (Stieß, Dunkelberg 2013). Technical and financial details of energetic refurbishments tend to overwhelm them. Moreover, homeowners make the decisions to refurbish rarely in their biography and cannot rely on internal information. Hence, Stieß, Dunkelberg (2013) argue that decisions with high upfront payments such as building envelope measures involve an external search. Nair et al. (2010b) finds that to the majority of adopters in Sweden, interpersonal sources are most important and only early adopters are likely to react to mass media communication (television or newspaper advertisement).

Our findings add the following aspects. In the category of passive information search, 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.

¹⁴ 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 through 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. This price reduction itself stimulates demand for energy advice.

¹⁵ A challenge in those campaigns is that even though the building structure is similar, each individual household and building may be very different regarding lifestyle, heating system or insulation. Individual homes in Germany tend to be particular cases and results usually are not transferable.

Energy advisers are consulted when the decision process already started and owner-occupiers are searching for information externally. Owner-occupiers have recognised a need but are still sceptical and long for information because they want to do everything right. Our transcripts indicate that it is most important for owner-occupiers to understand that they do something reasonable and useful. Owner-occupiers cannot filter and evaluate contradicting information and are suspicious about non-personal information sources. They need reassurance whether the statement of, e.g., the heating installer is correct. In addition, they want to know what the state of the art technologies are for a specific refurbishment measure. Driven by critical media messages, homeowners are bewildered, have doubts, concerns and objections. These reservations, e.g., increased fire risk or higher chances of getting mould because of insulation, are often addressed. Replacing windows, where humidity problems really can occur because of less (different) ventilation, is paradoxically not seen as critical. The belief that replacing windows is a measure with high energy reduction potential often needs to be corrected. Windows are rather expensive and savings quite small, although individual cases need to be evaluated.

Occasionally, consumers are pressed unexpectedly into the search process, prompted by situational factors beyond their control (Blackwell et al. 2006, p. 79). The urgency of the situation might restrain the amount of time available to search. When a heating system suddenly stops working, consumers need a replacement quickly, especially during the heating period. In such instances, they cannot afford to search extensively and not the best solution is chosen, but the most practicable one.

Independently from the information source, owner-occupiers are looking for information regarding their subjective evaluative criteria for alternative refurbishment options (cf. Chapter 4.3).

4.3 Pre-purchase Evaluation

In this stage, consumers use the information gathered during the search process to compare different products with what they consider most important and decide which options are feasible. Briefly, consumers buy a product when they believe the ability of a product to solve a problem is worth more than the cost of buying. They employ different evaluative criteria, “the standards and specifications used to compare different products” (Blackwell et al. 2006, p. 80).

Quite similarly, the evaluation of energy efficient refurbishment measures is based on several criteria (cf. Table 2 in Chapter 2.2). The decision is not driven by one motive, but by an alliance of motives (Stieß, Dunkelberg 2013). Owner-occupiers apply different criteria and weigh them subjectively, given their individual preferences and attitudes (Zundel, Stieß 2011). Moreover, homeowners’ individual preferences and living conditions change over the years (Organ et al. 2013). This diversity is reflected in the literature findings. Depending on the kind

of trigger, Hecher et al. (2017) find that economic factors are important in opportunity situations. However, operational convenience and access to information and energy consultancy services are important as well. Nair et al. (2010a) find that individuals prioritise reducing energy bills over environmental benefits. Aravena et al. (2016) conclude that environmental benefits are of little concern when making decisions on energy efficient refurbishment measures. Organ et al. (2013) postulate that environmental benefits may be a by-product rather than the fundamental motivation. Kastner, Matthies (2016) find that for heating system decisions, environmental consequences are only relevant for individuals with pro-environmental value orientation. Martinsson et al. (2011) claim that environmentally concerned or altruistic homeowners are more likely to have the propensity to implement energy efficiency measures. Similar, partly contradicting, partly supporting arguments can be found regarding thermal comfort and aesthetic aspects (see e.g., Aravena et al. (2016); Gossen, Nischan (2014); Sunikka-Blank, Galvin (2016); Nair et al. (2010a); Zundel, Stieß (2011)). Sunikka-Blank, Galvin (2016) conclude that there is logic behind homeowners' decision-making, but it is not necessarily economically rational.

