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The Effectiveness of Energy Performance Certificates - Evidence from Germany

CPI Report

Hermann Amecke

Climate Policy Initiative Berlin

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Contact	hermann.amecke@cpiberlin.org

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Executive Summary

Buildings account for about 40% of the final energy consumed in Germany and arguably offer both low-cost and large scale energy efficiency improvement potentials. The Energy Performance Certificate (EPC) was recently introduced to capture this potential by providing information about the energy performance of residential and non-residential buildings to owners and renters.

This study evaluates how effective EPCs have been in helping purchasers of dwellings in Germany to incorporate energy efficiency into their home purchasing decisions. The study both assesses to what extent the EPC is an effective information tool and examines explanations for the effectiveness found. The results are based on a survey of 662 resident owners who have purchased a dwelling since 2009.

The study aims to inform the discussion around the reimplementation of the EPC's underlying directive, the 2010 Energy Performance of Buildings Directive (EPBD). Member States will implement this directive until 2012.

The results of this study suggest that the EPC, as currently designed, has only played a limited role in purchasing decisions in Germany. Following are the key findings:

Purchasers frequently do not use the certificate, despite having a high awareness of it.

- *Results:* 81% of respondents were aware of the EPC, and 78% used the EPC at some point during their home search. However, only 35% of respondents reported that they viewed the EPC for a dwelling that they were closely considering. The EPC was actively promoted to them for 24% of these dwellings.
- *Possible explanation and implication:* Because of the current legal status of the EPC, sellers of existing buildings are only required to display the EPC when requested by the purchaser. This undermines its spread. The update of the European Performance of Buildings Directive (EPBD) requires that sellers will publish the results of the EPC in the building advertisements and that Member States introduce a compliance system for EPCs. This will likely increase the spread and use of the certificate.

Purchasers understand the information but often do not trust or remember it.

- *Results:* Most respondents indicated that they find the information in the EPC understandable. Yet, only a fraction correctly remembered the information on the EPC and only 44% of respondents found the EPC trustworthy.
- *Possible explanation and implication:* An international study found that purchasers are in general very skeptical of information on energy efficiency in the home purchase process and that the EPC is one of the most trusted information sources compared to alternative information sources on energy efficiency. In addition, this CPI study finds that both the trustworthiness and the relevance attached to the EPC significantly increase if it is presented to purchasers more frequently. This implies that the above mentioned update of the EPBD will also likely increase the trust and relevance attached to the certificate.

The EPC does not show the information that purchasers want: financial implications.

- *Results:* The financial implications of energy efficiency matter most to purchasers. Yet, the EPC is perceived as the least useful information source for conveying information about the financial implications of energy efficiency (6th out of 6), trailing, for example, energy utility bills, site visits, external professional advice, and other information sources.
- *Possible explanation and implications:* In Germany, the EPC only shows the energy efficiency of a dwelling by color (green to red) and in kWh/m². The conversion of this information into expected utility costs in EUR requires expertise that most purchasers likely do not have. One remedy could be the inclusion of financial implications in the EPC.

Purchasers do not care strongly about energy efficiency.

- *Results:* Energy efficiency is considered to be only a minor purchasing criterion, ranking 9th out of 13 criteria measured in our survey. The relevance of the EPC is likely limited by the relevance of the purchasing criterion which it informs.
- *Possible explanation and implication:* Home purchase involves a wide variety of criteria of which energy efficiency is only a minor one. Other policy measures as well as enhancing awareness and clarity on future energy prices could increase the importance of energy efficiency among these criteria. This would in turn increase the interest in information instruments that help home purchasers to understand the energy efficiency of their dwelling choices.

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1 Introduction

Buildings account for about 40% of the final energy consumed in Germany (CO₂online/Fraunhofer ISI 2007). At the same time, increasing energy efficiency of buildings is regarded as one of the cheapest forms of CO₂ mitigation (Barker and others 2007). While other forms of mitigation demand substantial net investments, CO₂ mitigation for energy consumption in the building sector would come in part at substantial financial net gains (Levine and others 2007). Yet, numerous market barriers and failures undermine investments in energy efficiency within the housing market (IEA 2008), and as a consequence the building sector fails to meet its potential to increase energy security and environmental protection.

This paper investigates the effectiveness of the European Energy Performance Certificate (EPC) which aims to increase investments in energy efficiency by addressing the issue of imperfect information (EC 2003). The EPC, which will later be described in more detail, is regarded as a cornerstone of the effort to reach the EU's emissions reduction target in the building sector (Ries and others 2009). So far, however, there has been limited research to assess whether the EPC has been effective in moving the housing market towards greater energy efficiency.

The EPC has several objectives against which one can measure the policy's effectiveness. The foremost goal of the EPC is to lower the CO₂ emissions of the building sector. However, the direct effect of the EPC on CO₂ emissions can only be assessed with great degrees of uncertainty. Therefore, this study will judge the EPC's effectiveness with regards to one of its two main intermediary objectives. These are:

1. The EPC aims to increase the rate and scope of building retrofit by highlighting the energy status quo for building owners/occupants and by suggesting options for thermal retrofits.
2. The EPC aims to increase the market capitalization of energy efficient investments by providing reliable information on the energy performance of buildings to potential buyers/tenants.

This paper will concentrate on the second objective and will investigate the private purchasing decisions of resident owners in Germany for existing dwellings, which is an area that has not been much examined to date. Specifically, the study explores:

- a) How effective have EPCs been in helping purchasers of residential buildings in Germany to incorporate energy efficiency into their home purchasing decisions?
- b) What factors explain the current positive/negative results for the EPC?

The paper proceeds as follows. Section two briefly reviews the theoretical and empirical literature on the effectiveness of EPCs. Section three depicts the research approach in more detail. Section four presents the results followed by an in depth discussion, including policy implications in section five. Finally, a conclusion summarizes findings and policy implications.

2 Information Instruments and their Relevance for Purchasing Decisions

2.1 Purpose of the EPC and characterization of its implementation in Germany

Currently, energy efficiency plays only a minor role in purchasing decisions, in part because imperfect information represents a frequent barrier for investments in energy efficiency (IEA 2008)¹. Imperfect information exists because the energy efficiency of buildings is not perfectly visible to the buyer at the moment of purchase and can only be fully experienced after the actual purchase. As a result, buyers are more inclined to concentrate on the immediate price of a property, which is perfectly visible (Lützkendorf and Speer 2005). Since energy efficiency improvements are not fully capitalized through higher home sale prices, sellers do not adequately invest in energy efficiency as a product quality and

buyers are not able to perfectly express their willingness to pay for energy efficient housing (Sanstad and Howarth 1994). This can be one reason for the undersupply of “energy efficiency”.

The European Union established the EPC as a policy measure to address imperfect information in the housing market. Art. 7 of the EPBD, 2002/91/EC, requires that “when buildings are constructed, sold or rented out, an energy performance certificate is made available to the owner or by the owner to the prospective buyer or tenant [...]” (EC, 2003, p. 68). The EPC displays the energy performance of a building with a comparison label, similar to the EU Energy Efficiency Label (see figure 1 & 2). In addition to information on the building’s energy performance, the EPC can also display cost-effective recommendations for investments that would improve the thermal energy efficiency of the building (Weglage and others 2010).

Member States had considerable discretion when implementing the EPC and were, for example, able to decide on the calculation methods of energy requirements and on the inclusion of indicators such as CO₂ emissions. Hence, national implementations of the EPC can differ considerably (for more information on the different designs and implementation view, for example, BMVBS 2010; BPIE 2010). The German version of the EPC uses two different calculation methods for existing buildings between which an owner can partly decide.ⁱⁱ An operational rating (*Verbrauchsausweis*) measures the energy performance based on the past energy consumption of inhabitants, with minor adjustments (figure 1). An asset rating (*Bedarfsausweis*) determines the energy performance using a calculation of the energy efficiency of a building based upon various building characteristics (Weglage and others 2010) (figure 2). Further, the EPC has two different legal statuses for new and existing buildings. While the display of the EPC is mandatory for new buildings, for existing buildings, it is only mandatory upon request by the purchaser/ tenant.

