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Energy efficiency consultants as change agents? Examining the reasons for EECs' limited success

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No. 1

Energy efficiency consultants as change agents?
Examining the reasons for EECs' limited success

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Göttingen, 2015

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Zusammenfassung: Der Energieverbrauch von Wohnhäusern stellt eine wichtige Zielgröße der deutschen Politik dar, um die CO² Emissionen langfristig zu senken. Die Förderung von Energieberatungen ist darauf ausgerichtet, innovatives Wissen unter Hauseigentümern zu verbreiten und potentielle Informationsasymmetrien im Sanierungsmarkt zu überwinden. Der Erfolg dieser Maßnahmen ist allerdings fragwürdig. Wir führen 17 Experteninterviews durch, um zu untersuchen, unter welchen Problemen der Energieberatermarkt leidet. Wir zeigen, dass der Energieberatermarkt von starken Informationsasymmetrien geprägt ist, die die Herausbildung eines Vertrauensverhältnisses erschwert. Die Zahlungsbereitschaft der Kunden ist niedrig. Wir identifizieren außerdem eine Diskrepanz zwischen den Anreizen der Berater (Energie sparen) und der Kunden (Kosten minimieren). Unsere Ergebnisse legen nahe, dass die Förderung von Energieberatungen ihr Ziele verfehlt. Weiterhin empfehlen wir die Stärkung von privaten und halb-öffentlichen Netzwerken und eine verbesserte Anpassung der Energiepolitik an die Bedürfnisse der Hausbesitzer.

Abstract: Residential energy consumption has been increasingly singled out by public policies as a key area for potential emission reduction. The public implementation of energy efficiency consultants (EECs) as change agents aims at the diffusion of innovation in building efficiency and overcoming information asymmetries in the construction sector. However, the success of these measures has been described as low. We conducted a case study involving 17 in-depth expert interviews to examine the causes of this failure within the German institutional context. This analysis has important implications for EECs in general and other European countries. We show that credence good characteristics in the ECC market led to a low willingness to pay. Certification of EECs does not suffice to overcome information asymmetries. We also identify a mismatch between EECs and customer incentives. As top-down policies have failed to facilitate a viable EEC market, we recommend a greater role for private and private-public networks, the cutting of EEC subsidies and a closer alignment between climate policy goals and home owners' economic efficiency considerations.

Keywords: asymmetric information, credence goods, labeling, change agents, energy audits

1. Introduction

One goal of environmental policy is to reduce carbon emissions, which requires an increase in energy efficiency. For example, the residential housing sector in Germany - accounting for 40% final energy consumption - has been targeted by energy policy (Friedrich et al., 2007). The German environmental agency defined the goal of doubling the full retrofit rate from one to two percent (UBA, 2014). In fact, many European countries have put policy measures in place to achieve related goals (see Friedrich, 2013).

Nonetheless, retrofit activities often lag behind expectations (Bürger, 2013; Weiss et al., 2012). The stricter and more expensive energy efficiency criteria of environmental policies do not always translate into actual building-modernization as house owners are primarily motivated by a desire to minimize energy costs (Galvin and Sunikka-Blank, 2013; Kornhardt, 2014; Sunikka-Blank and Galvin, 2012). In response, a variety of subsidies have been put in place across European countries (Friedrich, 2013). On the other hand, there are a number of cases in which building-retrofitting is viable without financial assistance, especially if the building is old or heating and hot water systems are not up-to-date (DENA, 2012).

A second set of obstacles identified by public officials (BMW, 2014, 4) as well as the academic literature revolves around information diffusion. The market of energetic retrofit displays a high degree of uncertainty due to its complexity and informational barriers. The German Federal Ministry for Economic Affairs and Energy states that home owners are frequently ignorant of the potential savings of retrofitting (BMW, 2014, 4).

Since innovation and its diffusion play a key for sustainable development, the role of innovation intermediaries has gained attention in recent years (Howells, 2006). In particular, policy instruments regarding the diffusion of innovative solutions in environmental goods markets have been critically discussed and evaluated (Jaffe et al., 2005; Vollebergh and Kemfert, 2005). According to Rogers (2003), 'change agents' foster the diffusion of knowledge.

Construction companies may be providers of relevant information, i.e. serving as change agents. By suggesting and implementing retrofit activities, they diffuse available technological know-how. However, the aforementioned strategy paper by the German government as well as other official documents and regulations indicate that a reliance on market forces (i.e. construction firms) will remain insufficient because the market for retrofit construction displays credence good characteristics, i.e. customers are unable to evaluate the quality characteristics of the obtained good or service (see Akerlof, 1970; Dulleck and Kerschbamer, 2006; Spence, 1973; Stigler, 1961). Home owners are less knowledgeable than constructors and they may find it difficult to evaluate quality ex-post. The Ministry of Economic Affairs and Energy states that construction mistakes and architectural failures as well as the focus on single efficiency measures (as opposed to longer term road maps) has reduced home owners' confidence in retrofit activities. This line of reasoning reflects the possibility of the misuse of expert knowledge. In the absence of reliable information and quality control, builders may either suggest the implementation of too many efficiency measures or they may provide lower quality than agreed ex-ante. In both cases, home owner trust will deteriorate and demand will decline, thus directly thwarting environmental policy goals.

