How do companies decide on non-strategic energy efficiency issues? An in-depth study of the decision-making process

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Abstract

Reducing energy demand is crucial to achieve climate goals. For energy-intensive industries, energy is obviously a very relevant cost factor and therefore an integral part of strategic decision-making. However, ambitious emission goals also require companies to improve their energy efficiency in other areas that are not part of their core business and therefore non-strategic. In this contribution, we report findings from a detailed survey of such non-strategic decision processes in German companies. The survey addressed investments in thermal conditioning (i.e. related to windows, facades, etc.) of office and retail buildings as an example to gain a more comprehensive understanding of non-strategic decision processes, which have not been sufficiently addressed in the literature so far. To identify relevant themes and topics, we drew on an earlier interview study. This study indicated the relevance of a variety of different triggers (e.g. need for repairs, shortage of space due to business growth or new regulations on fire protection and accessibility). For these triggers, we surveyed factors that might promote or inhibit the actual implementation of (ambitious) energy refurbishments on such occasions. Ambitious energy refurbishments are characterised by the implementation of an energy efficiency standard that exceeds the minimum legal requirements. This analysis includes the potentially significant multiple benefits of refurbishments, such as increased employee motivation and productivity or an improved image. We examined decision-makers' individual perceptions of these potential benefits and the possible downsides of ambitious energy efficiency (EE) measures, and analysed their influence of these perceptions on the willingness to champion EE measures. In addition, we analysed the role of different departments within a company and the potential influence of intermediaries e.g. like energy consultants, carpenters, plasterers, installers, architects, etc. on decisions about EE measures. We therefore chose a multi-actor approach and aimed at identifying innovative leverage points for policies and programmes to support companies in reducing their energy demand in areas outside their core business activities.

Introduction

To achieve climate targets and mitigate climate change, it is crucial that companies as important decision makers invest in decarbonisation goals. This includes making production processes as well as the provision of services more energy efficient. However, the infrastructure needed to perform these activities, e.g. buildings, office equipment, transport, must also become more energy efficient and the energy used less carbon-intensive. For some companies, these kinds of decisions relate to their core business activities, e.g. for energy-intensive industries like steel or cement with high energy costs or for transport companies like delivery services with high expenses for their fleets. However, for many companies, some of the fields that need to be decarbonised are not part of their strategic focus, because energy and therefore improved energy efficiency or switching energy sources only represents a minor factor in terms of costs and relevance. Nevertheless, in view of the ambitious climate goals that need to be achieved, they are still rel-

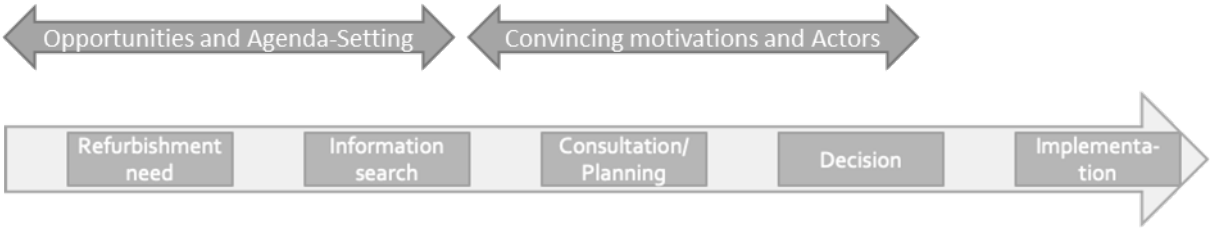

Figure 1. Decision-making processes in companies on EE measures (adapted based on Arning et al. 2020).

evant for the transition to a more sustainable economy. So far, there has been very little research into the factors that could steer decision-making processes in companies towards energy efficiency (EE) in these fields or the factors influencing the outcome of such a decision-making process in a company. With this paper, we intend to contribute to closing this gap in the literature. To do so, we carried out a questionnaire study with a net sample of 332 respondents from German companies. To specify the empirical research design, we focused on refurbishments as an example for such decision-making processes in the direction of greater energy efficiency. Before we present our statistical findings, we summarize the state of knowledge in the current literature and outline our research questions. Then, we describe our methodological approach in more detail and finally present our findings before discussing their implications.