Our empirical results exhibit agreement among energy advisers that in most refurbishment decisions monetary aspects are essential determinants. Advisers also agree that the main concern is not profitability but financial feasibility.¹⁶ The objective is not to choose the alternative with the highest rate of return (or highest net present value), as it usually would be with an investment. Considerations rather focus on which alternative is affordable with the given budget. This budget is determined by the homeowners' financial situation and their willingness to take a loan. This means that first of all, the upfront costs are important for owner-occupiers. Profitability or the question "when does it payoff" is secondary. Especially concerning extensive, all-encompassing measures, capital availability (financial restrictions) is the main barrier. Hence, owner-occupiers often do not refurbish the entire building at once but rather conduct single measures. A promising strategy is a stepwise refurbishment, meaning to start with the most important measure and postpone the rest. Many owner-occupiers are shocked when they see the actual costs of refurbishments. After reading advice reports, homeowners tend to be demoralized, since they are overwhelmed by payback periods above 15 years. Given that some components have a lifetime of 40 years, amortisation times of over 20 years are acceptable.¹⁷ However, this does not fit into manageable timeframes for

¹⁶ This dichotomy is analysed deeper as we asked what kind of profitability calculations homeowners or advisers conduct and what individual owner-occupiers understand by profitability. Advisers state that owner-occupiers rarely request profitability calculation but trust on the feeling / their gut instinct that at some point a measure will pay off. A good indicator for homeowners is expected annual energy cost savings. Given the upfront costs, they can roughly estimate amortisation time.

¹⁷ If the payback period is e.g. 29 years and the building components lifetime is 40 years, it is a profitable measure. When at the same time the owner is 60 years old, he has to live another 30 years to generate a profit.

homeowners. They like to hear about 3 or 4 years amortisation time. Only small, low-expenditure measures (e.g., insulating pipes) can accomplish that.

Financially well-situated owner-occupiers, who could afford to retrofit the entire building, often want to spend their money on something else and saving heating costs is not an issue.

Regarding funding, owner-occupiers favour grants over loans. Many homeowners are not willing to take a loan even if it is subsidised and interest is low. If the decision to refurbish (e.g., to replace the windows) is already made, the question is whether receiving a grant is an option. Advisers notice this free-rider behaviour. However, application procedures for some public funds are too complicated and time-consuming, which prevents homeowners from using them.

Homeowners perceive the prospect that less gas or oil is burned (the annual energy demand is reduced) after a refurbishment as saving money. They rarely reflect on the fact that CO₂-emissions are reduced and consequently a refurbishment is environmental friendly. At most, they perceive it as a nice co-benefit. Nonetheless, some owner-occupiers retrofit by conviction and are ecologically motivated (often reflected in their entire lifestyle). In general, homeowners understand and support the idea of reducing their CO₂-emissions. However, they narrow down the field of alternatives to affordable ones and often, environmental friendlier options are dropped. The original idea to do something pro-environmental is often shrinking to affordable measures.¹⁸ Homeowners are willing and ready to use wood pellets and solar systems, but they are often just too expensive and they rather stick to the incumbent technology.

If residents have problems with cold indoor temperatures, no longer want to bear comfort losses (e.g., air draught, leaky windows), or become more demanding regarding thermal comfort, financial aspects of energy efficient refurbishment measures are pushed in the background. People are willing to spend money on a product that satisfies the need of enhanced thermal comfort without thinking about payback. Advisers already advertise energy efficient refurbishments via comfort aspects and retreat from focussing only on financial aspects as this increases success (meaning acceptance of suggested measures).¹⁹

Some owner-occupiers prefer visible refurbishment activities (e.g., solar systems), which embellish the building's appearance and enhance prestige. They replace windows, because new windows look nicer, even if it is energetically not required. They rather tile the roof than

¹⁸ Aravena et al. (2016) finds that homeowners that are motivated by environmental benefits are less likely to complete the desired energy efficient refurbishment measures.