In order to overcome these problems (and increase transparency, information flows and ex-post quality controls), energy efficiency consultants (EECs)¹ have been promoted as key actors of energy policy in Germany (Feser et al., 2015) and elsewhere (e.g. Sweden: Mahapatra et al., 2011; Finland: Virkki-Hatakka et al., 2013; Belgium and Denmark: Gram-Hanssen et al., 2007; USA: Gillich, 2013; UK: Palmer et al., 2013) for over a decade. EECs in Germany provide energy audits for buildings and suggest possible routes of modernization. These road maps include estimated cost-effectiveness calculations and they are supposed to pay attention to the specific resources and requirements of each household. Audits are required to be independent assessments. As such, an individual who holds an energy consultancy certificate must not work as an EEC if he/she also runs a construction company, to avoid the temptation of biasing reports toward his/her own line of business. In order to be listed as an EEC expert, training at one of several educational institutions (e.g. universities, educational centers of the crafts organization) must be undertaken. Only certain individuals in certain occupations (architects, engineers, master craftsman) are eligible (see Henger et al., 2015).

The role and impact of EECs has been discussed in the literature. Initial results are presented by Bartiaux (2008), Gram-Hanssen et al. (2007), Gillich (2013), Mahapatra et al. (2011), Owen et al. (2014), Palmer et al. (2013) and Virkki-Hatakka et al. (2013). Being in an exploratory phase, the influence of EECs on customers' decisions to implement energy efficiency measures has been described as low.² Furthermore, customers' willingness to pay for EEC services is also low (see Feser et al., 2015). The puzzle of why the EEC impact on energy efficiency measures is weak remains unresolved in the literature.

In this paper, we present evidence from interviews with 17 experts in the residential sector in Germany, whereby we aim to understand why EECs currently fail to play the role of change agents. Our results suggest that the problem of asymmetric information in the market for retrofit construction might have been overemphasized. Residential constructors are mostly small businesses who operate locally. Reputation effects may partially mitigate the temptation to "sell lemons". As constructors usually provide more than one service (roofers also install PV equipment; carpenters also insulate building envelopes and floors, etc.), they hope to acquire follow-up business by providing acceptable quality.

In addition, the introduction of EECs has de facto replaced one asymmetric information problem with another. We cautiously suggest that the asymmetries in the market for EECs are potentially worse than those in the construction sector that they seek to overcome. The consultant interviewees in our sample complain about competition from construction companies. Home owners prefer unsubsidized advice from local craftsman who they know - at least to some extent - rather than seeking out EEC services. EECs operate in a wider geographical area, which reduces the effectiveness of reputation-building mechanisms. They do not strive to gain follow-up business as retrofit activities will be undertaken in 30 to 50 year intervals at best.

¹ In the literature, a variety of different names are given to the energy efficiency adviser, e.g. energy adviser (Mahapatra et al., 2011), energy auditor (Palmer et al., 2013), retrofit adviser (Owen et al., 2014).

² By contrast, Achtnicht and Madlener (2014) find evidence of a positive association between EECs and implementation. However, their results are based upon hypothetical scenarios.

Our interviews suggest that EECs do not succeed in signaling their quality to potential customers, i.e. they cannot overcome information asymmetries regarding quality. Consequently, they face a lack of trust and a low willingness to pay. In fact, most EECs' income is generated through subsidized audits mandated to receive government funding for retrofit activities. We find that mandatory training does not suffice to overcome information asymmetries.

We also identify a mismatch of incentives between house owners - who are mostly interested in economic efficiency - and EECs, who have an incentive to maximize technological efficiency.

While we focus on the case of Germany in this paper, this analysis has important implications for EECs in general and other European countries with a similar stock of buildings (Murphy, 2014; Rosenow and Galvin, 2013). In particular, the paper strives to highlight the potential problems regarding the introduction of energy consultants as a potential driver of home energy efficiency measures.

The remainder of the paper is structured as follows. In section two, the literature on credence goods, energy performance certificates (EPCs) and EECs is reviewed, followed by a description of the methodology and the sample. Section four presents the findings of the interviews. We conclude by highlighting policy implications, limitations and future research recommendations in section five.

2nd Asymmetric Information in the Market for Energy-Focused Home Refurbishments

Credence good characteristics of expert markets - in which customers cannot evaluate the quality of the product or service obtained - is fundamental for the analysis of the EEC market. Based upon Akerlof's (1970) seminal paper about uncertainty in markets and Darby and Karni's (1973) contribution in the classification of search, experience and credence goods, the literature on credence goods has evolved extensively and deals with the fraudulent behavior of experts. Dulleck and Kerschbamer (2006) offer a formalized theoretical framework, emphasizing overcharging, under-treatment and over-treatment as main problems arising from the informational asymmetry between expert and customer. Some empirical evidence has shown a market breakdown or a reduced demand for credence goods driven by experts' fraudulent behavior; for example, in the case of car repairs (Beck et al., 2014; Schneider, 2012), taxi drivers (Balafoutas et al., 2013) and online reviews (Latzy, Shannon et al., 2014). Overcoming these problems with expert services, d'Andria (2013) suggests sharing information on a broader basis, engaging in advertising, building reputation and assuming liability and certification.