Figure 1: The operational rating form of the German EPC.
Source: (Energieberater, 2010b)

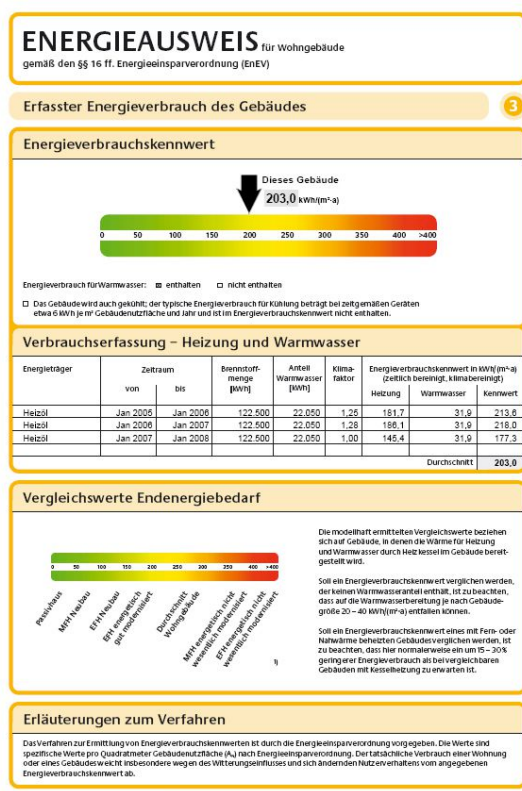
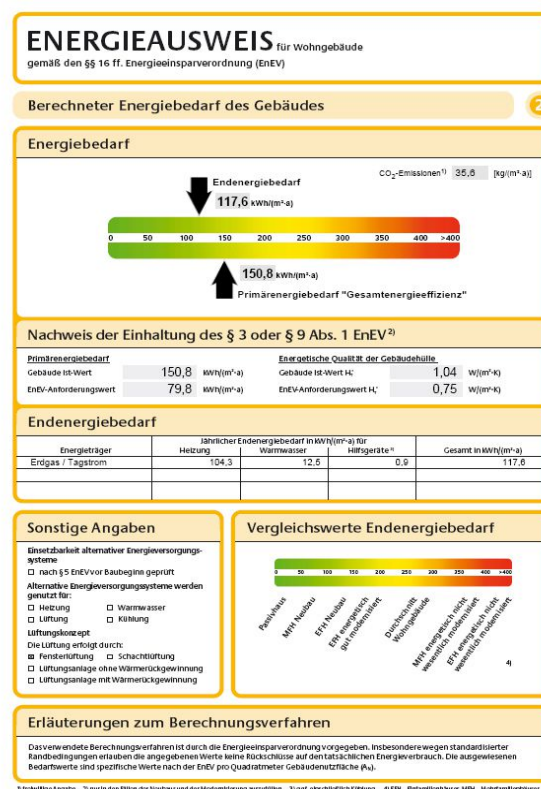


Figure 2: The asset rating form of the German EPC.
Source: (Energieberater 2010)



2.2 Current knowledge and debate on the impact of the EPC

Conceptual debate

Proponents stress that information programs such as the EPC have the potential to overcome imperfect information and in turn influence the purchasing decisions of costumers (e.g. Clinch and Healy 2000; Harmelinck and others 2008; Wiel and McMahon 2005). In line with the rational actor theory, the EPC is expected to influence purchasing and renting decisions by revealing reliable information on the energy efficiency of a building (Sanstad and Howarth 1994). More precisely, owners of buildings should conceptually be more inclined to invest in energy efficiency because a) their awareness of the energy efficiency of their buildings is increased, b) the performance certificate provides information on cost-efficient renovation methods, and c) investments in energy efficiency potentially translate into higher property value.

Theoretical arguments against positive the impact of labels on purchasing decisions for the building sector highlight that while information programs can potentially work in other markets, such as the household appliance market, the housing market is structurally different (Beerepoot 2007). The housing market, unlike the market for electric appliances, is demarked by scarcity and heterogeneity, which implies that households rarely choose between similar objects (O'Sullivan 2007). As a result, energy efficiency as a criterion of minor importance cannot play the same role for buildings as for electronic appliances even if energy efficiency is perfectly visible to the purchaser. Yet, most of the theoretical debate on the impact of labels concentrates on labels in general or on appliance labels in particular but not on energy efficiency labels for buildings.

Empirical Evidence

As in theoretical literature, the empirical literature on the impact of comparison labels on purchasing decisions in the private housing market is so far scarce. Much empirical evidence exists for other markets, which generally supports the effectiveness of information programs (e.g. Banerjee and Solomon 2003; Gillingham and others 2006; Stavins 2002 ; Wiel and McMahon 2005). Since the housing market differs from these other markets, these studies may however not be relevant.

Few empirical studies on the relevance and usefulness of the EPC for purchasing parties are known to the author:

- A German survey among 151 potential purchasers and tenants found that 42% stated that the EPC informs well about the energy quality of a building (N= 68) (BMVBS 2010). Interestingly, 30% of respondents believed that demanding the energy performance certificate was potentially disadvantageous in the purchasing process, because it puts the potential purchaser in a less favorable position (N=90). Yet, the study did not attempt to draw conclusions about the relevance of the EPC to the actual purchasing decision.
- A study in the UK investigated a panel of 2000 adults, 500 of whom had moved into a new dwelling within the last five years. The study found that respondents thought that the EPC was understandable, yet responses to a direct question about the influence of the EPC on purchasing decisions indicated that most respondents did not act on the information provided by the label (Lainé 2011).
- A large cross-country survey by Adjei and others (2011) found that the results of the EPC were not used as a negotiation instrument in the purchasing process, but were a relatively trusted information source (Adjei and others 2011). In addition the study found that the EPC was only rarely available during the purchasing process in Germany.

There are also only a few studies on the impact of the labeling programs on retrofit investments. Most studies found only a modest to no effect of the label (e.g. Adjei and others 2011; Beerepoot 2007; Gram-Hanssen and others 2007; Hansen Kjaerbye 2008; Lainé 2011; Lund 2007; NHER 2009). However, the validity of these findings with regard to the focus of this paper is limited. First, renovation decisions arguably differ from purchasing decisions. Additionally, most studies, with the exception of Adjei and others, were conducted in different countries with different market structures.

This paper aims to partially fill the current knowledge gap by presenting the results of a large-scale survey among private purchasers of existing dwellings in Germany. The survey examined several indicators for the effectiveness of the EPC. Further, the results of the study allow for investigating explanations for the effectiveness found and potential policy implications for an improvement of the EPC.

3 The Design of the Study

3.1 Population and sample

The study aimed to contact resident owners of existing dwellings (new constructions have different energy efficiency regulations) who have purchased a dwelling since 2009, when the EPC became mandatory for residential buildings. In addition, the study focused on existing dwellings because they constitute the highest share of energy consumption in the building sector (CO2online/Fraunhofer ISI 2007).

58,228 former users of the internet portal for the largest real estate market in Germany, immobilienScout24, were selected for the potential research sample fulfilling the requirements above. These users were subscribed to immobilienScout24 but ended their online search after January 2009. It was assumed that a large share of this sample had ended their search because they had successfully found a dwelling.

The survey was sent out via e-mail on the 12th of July, 2010 and closed by the 21st of July, 2010. Of the 2056 recipients who started the survey, 1239 completed it. However, the rate of non-response cannot be accurately determined. Immobilien Scout GmbH reported that about 25% of the mails had not been opened by respondents at the time the questionnaire closed. In addition, the share of actual purchasers of dwellings in the total research population was unclear, as immobilienScout24 does not gather data on whether an actual purchase was made. Therefore, the e-mails included a preselecting question which asked respondents to only take part in the survey if they had purchased a dwelling since January 2009. Hence, reasons for non-response were diverse and do not necessarily imply a self-selection bias.