¹⁹ Kastner und Matthies (2016) claim that for certain target groups it might be advisable not to focus on financial incentives when energy efficient refurbishments are promoted.

insulate the basement ceiling, which is unspectacular and invisible. Although owner-occupiers may insulate the basement ceiling by themselves and the measure is not that expensive.

Interest in and fascination with new technology is another factor that can upstage monetary aspects. Technically affine persons are driven to PV-systems, thermal solar systems or heat pumps. A solar heating system, which is often not cost effective, is still something people long for. At the same time, urgent overhauls (rather boring measures) that are better in terms of profitability are neglected or postponed. Homeowners' emotional appeal is higher with innovative technologies and consequently these alternatives are preferred.²⁰ Advisers then suggest doing the more important measures as well (if money is left). However, owner-occupiers have their own mind and ideas. It takes strong persuasive skills to lead people to those measures, which are cost effective and save energy. While technology often fascinates men (new heating systems, smart home), women are more concerned with comfort. Here, gender differences are sometimes visible. Especially when there is not one decision maker but two (generally a couple), with own distinct goals and aspirations some motivational conflicts can occur.

Our results reveal that the conservation of asset value is subordinate. The possibility to sell the house at a higher price is usually not considered, because the refurbishment costs cannot be recouped by selling. In addition, potential buyers might have a different taste. Our findings suggests that older people do not know what to do with their houses. It is not carved in stone that children inherit the house. In addition, the fear is present to be 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 older homeowners from undertaking measures. Further, plans about relocating shortly can stop the decision process. In contrast, if inheritance is likely, refurbishments are more likely. Reasons are the (in general) higher financial capability of the elder family members in comparison to their children. However, a refurbishment is cumbersome and often means too much stress for older homeowners. It implies dirt and unfamiliar people in the house.²¹ Owner-occupiers are sceptical of their own capabilities to manage a refurbishment.

Thermal insulation is a special case in Germany. First of all the amortisation time is rather high, if no regular refurbishment is needed anyway. In addition, other misgivings have become increasingly popular in Germany. TV documentations questioning the usefulness of insulation in general and the profitability in particular lead to huge insecurity, anxieties and prejudices of homeowners regarding insulation. In particular, owner-occupiers fear dampness, mould or fire

²⁰ Organ et al. (2013) finds that owner-occupiers who have a positive emotion towards a specific energy efficiency measure (like replacing the windows) are more likely to undertake that specific measure.

²¹ Wilson et al. (2015) argues the anticipated 'hassle factor' of having home life disrupted, while the renovation takes place, is a barrier.

risk and inflated claims regarding projected energy saving.²² This “anti-insulation movement” (Galvin 2014) has gained support from different architects and media groups. Advisers state that thermal insulation has been quite popular in 2007-2009. After that, hesitations grew and spread. Owner-occupiers are often not able to distinguish between correct and overdrawn information. The opinion that thermal insulation is bad in general is quite popular. When recommending thermal insulation, advisers often face complete rejection and strict opposition. Moreover, thermal insulation does not affect the core functionality of a wall, but rather provides co-benefits (increases the added benefit). Hence, homeowners perceive thermal insulation as a luxury good or a nice add-on.

To conclude, within monetary evaluation criteria of owner-occupiers the upfront costs are crucial and profitability is secondary. This contradicts the assumption of an investment that is guided by the annual rate of return or other profitability indicators (Gates 1983(Hassett, Metcalf 1993). In addition, owner-occupiers regard several non-monetary criteria, which have the potential to upstage monetary aspects and increase the willingness to spend money on energy efficient refurbishment measures. These are amongst other things enhanced comfort, reduced environmental impact, technological innovation and increased visibility. One energy adviser concludes “...that 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) Hidden beneath rational criteria, the decisions is influenced by hidden emotions, individual dispositions, and rather taken with gut instinct.