DECISION MAKING IN COMPANIES ON EE MEASURES

Traditionally, a large body of literature in the field of energy efficiency has explored the barriers to implementing EE measures (Cagno et al. 2019). A barrier is "a mechanism that inhibits a decision or behaviour that appears to be both energy efficient and economically efficient" (Sorrell et al. 2004). The barriers frequently discussed in the literature include (Sorrell et al. 2004): 1) no monitoring of energy consumption or knowledge about the current energy demand or efficiency level, 2) lack of awareness of EE issues, 3) lack of knowledge about appropriate measures, e.g. refurbishment, 4) split incentives, also discussed as the landlord-tenant dilemma, 5) the investor's lack of time to engage in information searches and decision-making, 6) lack of capital, and 7) unreliability of technology/measures. This list of barriers shows the variety of technological, economic and behavioural-institutional aspects that seem to be relevant for companies' decision-making on EE. Overall, the literature on barriers remains descriptive to some extent and is not able to capture the development of decision-making processes over time or as a multi-actor process (cf. Cagno et al. 2013 for a recent perspective on the barriers literature).

Beyond the literature on barriers, however, few studies have looked into decision-making processes concerning EE measures in companies. For refurbishments of office and commercial buildings, which form the research case of our study, the academic research so far mainly consists of a small number of studies from the United States. They highlight the role of costs and the motivation of reducing energy bills (Kontokosta 2016; Gliedt and Hoicka 2015), but also necessary repairs as an opportunity for energy-related refurbishments as well as further co-benefits of renovations like market recognition, increased tenant comfort, environmental benefits and peer influence (Kontokosta 2016). Finally, Curtis et al. (2017) extend the actor perspective on company decision-making by analysing the role of facility managers in initiating and implementing retrofits. Based on an explorative interview study, they find a large degree of heterogeneity regarding the actual influence, which is shaped by facility managers' personal interest and expertise in energy efficiency issues amongst other things.

DECISION MAKING FROM A PROCESS PERSPECTIVE

In a recent book chapter, Arning et al. (2020)[1] further develop the idea of decision making as a process – a conceptual focus that has gained some relevance in analyses of the buildings sector (Wilson et al. 2018; Stieß and Dunkelberg 2013) not only for the residential, but also the non-residential buildings. Their considerations form the conceptual basis for our study and are therefore outlined in more detail. For companies, they propose a five-stage model and empirically explore and refine this in an interview study (n=5 corporate decision makers, n=5 experts such as energy consultants). The model starts with (i) the emergence of the refurbishment need and a (ii) search for information followed by (iii) consultation and planning, and then the (iv) final decision for (v) implementation (see Figure 1). They emphasize that especially stages i and ii, and similarly iii and iv, overlap to a large extent and seldom develop linearly, but rather that companies move forwards and backwards between stages within this process.

They further emphasize that the initial phases are shaped by what they call 'agenda setting'. Agenda setting relates to how ideas make it onto the organisation's agenda, i.e. are noticed and discussed by the relevant parties. Opportunities that lead to the initiation of this process include a variety of factors, which might be internal or external as well as energy-related or non-energy-related. Internal energy-related factors encompass, e.g. energy costs or energy audits. The latter could also be an external factor if triggered by regulation. External energy-related factors include pressure from customers or third parties like consultants. Non-energy-related internal triggers include changes in the work process (e.g. extensions or changes in production or services) or damage to existing installations. The external factors here also relate to legal obligations like adaptation in line with enhancing accessibility, or the desire to make the building more attractive to customers.

In stages iii and iv, many companies often involve additional actors in the process, so-called advising intermediaries, e.g. architects and consultants, or implementing intermediaries, e.g. craftsmen. Both types of intermediaries can have a substantial

1. This book chapter was written as part of the same project, DiffusionEE, which also funded the survey presented here.

influence on the options that are actually considered in the decision-making process, including (more or less ambitious) EE measures. Sometimes this role is internalized, e.g. if an energy manager is appointed. However, the influence of implementing intermediaries like craftsmen is usually limited to the different options considered once the decision about the type of measure has been made (e.g. the efficiency of a new facade). In contrast, advising intermediaries can influence the type of measure as well (e.g. whether to combine a facade renovation with a new heating system or an overall refurbishment including the roof and windows).

RESEARCH QUESTION

Drawing on the concept developed by Arning et al. (2020), this paper aims to increase the knowledge with regard to decision making in companies by addressing the research questions (RQ) described below. Arning et al. (2020) compile a list of internal and external triggers or opportunities that cause companies to initiate a decision-making process for an EE measure. Based on a survey, we aim to make quantitative evaluations of the frequency of these opportunities to answer the following research question:

RQ1 What (internal and external, energy-related and non-energy-related) opportunities make companies initiate a decision-making process on EE measures?