The discrepancy between climate policy goals and home owner behavior regarding energetic retrofits fostered the idea of providing additional public information through EPCs. The European parliament implemented the *Directive on end use energy efficiency and energy services* (Directive 2006/32/EC), which requires the member states to provide information on energy efficiency measures and values the role of advice (European Union, 2006).

Current research focuses on the perspective of house owners. EPCs provide information on the energy efficiency level of specific buildings. Ideally, they reduce search costs (Gilmer, 1989). EPCs have been found to produce price premiums (Kahn and Kok, 2014), although a number of downsides have been discussed in the literature. The certificates have been found to weakly affect home owner decisions since the customers failed to remember the EPCs (Amecke, 2011). In the pre-purchase phase, house owners do not perceive a reduction of informational hurdles (Murphy, 2014).

Effects on the energy efficiency of the housing sector are hardly visible in the short and medium run (Stavins et al., 2013). Furthermore, the lack of customer understanding of EPCs is discussed as a barrier for the establishment of EPCs in the literature. The function and effect of EPCs remains somewhat unclear for the user (Backhaus et al., 2011). Moreover, adding house-specific information is costly but more general information is less useful for home owners (Stavins et al., 2013). In particular, experimental evidence showed that economic information is valued more than information on carbon emission and real energy use (Newell and Siikamäki, 2013). However, the latter information is mostly displayed on European EPCs. Belgian and Danish customers interpreted the additional information of EPCs critically, questioning its content (Gram-Hanssen et al., 2007). Furthermore, Christensen et al. (2014) have found that EPCs hardly offer reliable information for house owners since the majority lack trust in the content of EPCs.

EECs have been implemented as change agents to issue EPCs and advise customers about the possibilities for innovative retrofits. Change agents support the diffusion of innovation and reduce uncertainty in the innovation process. They provide knowledge about the application and implementation of innovative technologies (Rogers, 2003). Change agents may foster technological progress (Backhaus, 2010; van Lente et al., 2003). Implemented as a top-down

policy (Backhaus, 2010), EECs are intended to support the technological progress of retrofits in the residential sector.

The literature concludes that the introduction of EECs has yielded mixed results, pointing at various obstacles for change agents, which - according to Owen et al. (2014) - are “beyond the reach of current policy interventions”. The heterogeneity of professional backgrounds leads to uncertainty concerning the outcome of audits (Virkki-Hatakka et al., 2013). The subjectively perceived success of energy consulting depends on the motivation and job satisfaction of the EECs (Mahapatra et al., 2011). While the dependency of EEC markets on public intervention is part of the discussion (Gillich, 2013; Gillingham and Palmer, 2014), the weak effect of EECs on rates of home modernization has been analyzed, referring to credence characteristics of EECs (Owen et al., 2014). Nonetheless, the specific reasons underlying the failure of EECs remain unclear.

The policy intended to reduce information asymmetries concerning the planning, implementation and execution of energetic retrofits by politically implementing a market for EECs (Feser et al., 2015). EECs may support customers in understanding the complexity of the retrofit and apply innovative solutions. Moreover, access to public subsidies is granted via EECs who have to monitor and certify the retrofit, aiming to improve the efficiency of the housing stock.

The regulatory framework permits EECs to offer EPCs. House owners can only receive public retrofit funds if they have hired an EEC. In order to bear the label of an EEC, the individual must complete training provided by a university or an organization in the field of architecture, engineering or crafts, or a host of other institutions (see Henger et al., 2015). The occupation is open to most actors in the building sector, which explains the heterogeneous educational backgrounds of the EEC sector. However, the EEC can only access public retrofit funds if specific certificates are obtained from an educational institution such as a university, architectural or crafts organization.³

To increase the visibility of EECs' quality, a web portal with a public EEC list has been established, which is accessible online and registration is administrated from the national energy agency (DENA). DENA grants access to the list and evaluates the prerequisites of being listed by checking the individuals' certification. Most federal subsidy programs demand that house owners hire an EEC who is listed. Currently, there are about 13,000 individuals on that list.⁴

In order to prevent fraudulent EEC behavior, subsidies can only be received if an independent consultant is hired. The EECs are obliged to consult customers without providing specific product recommendations and they are prohibited from profiting from the actual retrofit implementation. The owner of a construction company thus cannot be hired as

³ The certificates are structured as follows: According to different building types, different certificates are required to conduct energy efficiency consulting in the specific programmes. For example, in order to apply for public funds for retrofitting historic buildings, courses with specialization in this subject need to be attended. Higher quality retrofits require higher quality standards. The certificates usually cannot be combined, which means that for every certificate a new number of courses needs to be attended. Due to the technological progress and dynamic changes in retrofit, the certificates need to be renewed every two years.

⁴ The list is regularly updated and can be found at: <https://www.energie-effizienz-experten.de> (retrieved 07/17/2015).

an EEC and subsequently implement the suggested measures. There is one exception at the federal level, namely the subsidy program for single energy efficiency measures - in contrast to comprehensive measures - of the KfW. Given that this one program already covers 82% of all subsidies (KfW, 2014b), the neutral position of EECs is only effective for a small proportion of all subsidies.