4.4 Purchase Decision

After deciding to purchase, consumers still need to choose where to buy. The purchase involves in-store choices influenced by sales persons and point-of-purchase advertising (Blackwell et al. 2006, p. 81). Consumers sometimes buy something quite different from what they intended or opt not to buy at all, because of what happens during the purchase stage. Given a perceived positive environment of the purchase, the purchase intention is likely to increase (Solomon et al. 2006, p. 178). Thus, the chance to trigger further purchases rises.

In the case of refurbishments, at the point of sale mainly artisans and to some extent energy advisers influence the decision. Weiss et al. (2012) finds that a lack of access to competent or trustworthy contractors might hamper the final decision to refurbish. Our findings add that an already made decision to refurbish can still be reversed, if no qualified or willing artisans are available. This may increasingly become a barrier in some regions. In addition,

²² See Galvin (2014) or Sunikka-Blank and Galvin (2016) for more information.

mistrust regarding artisans, or the perception that owner-occupiers do not get good quality for what they pay, is an impediment.

Advisers state that in lots of cases, consultees had already made a decision or more specifically, chose a certain refurbishment measure before the advice. They just seek validation for their decision, as there is a tendency to rationalize prefabricated decisions. If the decision is not a good or the best option in view of the energy adviser, it is difficult to argue with owner-occupiers. They are often not responsive to rational arguments. Advisers often identify underlying, hidden emotional influences as they try to find out why a specific refurbishment measure is preferred. However, the energy advisers frequently are capable to modify the decision. This includes notably intensified refurbishment measures, completely different measures, and additional measures. As the personal information by the energy adviser comforts and helps owner-occupiers, the implementation of an energy efficient refurbishment measure is likely to increase. Problems with contractors during the implementation can be tackled through construction support from energy advisers.

4.5 Consumption

After the purchase, consumers can use a product immediately or with some delay. The proper use of the product influences the satisfaction with the purchase and how likely consumers are to buy a similar product in the future (Blackwell et al. 2006, p. 81). If the product is good but not used properly, dissatisfaction may occur. Thus, good use instructions are important. Especially with big-ticket items (like energy efficient refurbishment measures) consumers often have second guesses regarding the product. This type of questioning is called post purchase regret or cognitive dissonance. The higher the price, the higher the cognitive dissonance (Blackwell et al. 2006, p. 81). In response, successful firms provide additional information to comfort customers, e.g., use toll-free numbers to answer questions, provide brochures or follow up with a phone call a day or so after the sale. These tactics ensure that customers are satisfied.

Unlike an investment, thermally insulated building envelope components or efficient heating systems are consumer goods, which deliver not only economic impacts but a range of useful services which are utilized (Gram-Hanssen et al. 2007; Zundel, Stieß 2011; Wilson et al. 2015). Owner-occupiers experience the manifold effects of energetic refurbishments and evaluate the convenience, the comfort and lower energy costs during the utilization phase. For adopters of energy efficient refurbishments compared to those who did not adopt, Aravena et al. (2016) find the increase in comfort is a significantly more important factor in the ex post evaluation. In addition, the authors find that households who experienced energy savings as a consequence of implementing energy efficient refurbishments, are more likely to undertake further measures. Thus, we suppose that small, low-cost measures that achieve energy

savings and/or comfort gains might be a promising starting point for more extensive energy efficient refurbishments.

Our research shows that retrofiters often do not keep track of and quantify the achieved energy and cost savings in the utilization phase. E.g., they do not have a heat meter installed with their thermal solar system and they are not able to evaluate the performance. Here lies a large potential to enhance satisfaction, for instance through visualisation of achieved savings or follow up advice including before/after comparisons.

4.6 Post-purchase Evaluation

In the post-consumption evaluation, consumers experience either satisfaction or dissatisfaction. "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. 83) The outcome is significant as consumers store their evaluations in memory and refer to them in future decisions. Subsequent purchase decisions become easier if the customer is satisfied.