The actual sample used for the analysis was significantly smaller than the 1239 responses because of the following pre-selection prior to the analysis. First, the opening questions of the survey controlled for whether respondents had built a new dwelling, bought a dwelling for commercial purposes, rented a dwelling, or bought a dwelling before January 2009. For these respondents the survey was terminated immediately. Additionally, respondents who indicated that they were still searching for a dwelling were excluded. Respondents who lived in a landmarked building or who purchased a holiday home were also taken out of the sample because of different legal requirements. The analysis also excluded respondents who indicated that they did not actively participate in the purchasing decision process. In addition to controlling for these selection variables, all completed surveys were tested for random response patterns (diagonal or straight lines) that indicated a lack of motivation in the respondent. Further, some respondents seemed to have mistaken the survey's Likert Scales (1 to 7; 1 standing for worst performance) for the German grading system (1 to 6; 1 standing for best performance), despite the labeling in the survey. Answers which stated that the number of plugs and the type of internet connection were much more important than location, size, condition of the building, and price were taken as an indication of such misunderstanding and were excluded from further analysis (some qualitative responses further confirmed that this misinterpretation was indeed happening). The final sample of respondents used for analysis was 662.

3.2 Survey design

Choice of method

There are two main options for empirically assessing the effectiveness of the EPC for the purposes of this study's research question. The first option studies 'revealed preferences' and assesses, for

example, whether the EPC leads to a higher resale price of energy efficient buildings. Despite the potential of this approach, it has not yet been conducted for purchasing decisions, mainly due to data and methodological difficulties. The second option, which this study follows, analyses 'stated preferences' by interviewing market participants. This method assesses the perceived effect of the EPC on purchasing decisions. A variety of questions were asked so as to verify responses and their plausibility through cross-checks.

Indicators for the effectiveness of EPC

The study assumes that the following indicators will yield positive results if the EPC was effective in helping purchasers of residential buildings to incorporate energy efficiency in their home purchase decisions:

- a) Awareness of the EPC
- b) Use of the EPC
- c) Understanding of the EPC
- d) Trust in the EPC
- e) Perceived usefulness of the EPC
- f) Self-indicated relevance of the EPC
- g) Recommendability of the EPC to friends

To explain the effect attributed to the EPC by these responses, the study further investigated two contextual factors explaining the relevance of the EPC: first, the legal status of the EPC, and second, the importance of the purchasing criterion which the EPC informs, "energy efficiency".

Structure of survey and handling of data

The survey was structured into six main parts. The first determined whether respondents belonged to the envisaged research population. The second captured how purchasers made their purchasing decisions in general. The third focused specifically on energy efficiency. The fourth part examined the value, understanding, and trust attached to the EPC and determined how often it was displayed and used. The fifth targeted demographic variables. Last, two questions about the two different forms of the EPC were added after the launch of the survey as a reaction to qualitative comments. The survey used a mix of Likert scales (scale of 1 to 7), closed ranking, and categorical questions. Answers to Likert scales were handled as interval data (as discrete numerical data).ⁱⁱⁱ

4 Results of the Survey

4.1 Indicators for the impact of the EPC

As mentioned above, this paper defines an effective information instrument to be one that is a) known and b) used by purchasers. Further, the information contained shall be c) understood and d) trusted by purchasers, and e) the information should be useful to purchasers. Finally, an effective information instrument is judged by purchasers as highly relevant and recommendable to others.

The following section will assess how the EPC performed across these criteria. In addition, it will explore further contextual factors for the found effectiveness.

Awareness (a) and Use of the EPC (b)

Respondents indicated a high awareness of the EPC. 81% of respondents stated that they knew of the certificate, 77.8% indicated that they used the certificate at some point during their search process, and 34.7% stated that they viewed the certificate for a favorite dwelling.^{iv}

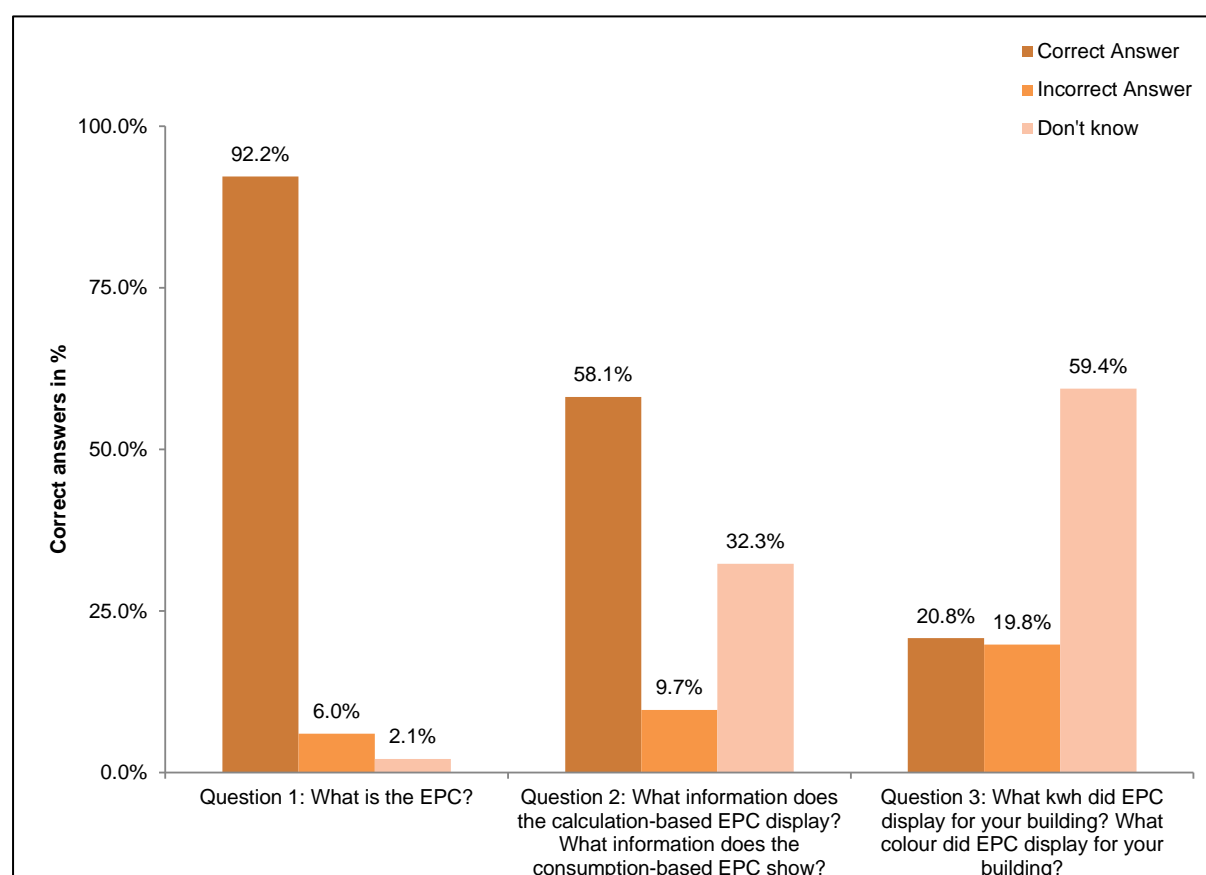
Understanding (c)

In order to test how understandable the EPC was for purchasers, respondents were asked how much they agreed with the statement, "I find the information in the EPC understandable," indicating their answers on a scale from 1 to 7 (1=completely disagree; 7=completely agree). Their answers indicate that the information displayed on the EPC is fairly understandable ($M = 4.73$, Mode = 5).