Decision making in companies is a multi-actor process and usually integrates a variety of internal and external actors as outlined with reference to intermediaries above. Therefore, our study will take a closer look at the roles of several actors and to what extent they typically act as initiators, supporters or opponents of energy efficiency measures. In this context, our analysis addresses the following two research questions:

RQ2 Which departments are involved in the decision making on EE measures and what role do they play?

RQ3 Which intermediaries can influence the decision making on EE measures in companies?

To achieve emission reduction goals, it is important that the frequency of ambitious EE measures increases. Therefore, it is crucial that more opportunities that could potentially trigger ambitious EE measures (including non-energy-related opportunities; cf. RQ1) actually result in the implementation of ambitious EE measures. Therefore, we take a closer look at the motivations of the individuals involved in corporate decision making. More specifically, we analyse how they perceive EE measures, how different perceptions of EE measures affect the motivation to campaign for ambitious measures, and how these perceptions interact with company characteristics and the position of individuals in the organisational hierarchy. These considerations are reflected in the following two research questions:

RQ4 Which perceptions of EE measures influence decision-makers' intentions to aim for ambitious EE measures?

RQ5 Which personal and company characteristics influence the willingness to strive for ambitious EE measures?

Methods

In this chapter, we first explain our decision to focus on refurbishments of existing office and commercial buildings as a research case. Subsequently, we describe the collection and preparation of the data our analysis is based on as well as the content and structure of the survey. Finally, we provide a descriptive overview of the collected sample.

REFURBISHMENTS AS THE RESEARCH CASE

We focused on energy-efficient refurbishments of non-residential buildings to limit the scope of our survey and to make it easier to answer for our respondents by referring to a specific type of decision making. We chose refurbishments because the building sector harbours huge potential for reducing CO_2 emissions. The building sector is responsible for about 30 % of global energy consumption and over 50 % of global electricity consumption (IEA 2018). To achieve a climate-neutral building stock, energy-efficiency measures are crucial (e.g. thermal insulation or efficient/renewable heating technologies). As the investment rate in energy-efficient (EE) refurbishment measures and technologies is currently too low (cf. dena 2018 for Germany), numerous policies to encourage such EE measures have been implemented in many countries. For example, the Energy Performance of Buildings Directive (EPBD) and the Energy Efficiency Directive (EED) require EU Member States to establish strategies for the renovation of their national building stocks and report on them every three years. Our analysis concentrates on refurbishments in the existing building stock as energy efficiency standards in new buildings are covered by legislation. We examine decision-making processes around measures related to the thermal conditioning of buildings, mainly heating and insulation, but also cooling and ventilation. For reasons of consistency within the survey, but also due to their high relevance as consumers of space heating in the non-residential building sector[2], we further focused on offices and commercial buildings.

DATA COLLECTION AND PREPARATION

Our survey aimed at decision makers who have both direct experience of and influence on refurbishment decisions related to the office and commercial buildings owned by their company. Therefore, the fieldwork for our study was subcontracted to a market research company with special expertise in surveys concerning non-residential buildings. The data collection took place between the end of October 2019 and the end of February 2020. Recruitment was primarily via e-mail invitations and was partly supplemented by telephone enquiries, in order to identify suitable contacts in companies.

Participation criteria were checked using screening questions at the beginning of the questionnaire. In particular, it was asked whether the respondent's company has owner-occupied offices and/or commercial buildings in Germany. If the respondent answered "no", the survey was discontinued. If there were such buildings, we then asked whether the respondent had been involved in investment decisions regarding these buildings in the

2. Offices and retail/trade buildings consume more than half of the final energy demand for space heating in non-residential buildings in Germany (Steinbach et al. 2016).

