

Bridging the information gap on energy efficiency? Experiences from energy advice experiments in three German cities

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Abstract

One of the most pressing issues of climate policy is how to get building owners to invest in the energy efficiency of their homes. The German federal government has set the goal of decreasing the energy demand of buildings by 80 to 95 percent until 2050. One pillar of the strategy to support building owners in this task is the provision of targeted energy advice, to both motivate owners to implement an energy efficiency refurbishment and help them to choose the most efficient measures. In this paper we analysed the demand for energy advice in three German cities of the Ruhr area finding the number of energy consulting provided to be extremely low compared to the stated goals. Based on the approach of joint knowledge production we invited stakeholders from the three cities to participate in a series of workshops in order to develop ideas how to more effectively bring homeowners and energy advisors together. As a result, different energy advice experiments were co-operatively developed for each city targeting different groups by using tailored channels for outreach. The evaluation of both the process as well as the outcome of the experiments indicates that while joint knowledge production is a suitable approach to enable knowledge transfer and formation of new networks between different stakeholders in science and practice, it does not necessarily lead to superior approaches with regard to effectively addressing a policy issue at hand. Apart from the experiment in which the window of opportunity *change of building ownership* was taken advantage of, participation of target groups in

the experiments has been soberingly low, underlining the value of so-called trigger points when designing effective outreach strategies to building owners.

Introduction

Improving the energy efficiency of buildings is at the centre of the German Federal Government's strategy to achieve a nearly climate-neutral building stock by 2050, as specified in its Energy Concept (BMWi/BMUB 2010). To this end, a variety of energy efficiency policies and programmes are being implemented to support building owners in this challenging task. Besides financing offers such as the KfW programmes for energy efficient construction and refurbishment, which are linked to building energy regulations, major efforts are put into helping building owners to overcome what is assumed an information gap regarding the options for and merits of energy efficiency measures in buildings. In the German federal state of North Rhine Westphalia which is the focus area of our study, two important policies offering energy advice are a subsidy provided by the Federal Office for Economic Affairs and Export Control (BAFA) and a low-cost energy advice by the Consumer Association of North Rhine Westphalia.¹ The BAFA subsidises on-site energy advice by accredited freelancers with at most 800 Euro

1. There are additional public energy advice services available in the state, which however do not offer in-depth consultancy on renovation measures but are confined to the provision of first information on the adequacy of heating energy consumption/expenditure levels (free energy checks are provided online for citizens in the framework of the Climate Protection Initiative of the German Government (www.heizspiegel.de) or the provision of general information on energetic building refurbishment (the German energy agency dena operates a free energy hotline since 2001).

in case of single- and two-family homes and 1,100 Euro in case of multi-family buildings, but no more than 60 % of the total cost². As the comparatively high costs indicate, the program aims to provide tailored advice to ensure that planned investments in energy efficiency are sensible and optimised.³ Energy advice offered by the Consumer Association is also provided on-site and develops recommendations for measures to improve a building's energy efficiency by insulating its envelope or renovating the heating system. Duration of the energy advice is shorter than in the BAFA program and with 60 Euro costs per case are considerably lower. Generally speaking, the rationale for energy advice is twofold: firstly, homeowners who do not already plan to invest in the energy efficiency of their building shall be motivated to do so. Secondly, homeowners planning to invest in the energy efficiency of their building on the other hand shall learn about the best way to do it. The persistently substantial discrepancy between energy efficiency refurbishment rates⁴ and the goals stated by the federal government suggests that more building owners have to be motivated to invest in energy efficiency. Energy advice as a means to both motivate and inform investment decisions could be a tool to perform this function. In the research project EnerTransRuhr on which this paper builds, we investigated data on the utilisation of energy advice services by private building owners in three German cities of the Ruhr area, finding astonishingly low demand compared to the stated official goals. In light on this finding, the target was set to develop new approaches for energy advice in order to increase outreach (and thus potentially effectiveness) of respective activities. With applicability of the outcome being a central criterion, the chosen strategy to this end was to draw on both scientific and practical knowledge from different stakeholders in order to develop innovative energy advice experiments.

The role of energy advice

Understanding the determinants of home-efficiency improvements is significant to a range of energy policy issues, including the reduction of fossil fuel use and environmental protection. Accordingly, there has been a multitude of studies attempting to explain why the implementation rate of energy efficient refurbishment measures among home-owners lags behind what appears to be rational from an economic point of view (cf. Hasset/Metcalf 1993; Jaffe/Stavins 1994; Knight et al. 2006). In explaining this energy efficiency gap, the focus of pertinent research has been on identifying incentives and barriers to energy efficient refurbishment decisions at individual level. Commonly identified barriers to energy efficient renovations in owner-occupied homes by applied behavioural research relate to finances, information and decision making (Wilson et al. 2014).

Financial barriers include insufficient capital availability (Weiss et al. 2012) and strong preferences towards immediate over delayed gains as indicated by apparently disproportionately high discount rates for energy efficiency investments (Train 1985). For rented housing an additional key financial barrier are split incentives (Williams 2008). Information related barriers for home-owners to invest in energy efficiency measures include a perceived lack of credible and available information on these measures (COI 2010), low salience or misperceptions of energy costs (Sanstad/Howarth 1994), and uncertainties about contractor reliability and cost-saving outcomes (Weiss et al. 2012). Decision-making barriers relate to the cognitive burden (or transaction costs) associated with making complex and irreversible energy efficiency investment decisions (Philips 2012), and the anticipated disruption of home life due to the implementation of renovations works (Roy et al. 2007).