It is important to ensure owner-occupiers' satisfaction with the overall process of implementing energy efficient refurbishments, including information search, advice services, artisans and post purchase experiences. Aravena et al. (2016) find that these aspects are crucial to guarantee further adoption of energy efficient refurbishments. Our findings suggest that if the post-purchase status is perceived as an improvement, the positive message is likely to be propagated and circulates. This again might trigger refurbishment activities of people who are receiving those messages.

On the other hand, if the information search is unrewarding, the information cannot be processed correctly and thus unsuitable measures are taken or measures are implemented badly, dissatisfaction occurs and evokes reservations towards refurbishments. The wrong measures may be harmful and damaging to the house, e.g., because of humidity can no longer diffuse through too dense windows. Technical failures of heating systems lead to problems and bad experiences. These messages will also spread and their influence prevents further refurbishment activities. Hecher et al. (2017) therefore conclude that it is crucial to reach owner-occupiers early enough in the decision-making process to prevent problem situations.

Divestment or disposal is the last stage in the CDP model. Consumers have several options, including outright disposal or remarketing. In the case of energy efficient refurbishments, the product cannot be used for a different purpose anymore or be reused. The decision cannot be annulated and only be taken back under financial losses.

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, p. 83). As the decision-making on energy efficient refurbishment measures of owner-occupiers can be unfold into the stages of a consumer decision process, strategies aiming to facilitate energy efficient refurbishments and to increase the refurbishment rate should consider these stages.

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 the implementation of energy efficient refurbishment measures. 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 (see, e.g., (Kastner, Matthies 2016; Kastner, Stern 2015). Concerning the low salience of energy bills, higher energy prices would raise consumers' awareness and provide financial advantages for energy saving refurbishment measures. Higher energy prices could be induced by higher CO₂-prices (e.g. through a CO₂-tax or certificates).²³ However, we have shown that monetary aspects are only one of many evaluation criteria. In the following, we thus concentrate on non-monetary implications for strategies to promote refurbishments.

For widespread energy efficient refurbishments activities, it is critical to induce problem recognition and to overcome this first hurdle of apathy and neglecting. Refurbishment activities have to go beyond taking action in problem situations. The question is how targeted actions can improve need recognition and thus enable, facilitate or accelerate the diffusion of energy efficiency measures. From our empirical findings, we derive some tentative conclusions and recommendations for marketers and policy makers to guide promotion and communication strategies for energy efficient refurbishments.

There are two major reasons, why need recognition is a general problem for energy efficient refurbishments. First, the low salience of energy costs. On the one hand, energy prices are currently rather low. On the other hand, the energy bill usually comes only once a year and is thus not a highly recurring issue. Second, owner-occupiers regard their homes as ideal, comfortable and resilient. They often prefer the incumbent, more familiar heating system (Hecher et al. 2017) especially for oil and gas based systems (Kranzl et al. 2013). Residential buildings can usually be lived in with hardly any constraints or problems for decades; especially

²³ A recent survey on climate protection in German households by the *Deutsche Umwelthilfe* and *Vaillant* states that a 20% increase of energy prices would prompt around 60% of those polled to contact an expert on how to reduce energy costs. (URL: http://www.duh.de/fileadmin/user_upload/download/Projektinformation/Energieeffizienz/Gebaeude/Umfraageergebnisse_Energiewende-im-Eigenheim_final.pdf, Accessed on July 6th, 2017)

without additional insulation (Jakob 2007). Combining these two, owner-occupiers are mostly satisfied with their home and do not perceive demand for changes. Known from marketing, competitors mostly have a hard time accessing the minds and decision processes of satisfied customers as these customers tend to buy the same products from the same retail (Blackwell et al. 2006, p. 78). Unless owner-occupiers face problems or they change residence, decision-making processes regarding energy efficient refurbishment measures are hardly ever initiated.

Fundamentally, there are two marketing strategies to overcome this obstacle and encourage consumers to see that the existing state does not equal the desired state. First, innovations and product improvements can raise consumers' awareness of unperceived needs or problems and alter consumers' wishes (e.g., attract attention to innovative heating systems). Second, the consumer's recognition of his current state may be influenced and trigger the decision (e.g., attract attention to high energy bills or high environmental impact of the building, dependence on energy supplier). The specific design of marketing measures or public policies is beyond the objective of this study, but is an important area for future research. Nonetheless, a few implications are worth considering, regardless of who is going to enforce them (policy makers, marketers).

