# Assessing developments in a type of German on-site energy consultation for private homes on the basis of evaluations carried out over a set time period

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# **Keywords**

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# Abstract

The energy renovation of residential building plays an important role in the German "Energiewende". Energy consultation with private homeowners is one of the most important instruments in achieving the ambitious goals of the 'Klimaschutzplan 2050', which has been part of the accepted roadmap for the national strategy towards climate protection since December 2016.

The Consumer Association in North Rhine-Westphalia (Verbraucherzentrale NRW) has offered energy consultancy products to their customers since 2008 in three different projects. These include an on-site energy audit for private homeowners for a subsidised fee. The energy consultation is an essential component that is designed to improve the customer's knowledge about the energy efficiency standards of their buildings, and to develop individual measures to lower energy consumption. An additional thermograph examination was offered in order to reach customers in a different way during several winter periods. The on-site consultation is offered mainly to owner-occupiers with single family buildings, or small to medium-sized buildings with up to six residential units. The results of the energy consultations have been evaluated by the Institute for Energy and Environmental Research (ifeu) in collaboration with Kantar Emnid for the years 2008 (MHS project evaluated in 2011), 2013 (KEK project evaluated in 2014), and 2015 (ENeRWin project evaluated in 2016). Each evaluation was based on a survey of 500 customers. In 20-minute CATI interviews the customers answered a set of individualised questions based on the measures conducted. The consistent nature of the surveys throughout the three evaluation periods enables tracking of developments over time. What were the preferred building components for insulation? Which heating systems were installed in which period? How did the energy savings develop? The results show small but significant changes in the decision-making of the homeowners concerning renovation measures for thermal protection and changes in the heating system.

# Introduction

More than 30 % of the total energy consumption in Germany is related to the heating of buildings. In spite of the necessity of increasing the thermal protection of the existing building stock, there has been no significant improvement of the renovation rates. Public efforts to improve the situation focus primarily on private homeowners. Both in the national roadmaps as well as in the concepts of the regional Climate Protection Plan of North Rhine-Westphalia<sup>2</sup>, one important goal is to increase of

Klimaschutzplan BMUB: Climate Action Plan 2050 - Principles and goals of the German government's climate policy. http://www.bmub.bund.de/themen/ klima-energie/klimaschutz/nationale-klimapolitik/klimaschutzplan-2050/, http:// www.bmub.bund.de/fileadmin/Daten\_BMU/Download\_PDF/Klimaschutz/klimaschutzplan\_2050\_kurzf\_en\_bf.pdf.

<sup>2.</sup> Klimaschutzplan NRW: Climate Action Plan of the state North Rhine-Westphalia https://www.klimaschutz.nrw.de/klimaschutz-in-nrw/klimaschutzplan/; https:// www.klimaschutz.nrw.de/fileadmin/Dateien/Download-Dokumente/Sonstiges/ NRW\_BR\_Klimabericht\_web\_januar.pdf.

the energy renovation rate from around 1 % to at least 2 % per year.

There is a high demand for an easy and cheap type of onsite energy consultation in Germany. The regional government of North Rhine-Westphalia has therefore funded several projects undertaken by the Consumer Association of North Rhine-Westphalia (Verbraucherzentrale NRW e.V. – following VZ NRW) in order to test a specific approach: on-site consultation with standardised reports at a lower cost than other assessments (such as Bafa), but still performed by highly-qualified experts.

The paper describes the samples of consulted homeowners and presents the results of the evaluations based on surveys, particularly with reference to the implementation of renovation work following the consultations.

The energy audit products have been evaluated by the Institute for Energy and Environmental Research (ifeu) in collaboration with Kantar Emnid for the years of consultation – 2008[ifeu 2011], 2013[ifeu 2014], and 2015[ifeu 2016].

The paper first shows details of the methodology used in the evaluations and then describes the basic findings, i.e. the changes observed in the implementation of the measures after the consultation. In addition, we attempt to link the evaluation results to contextual developments that influence the German market for energy renovation, such as oil prices and the public image of energy renovation.

#### The on-site consultation for private homeowners

The energy consultation offered to private homeowners, "Energieberatung bei Ihnen zu Hause", is an attempt to initiate and support private measures relating to energetic modernisation and an optimised renovation sequence. It aims to motivate homeowners to invest in improved thermal insulation or sustainable alternatives in heating systems.