In response to the non-financial types of barriers, a central pillar of the political strategy to support building owners with regard to the energy efficient renovation of their property is to provide sound energy advice from reliable sources and thus reduce uncertainties and transaction costs for building owners. This strategy is corroborated by scientific findings such as those by Achtnicht/Madlener (2012), who, through simulations based on stated preferences survey data of 400 German owner-occupiers, showed that professional energy advice can provide strong incentives for house owners to retrofit their homes.

In terms of empirical evidence, there are comparatively few empirical studies assessing the effectiveness of energy advice measures on energy efficient refurbishment decisions. Those that do, face difficulties to evaluate the actual impact of energy advice on retrofit decisions *ex post* due to several methodological issues associated with reported behaviour (e.g. social desirability bias) and self-selection bias of those availing themselves of the service in the first place. Evaluating the impact of different utility Home Energy Audit Programs in the US, Hirst et al. (1981) found only small differences between participants and non-participants with regard to the subsequent implementation of extensive energy efficiency measures (wall and/or floor insulation). For Germany, based on a survey of 198 households, Frondel et al. (2008), though being sceptical about its cost-efficiency, found that energy advice was the crucial factor to implement recommended energy efficiency measures in between 11 and 34 % of the cases (depending on the measure in question). Furthermore, also the two energy advice programs discussed in the introduction have been evaluated recently (BAFA 2014; Duscha et al. 2014) providing information on the impact of energy advice provision. The evaluation of the BAFA program included a survey among homeowners who did invest in the energy efficiency of their residential building but did not partake in an energy advice subsidised by BAFA. Based on this survey the evaluation study concludes that this energy advice program is in fact successful in improving the quality of the investments in energy efficiency (BAFA 2014). Within the Consumer Association program evaluation (Duscha et al. 2014), an *ex-post* survey among participants confirmed that for many the advice had served as a starting point to gain information about the energetic state of the building (86 %) and which investments in its building envelope and heating system are sensible (93 %). Nevertheless, 88 % of the participants also implemented or planned to im-

2. The subsidies used to be markedly lower in earlier years. In fact, one of the main recommendations of the evaluation was to increase the subsidy (BAFA 2014).

3. This is also shown by the evaluation, according to which 95 percent of homeowners who got an energy advice subsidised by BAFA either had already implemented at least one measure to improve the energy efficiency of their building at the time of the survey or were certain that they will (BAFA 2014, p. 103).

4. A study on behalf of the German Federal Ministry of Transport, Building and Urban Affairs (BMVBS) (2013) identified a yearly rate of 0,8 % which clearly deviates from the 2 % required to achieve the Government's climate protection targets.

plement at least one measure to improve the energy efficiency of their building within the following two years. The evaluation found the average number of implemented measures to be 1.7 and the average number of planned measures to be 0.8, the measures being e.g. adding some insulation, a renovation of windows, a renovation of the heating system or adding solar thermal collectors.

The evaluation results discussed provide evidence that energy advice can perform both functions to motivate and inform. However, the crucial part for policy makers remains to get homeowners to make use of an energy advice in the first place. Devising and testing new approaches for this task was part of the project on which this paper is based. The following section describes the design of this approach.

Experimental design through joint knowledge production

In order to successfully tackle socio-technical challenges within sustainability transitions such as the energetic transformation of the building stock, scientific knowledge needs to be made productive for the design of effective policy to support societal transition processes. To this end, different participatory, co-operative and interactive modes of knowledge production have gained momentum in the recent two decades. In line with the ideas of “mode-2 science” (Gibbons et al. 1994) and “post-normal science” (Funtowicz/Ravetz 1993) contemporary societal issues are being addressed by problem focused teams that extend across scientific disciplines and academia itself into the realm of civic, economic and political stakeholders. Such “context-driven research” (Limoges 1996: 14–15) or action research (Greenwood and Levin 2007) is considered to deliver knowledge through a process of mutual learning/exchange between scientists and practitioners, which is characterised by its immediate applicability to specific real-life problems while at the same time enhancing theoretical understanding of the subject. To describe projects in which policies are developed through direct cooperation between scientists and policy-makers, the term of joint knowledge production (JKP) has recently emerged (van Buuren and Edelenbos 2004, Edelenbos et al. 2011, Hegger et al. 2012a,b). JKP is not only claimed to lead to better, more policy-relevant or more socially robust knowledge (de Pater et al. 2010) but also to enhance the role of scientific knowledge in the policy process (Kemp and Rotmans 2009).

Accordingly, within the project described in this paper, the research team chose an approach along these lines aiming to design innovative and problem oriented energy advice experiments in cooperation with local stakeholders. For the joint development of the energy advice experiment(s), a series of 8 workshops was scheduled to which a range of different local stakeholders from three German cities were invited to participate (Figure 1).

The selection of the cities was based on considerations of their structural properties as well as pragmatic reasons. All of the three cities are located in the Ruhr area, which is the geographical focus of the project on which this study builds. The Ruhr area used to be one of the industrial hearts of Germany with many hard coal mines, coke ovens and steel mills. The last few decades have however been characterised by a stark deindustrialisation.