Improving energy efficient products reduces barriers to implement them, as the advantages prevail and costs decrease. Marketing can communicate new or improved states and products (e.g., passive houses) and thereby establish consumers' awareness of options they not have considered before. Rogers (2003) finds that the level of awareness of innovative products influences adoption. Owner-occupiers' awareness of energy efficient refurbishment measures might thus lead to greater uptake (Weber et al. 2002). Several refurbishment measures are market-ready but might still not have reached owner-occupiers' awareness. In addition to the improvement and cost reductions of energy efficient products, the communication of their availability and advertising of the positive consequences can facilitate their uptake.

Social values and norms can engender pressure to change behaviour, e.g., to more pro-environmental actions. Through social influence (comparison, persuasion), it is possible to change a consumer's environmental judgement of his current state. Earlier findings by Hansen, Schrader (1997) or Bodenstein et al. (1997) already claim that an awareness that a business as usual attitude aggravates climate change has to be created and greater information efforts are necessary to provoke changes concerning energy efficient refurbishments. Hille (2016) finds that personal norms influence energy-saving behaviour and suggests that campaigns should boost personal norms, e.g., convey the message about the possible harmful effects of current behaviours (such as climate change), which could translate into more eco-friendly decisions. Klockner, Nayum (2016) conclude that if owner-occupiers perceive using more

energy than necessary as socially wrong, and they understand that this is due to the building's bad insulation, this feeling might internally drive the recognition of the need for an energy efficient refurbishment. The authors suggest that with respect to the long-term CO₂-emission reduction strategies in the household sector, a stronger pro-environmental value orientation may be created with long-term measures (e.g., broad educational measures). Hille (2016) adds that information strategies are needed to increase people's awareness of their (to them invisible) energy use and concomitant environmental impact.

Our findings indicate, that the lacking enthusiasm about energy efficiency measures is certainly due to the fact that they do not rank as a status symbol. One adviser claims that "Energetic refurbishment measures should be as fashionable as new bathroom tiles." (Interview 11)

If energy efficient refurbishment measures connote improved status (similar to other consumer goods like new kitchens), they may invoke an image of prestige and prosperity, motivate owner-occupiers to spend money on energy efficiency and facilitate a broader uptake of these measures. The wish for the newest car may be transformed into the wish to own the newest heating system. However, enhanced status as a motive is primarily conveyed via visual perception and thus reduced to visible refurbishment measures (e.g., windows and roofs). Common purchase motives are useful services of a product. People are willing to perform amenity renovations (which never pay back) as they appreciate these things as providing useful services. However, owner-occupiers do not perceive and value energetic measures (which at some point even pay back) in the same way, although energy efficient refurbishment measures offer several useful features. The indoor climate becomes more comfortable, the general living quality improves and the building gets more robust against climate impacts (Jakob 2007). One energy adviser stresses, "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)

These benefits are not emphasized enough in the public discussion about energetic refurbishments. A marketer or the media often play a role in educating consumers about which evaluative criteria they should use (Blackwell et al. 2006, p.79). Unfortunately, the most common evaluative criteria for energy efficient refurbishment measures in Germany has become profitability. Still, the meaning of profitability is often a black box to owner-occupiers (Zundel, Stieß 2011). Our findings show that owner-occupiers do not perform profitability calculations before a refurbishment. Energy advisers usually include these calculations in their consultation. Advisers state that owner-occupiers in theory understand the difference between

the entire refurbishment costs and the purely energy related costs.²⁴ In practise however, owner-occupiers do not approve, if advisers calculate only with energy related costs (see also Galvin (2014)). They ask for calculating with the entire refurbishment costs, as this is the amount they have to spend. If the total costs are considered, the building condition is rather good and energy prices are low, capital-intensive measures have enormous payback periods or do not pay off at all.²⁵ Thus, the common evaluative criteria profitability is rather counter-productive for refurbishment decisions of owner-occupiers. Other benefits must be emphasized and established as evaluative criteria. The promotion of energy efficient refurbishments may be structured similar to the marketing of other consumer durables or luxury goods, as owner-occupiers are willing to spend money without being impeded by lacking profitability.