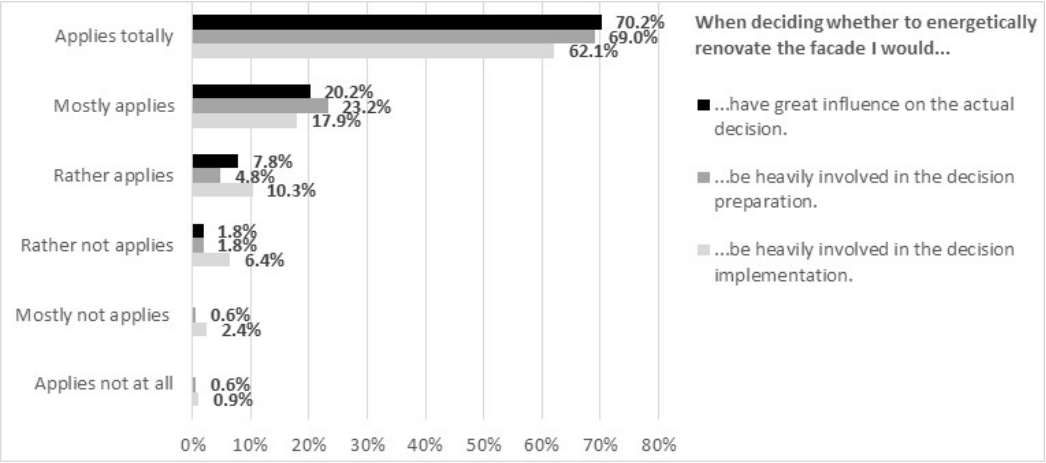

Figure 2. Respondents' influence on investment decisions.

last ten years. If this was not the case, the survey was discontinued, and the respondent was asked to forward the invitation link to someone who had been involved in such decisions. If the respondent was involved in investment decisions for at least one of these buildings, we asked them (for a hypothetical case) about their influence on the decision to carry out an energy-efficient facade renovation. This question referred to the largest of the office/commercial buildings for which the respondent stated their involvement in a real world investment decision during the last ten years (this building is subsequently called "reference building"). The distribution of responses is depicted in Figure 2.[3]

The market research institute contacted a total of 16,000 persons from its database. Participation was on a voluntary basis without any compensation offered. This resulted in 5,120 hits on the online questionnaire, of which 2,365 only visited the introduction page. In 1,299 cases, the survey was discontinued due to the answers to the screening questions. In 1,101 cases, the survey was abandoned at a later point by the respondents. In total, 355 respondents completed the survey. Our analysis is based on data from 332 respondents due to excluding cases with more than 30 % missing values. For the remaining respondents, we imputed missing values for the questions regarding the eleven promoting or inhibiting factors addressed in section 3 of the questionnaire (cf. next section and Table 1) by **E**xpectation-**M**aximisation imputation. The use of EM imputation for the independent variables of our statistical analysis was necessary to reduce bias resulting from estimations impacted by missing values (Allison 2002) and to avoid a loss of statistical power that would result from listwise deletion.

SURVEY CONTENT AND STRUCTURE

Besides the described screening questions, the survey consisted of five parts and (1) contained some technical questions on the size, use and energy consumption of the reference building. Then further questions were asked about (2) the investment decisions made for the reference building over the last ten years. These included questions about the reasons for the investments, the parts of the building concerned, the implemented energy efficiency level, and the role of different departments in the decision-making process. In part (3), questions were asked about a hypothetical situation, which we subsequently referred to as the *reference* measure. In order to obtain comparable results, respondents were asked to imagine that the company had moved to a new building. A scaffolding would have to be put up for facade repairs anyway, and the question was asked whether an energy-efficient renovation of the facade should be carried out as well on this occasion. In this context, the interviewees were asked what results they would expect from an energetically ambitious renovation compared to simple repair work. In this part, questions were asked concerning eleven potentially promoting or inhibiting factors (cf. Table 1). Part (4) contained questions on the role and influence of different internal actors (departments, hierarchical levels, etc.) and external intermediaries (craftsmen, architects, etc.) on the decision about the reference measure. In the last section of the questionnaire, (5) information was collected on the attitude and demographics of the respondent as well as on the structural characteristics of the company involved.

SAMPLE DESCRIPTION

Most of the sampled companies are from the manufacturing sector, provide administrative and support services or belong to the wholesale and retail trade sector. Other economic sectors account for only minor shares in our sample (cf. Figure 3).

Although the majority of the companies in our final sample can be characterised as owner-managed small and medium-sized enterprises (SMEs), our database covers a wide range of different company sizes (cf. Figure 4).