Despite a substantial expansion of the service sector, it has a comparatively high unemployment rate and, altogether, faces a decreasing population, making it a challenging area for socio-ecological transformation processes. The three cities also represent the Ruhr area demographically. Bottrop is a rather small Ruhr city, Oberhausen is of intermediate size and Dortmund is one of the largest cities and centres in the area. While Dortmund is expected to increase its population in the next two decades, Bottrop and Oberhausen face a substantial decline in the number of inhabitants⁵ and the challenges associated with that. The three cities were also chosen out of pragmatic considerations due to existing networks with stakeholders in the cities and experience-based knowledge about the cities from earlier projects. Bottrop is a special case as it is implementing an ambitious project together with an association of large companies situated in the Ruhr area (Initiativkreis Ruhr) to reduce the CO₂ emissions by 50 percent until 2020 compared to the level of 2010. To achieve this goal, increasing the energy efficiency of residential buildings is seen as an important building block. To this end complementary energy advice to the inhabitants of the project area are offered, which could be utilised in the course of our project.

The joint kick-off workshop had the goal to identify target groups of the experiments within the cities as well as additional stakeholders to be included in the further development process. Moreover, the question was to be decided whether to design distinct experiments for the different municipalities or to implement the same concept uniformly. Participants of this first workshop came from the regional Consumer Association of North Rhine-Westphalia and its local office in Oberhausen as well as the city administrations of Oberhausen, Bottrop and Dortmund. Furthermore, representatives of the urban district office of Hörde (Dortmund), which functions as intermediary between citizens and the municipality, were present as well as from the management of InnovationCity Bottrop, an initiative aiming for sustainable transformation of the formerly industrial city including the energy efficient refurbishment of a whole quarter.

In preparation of the process, the research team performed a socio-spatial analysis for the three cities with view to provided energy advice by the Consumer Association of North Rhine-Westphalia between 2012 and 2015 and cases of energy advice subsidized through the BAFA program between 2007 and 2015.

Figure 2 compares the number of BAFA subsidised energy advice cases in the three cities with the respective values for Germany. It shows that the number of cases per year follow a similar trend: A growth until 2009 with a steep decline afterwards. The BAFA evaluation study discusses various reasons for this trend. Foremost, they see this decline as caused by the more general trend among homeowners towards implementing single measures instead of deep renovations (BAFA 2014). While the respective development in the three cities follows the German trend, the case numbers are below the German average in relative terms. To show this, we have divided the number of cases by the number of residential buildings. If we consider this share for each year and each city, there are just four out of 27 instances (14.8 %) in which the share is as high as in overall Germany.

5. Based on projections by the Statistical Office of North Rhine-Westphalia.

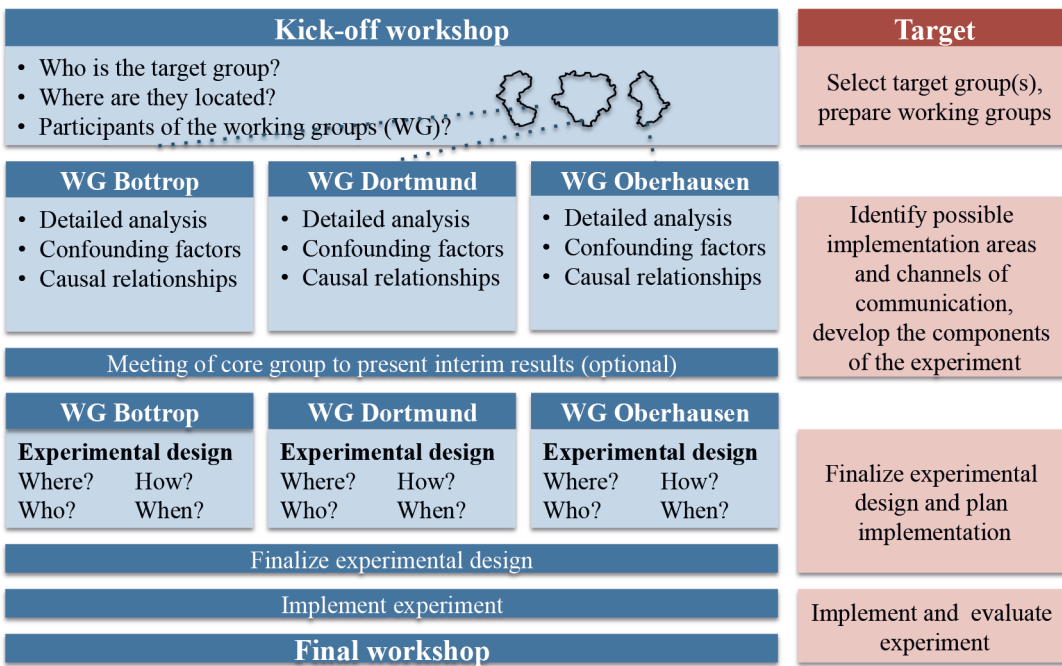


Figure 1. Proceeding within the project and targets of the different stages. Source: Own illustration.