Kastner, Stern (2015) conclude, that strategies promoting energy efficient refurbishment measures should primarily address those aspects most important to the decision maker. In their review, they find the independence of energy suppliers, thermal comfort, consequences for the environment, financial factors and operation comfort as most frequently associated. Aravena et al. (2016) suggest that policies stressing comfort gains may be more efficient than those highlighting financial aspects in incentivizing energy efficient refurbishments. Regarding heating energy, Royston (2014) claim that it might be valuable for policy, practice and research to pay greater attention to the experiential know-how (i.e., monitor heat flows) used in other energy-using practices, such as lighting, showering or laundering. Likewise Wallenborn, Wilhite (2014) argue that current energy policy has ignored the importance of sensory and physical experiences. Positive impacts of energy efficient refurbishments, which owner-occupiers experience in the consumption or post-purchase stage have high motivational potential. Consecutively, instead of profitability, other attractive experiential features of energy efficient refurbishments such as comfort gains or the reduced environmental impact etc. need to be stressed and thereby product superiority communicated.

Wilson et al. (2015) suggest that policies should promote the bundling of energy efficient measures into other types of home renovations (amenity renovations) rather than try efficiency-only renovations in a narrow market segment of committed efficiency renovators. 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

²⁴ Energy related costs are ,e.g., only the costs for external wall insulation, and not the full costs of a retrofit. These also include the cost of the scaffolding, render and paint.

²⁵ Information are drawn from own calculations. If only the insulation costs are used for the calculation, refurbishment measures are often cost-effective (Zundel und Stieß 2011). However, this only makes sense, if the building has to be renovated anyway (Galvin 2014).

for creative policy approaches aimed at homeowners not considering energy efficient refurbishment. One possibility is to advertise these bundled renovations via increased comfort.

For high involvement products with high perceived risk, marketers need to reduce perceived risk by educating consumers about why the product is the best choice well in advance of the decision (Solomon et al. 2014, p. 148). Existing negative emotions and biases towards refurbishments (fear of mould, lack of trust in energy advice, doubts that energy saving will be realised) need to be corrected in order to regain trust in refurbishments. Aravena et al. (2016) claim, that if psychological factors, such as attitudes and motivations, preclude homeowners from adopting energy efficiency measures, it is crucial to design effective policies aimed at incentivising energy efficiency refurbishments. Organ et al. (2013) find that even if there are positive emotions, an existing negative emotion is likely to override it. Due to loss aversion, individuals overestimate losses, underestimate gains and are more likely to favour the status quo (Heinze 2013). Hence, positive communication about outcome expectations (enhanced comfort, improved status) must be high in order to outweigh perceived losses and risks. Targeting loss aversion, communication strategies stressing incurred financial losses due to not adopting energy efficient refurbishments may be more effective than announcing energy and cost saving potentials.

Following the suggestions of Wilson et al. (2015) and Aravena et al. (2016), information on and promotion of energy efficient refurbishments should be trustable, simple, personally relevant and easily comparable rather than technical and detailed. Kastner, Stern (2015) find that individual energy consulting is likely to provide reliable information. Given the great diversity of buildings on the one hand and owner-occupiers on the other, we agree that an effective measure to support decisions is supplier-independent energy advice. Such consultations generally lead to an investment in more ambitious and qualitatively better energy efficiency measures (Stieß, Dunkelberg 2013). Advisers take the individual building and owner specifics into account and provide a suitable energy saving concept accompanied by financing advice. In order to unlock the potential of energy advice, the interaction between house owners and advisers has to be increased. Unfortunately, energy advice is utilised infrequently in Germany (Gossen und Nischan 2014).²⁶ One possibility may be making it mandatory to contact an energy adviser when undertaking a major retrofit or when selling/buying a residential building. Kastner, Matthies (2016) suggest closer cooperation between the craft business and professional energy advisers, as craftsmen are rated to be the most trustworthy information source in their study. It is crucial to reach homeowners early enough in the decision process in order to avoid the emergence of concerns and bad decisions. In this regard, our findings show that special campaigns, such as door-to-door energy advice or neighbourhood