As an initial assessment, the on-site consultation is designed to provide a brief overview of the building's current energy performance and recommended measures for improving the energy performance of the building. The consultation takes around 90 minutes at a cost of 60 euros.

More details about the on-site consultation can be found in the different evaluations (MHS<sup>3</sup>, KEK<sup>4</sup>, ENeRWin<sup>5</sup>) and in a previous paper [eceee 2015].

In order to attract different target groups, the VZ NRW launched a special offer during several winter periods. An additional thermographic inspection of the thermal protection of the building (wall, windows) could be combined with the standard consultation.

# **Evaluation**

#### **OBJECTIVES AND METHODOLOGY**

Three evaluations were performed in order to demonstrate the success of the different MHS, KEK and ENeRWin projects. They were designed to investigate the implementation of given recommendations and the effects, primarily in terms of energy savings and  $CO_2$  reductions.

Each evaluation was based on a survey of 500 customers, who had consented to answer follow-up evaluative questions. This sample is assumed to be representative of the full group of participants. Every interview was conducted at least 12 months, and up to a maximum of approximately 4 years, after the date of the energy consultation. The CATI interviews lasted for 20 minutes on average. The customers answered a set of individualised questions based on the work that had been completed. In all surveys the samples consisted mainly of owner-occupiers with single family buildings or small to mediumsized buildings with up to six residential units.

#### CHARACTERISTICS OF THE SAMPLES

There are strong similarities between the samples from the three different evaluations in relation to important characteristics such as building types and the distribution of the years of construction (Figure 1).

In all three evaluations, the number of measures (completed and planned within two years of the survey) and the initiated net reduction of final energy are very similar (Table 1). This indicates that the effects of the consultation in terms of overall energy saving remained more or less constant during the different projects. The observed decrease in  $CO_2$  reduction may be related to fewer changes in energy sources during the time period (see Table 1).

On average across the whole sample (including customers who do not carry out any renovation work), the EZH consultation initiates final energy reductions of around 4–5 % in relation to the gross usage. A further reduction is generated by the renovation work which was previously planned by the owners and also evaluated during the consultation (as the difference between the net and gross reduction).

Between the three evaluated projects there is a shift in the proportion of completed and planned measures depending on the different time delays between consultation and survey interviews (Figure 2). This indicates that it takes a significant amount of time to complete the implementation process. We have to take into account that seasonal conditions affect the relationship between completed and planned measures, and that most renovation work is carried out in the months between spring and autumn.

This observation corresponds to the answers to the question concerning the individual time frame (Figure 3). Most of the homeowners estimate their individual time frame to be between 1 year and a few years.

### Results

#### DEVELOPMENTS IN THE RENOVATION OF THERMAL INSULATION

The strong decrease in outer wall insulation became visible in the evaluation from 2014. Stakeholder interviews cited negative publicity as the main reason. There had been several reports in

<sup>3.</sup> Project ,Mein\_Haus\_Spart', period 2007–2011, funded by EU-ERDF programme, the government of North Rhine-Westphalia, and the participating cities. The main evaluation was carried out in 2008 – a second part was conducted in 2010 to verify the data and the results, but not for quantification due to the limited numbers of cases.

Project 'Klimaschutz und Energiewende konkret (KEK)', period 2012–2014, funded by EU-ERDF programme, the government of North Rhine-Westphalia, and the participating cities.

<sup>5.</sup> Project 'Projekt Energiewende der Verbraucherzentrale NRW (ENeRWin)', period 2015–2017, funded by EU-ERDF programme, the government of North Rhine-Westphalia, and the participating cities.



Figure 1. Comparison of samples (n = 500 per evaluation).

#### Table 1. Implementation of measures and effects of consultation.

	No. of measures (completed & planned)	Net final energy reduction (kWh/a)	Net CO <sub>2</sub> reduction (kg/a)	Final energy: net reduction vs. gross usage
2011 (MHS – n = 500)	2.63	1,963	753	not available
2013 (KEK – n = 331 without thermography	2.65	1,746	703	3.9 %
2016 (ENeRWin – n = 500)	2.69	2,076	638	4.6 %



Figure 2. Proportion measures (completed before the survey/planned up to max. 2 years in the future).