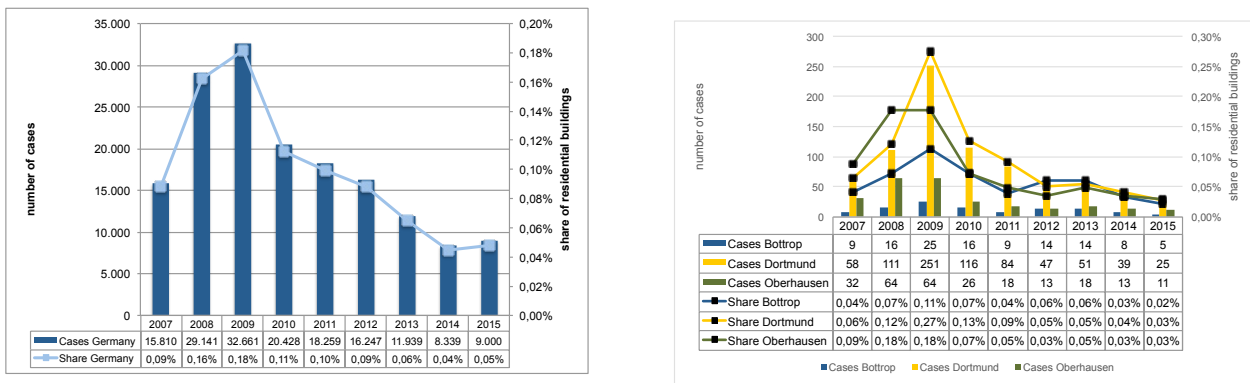


Figure 2. Number of energy advice cases subsidised by BAFA in Bottrop, Dortmund, Oberhausen and Germany. Source: Own illustration based on data provided by BAFA and by the Statistical Offices of North Rhine-Westphalia and Germany.

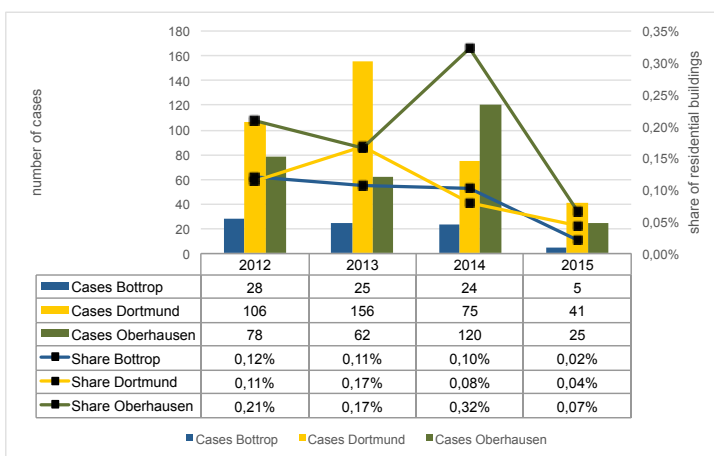


Figure 3. Energy advice provided by the Consumer Association in Bottrop, Dortmund and Oberhausen. Source: Own illustration based on data provided by the Consumer Association of North Rhine-Westphalia and by the Statistical Office of North Rhine-Westphalia.

Within the analysis we were also able to utilise data on the energy advice provided by the Consumer Association as shown by figure 3. No distinct trend in the number of cases can be found here except for a marked decline in the year 2015. This decline might be related to the fact that while a comparable energy advice is still available, the project under which the energy advice was originally funded ended with the year 2014. As data on the number of cases on the state level for 2015 was not available (yet), we were only able to compare the total number of cases in the years 2012 to 2014 for each city with the total number of cases in North Rhine-Westphalia. Calculating a share as described before shows that energy advice was provided to 0.45 % of all residential buildings in North Rhine-Westphalia. The respective shares for the three cities were 0.33 % (Bottrop), 0.36 % (Dortmund) and 0.7 % (Oberhausen).

This information on energy advice cases was then merged with data on the built environment regarding the number of floor levels per building and socio-demographic and socio-economic data on the share of senior citizens (>65 years of age), the share of citizens receiving social welfare and the share of people with a migration background within the quarters⁶ and then visualized in order to identify geographical patterns of availability or non-availability respectively and thus aid the identification of potential target groups and areas for implementing the planned energy advice experiments. Furthermore, information on the ownership structure (i.e. owner-occupier, tenant, landlord, ...), the age and type of buildings (i.e. detached, duplex, apartment, ...) for which energy advice had been provided were analysed for each city. In addition to this analysis, a short survey was conducted among the invited workshop participants, in which they were asked for their perspective/opinion regarding:

- The central barriers for energy efficient refurbishments (within their cities)
- The significance of energy advice for increasing the quality and quantity of energy efficient refurbishments within their cities
- Whether currently offered advisory services are sufficient and
- Where they see deficits of these services (e.g. regarding the form, content or outreach to specific target groups)

Within the workshop, first the representatives of the Consumer Association and the city organisations presented the energy advice programs/activities currently being implemented within the cities and experiences with former projects and activities. Following that, the research team presented the results of the upfront survey and the socio-spatial analysis. Based on this information, smaller working groups were formed along the lines of city affiliation to discuss the further proceeding within each of the cities. As an outcome of the group work, for each city the target groups to be addressed within the respective experiment, the implementation area and potential channels of communication to reach out to the target groups were identified and, for Bottrop, the respective energy advice experiment outlined.