This is also reflected in different degrees of internal diversification as can be seen in Figure 5. Over 40 % of the surveyed companies have specialised departments or specialist staff for human resources, sales or purchasing. Controlling and marketing/PR exist in 32.5 % and 30.1 % of the companies, respectively. Other specialised departments (facility management, sustainability management, CSR/compliance) and works councils are relatively rare. The existence of production and logistics/

3. In general, only those participants who stated that it "totally", "mostly" or "rather" applies that they have great influence on the actual investment decision were allowed to participate further in the survey. In addition, participation was also possible for respondents who stated that this "rather not applies" if they stated that it "totally" or "mostly" applies that they are heavily involved in the preparation of the decision. The question regarding the involvement in implementation had no screening purpose, but is depicted for completion. Beyond the described screening questions, no other criteria or quotas were set.

warehousing (36.7 % and 34.6 %, respectively) reflects the different economic sectors in our sample (cf. Figure 3). 37.3 % of the companies have a middle management, which was defined in the survey as an executive level below the company leadership.

The vast majority of the respondents are managing directors or members of the executive board (64.8 %). The second largest group are persons from middle management (15.1 %). In total, almost 85 % of the respondents hold an executive position. The other departments account for relatively small shares and 12.3 % did not specify their main job in the company.

Results

In this section, we report the results with regard to the research questions of our study. These are structured in three subsections. First, based on part two of our questionnaire, we provide descriptive information about the real investment measures that were implemented in the reference building over the last ten years and thereby refer to RQ1 on opportunities that could lead to EE investments. Second, we report descriptive results from the fourth part of the questionnaire, which addressed the role and influence of different internal and external actors with regard to the reference measures responding to RQ2 and 3. In the third subsection, we report results regarding barriers and drivers that might influence the willingness to conduct an energy renovation in the context of the reference measure addressed in the third part of the questionnaire. This comprises descriptive results as well as the findings from a regression analysis and relates to RQ4 and 5.

FREQUENCY OF AND OPPORTUNITIES FOR INVESTMENT MEASURES (RQ1)

As our screening questions required prior experience with actual investment decisions regarding (not necessarily energy-related) renovations of office and commercial buildings, only respondents who had experience with at least one investment measure in the last ten years were part of the sample (cf. Figure 6). In 47 % of the cases, there was only one investment measure for the reference building over the past ten years, i.e. more than half the sample had implemented more than one

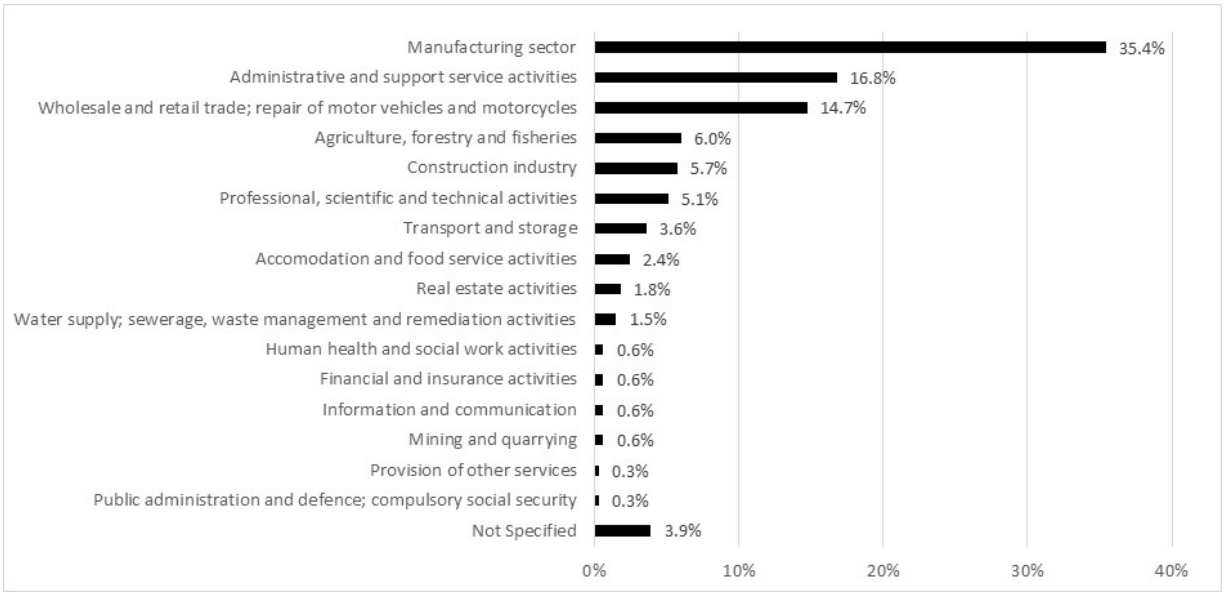

Figure 3. Economic sectors of the surveyed companies.