Three further questions sought to determine how well respondents understood the information provided by the EPC (figure 3). First, respondents were asked how well they understood what type of information the EPC displayed. 92.2% of the respondents who indicated they were aware of the EPC correctly answered this multiple choice question. The second question asked a subsample of respondents whether they understood the difference between the two forms of the EPC, the operational rating (*Verbrauchsausweis*) and the asset rating (*Bedarfsausweis*). 58.1% of these respondents answered correctly.

A third question determined how well respondents remembered the information provided by the EPC. This test was divided into two sub-questions. First, respondents^v were asked whether they remembered how well their dwelling performed on the colored label. Respondents were provided with the different color categories of the label as well as a 'don't know' option as answer categories. The second question asked if respondents remembered how well their dwelling performed in kWh/m²/a, which is also noted on the label. The survey collected open text data here, and included a 'don't know' option. The answers to the color scheme question and the kilowatt hour question were subsequently compared, and if answers corresponded, this was considered to be an indication that respondents remembered the information well.^{viii} 20.8% of respondents were able to answer this question correctly.

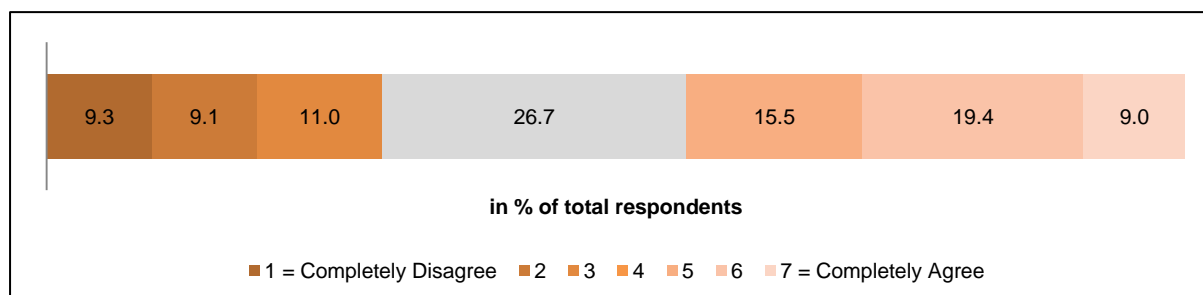
Figure 3: Responses to three questions about respondents' understanding of the EPC. Question 1 and 2 were multiple choice questions. Question 3 included two questions with subsequently matched answers.



Trust (d)

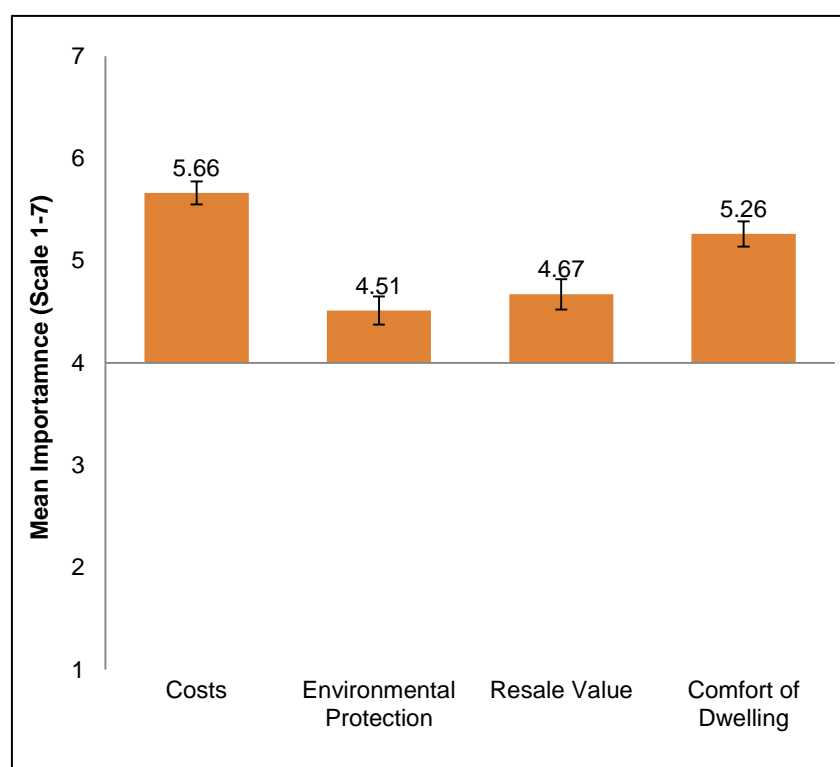
The survey also aimed to elicit the level of trust attributed to the information provided by the EPC. Respondents rated the trustworthiness of the EPC at a mean of 4.24 and a mode of 4 (scale 1 to 7) (figure 4). Further, a sub-sample of purchasers of existing buildings was asked which rating form of the EPC they found to be more trustworthy. The results revealed equal trust attached to both forms.

Figure 4: Respondents were asked to rank their agreement with the statement: The information in the EPC is trustworthy on a scale of 1 (completely disagree) to 7 (completely agree). Overall, 44% of respondents found the information in the EPC to be trustworthy.

*Perceived usefulness of the EPC (e)*

In order to determine whether the EPC was useful, purchasers were asked to indicate why energy efficiency was important to them (if at all). Respondents were able to rate four reasons for caring about energy efficiency on Likert scales: a) running costs, b) environmental protection, c) resale value, and d) comfort of dwelling.^{viii} The question was only posed to respondents who valued the importance of energy efficiency to their purchasing decision above a rating of 1. The financial implications of energy efficiency were clearly the most important reasons for purchasers to consider energy efficiency in their purchasing decision, followed by the comfort of the dwelling (figure 5).

Figure 5: Responses to question: how much do you agree (on scale 1 to 7)? Energy efficiency plays a role in my purchasing decision because of...



Respondents were subsequently asked which information sources were most useful in understanding the financial implications of energy efficiency. The EPC was the least important information source and was significantly less useful than energy bills^{ix}. It performed slightly better when respondents were asked about the usefulness of the EPC for understanding energy efficiency in general (figures 6, 7).

Figure 6: Responses to question: how well were you informed by the following information sources about costs from utilities (from electricity, water, gas)^x for the building (scale 1 to 7)? EPCs were the least useful information source for disclosing such information.