3. Methodology and Sample

Case studies and qualitative research is a recognized approach to discover theoretical insights (Edmondson and McManus, 2007; Eisenhardt 1989; Eisenhardt and Graebner, 2007). Case studies support the development of abstract concepts (Ben and Steemers, 2014; Muench et al., 2014; Rogers et al., 2012). Based upon the grounded theory (Glaser 1965; Glaser and Strauss, 2008), our observations are used to develop an understanding about why EECs have such a low impact on the implementation of energetic retrofitting (Edmondson and McManus, 2007).

The selection of experts follows the logic of the theoretical sampling (Glaser and Strauss, 2008). Our sample aims at theoretical saturation, while we are oriented by the different requirements that a certified EEC needs to meet. First, we analyze access paths to becoming a certified EEC, which is limited to architects, civil engineers and craftsmen in the construction sector in the German case. We interviewed stakeholders in all three groups, as well as individuals in related political associations and institutions. An overview of the interviewed experts and their professional background is provided in table 1. All experts were working in Germany at the time of the interview. We refer to the experts in our paper by using IDs - which can be found in the first column of table 1 - to provide anonymity and reduce social desirability biasing when answering. 17 interviews were conducted personally and via phone between February and May, 2015. The interviews lasted between 40 and 70 minutes.

Our semi-structured questionnaire is separated into three sections (see table 1) following the approach of Muench et al. (2014). First, we asked about the role of EECs in home energy refurbishing. Only the legal framework of the certified EECs provided orientation for the definition, while the details about the job description remained unclear. Second, we asked about obstacles that EECs face in their daily work. Finally, recommendations about the consulting process and the policy changes concluded the interviews. Within each section, we began by asking open questions, followed by closed questions derived from the EEC literature. The questionnaire was discussed and reviewed with academics with an economic, legal, architectural or engineering background to assure theoretical fit and comprehension. Finally, the questionnaire was double-checked with a cognitive pre-test using thinking-aloud and comprehension (Collins, 2003).

Table 1

Key questions
Describe the activities of energy consulting.
Which are the most important elements of energy consulting?
Characterize barriers for the success of energy consulting.
Which problems arise from the certified energy consulting?
What can you recommend to overcome the mentioned barriers?
Which recommendations can you identify as central?

Based upon Mayring (2004), a qualitative content analysis was conducted focusing on the reduction of content, followed by the analysis of the relevant content. After recording, the interviews were transcribed and cross-checked with press material and online research. Furthermore, the material was first inductively coded (Glaser and Strauss, 2008). Beginning with open coding, we marked the relevant content that was connected to our research question. Subsequently, we created categories and sub-categories, defined by the collection of related codes. Categories were revised with deductive codes from the literature (Mayring, 2004). In the case of misleading categories, categories were adjusted and newly defined. These categories and sub-categories were described in a coding manual to assure the comparison of the codes. For preventing critique of subjective coding - which appears as a major disadvantage (White and Marsh, 2006) - memos for the codes were written and the codes were discussed between the authors.

Table 2

EEC Coding	Research and Education	EEC	Political and professional Association	Background
#A	X			Architecture
#B	X			Engineering
#C	X			Craft
#D	X			State Regulation
#E		X		Craft
#F		X		Craft
#G		X		Engineering
#H		X		Architecture
#I		X		Architecture
#J			X	Regional Energy Agency
#K			X	National Energy Agency
#L			X	Innovation support coordination
#M			X	Innovation support bank
#N			X	EEC Journal
#O			X	Architect Association Professional
#P			X	EEC Association
#Q			X	EEC Association
Total	4	5	8	

The following chapter discusses the results of our interviews in detail concerning the willingness to pay for EEC, the public certification system and a mismatch between customers and EECs owing to the phenomena described above.

4. Results

The analysis of the interviews has revealed a variety of impediments to the smooth functioning of the EEC market. A large number of interviewees criticized the discrepancy between ideal energy efficiency consulting and its practical implementation within a dynamic environment characterized by the heterogeneity of its actors. Another central argument for problems in the EEC market was the long amortization duration of retrofit measures and the low willingness of the polity to pay for increasing the rate for retrofit to fulfill energy-reducing goals. In the following section, we analyze the informational asymmetries of retrofits, whereby our research focuses on the intended role of EECs as change agents.

4th1 Complexity and Credence Goods Characteristics in the Market for Energy Consulting

Willingness to pay reflects a customer's expectation of benefiting from buying a product. In markets with perfect information, prices signal differences in quality. In particular, the customers' willingness to pay reveals demand for a certain quality level and attributes a subjective value for a good or service. All interviewees aside from one mentioned a low willingness to pay as a barrier for offering high-quality services. Therefore, there is a need to understand the information asymmetries and how they contribute to a lower willingness to pay.

According to the interviewees, the costs of energetic retrofits are too complex for customers to fully understand (#D, #F, #H, #I, #K, #M, #N, #P): Ex-ante, the energy-related costs have not been noticed as relevant; indeed, the energy costs incurred are often unknown (#K, #P). Additionally, the current low energy prices and the uncertainty about the future prices affect customers' decisions to renovate their houses (#A, #B, #G, #L). After the retrofit, the evaluation of outcomes remains difficult due to user-driven rebound effects (#I, #P) and the limited observability of hired companies' behavior, which can lead to lower savings than expected (#D). In addition to the technical complexity, renovation is a once-in-a-lifetime decision for most homeowners (#M) since the retrofit cycle ranges from 30 to 50 years (#A, #P). Thus, owners cannot rely on past experience and knowledge.