Figure 3. Time frame for carrying out modernisation work (n = 500).

the media in relation to façade fires from 2012 onwards. This resulted in a significant decline in wall insulation, even those using inflammable materials.

A detailed analysis of the different measures shows a shift in conversion rates for wall insulation towards other types of building insulation (figure 4). The wall insulation rate decreases significantly between 2008/2009 (the MHS consultation period evaluated in 2011) and 2012/2013 (evaluated in 2014).

Following the public discussion, a question was added to the evaluation in 2016 asking about the reasons why outer walls were not being insulated, even though they were the subject of the audit. In this partial group of homeowners, 41 % judged this measure to be too laborious and expensive. Some of the homeowners felt that the measure would not be effective in terms of energy saving (20 %), or were worried about the potential negative side effects of the measure (21 %).

Figure 5 appears to show a strong correlation with the age of the house owner: the younger owners tend to believe that the insulation does not reduce energy consumption significantly, whereas older owner are more worried about the significant expenditure and labour that they associate with thermal wall insulation.

# DEVELOPMENTS WHEN CHANGING THE HEATING SYSTEM AND ENERGY SOURCE

About 40 % of the homeowners change their heating system, especially boilers. This value is nearly identical in all evaluations, perhaps indicating that the proportion of old boilers which have to be changed due to their age is similar across all samples.

Detailed analysis of the new heating system shows a significant change of energy source from oil to gas, and to renewable energy sources such as solar energy or wood (Figure 6). The proportion of installed boilers differs strongly and is likely to correlate with oil prices: in 2008 there was a period of very rapidly increasing oil prices. This may have been the main impact on the decision to opt for heating systems using renewable energies. The decision to select a specific energy source is strongly influenced by its economic efficiency – which became more critical during the last few years.

#### CHANGING THE TARGET GROUP WITH THERMOGRAPHIC INSPECTIONS

In order to address different target groups the VZ NRW offered thermographic inspections at a very low price (consisting only of 4 to 6 pictures of the building and a short thermographic report), carried out in addition to and prior to the on-site consultation.

The evaluation shows that recipients of thermographic inspections have different reasons to take part in the on-site consultation compared to "normal" customers. Their motivation is more about checking the energetic performance of the building than renovating it.

This may be an indication that the consultation is addressing a special group of curious homeowners. Another study [behave 2014] of a campaign involving thermography in winter 2012/13 also confirmed "the curious" as a further type of homeowners requesting a consultation. The comparison between participants with and without thermographic inspections shows a slightly smaller number of completed measures and net energy savings (Figure 8). This also indicates a lower level of planned measures. The main points of interest for recipients of a thermographic inspection are the outer wall and the roof. This makes sense because thermographic images are particularly good at showing energy leakage in those areas.



Figure 4. Insulation conversion rates.



Why didn't you insulate the outer wall?

Figure 5. Age of owner & reasons against outer wall insulation (n = 263; selection: outer wall insulation was part of the consultation, but no work was completed or planned).



Figure 6. Renewable heating technologies (at average time of consultation).



Figure 7. Reasons for requesting on-site energy consultation (n = 500: 169 with thermography; 331 normal – multiple answers – KEK 2014]).



Figure 8. Number of measures already planned prior to the consultation.

# Conclusion

The consistent execution of the surveys throughout three evaluation periods enables to derive temporal developments. The number of insulation measures has risen constantly for all building components except for outer walls. They have dropped by about 25 % in 2013 and still remain at a low level.

There is a decline in oil-fuelled heating systems leading to much higher numbers of gas-fuelled systems. Renewable energies, especially wood heating systems, play an important role, however their numbers seem to have declined in line with the low oil price in recent years.

The analyses also shows that different methods of acquiring and addressing customers can be used for different types of customers and their varying attitudes towards renovation work.

The results of the evaluation of comparable consultation initiatives across three projects could be linked to contextual developments that influence the German market for energy renovation, for example oil prices and the negative image of outer wall insulation.

These results may contribute to the discussion about monitoring energetic measures and the appropriate instruments for the "Energiewende".

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