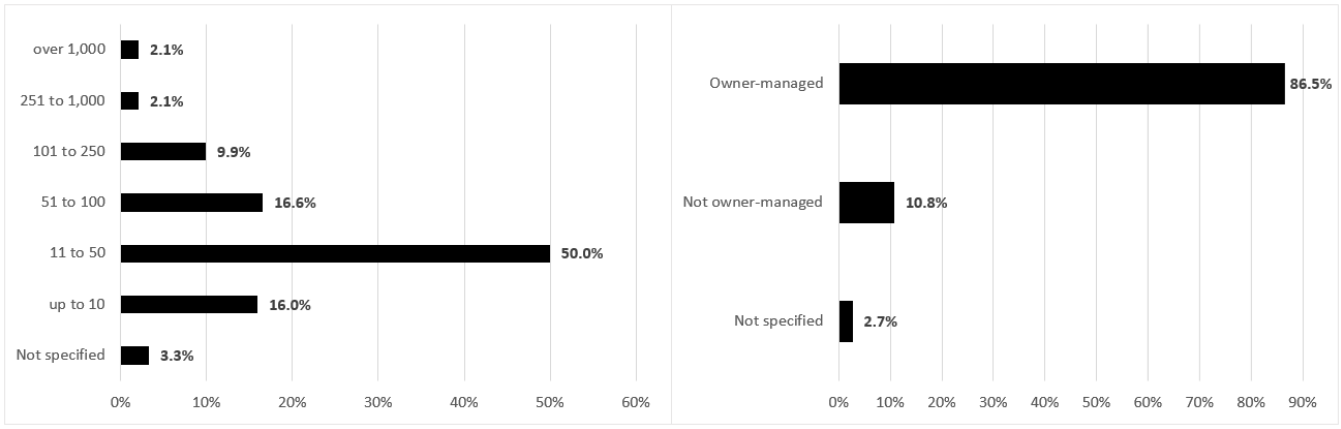

Figure 4. (a) Size by number of employees and (b) Ownership structure of the companies.

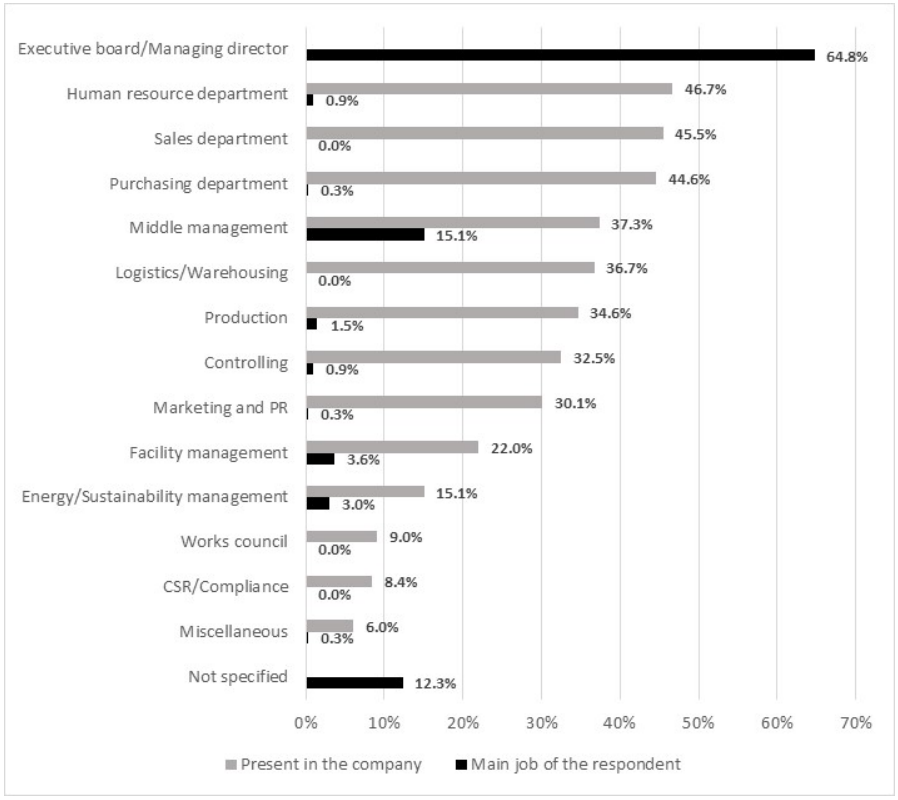

Figure 5. Main job of respondents and organisational structure of their companies.