Since the future costs of energy use are unknown, the estimation of the additional benefit of using EECs in relation to the outcome of the retrofit appears difficult (#A, #P). The low willingness to pay for EECs is interpreted by the interviewees as a lack of interest in EECs due to the complexity of retrofit (#D, #F, #H, #I, #K, #M, #N, #P). One interviewee described the case of acquaintances who had planned on retrofitting to save energy and reduce their personal emissions. The couple started to obtain information on regulations, subsidies and innovative opportunities for energy efficiency solutions, but ultimately they decided to postpone as the complexity of the retrofit was perceived as too high and the contribution to their environmentally-friendly way of living was only indirectly visible (#N).

In addition to retrofit-related information asymmetries, the EEC service itself suffers from information asymmetries. EECs have more information about their service than the customer. While the majority of the interviewees stated that finding an economically efficient solution is important, information deficiencies regarding economic efficiency were confirmed by all interviewees and represent a main problem for EECs. Interviewee #K characterized the poor information state as a “key problem” for the low acceptance of retrofit. There are different possibilities for consultants to measure economic efficiency depending on the methodology as well as assumptions about the customers’ consumption and future behavior.

Furthermore, non-monetary arguments - namely providing better living conditions after the retrofit - are promoted by EECs (#B, #J). In part, EECs do not present reduced energy consumption as a main outcome of retrofit, but rather they emphasize better living standards in renovated houses. However, the result can hardly be measured or objectively evaluated ex-ante; rather, this additional factor adds further complexity to customers’ decisions and the visibility of the benefit of using EECs decreases (#A, #M). The use of non-monetary arguments thus creates a higher degree of uncertainty since the ex-post success of a high-cost decision relies on an additional non-monetary aspect.

The information asymmetries between experts and customers lead to the perception of EECs as being prone to fraudulent behavior (#A, #B, #G, #J). In particular, the uncertainty about possible benefits makes customers fearful about paying for a service without receiving tangible benefits in return (#A, #G). This critique has particularly arisen since the experience in using EECs is low (#I, #P): in its current market size, it has only existed for about seven years.

Two other developments in the EEC sector contribute to a lower willingness to pay. The informal supply of low-cost and low-quality EECs is problematic. First, the competition with EECs from non-certified experts was mentioned by 11 interviewees. This means that other companies like construction businesses and craft companies offer informal energy consulting with the goal of selling their product or service and receiving additional contracts from the retrofit. Moreover, due to EU regulation, energy suppliers are obliged to offer a certain number of EECs (Directive 2012/27/EU). The effect of competitive non-certified EECs is described by the interviewees as lowering the general quality level of EECs. In particular, the existence of low-quality offers has increased the difficulties for customers to differentiate them from high-quality EECs (#F, #K, #N). Second, numerous low-cost public EECs have increased the noise to signal ratio in the market. There are a variety of public EECs, often not coordinated between different state authorities (#J, #L, #Q). Public services provide so-called “entry” energy consultancies aiming to lower the level of complexity of retrofit. While the low-price public consulting intends to communicate basic knowledge about the energetic status of a building, it is difficult for the customer to understand whether the entry consulting offers sufficient knowledge for a retrofit (#H, #J, #O, #P). Therefore, it is difficult for the customer to understand the difference between a public low-cost EEC and a complete high-quality EEC offered on the market.

Dealing with the information asymmetries, customers’ trust in the competence of EECs is a prerequisite for a successful relation and the basis for cooperation with EECs (#D, #H, #I, #F, #Q). Since customers can hardly base their judgments on solid facts, a high degree of uncertainty is observable (#D, #F, #H, #K, #P). The complexity of retrofits and the difficulties of EECs in translating the technical circumstances into a language that customers understand fosters problems with EECs (#L, #O, #P). Therefore, potential customers search

for EECs via informal networks comprising family, friends and business partners, based upon recommendations (#D, #H). In particular, EECs know about the sensitivity of the relation to the customer and value the success of retrofit as being important for their own reputation. The majority of the interviewees emphasized the negative publicity due to fraudulent experts and its consequence for future demand.

Prices for EEC are not regulated and can be chosen freely by the EEC (#C), in contrast to other consulting services in the building sector (#G). Therefore, price differentiation contingent on quality may ensue (#C, #D, #Q). However, the price for EECs fails to signal quality due to information asymmetries. Even in cases of business customers, it appears difficult to differentiate between different offers (#C). EECs in training courses organized by the craft chamber are often surprised by the variety of the offers, despite having several years of experience in this sector (C#). Specifically, the connection between EECs' quality and the willingness to pay a higher price is questionable due to ex-post difficulties to verify the received quality.

Overall, the market for EEC is characterized by a low willingness to pay. An analysis of information asymmetries has shown that retrofit activities display information asymmetries while energy consulting itself also has credence characteristics. Consequently, a lack of customer trust is observable. Quality signals in the market for energy consulting are hardly credible and the correlation between prices and quality is not inherent.