For **Bottrop**, home owners with migration background were identified as a target group that is currently hard to reach. Against the background of current developments on the local real estate market, namely the sale of numerous detached and duplex houses by housing companies in the city quarters Ebel, Bartenbrock und Rheinbarben, and in consideration of the relevance of favourable occasions for energy efficiency refurbishments (Stieß et al. 2009), the idea was to seize those opportunities to offer energy advice to buyers. For **Dortmund**, senior female landlords of apartment buildings were identified as a target group hard to reach and potentially overwhelmed with the financial and cognitive requirements of building management and maintenance. As areas for implementation the three quarters of Hörde, Unionsviertel and Nordstadt were chosen due to pre-existing contacts and networks potentially conducive for the implementation. Lastly, for the city of **Oberhausen**, similar to Dortmund, senior landlords of apartment buildings were identified as target group for the experiment for the same reasons. In contrast to Dortmund however, the target group should also include those landlords not having their residency within the city boundaries. As areas for implementation the quarters Mitte and Lirich were chosen, again due to pre-existing contacts and networks in these areas.

The results of the workshop were documented and taken to be further developed in the next round of workshops taking place in the cities. To this end, the socio-spatial analysis was refined to the level of selected quarters and the previously identified civic and economic actors were invited to participate and contribute to the development of the experiment.

As for **Bottrop** the concept had already been fairly elaborated and thus did not require additional input, the working group basically remained confined to the participants of the kick-off workshop merely including a representative of the company selling the real estate (Vivawest). The specific aspect of a migration background for the target group had been dropped during the further planning process of the experiment for the benefit of the larger group of home buyers in general. Due to an extensive door-to-door energy advice project in Bottrop, mainly new inhabitants are considered to be not informed about the existing energy advice offer in Bottrop. For **Dortmund**, in addition to the city based participants from the kick-off workshop, representatives from the local home-owners association *Haus+Grund*, the Technical University of Dortmund, the local office of DHB Netzwerk Haushalt⁷, a church affiliated think tank and the municipal energy efficiency advice centre (dlze) participated. During the meetings the idea was developed to invite the target group to a thematic afternoon coffee table linking the structural change of the former industrial city quarter of Hörde and energetic refurbishment as an important aspect of development in the built environment. The urban district office officially hosted the event, the home-owners association, and the network household acted as the main multiplier to spread the invitation in their networks. Lastly, for **Oberhausen** additional participants came from the urban district office of Lirich and from the center for environment and energy of the Chamber of Crafts Düsseldorf, an institution providing advice on environmental and energy related matters to craft businesses.

6. Assuming these being properties of groups that are generally difficult to reach by current energy advice service offers.

7. An advocacy association for the concerns of housewives.

The working group discussed the challenges private landlords of smaller multi-family houses are facing in the city. Thus, the decision was not to place energy efficiency as main topic on the agenda but to hold informational evenings regarding these challenges and show the linkages to energetic refurbishment.

Energy advice experiments

The experiments implemented in the three cities differed with respect to few important factors, most importantly:

- the target group,
- how the experiment was advertised,
- the type of activity, and
- the information presented.

Table 1⁸ summarises the three energy advice experiments. As discussed before, the goal of the experiments was not to devise new approaches to conduct an energy advice, but to improve the outreach of the existing programs. In light of the results of the energy advice evaluation studies discussed in the literature review, our hypothesis was that getting more people to get an energy advice could help to increase building energy efficiency investments. Our survey among stakeholders before the first workshop supported the impression that there was no lack in programs offering energy advice and that creating new demand for energy advice was a worthwhile goal.

Bottrop: This experiment targeted new owners of residential buildings. As indicated previously, the approach builds on the results of various studies (e.g. Friege 2016; Stieß/Dunkelberg 2013) that emphasise the importance of using windows of opportunity such as a change in ownership to promote energy efficiency refurbishments. The experiment utilised a cooperation with the existing InnovationCity-Bottrop-project, which entails a complementary energy advice for homeowners living in the project area. The energy advice experiment aimed to supplement the existing programme by adding two new ways to advertise it to new homeowners. First and more importantly, every buyer of a residential building in Bottrop was informed about the possibility to get a complementary energy advice. To inform its new citizens, the city of Bottrop sent a letter, which included an information flyer and was signed by the mayor, to every buyer. Second, within our cooperation with the Vivawest housing company, they included the information flyer on the energy advice programme in their sales documents thereby informing potential buyers about it. The energy advice experiment did not entail provisions for the energy advice itself, meaning that the energy advisors employed by the InnovationCity project gave advice based on the individual state of the residential building and the wishes stated by the new owners.

Dortmund: For Dortmund it had been decided to address a comparatively narrow target group, namely female landlords aged 60 and older. Potential participants were invited by the DHB Netzwerk Haushalt via announcement in their magazine and by the city of Dortmund's energy efficiency advice centre (dlze) via announcement on their homepage. The energy ad-

vice experiment itself included four presentations on (energy efficiency) refurbishments of residential buildings and how to fund and implement them. After the presentations attendees could discuss and ask questions to the experts, which comprised two architects, representatives of the city of Dortmund, a craftsman and a representative of the landlord association Haus+Grund. While the event could only provide the participants with general information on energy efficiency refurbishments of residential buildings, it aimed to motivate participants to later get an individual energy advice.

Oberhausen: For Oberhausen, landlords owning a limited number of dwelling units in the districts of Mitte and Lirich were defined as target group and to be reached via invitation for information events. The city of Oberhausen's database on proprietors of residential buildings was used to invite all landlords in the two districts to participate in the energy advice experiment by mail. In total, 1,759 letters have been sent. The energy advice experiment has also been advertised in local newspapers and magazines as well as on the city's official homepage. The activity comprised four information events covering different topics. The topics have been chosen with the idea in mind to link the subject of energy efficiency refurbishments to other issues of high relevance to landlords. These topics were:

- How to preserve real estate value and rentability
- How to make residential building better accessible (e.g. for seniors or people with impairments)
- How to embellish facades and patios
- How to finance (energy efficiency) refurbishments?