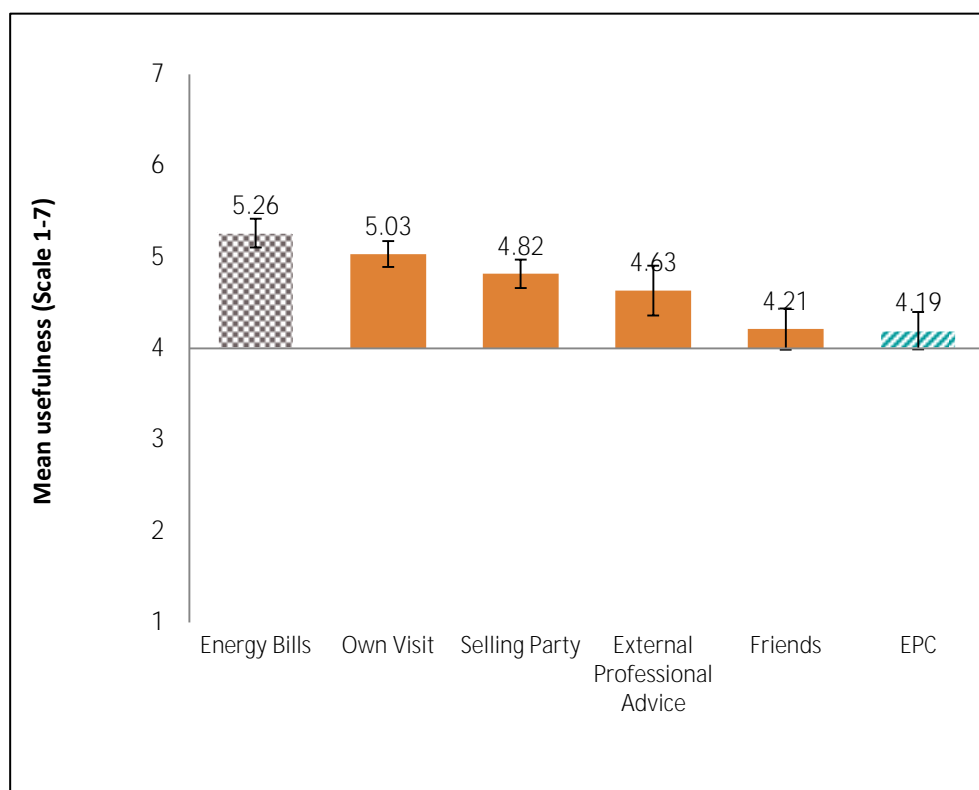
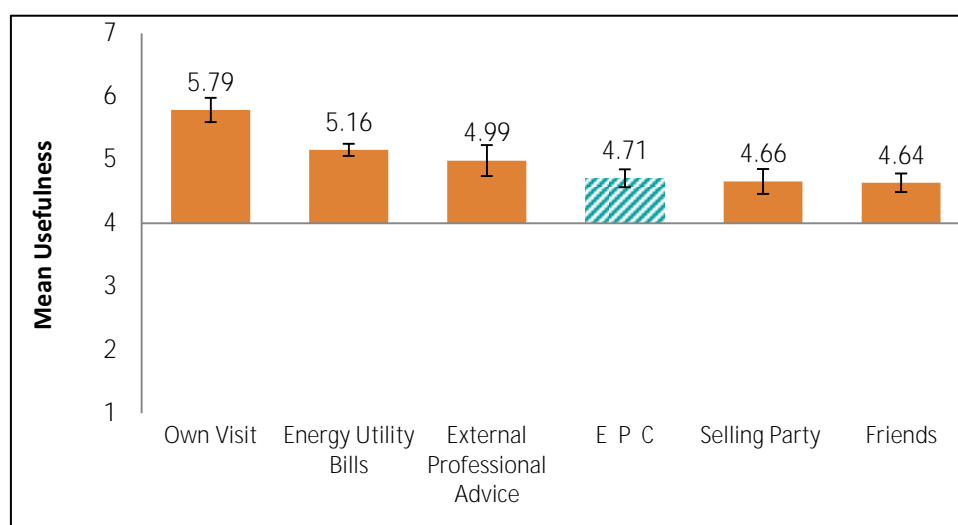


Figure 7: Responses to the question: How well were you informed by the following information instruments about the energy efficiency of a dwelling (scale 1 to 7; 1 stands for extremely poorly, 7 extremely well)? EPCs were found to be less useful than energy bills in disclosing energy efficiency information.



Self-indicated relevance of the EPC

Respondents indicated that the EPC played only a minor role in their purchasing decision. Respondents were asked to rate the relevance of different information sources to their purchasing decision on a scale of 1-7, where 1 stood for extremely irrelevant and 7 for extremely relevant. The EPC was only a minor purchasing criterion, as displayed in figures 8 & 9, with a mean of 4.35 and a mode of 5.

The EPC was even less relevant when compared to an alternative information source solely dedicated to energy efficiency--'energy utility bills'.^{xi} Interestingly, EPCs were significantly more relevant for new buildings, where energy utility bills are not available.^{xixiii} However, this difference can be explained through various contextual factors. Despite the relatively low relevance of the EPC, 64% of respondents would recommend the EPC to friends (20% would not recommend it and 16% were neutral).

Figure 8: Distribution of responses to the question "How relevant were information sources to your purchasing decision on a scale of 1 (extremely irrelevant) to 7 (extremely relevant) in %. Especially in comparison to other information instruments, the EPC was regarded as a rather irrelevant information source.

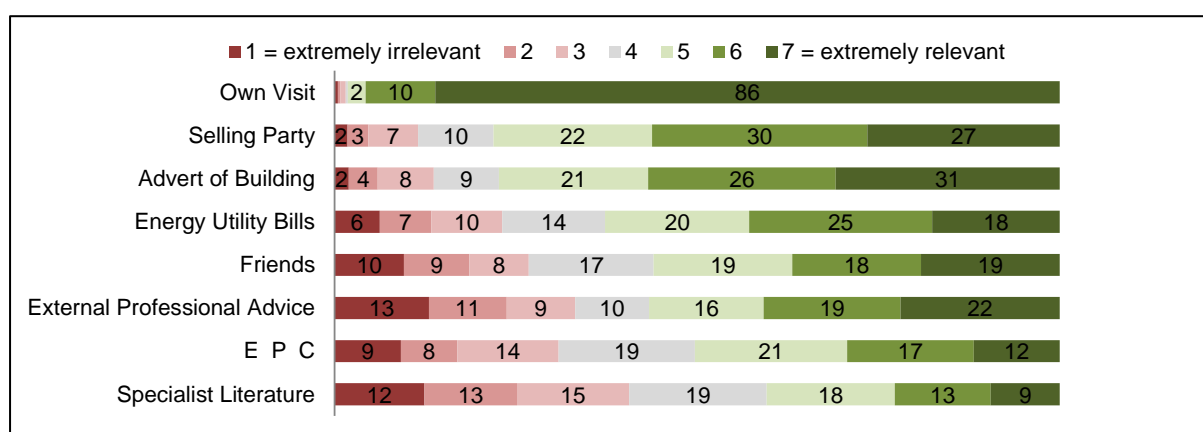
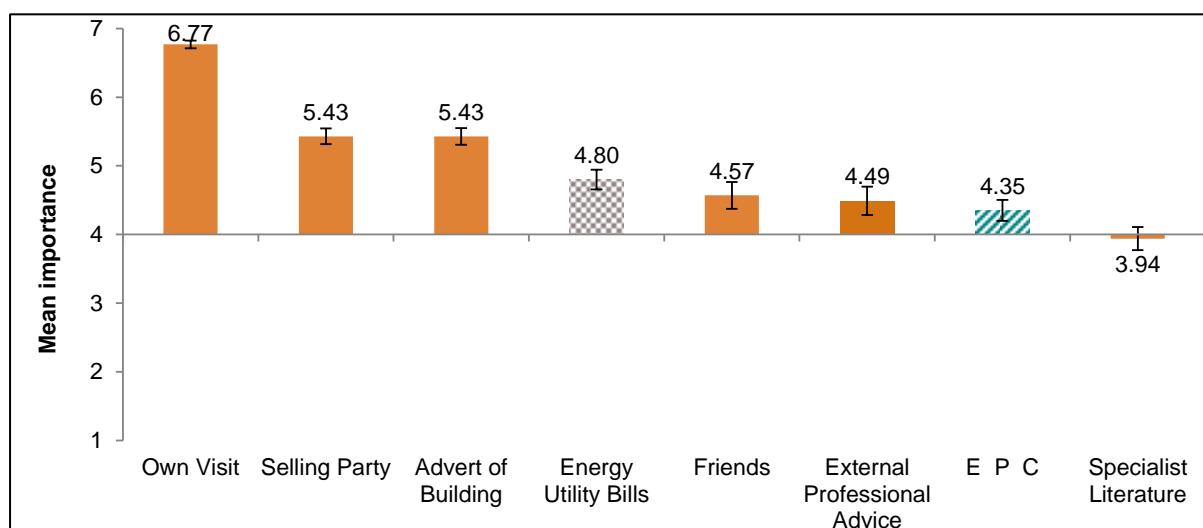


Figure 9: Responses to the same question as above; here depicted as the average score: How relevant were the information sources listed below to your purchasing decision on a scale of 1-7 (1 stands for extremely irrelevant; 7 stands for extremely relevant)?