4th2 Entry requirements and licensing as solutions to information asymmetries

Regardless of educational background, anybody can offer their services as an EEC (#E, #G, #H, #I, #K, #N). The existence of unqualified EECs creates uncertainty in the EEC market since negative reports have been published in the media, negatively affecting the perception of EEC markets, which are often described as "lemon" markets (#N). Due to regulatory barriers from the EU and the federal level, entry regulation of the profession is not likely, in contrast to other professions such as car mechanics or medical doctors in Germany (#H, #N). The market is characterized by unrestricted entry and an inability to credibly signal quality.

In order to overcome these problems, the German government has implemented a system of certificates, an online EEC listing for improved transparency and independency regulation for EECs (as described in section two). However, these interventions have only been partially successful. At present, the publicly sponsored EEC market remains sluggish (Henger et al., 2015). As laid out above, the majority of interviewees state that mistrust about the quality of the EEC service has been generated by fraudulent EECs in the market.

The interviewees evaluated the role of the state for the EEC sector critically, but mostly considered it was necessary to assure a quality minimum. The value of the certificates was seen as mixed as they provide little quality information for customers (#A, #G, #P, #Q). In order to receive the certificate, a certain number of course credits have to be obtained. In particular, to become listed in subsidy programs, a minimum of 70 hours of lessons need to be attended. In addition, 16 class hours are required every second year (KfW, 2014a). According to professional EEC associations, this prerequisite is evaluated as too little and they have demanded up to 25% of the working hours being devoted to attending courses to keep up with the technological change (#P, #Q). The EEC associations expect their

members to take up additional courses since the public requirements do not guarantee a sufficient quality standard (#P, #Q). Different quality levels can be observed in the courses (#A, #K).

The number of classes attended counts toward receiving the certificates. Qualitative differences in the courses are imperfectly mirrored by the certificates, whereby public authorities rely on the information provided by the educational institutions themselves. Thus, relevant stake holder associations are permitted to evaluate the courses that they offer without external validation (#B, #L).

Educational institutions are somewhat autonomous in creating course content. Some educational institutions have tried to make the courses comfortable for EECs neglecting the quality of the courses (#A, #B, #C, #D). The interviewees confirmed that this situation has improved, although the incentive to attract EECs with easy courses remains present. According to the interviewees, there is an incentive for EECs to participate in low-quality courses (#I, #P). Interviewee #P described a low-quality course as follows: "I remain seated the whole day, have good food, have good drinks, speak with colleagues and have 8h of certified courses."

Furthermore, the regulatory system requires home owners to employ EECs as monitors for ongoing construction projects if they receive public retrofit subsidies. Thus, EECs spend a considerable amount of time as monitors rather than consultants (#G, #M). To some extent, EEC courses are designed to teach participants to understand the details of public grant regulations. This necessarily subtracts from the courses' potential to teach technical and consulting skills (#M, #Q). The ability to explain technical processes to home owners is rarely addressed by the courses. Moreover, relevant skills of the EEC profession are not always considered in certified courses (#G, #M). In particular, marketing and financial issues are neglected (#A, #E, #N).

Interviewees stated that the market intervention has been partially successful since a minimum quality has successfully been established. "It's an improvement", stated interviewee #B. The introduction of certificates has been successful to the extent that unqualified consultants can be excluded from receiving grants (#K, #N). Nonetheless, despite the introduction of certificates, signalling high quality still seems impossible.

It should be noted that EEC training only pertains to one aspect of a broader information asymmetry problem. If EECs had the ability to signal high-quality training via certificates, customers would nevertheless remain ignorant about the level of actual consulting effort that they receive, just as a highly qualified doctor may still underprovide screening effort or suggest too many medical interventions. While the current certification scheme assures a minimum quality level, it does not improve the quality (signal) of EECs beyond that standard.

Due to the complexities of the certification system, the information benefit for customers is small, according to the majority of the interviewees. The certificates are not understood as a quality signal for consulting since there are more than 15 different subsidy programs at the

federal level requiring different certificates.⁵ The programs are only known by a small share of home owners who potentially conduct a retrofit.

Furthermore, reduced awareness of high-quality EECs is also caused by bureaucratic circumstances. New programs lead to further differentiation of certificates, whereby every new subsidy program requires additional certificates with slightly different prerequisite and monitoring reports (#A, #D, #H, #I, #J, #L, #N, #P). There have been frequent policy changes regarding EEC certificates in recent years, excluding some groups of EECs⁶ or demanding extra attendance of additional courses (#A, #B, #C). Due to frequent changes, it is difficult for customers to understand the meaning of certificates. Interviewee #A commented on the visibility: "I am not even sure if the public knows that there are certified EECs." Consequently, the awareness of certificates as a signal for qualification is low (#E, #F).

The introduction of a public list of approved EECs was evaluated somewhat positively as it enhances transparency for customers. According to the interviewees, the list has made it easier for customers to contact EECs (#D, #H, #N). Nonetheless, other interviewees stated the list is hardly known to homeowners (#A, #C).