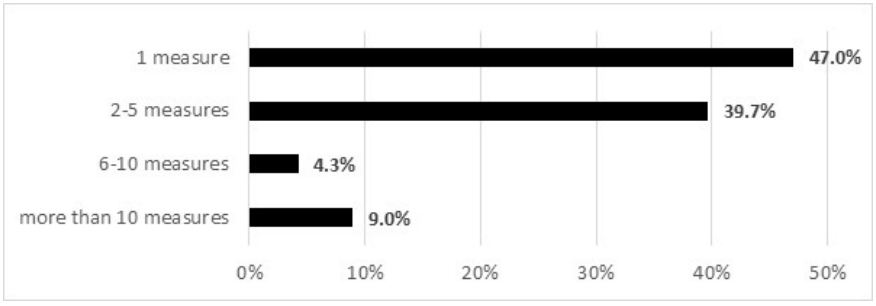

Figure 6. Number of investment measures implemented in the last ten years.

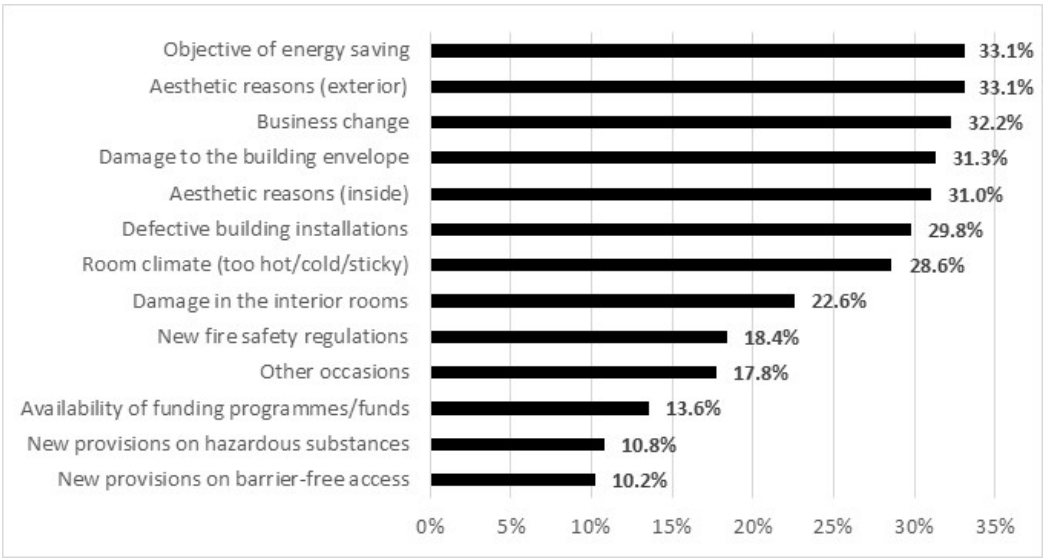

Figure 7. Main opportunities for investment measures in the last ten years.