4.2 Contextual factors explaining the relevance of the EPC

Legal Status of the EPC

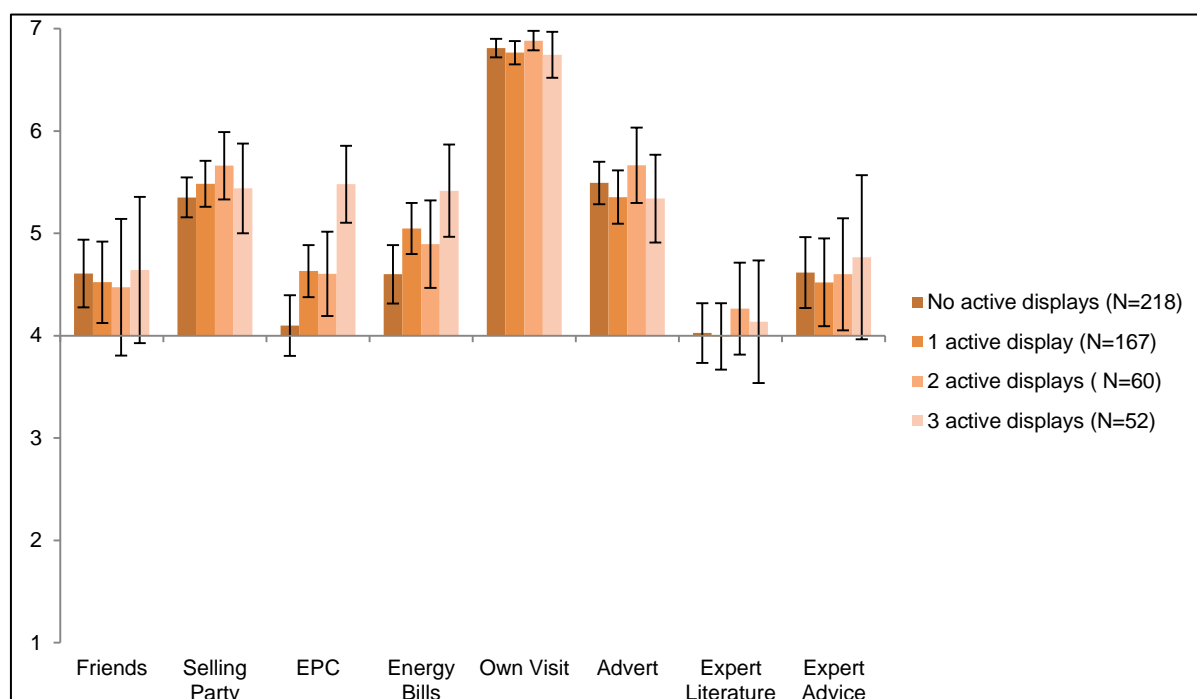
The following subsection investigates the contextual factors that explain, in part, the low relevance of the EPC.

The current legal status of the EPC for existing buildings in Germany requires only that EPCs be displayed by the seller if the potential buyer actively demands it (§ 16 EnEV). Respondents remembered viewing the EPC for only 34.7% of their favourite dwellings and stated that EPCs were actively promoted for only 24.2% of their favourite dwellings.^{xiv}

Therefore, a likely explanation for the low relevance of the EPC could simply be that purchasers were able to access other information sources more easily than the EPC and hence found these sources to be more relevant. Although the conducted relevance comparison between these other information sources and the EPC applied only to respondents who indicated that they used the EPC at some point during their search, information sources other than the EPC could still have been present more frequently and hence better used for a comparison among dwellings. In order to control for this effect and simulate a situation similar to 2013 when the EPC will begin to be mandatorily published in dwelling advertisements, we analysed the relevance of the EPC in situations where it was available to respondents for all purchasing options. In such a situation, purchasers were fully able to use the EPC to compare the energy efficiency of different dwellings.

Respondents who had sellers promoting the EPC for all of their choices rated the EPC as significantly more relevant than purchasers whose sellers did not promote the EPC (figure 10). In addition, EPCs were perceived as significantly more trustworthy when they were presented for all favourite dwellings rather than none or only a few. Even if the EPC was displayed actively, however, energy bills still remained a significantly more useful source of information about the financial impacts of energy efficiency. The implications of these results need to be interpreted with caution, however, because sellers who actively promoted the EPC might have done so because it depicted positive information and purchasers caring for energy efficiency and also for EPCs could have targeted these sellers specifically. The results of the survey do not control for this self-selection.

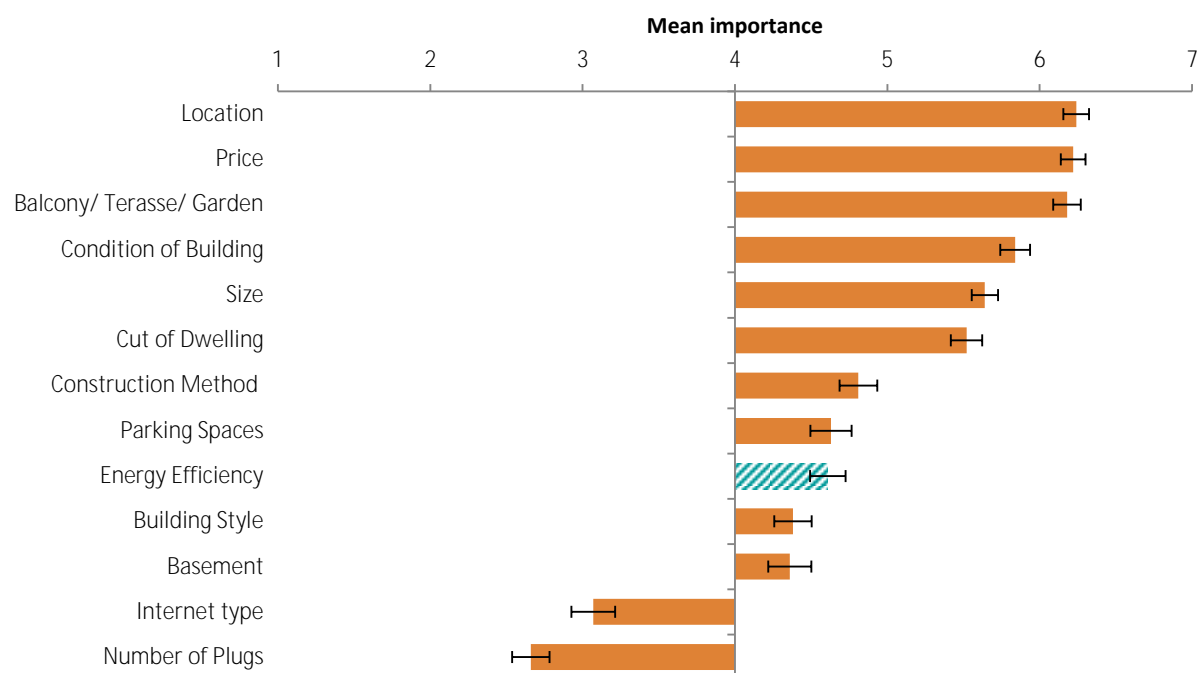
Figure 10: The relevance of the EPC to purchasing decisions in relation to the number of active displays of the EPC by the seller to the purchasing party indicates that the EPC becomes more relevant the more actively it is promoted.



Importance of energy efficiency as a purchasing criterion

Respondents were asked to rate the importance of different purchasing criteria to their purchasing decision on a scale of 1 to 7. The results indicate that energy efficiency ($M = 4.61$) was a purchasing criterion of only minor importance (figure 11) while location, price, outdoor spaces, and the condition of a dwelling were the most important purchasing criteria.

Figure 11: Responses to “Please rate the importance of the following purchasing criteria on a scale of 1-7.” Energy efficiency was evaluated to be a relatively unimportant purchasing criterion.



In addition to this indicator, the study tested whether energy efficiency as a purchasing criterion becomes more important if alternative home purchase options were similar. Purchasers were therefore asked to mark all purchasing criteria for which their three favorite home purchase options were similar. Respondents were then grouped into purchasers who had the opportunity to decide between similar alternatives with regard to location, price, and balcony/terrace/garden and into purchasers who only had heterogeneous alternatives at their disposal. Three Mann Whitney tests were conducted (one for location, price, and balcony/ terrace/ garden respectively), which compared the importance of energy efficiency as a purchasing criterion between groups of similar and dissimilar alternatives. The differences were all insignificant, suggesting that energy efficiency does not become more important even when purchasing options are similar.