These topics were jointly discussed with the topic of energy efficiency refurbishments. The presentations were held by representatives of the Consumer Association, the Chamber of Crafts and the Wuppertal Institut.

Assessment of the joint knowledge production

In order to assess the success of the project, different approaches have been chosen to evaluate both the process of JKP as well as the outcome. With regard to the former we drew on a framework developed and refined by Hegger et al. (2012a,b) who made a case for assessing JKP processes in a constructivist way by putting the opinions of the project participants at the center of the analysis. According to them, successful JKP can be defined as "a process in which the actors involved have managed to maximize synergy and minimize tradeoffs between the salience and credibility of the knowledge produced as well as the legitimacy of the process" (Hegger et al. 2012a: 54). Credibility relates to the scientific adequacy of evidence and arguments fed into the process. Salience refers to the relevance and applicability of knowledge to the needs of decision-makers. Legitimacy of the process is generated if knowledge development has been "respectful of stakeholders' divergent values and beliefs, unbiased in its conduct and fair in its treatment of opposing views and interests" (Cash et al. 2003: 14). A positive perception of the process with regard to these features by those involved is considered an indicator of the extent to which actors' interests were met, which -in line with the constructivist approach- is treated as a measure for the projects' success. With view to these concepts,

8. Small-scale landlords – with at maximum one or two real estate properties.

Table 1. Overview of the energy advice experiments.

	Bottrop	Dortmund	Oberhausen
Target group	“New” owner-occupiers	Senior female landlords, aged 60 and older	Small-scale landlords
Main channel of communication	Mail by the city of Bottrop	Publications of relevant stakeholders	Mail by the city of Oberhausen
Approach	Invitation to a tailored energy advice by InnovationCity	Inform about energy efficiency; motivate participants to get an energy advice	Inform about topics of relevance to landlords, motivate participants to get an energy advice

Table 2. Indicators for the success of JKP and their operationalisation.

Success indicators	Item(s)
Credibility	The information presented by Wuppertal Institute in the workshops were comprehensible. The information presented by Wuppertal Institute in the workshops were credible.
Saliency	The insights acquired within the project are relevant for my daily work. The energy advice experiment has specifically addressed the needs of the target group/participants. Have you due to your participation in the project gained new insights regarding the design of promising energy advice services? Have you due to your participation in today’s event (meaning the final project workshop) gained new insights regarding the design of promising energy advice services?
Legitimacy	I was able to contribute my know-how and work experiences in the development of the energy advice experiments. Divergent opinions and views were adequately taken into consideration in the development of the energy advice experiment.

questionnaires were developed to capture the perceptions of the actors involved in the JKP process. To this end, closed items as well as some open questions were used (Table 1) and asked in written form within the final workshop. Results of the survey are displayed in Figure 2.

Based on the responses, legitimacy of the process seemed to have been widely achieved, with 12 out of 17 participants (~71 %) of the final workshop fully (8) or somewhat (4) agreeing that divergent views and opinions have been adequately taken into consideration in the development of the energy advice experiment. Furthermore, 13 out of 17 (~77 %) fully (5) or somewhat (8) agreed that they have been able to contribute their know-how and work experiences in the development of the energy advice experiments. In both cases, merely one participant somewhat disagreed with the statement.

Credibility of the scientific inputs into the process also has been perceived well among participants, with 12 out of 15⁹ (80 %) fully (7) or somewhat (5) agreeing that the information presented by Wuppertal Institute in the workshops have been credible. This result has been affirmed by similar results regarding the comprehensibility of the presented information and its helpfulness in developing the energy advice experiments.

Regarding the saliency of the produced knowledge, 11 out of 17 (~65 %) fully (2) or somewhat (9) agreed that insights acquired within the project are relevant for their daily work. However, also three participants (~18 %) somewhat disagreed

with the statement and only six (~35 %) stated that they had gained new insights in the first place. When asked for the content of the newly acquired knowledge, replies predominantly revolved around the importance of windows of opportunity or ‘trigger points’ (EST no date) as taken advantage of in the Bottrop experiment. Furthermore, the exchange with other stakeholders and the scientific partners was deemed conducive for knowledge transfer.

Apart from the three concepts, participants were also asked to assess the overall approach of JKP and its implementation. 15 out of 17 (~88 %) fully (5) or somewhat (10) agreed that the co-operative development of political solutions with research facilities offers advantages compared to an isolated proceeding. Furthermore, 13 out of 17 (~77 %) fully (6) or somewhat (7) agreed that the workshops were a suitable format for the development of an energy advice experiment. Also the participants largely confirmed that all relevant actors were included in the development of the energy advice experiment, with 14 out of 17 (~82 %) fully (4) or somewhat (10) agreeing with the statement. However, in response to open questions asking for comments on the energy advice experiment designing process and suggestions for improvement or comments on the overall project, also critical remarks were made relating to the project outcome vis-à-vis the efforts made. Furthermore, some participants criticized that the role of the research team was not made sufficiently clear and that interim results were not shared early on by the research team with the other stakeholders, indicating room for improvement with regard to the project implementation.