The aforementioned emphasis on the monitoring function of EECs affects customers' trust in the certificates as a quality signal (#M, #G). In addition, negative press about EECs and their monitoring function has created a reserved attitude among customers, as mentioned by the majority of the interviewees. Consequently, home owners discount the informational content of certificates (A, #C). According to the interviewees, trust in certified EECs is perceived as low (#A, #H). In its current design, the certification does not lower information asymmetries (#H, #N, #K). The design of the certification adds little in the way of new information about EECs' quality for home owners, while retrofit monitoring by EECs lowers the trust in receiving high-quality consulting.

The majority of interviewees valued the independence of EECs and construction companies. Interviewees pointed to fraudulent expert behavior such as heating contractors recommending new heating systems, painters recommending insulation, etc. (#A). However, the alleged problem of information asymmetries in retrofit construction - reflecting one of the reasons for government intervention and support for home energy consulting - starkly contrasts with actual customer behavior and opinions. Since owners deal with construction companies on a somewhat regular basis, they are often contacted first (#B, #F). According to a recent survey, the most trustworthy source of advice - second to acquaintances - is craft companies (Amecke, 2012). Since retrofitting is an uncertain and costly decision for the home owner, trust is important (#D, #H, #I, #Q). Accordingly, home owners consult known and trusted experts, conducting their search via small and informal networks (#C, #D, #F, #H, #N) where reputation mechanisms work well. Interviewee #C describes a typical conversation in his neighborhood: "How was it [the retrofit] for you? Who did you cooperate with? Was he [the expert] competent?"

⁵ Due to frequent regulatory changes, the federal government has implemented a webpage (www.foerderdatenbank.de) to collect all the possible subsidies for retrofit.

⁶ New regulation excluded EECs with craft companies from the KfW subsidy program in March 2013. From January 2014 onwards, this exception was been removed again following protests of the craft chambers HWK (2014).

According to the interviewees, customers find it appealing to deal with construction companies directly as it does not involve the bureaucratic hurdles of applying for public EEC subsidies. In addition, home owners are required to contract with consultants when they apply for publicly subsidized low-interest loans. Due to the availability of low-interest loans in the regular credit market, customers no longer see the need to acquire EEC services (#A, #C, #E, #H). Additionally, larger construction companies employ their own EECs to inform customers and evaluate the outcome of the retrofit (#N).

The intervention's aim was to guide home owners, diffusing innovative solutions by assuring the quality level of EECs. The low willingness to access EECs is largely caused by the EECs' function as retrofit monitors, which distracts from their role as advisors. Home owners search for energy consultants via informal networks, whereby they appear to favor local constructors as consultants with whom the more frequently interact compared with EECs.

4th3 Mismatch between user preferences and experts' incentives

We have identified a mismatch between EEC incentives and home owner demand. The size of the proposed retrofit project correlates with the consultant's revenue.⁷ Regulation requires that after the project exceeds a specified size, the certified consultant must observe and monitor the construction phase. According to several interviewees, there is an incentive to increase the size of the retrofit project beyond what is economically feasible as the EECs benefit from a more costly planning and implementation phase (#A, #B, #D, #I). Interviewee #A identified a "hardcore" energy-saving attitude among EECs, leaving economic arguments aside, contributing to the mixed reputation of EECs. The customers possibly know about the incentive of EECs to enlarge the project size but they cannot ascertain what amount of consulting and retrofitting would be optimal for them (#A, #G).

EEC subsidies also facilitate an incentive to suggest efficiency measures that are more than optimal (#B, #F, #I). EECs must write a final report. The stated goal is to achieve a high energy efficiency level, which only translates into economic efficiency for houses with specific preconditions (old building with few previous renovations) (#Q). Therefore, it is difficult for customers to know whether the suggested measures are economical or if it is aimed at the optimum in energy savings.

The regulatory framework aims at energy saving rather than economic efficiency (#A, #O). The socio-economic circumstances of the home owner are rarely considered, particularly their age, financial situation and the state of the regional economy (#D, #E, #H, #I). There is a tension between everyday behavior and the technological requirements to reach technical efficiency. In an exemplary case described by an interviewee, one homeowner demanded to receive funds for the highest energy efficiency standard. In order to achieve this standard, the EEC had to plan for an automatic ventilation system. However, after the retrofit, the system only worked efficiently if the windows remained closed. Since the home owners were

⁷ The size of Kf subsidies depends on the efficiency level of the house achieved after the retrofit. The funds vary from 15,000 Euros for the lowest energy efficiency level up to 30,000 Euros per apartment unit in the highest energy efficiency level. A higher retrofit budget means more EEC involvement. Additional subsidies for EEC are granted up to 8,000 Euros (KfW, 2015).

unwilling to change their behavior, this retrofit resulted in a lower de facto efficiency status (#I).

According to all interviewees, the demand for certified EECs is largely driven by public subsidies. Customers only acquire EEC services to receive public subsidies (#A, #D). The available evidence indicates a minor influence of EEC on retrofit decisions. Most customers plan retrofits with the support of non-certified EECs before they access funds through certified EECs. The impact of EECs on the choice of technology and innovative solutions is perceived as low (#B, #E, #H).