4.3 Summary of the main results for indicators and contextual factors

Number	Indicators for effectiveness	Results
A	Awareness	81% of purchasers know certificate
B	Use	78% used EPC at some point, but only 35% viewed certificate for home under close consideration
C	Understanding	Most respondents found EPC understandable (Mean = 4.73), yet only 58% understood difference between the two forms of EPCs, and only 21% remembered the information in the EPC correctly.
D	Trust	Low absolute score of trust (Mean=4.24), only 44% trusted EPC.
E	Usefulness	Least useful information source for disclosing financial implications of energy efficiency (Mean=4.19, Rank= 6 th of 6)
H	Self-indicated relevance	Relatively low relevance of EPC for purchasing decisions: Mean = 4.35, Rank = 7 th of 8
I	Recommendation to Friends	64% would recommend EPC to friends, Mean = 4.98

Number	Contextual Factors	Results
1	Legal Status	EPC only displayed actively for 24% for dwellings under close consideration by purchasers. However, relevance and trust attached to EPC was significantly higher when EPC was presented for all three dwellings under close consideration
2	Importance of energy efficiency	Energy efficiency only minor purchasing criterion (Mean=4.61, Rank=9 th of 13)

5 Discussion and Policy Implications

The results presented in the above section indicate that the EPC is only a moderately effective information instrument for helping purchasers to incorporate energy efficiency into their purchasing decisions. The EPC performs well with regard to general awareness, general use, and recommendability to friends. For all other indicators, however, the EPC achieves positive but, especially in relation to other information sources, low scores.

The following section investigates some of the indicators as well as contextual factors more closely in order to derive policy implications.

5.1 High general use of the EPC, but low views for homes under close consideration

Results

Although the awareness and general understanding of the EPC among respondents was strong, especially considering the recent introduction of this policy, the use of the EPC is still limited. While the majority of purchasers used the EPC at some point, only a minority viewed the EPC during their actual decisions between dwellings under close consideration.

Interpretation and Implication

The current legal status of the EPC means that sellers only need to make the EPC available on request (§ 16 EnEV). As a consequence, the EPC was only displayed by sellers for a quarter of the dwellings under close consideration by purchasers. In principle, purchasers could demand from sellers to get access to the EPC. However, the above mentioned BMVBS study found that many purchasers are hesitant to actively ask for the EPC, because they are afraid that it could result in alienating the selling party (2010). In addition, only purchasers who have a high *a priori* interest in an EPC would demand to see it, further decreasing the EPC's ability to convince previously uninterested purchasers of its usefulness.

The disadvantageous legal status of the EPC for existing buildings in Germany will be fundamentally changed through the implementation of the EPBD recast. The recast, which will have to be adopted until 2012, demands that the results of the EPC will have to be published in the building advertisements, and a compliance system will have to be introduced. The EPBD's recast will therefore likely increase the spread and use of the EPC. The correlation between number of displays of the EPC and the relevance of the EPC also implies that the EPBD will not only increase the EPCs' spread, but will also increase the EPC's relevance for each individual purchaser.

5.2 Purchasers frequently do not trust the information in the EPC

Results

Only 44% of the respondents found the EPC trustworthy (Mean=4.24).

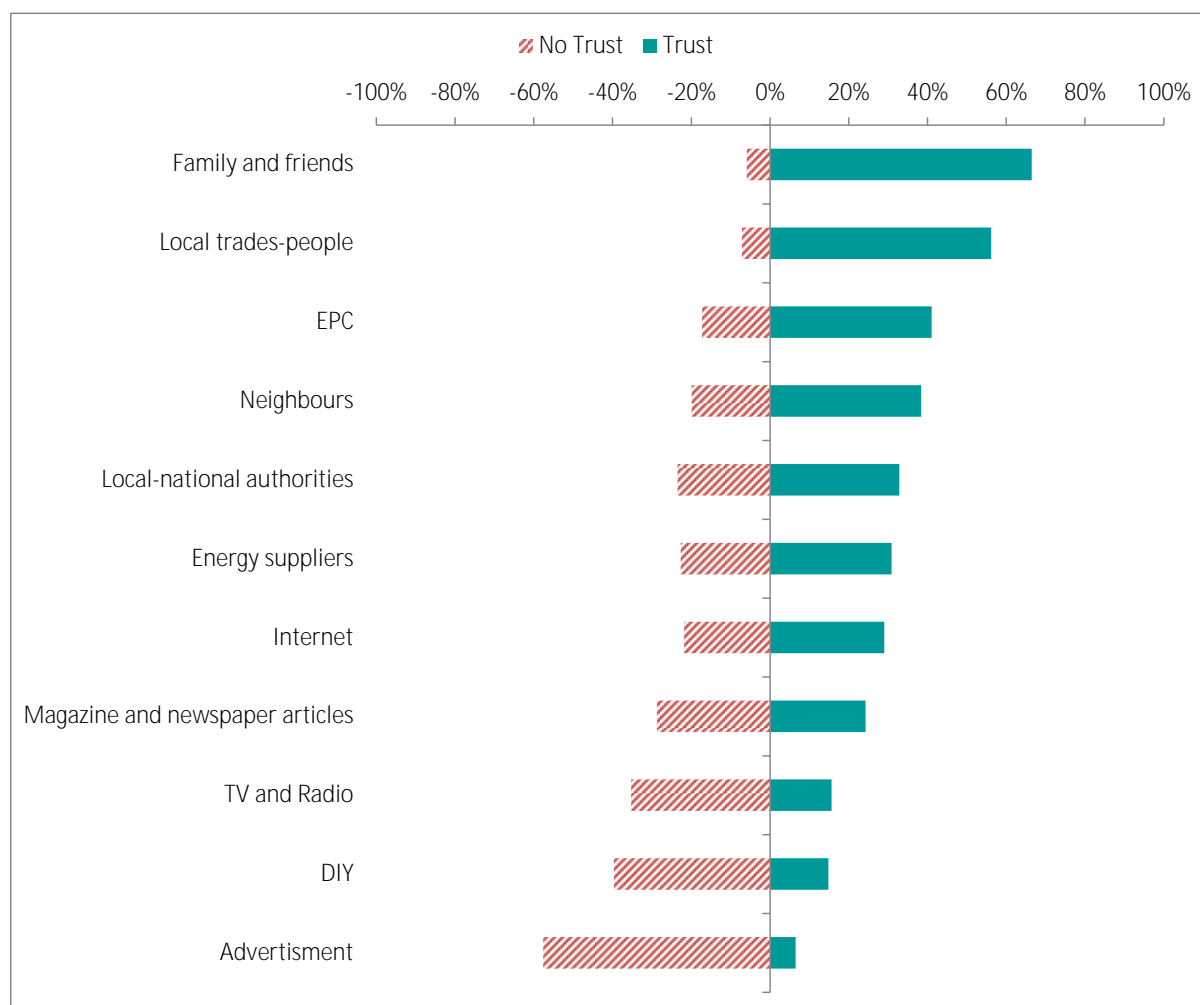
Interpretation and Implication

The mean score for the trust in EPCs is one of the lowest scores for a question in the entire survey. One possible explanation for the low trust in the EPC is that different interest groups have viewed the certificate's different calculation methods as problematic. During the course of this study, a small media review was conducted to assess the media coverage of the EPC. The review found that sellers of buildings are critical of the EPC's asset rating, due to its strictness and the higher costs of its calculation (e.g. Löwer 2009). Organizations close to tenants and purchasers, on the other hand, have been generally skeptical of the operational rating, because of its dependence on past behavior and its favorable rating, a conclusion which corresponds to findings in the academic literature (e.g. Bethune 2010; Jensen and others 2007). The result has been a partially negative discussion about the reliability of the two forms of the EPC. As a consequence, it is possible that purchasers, who frequently do not understand the difference between the two forms of the certificate, translate the negative policy discussion about one form of the certificate into a low reliability for all EPCs.^{xv}

A second explanation is indicated by results from a cross-country study (Adjei and others 2011). The results summarized in figure 12 suggest that the EPC is not a highly trusted information source in absolute terms. Yet, relative to other information sources, the EPC is one of the most trusted sources (although the quoted survey did not compare the EPC with highly performing information sources, such as energy bills and site visits). Therefore, the low results for the trust in the EPC found by this CPI study could also be a result of the general skepticism of home purchasers about the trustworthiness of information sources on energy efficiency. This interpretation would imply that the

EPC, as a government-backed information source, could fulfill an important role in helping purchasers to invest into energy efficiency, despite its low absolute rating.