9. The present members of the research team did not answer the questions related to their own contributions.

Assessment of the energy advice experiments

Bottrop: In total, Vivawest reported to have disseminated between 350 and 400 flyers up until January 2017. Beginning in September 2015 the city of Bottrop started to invite buyers of residential buildings. In total, the city of Bottrop has sent out 916 letters until December 2016. Between December 2015 and December 2016, 47 new homeowners have been counselled by the energy advisors employed by the InnovationCity-Bottrop-project. This translates to 5,1 percent of all new homeowners who received a letter. Of those who have been counselled, 24 buyers of residential buildings said they learned about the programme from the letter sent by the city of Bottrop. This translates to roughly 51 % of all participants, indicating a proper result of using this channel for outreach.

The energy advisors participating in the energy advice experiment were asked to hand a survey to their clients to learn more about their perspective on energy advice in general and with regard to that provided in the experiment. Unfortunately, we only received seven responses. Since the response rate (~15 %) has not been in a range we hoped for, the low number of responses calls for caution when interpreting the results.

In order to examine participants' perception regarding the usefulness of energy advice, these were asked if they believed that an energy advice can help them to identify useful measures to improve the energy efficiency and overall quality of their building. Three respondents agreed with the statement, two disagreed and two were unsure. Furthermore, to examine whether previously uninformed homeowners had been activated and to identify the sources used, we asked whether respondents had received advice on how to improve the energy efficiency of their residential building(s) before and where they did get the advice. Four out of seven respondents did discuss options for improving energy efficiency with craftsmen before receiving advice through the project. This might indicate that availment of the energy advice offer is more likely if homeowners have already considered to implement energy efficiency improvements and provides hints for potentially fruitful collaborations between craftsmen and institutionalised energy advice.

Dortmund: To evaluate the success of the experiment, we conducted a survey with all participants. In total, eight individuals participated, all of which were aged 60 or older, and seven out of eight were female. While the low number of participants did not match our expectations, we were successful in addressing the a priori defined target group. The survey also showed that half of the participants had learned about the event from the DHB Netzwerk Haushalt. The other participants named a local office for seniors or the press as source of information or did not answer the question. While the communication channel used in this experiment has the advantage of being very inexpensive, in our case it did not help to motivate a large number of individuals.

The respondents were quite optimistic with respect to the usefulness of energy advice. Five out of eight believed that an energy advisor can help them to identify suitable measures to improve the quality of their building. We also asked the participants, whether they made use of the services of an energy advisor before. Half of the respondents did. Again, the most important contact persons were craftsmen and utilities. However, among the participants two individuals had also utilised

specialized, publicly funded energy advice programs conducted by the Consumer Association of North Rhine-Westphalia or the city's energy advice centre dlze.

In light of the defined goal of the event, we also asked participant if the event motivated them to get an individual energy advice tailored to their building, which four out of eight participants confirmed, two denied and two did not know. When asked if they had already planned to get an individual energy advice before the event, two participants confirmed, five denied and one did not know. Based on these responses, two persons (or one fourth of participants) changed their intention to get an energy advice due to their participation in the event. In our survey we also asked for the participants' perspective on the significance of various barriers for energy efficiency refurbishments. Just two agreed that the lack of an independent and well-qualified energy advisor is an important impediment for them making a decision on an energy-efficiency refurbishment. This can be interpreted in two ways: First, the existing programs offering energy advice are well-known and sufficient or, secondly, other barriers are more important when it comes to making a decision on an energy-efficiency refurbishment and an energy advice alone will not suffice.

Oberhausen: Since the energy advice experiment in Oberhausen employed the costliest method to canvass for participants, the results of this experiment are particularly interesting – yet also the most sobering. In total, 22 individuals participated in at least one of the information events. Based on our survey, just ten of the 22 participants learned about the information event from the letter sent by the city of Oberhausen. In relation to the total number of letters sent (1,759), this translate to a success rate of 0.6 %. Twelve of the participants¹⁰ read about the information event in the press and one heard about it from friends.

The participants received the same questionnaire as used in Dortmund. Being asked about the usefulness of energy advice, 15 participants agreed (~68 %) with the statement, three participants (~14 %) disagreed, two (~9 %) were unsure and two (~9 %) did not answer the question. With respect to previously received energy advice, ten participants (~46 %) had already been advised before, ten (~46 %) had not and two participants (~9 %) did not answer the question. The most important actors in this respect have again been craftsmen (named five times), the local utility (named four times) and Haus+Grund (named four times). In accordance with the results of the other surveys, this shows that the institutionalised energy advice programmes mentioned above are of lesser importance when it comes to experiences with energy advice. Though, being very specialised and costly it can be expected that they are no point of entry when it comes to getting an energy advice. Ten participants (~46 %) confirmed that they will get an energy advice within the next year, six participants (~27 %) denied, two participants (~9 %) were unsure and four participants (~18 %) did not answer this question. Regarding the motivational impact of the event, eight participants (~36 %) confirmed they already had the intention to get an energy advice before participating, ten participants (~46 %) denied this and four participants (~18 %)

10. One participant named both the letter and the press as his source of information.

did not answer the question. Accordingly, just two participants changed their intention of getting an energy advice due to the information event. Given the efforts made regarding the organisation and implementation of the four events, this is a rather disillusioning result for the respective experiment.