²⁶ Arguments for not deploying an energy adviser are seemingly sufficient knowledge about energy saving potentials and measures, as well as lacking trust in the objectivity of energy advice.

approaches as well as thermography actions are promising. Hence, to sustainably activate potential renovators, the supply of out-reach consulting through energy advisors and local craftsmen should be enforced. Experts can give a better understanding of the non-financial benefits and create a lasting awareness for the topic. In this way, eventual deficits in knowledge about the outcome of particular measures can be reduced and make the decision for the homeowner more manageable. These campaigns reach residents who do not consider a refurbishment by themselves and who do not think about the energy topic at all. From the beginning of the decision-making process, owner-occupiers perceive a feeling to be able to manage the energy efficient refurbishment measures and understand the several benefits.

6 Conclusions

Widespread energy efficient refurbishments are necessary to reduce building energy demand and achieve carbon reduction targets. The refurbishment decision determines the personal impact on the environment and sets the course for energy savings in the following years and decades, due to the long utilization phase of these goods. The choice of the building envelope's thermal insulation level sets the boundaries for yearly heating demand and the choice of heating system determines the primary energy source and concomitant CO₂-emissions.

Owner-occupiers' decision-making is multifaceted and complex. As a precursor to a greater uptake of energy efficient refurbishment measures, a better understanding of the decision is required. Against the background of recent studies and based on consumer behaviour theory, we describe and analyse owner-occupiers' refurbishment decisions using the CDP model. We find that the decision is not sufficiently explained when framing it as an ordinary investment decision. But an improved explanation 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). Contrary to former explorations, which tend to view the refurbishment decision as a static event, we consider the entire decision-making process, deriving influences and leverage points at the stages: need recognition, search for information, pre-purchase evaluation, purchase, consumption and post-consumption evaluation. Since need recognition is a precursor to action, it is essential to understand what triggers off owner-occupiers to undertake energy efficiency retrofits. Post purchase influences of energy efficient refurbishments are equally important as owner-occupiers evaluate the effects by physical and emotional experiences in their daily utilization and not only by financial aspects.

Analysing energy efficient refurbishment decisions as a consumer decision, we conclude that within monetary evaluation criteria of owner-occupiers, the upfront costs are crucial and profitability is secondary. In addition, owner-occupiers regard several other non-monetary criteria, which have the potential to upstage monetary aspects and increase the willingness to

spend money on energy efficient refurbishment measures. These are amongst other things enhanced comfort, reduced environmental impact, technological innovation and increased visibility. Strategies that promote energy efficient refurbishments must emphasize these benefits and establish them as significant evaluative criteria. Moreover, if there was broad agreement that energy efficient refurbishment measures 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. In order to alleviate climate change, it is necessary to achieve a different perception of energy efficient refurbishments, which can foster their implementation among owner-occupiers.

Introducing the CDP model to the discussion about energetic refurbishments may help to develop strategies and policy instruments that henceforth take the entire decision-making process of homeowners into account. More research is needed to help optimise policies to promote high environmental impact decisions and thus, make crucial contribution to sustainable development. Finally, it is essential to acknowledge the limitations of the current study. Primarily, it cannot be concluded from the rather small empirical study (12 interviews) that every owner-occupier completes the entire decision-making process when adopting or not adopting energy efficient refurbishment measures. The use of this model in future studies questioning directly owner-occupiers is advisable to obtain findings that are more significant. However, our primary focus has been to provide a consistent framework to describe the decision-making process and to structure the empirical evidence obtained from energy advisers. Learning from their experience certainly is a prerequisite to identify effective strategies for political activities.

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