Figure 12: Results to question: How much do you personally trust the following information sources for information about the energy efficiency in the home. The EPC was seen as the third most important information source in Germany. Source: (Adjei and others 2011).



A third explanation is that trust in the EPC is low because it is a relatively new information instrument and is currently only rarely available. The results in section 4.2 suggest that the overall low relevance of the EPC to purchasing decisions and the low trust in its information are linked to its current low proliferation throughout the market. The relevance of the EPC and the trust in its results significantly increase if it is available for all dwellings. This finding is in line with the labeling literature, which finds that proliferation is a determinant of the perceived relevance of a label (Krarup and Russell 2005). This again implies that the EPC will likely have a higher trust attached to it once the recast of the EPC is implemented.

5.3 The EPC does not show the information that purchasers want

Results

The financial implications of energy efficiency matter most to purchasers, yet the EPC is perceived to be the least useful source of this type of information.

Interpretation and Implications

In Germany, the EPC only shows the energy efficiency of a dwelling on a label (red to green) and in kWh/m². Translating this information into the amount of energy bills to be incurred by a home purchaser is cumbersome. Conceptually, the relevance of the EPC to purchasing decisions could therefore be increased by including financial implications of energy efficiency in the EPC. Yet, the inclusion of this information does not automatically lead to a higher perceived usefulness of the EPC. Adjei and others have, for example, found that the usefulness of the EPC for revealing financial implications in the UK is lower than in Germany, although the UK directly includes financial implications in its certificate (Adjei and others 2011). How much of this is due to specific problematic factors of the underlying calculations and display in the UK, as criticized by Banks, needs to be subject to further research (Banks 2008).

5.4 Purchasers do not care strongly about energy efficiency

Results

Energy efficiency is only a minor purchasing criterion and does not become more important even when dwelling choices are similar.

Interpretation and Implications

One option to interpret this result is to assume that the energy efficiency of a building is reflected in other attributes of a building, like quality or selling price. In this case, differences in energy efficiency would not create additional differentiating factors in the decision process.

Alternatively, the low relevance attached to the EPC can be attributed, in part, not to the design of the EPC, but to its policy circumstances. Conceptually, the EPC can only be as relevant to purchasers as the criterion it informs. Hence, one trigger to increase the impact of the EPC is to increase the importance of energy efficiency as a purchasing criterion. It is, however, beyond the scope of this study to determine which forms of financial and non-financial instruments are best placed to pursue this objective.

5.5 Limitations of the study

This study has several limitations. First, the scope of this paper was deliberately focused only on private purchasing decisions for existing buildings in Germany from the perspective of purchasers. This focus inhibits the finding's generalizability for other countries with different market structures and labels. The study also cannot make any predictions for commercial purchasers, commercial buildings, new buildings, or tenants. Further, the paper does not take into account the perspective of sellers, which could potentially differ from the perspective of purchasers. Most importantly, the paper has only focused on the impact of the EPC on market transactions and has not established how much the EPC has directly impacted investments in energy efficiency. Finally, the response rate for the study is unclear, as noted in the methodology section.

Overall, self-report and selection biases are two of the potential weaknesses of stated preferences studies in general, although this survey was constructed to minimize these distortions. First, the invitation letter was worded neutrally. It framed the web-survey as being about purchasing decisions and information in general and not about energy efficiency and the EPC as such. Second, the survey always asked about the importance of several purchasing criteria and information sources, of which energy efficiency and the performance certificate were only one. Third, the questions were carefully ordered to avoid bias; for example, questions about the EPC were only asked after respondents had already rated the importance of information sources in general.

6 Conclusion

The energy efficient upgrade of the building stock is both a pressing and economic option for addressing climate change and energy security issues. However, multiple market failures and barriers undermine the realization of this potential. Therefore, the European Union (EU) introduced Energy Performance Certificates (EPCs) in order to address one these market failures—‘imperfect information.’

This study evaluated the EPC’s effectiveness and focuses on its impact on private purchasing decisions for existing dwellings in Germany. As its main research method, the paper analyzed the responses to a web-based survey, which was conducted among 1239 former customers of ‘Immobilien Scout GmbH.’

Prior to the analysis, a review of the scarce literature available revealed that the EPC is, in principle, well placed for reducing market frictions caused by imperfect information, but that it also faces several potential inhibitions. The results of this study subsequently suggested that the EPC has only played a limited role in purchasing decisions. The main explanations for this were that a) the EPC is only viewed and depicted for a minority of dwellings, b) purchasers understand the information but do not trust it, c) EPCs do not show the financial implications of energy efficiency well d) purchasers do not strongly care about energy efficiency. Implications discussed were i) that the update of the EPBD will likely increase the use, relevance and trust of the EPC, ii) that a redesign could consider highlighting financial implications of energy efficiency, and iii) that other policies could increase the importance of energy efficiency as a purchasing criterion.

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Footnotes

ⁱ For an overview of the other market failures and barriers undermining energy efficiency investments, consult for example the IEA study “Promoting Energy Efficiency” (2008).

ⁱⁱ A calculation based EPC is obligatory for buildings with less than five dwelling units, new buildings, and buildings built before 1st of November, 1977 (unless § 17 (2) EnEV).

ⁱⁱⁱ This paper however notes that the handling of Likert scales as interval data is subject to debate (e.g. Jamieson, 2004).

^{iv} The term favorite is understood in this context as one of three dwellings among which the purchaser made his final decision after screening several buildings.

^v This question was only posed to respondents who had viewed the energy performance certificate for all three of their favorite buildings, so as to guarantee that the EPC was actually available at their purchased dwelling.

^{vi} This test was possible because the certificate is standardized and a certain color should always represent a certain range of kWh/m² consumed by the dwelling.

^{vii} A wide band of discretion was used in order to count answers of respondents as correct who did remember the information of the EPC at least vaguely.

^{viii} The German word ‘Wohnqualität’ which was used in the survey cannot be directly translated, but vaguely means ‘quality of life regarding inhabitation’.

^{ix} According to a Wilcoxon signed-rank test; $z = -8.292$, $p = .000$, $r = -.44$. The Wilcoxon signed-rank test is a non-parametric test which analyses the differences between two dependent samples. z expresses the observation in standard deviation units. p is a measure of the probability that a test result has occurred by chance. If $p < 0.05$ it is assumed that the test result is significant, hence that the null hypothesis is not true. r indicates the Pearson’s correlation coefficient, which is a standardized measure of the size of an observed effect. For an introduction into these statistic measures view for example Field (2009)

^x The wording of the question on financial implications was not ideal, as the bracket behind the term “energy bills” should have been (from heating and warm water) instead of (electricity, water, gas). This could have resulted in a bias and the results should therefore ideally be replicated by a further study.

^{xi} Using a Wilcoxon signed rank test ; $z = -6.623$, $p = .000$, $r = .30$

^{xii} Using a Wilcoxon rank-sum test $z = -4.734$, $p = .000$, $r = -.20$

^{xiii} Data of purchasers of new buildings were also collected (N=80), but excluded from other test results as mentioned in section three.

^{xiv} The term favorite is understood in this context as one of three dwellings between which the purchaser has made his final decision after screening several buildings.