EECs only profit from retrofits that fulfill subsidy regulations (#B, #C, #E, #N). EECs' profit maximization depends on the overall retrofit project size. The incentive to enlarge the project size results from the structure of the regulation emphasizing energy saving rather than economic efficiency. The interviewees described EECs as being environmentally-conscious and supportive of energy-saving regulations (#A, #B, #O, #Q). Customers' incentives for economically efficient consulting and the EECs' incentives to enlarge the project size causes a mismatch between demand and supply.

The diffusion of innovative technologies and solutions are hardly observed in EECs' activities. The regulation hinders EECs from selecting economically profitable and innovative solutions (#B, #C, #H, #I, #O). One interviewee described a customer who considered various scenarios for the retrofit. The customer only stayed in his house at night. A particular technology was the economically efficient solution but was not publicly funded, meaning that the EEC could not offer his service (#I). Moreover, unusual solutions are not of interest to EECs, since they are also responsible for monitoring customers following strict regulations (#B, #P). The consulting report - which is a prerequisite to receive public funds - follows a standardized guideline (#L). Non-mainstream solutions are hardly offered by EECs, given that the monitoring rules are not sufficiently flexible and they preclude some innovative proposals (#I).

In particular, the final EEC evaluation of the finished retrofit project does not examine the achieved efficiency level of the retrofit but rather the formal standards that are often approved by administratively - rather than technically - trained staff (#L, #M). Consequently, the monitoring of retrofits mainly evaluates whether the implemented retrofit fulfills the regulatory standards, while ex-post energy saving is not monitored. The EEC has strong incentives to comply with the regulation since the home owner receives direct feedback about whether he/she will receive public funds. However, the outcome of the retrofit and the EEC cannot be directly evaluated by customers due to its credence characteristics. Additionally, the regulatory framework for obtaining funds for higher energy efficiency levels hardly supports innovative solutions because the regulation prescribes a fixed set of specific technologies (#A, #I).

There is a mismatch between customers' demand and EECs' supply based upon conflicting incentives. Customers' trust in EECs suffers from this mismatch and consequently leads to EECs' low impact on the diffusion of innovative ideas. The customer searches for trusted experts who are recommended by local informal networks. EECs do not act as change agents. Economic policy may have generated an information asymmetry problem in a publicly-created EEC market, intended to solve information asymmetries in retrofit construction. Accordingly, customers appear to partially prefer construction companies over EECs in terms of energy advice.

5. Conclusion and Policy Implications

Public policy has generated a market for home energy efficiency consulting. Consultants were intended to serve as change agents - i.e. to facilitate innovation diffusion - while EECs were also intended to resolve problems of asymmetric information between construction companies and home owners. The former have more technical expertise than the latter and thus they are in a position to suggest too many efficiency measures. However, the success of public policy is - at best - mixed. In this paper, we have identified a number of reasons for the failure of public policy.

Based upon semi-structured expert interviews, we have found that the EEC market is substantially affected by credence goods characteristics, i.e. there is a lack of customer trust as EECs find it difficult to signal their level of quality. Customers' willingness to pay for the service is low. In order to overcome the sluggish market conditions, publicly-introduced educational certificates have led to the establishment of a minimum standard. However, EEC services remain largely driven by the demand for public funds - which cannot be obtained otherwise - rather than a genuine desire to acquire consulting services.

We have also identified a mismatch between EECs' supply and customers' needs. Guided by state regulation, EECs aim at lowering emission and energy use while customers require energy efficient solutions that are also economically efficient.

Our results show that the EEC market is affected by credence characteristics leading to a market with a low quality offered, comparable to results in the literature (Balafoutas et al., 2013; Dulleck et al., 2011). Government intervention has not established a higher quality level, thus supporting the preliminary results discussed in the EPC literature (Amecke, 2012; Gram-Hanssen et al., 2007).

We cautiously suggest the following policy recommendations. First, the current certification scheme is implemented as a top-down regulation, leading to a widespread perception of low-quality certificates. Therefore, we propose strengthening private or public-private networks that benefit from market feedback and associated knowledge signals. A bottom-up certification could be realized by the support of professional organization in formal networks. It would offer incentives for members to upgrade their own knowledge level in a competitive environment and thereby increase the share of high quality in the EEC market. For example, in Spain and Germany, craft and commercial chambers have supported knowledge diffusion for many professions affected by credence characteristics, supporting higher quality levels with their educational institutions. These organizations lower information asymmetries because they support the acquisition of quality signals for their member firms.

Additionally, cutting public EEC funds would lead to a clearer quality signal on the EEC market by reducing low-cost public EEC offers and fostering the acceptance of EEC as market services, as opposed to being entirely subsidy dependent. Consequently, the use of EECs in public support programs should be more strongly focused on economic efficiency criteria rather than the energy- saving paradigm, since the current support of non-efficient solutions has lowered the public's approval of energy efficiency measures in the residential building sector. Our results exemplify the difficulties of intervening in a market influenced by credence characteristics.

Given its exploratory approach, our study has certain limitations. Further research on economic policy in credence goods markets requires a more in-depth analysis to test our

hypotheses with quantitative data. Additionally, while our research was carried out in Germany, analyses of expert markets from different sectors and other countries would offer the opportunity to develop a more diverse picture about the possibilities and limits of public intervention in markets suffering from asymmetric information that are associated with climate and energy policy goals.

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