As in Dortmund, we asked for the participants' perception regarding the relevance of different barriers for energy efficiency refurbishments. Also here, the lack of an independent and well-qualified energy advisor was predominantly not seen as a major barrier. Seven participants (~32 %) fully disagreed with the respective statement, three (~14 %) somewhat disagreed, four (~18 %) replied neutrally and two (9,1 %) somewhat agreed. The other six participants (~27 %) did not answer this question. In order to examine the validity of our impression a second kind of energy advice experiment was implemented in Oberhausen. Here, project funds were made available to offer the energy advice conducted by the Consumer Association of North Rhine-Westphalia free of charge to twenty landlords. This offer was on a first come, first serve basis and was advertised as such in the local press and the websites of the city and the Consumer Association in August 2016. Until the end of the project in November 2016 just three landlords had taken advantage of the offer. To put it bluntly, landlords in Oberhausen apparently wouldn't take energy advice for free. The fact that we could not find twenty landlords interested to participate in a free energy advice was astonishing and indicates other impediments for homeowners to get an energy advice beyond the financial barrier.

Apart from the participants of the respective events and activities, also the stakeholders involved in the development were asked for their assessment of the experiments and the overall project. With regard to the energy advice experiments themselves, 10 out of 17 (~59 %) fully (4) or somewhat (6) agreed that these have specifically addressed the needs of the target group/participants. Three participants (~18 %) somewhat disagreed with the statement. Assessment of the overall success of the experiments by the participants has however been rather sobering with only five out of 17 (~29 %) somewhat agreeing but six participants (~35 %) somewhat disagreeing with the statement. The remaining participants took a neutral stand in this regard.

Beyond the primary target of the experiments (i.e. the improved outreach to specific target groups) other benefits of JKP relate to the connection of different stakeholders. With regard to this, the overwhelming majority of participants confirmed that the project has enabled an exchange with relevant actors, with 16 out of 17 (~94 %) fully (9) or somewhat (7) agreeing with the statement. Also the exchange between some of the actors might extend beyond the project timeframe, seeing as 11 out of 17 (~65 %) fully (5) or somewhat (6) agreed that the project has contributed to the formation of new topic related networks.

Conclusion

To assess whether our experiments have been successful is not an easy task – even more so because these were deliberately not assigned quantitative goals in advance. In the end, both the process and the energy advice experiments themselves can be seen from two perspectives. To begin on a positive note:

the process of designing the energy advice experiments has been successful in that the workshops enabled stakeholders from different backgrounds to work together and were utilised to design new approaches to be subsequently put into action. Based on the stakeholder's feedback, the process of joint knowledge production also facilitated the establishment of new networks among actors concerned with the energetic refurbishment of the residential building stock who had not worked together before. These networks may serve as a basis for further pertinent exchange and activities and will hopefully remain active to be harnessed in the future. Furthermore, the involvement of scientists in the workshops allowed the stakeholders to learn about new results of research, which are otherwise hard to keep track of in the daily routine of practitioners. In our case, pointing out the importance of windows of opportunities or 'trigger points' has been especially fruitful in terms of knowledge transfer. Their practical relevance could be demonstrated in the energy advice experiment in Bottrop harnessing the window of opportunity related to a change in ownership. In addition, this approach can also be considered the most successful from a cost-benefit perspective. The practice to invite buyers of residential buildings to a complementary energy advice is kept to this day and has sparked interest among the stakeholders from the other cities for replication. While the process of designing the energy advice experiments in co-operation with other stakeholders has been mostly perceived in a positive light, the energy advice experiments themselves must be regarded more sceptically in light of their rather disappointing outcome. This also necessarily questions the design and/or implementation process of the experiments and raises the question whether the produced co-benefits of knowledge transfer and network-building justify the increased efforts associated with the JKP approach. The low number of participants has clearly limited the possible impacts of the energy advice experiments. In light of the efforts undertaken – especially in Oberhausen – the chosen approaches are hardly recommendable for replication without further adaptation. One such adjustment could be to include marketing experts within the design process in order to improve the communication strategy. Another lead to follow relates to the role of craftsmen as the frontline of initial energy advice, which could be incentivised to refer interested homeowners to the respective public services. While the exact reasons for the low turnout remain unclear, the energy advice experiments have shown that landlords are a group that is hard to reach for actors aiming to motivate them to implement energy efficiency refurbishments. Unfortunately, within our case studies it was not viable to conduct a survey among non-participants on why they chose not to partake. Therefore, the question to what extent "low" participation of landlords in energy advice programs is due to factors inherent to the program (e.g. advertising, costs, contents) and to what extent it is due to fundamentals (i.e. perceived nonviability of investments in energy efficiency) remains for future research. Previous research points to the investor-user dilemma as a central reason why landlords are difficult to motivate in this respect (IEA 2007). In light of this, policy responses likely have to go beyond the mere provision of energy advice by creating a regulatory environment which provides economic incentives to make energy efficiency investment in rented housing.

Nevertheless, in order to improve our understanding further research should investigate more closely the decision-making of landlords with regard to what aspects factor into it, what are the main barriers and trigger points for them to utilize energy advice in the first place and how public energy advice service offers can be designed to more effectively perform their motivational function. While using tailored channels for reaching out to specific target groups should not be discarded completely, our results indicate that the combined utilization with trigger points might significantly increase the chances for a program to successfully motivate building owners to avail themselves of energy advice offers.

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