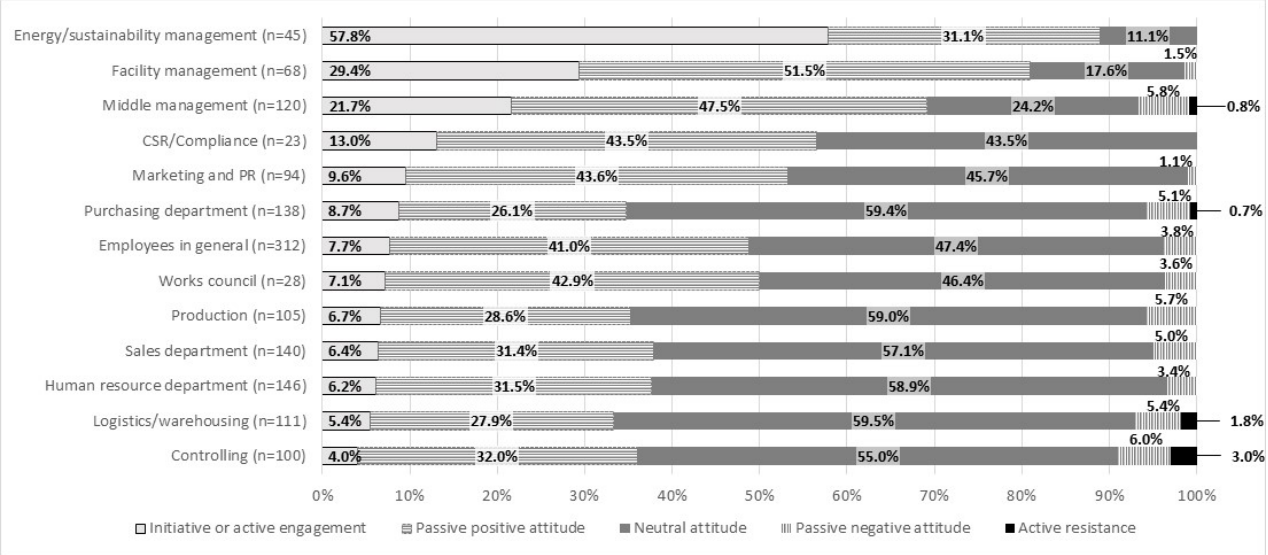

Figure 8. Expected role of different actors regarding an energetic renovation.

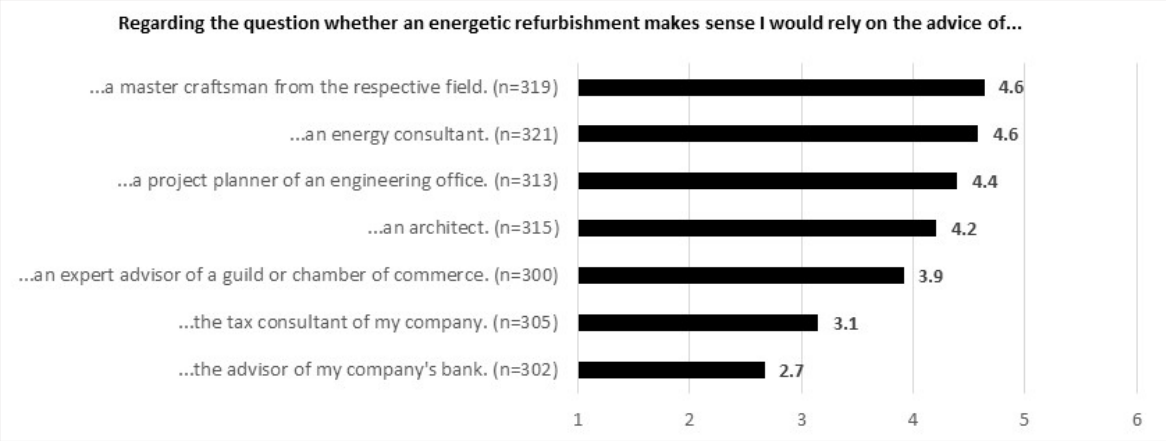

Figure 9. Influence of intermediaries on (energetic) renovations.

measure. 39.7 % implemented between two and five measures, 4.3 % between six and ten measures and 9.0 % more than ten measures.

There are manifold main reasons for these investment measures (cf. Figure 7[4]; secondary reasons were also surveyed but are not reported). The most frequently mentioned were the desire to save energy, aesthetic reasons, change to the business (e.g. growth of the company) as well as damages and defects. Although they were mentioned less frequently, new regulations regarding fire safety, hazardous substances or barrier-free access also triggered a noteworthy share of the investments. In addition, the availability of funding programmes was also of relevance. The stated "other occasions" largely related to the standardised answer options and contained more detailed information (e.g. which building installations were defect).

4. Multiple answers were possible as there could have been more than one investment measure over the last ten years (cf. Figure 6).

INVOLVEMENT OF INTERNAL AND EXTERNAL ACTORS (RQ2 AND 3)

With regard to the reference measure, respondents were asked whether they expected the different departments and other internal actors to support or oppose an energetic renovation. The results are depicted in Figure 8. When interpreting the reported shares, it must be taken into account that not all of the listed departments/actors exist in all of the surveyed companies (cf. Figure 5 and information about the size of the respective subsamples in Figure 8). If present, energy/sustainability management is most often expected to be the initiator or active proponent of an energetically ambitious renovation, followed by facility management, middle management and CSR/compliance department in second, third and fourth place, respectively. The remaining departments and other actors are rarely expected to act as the initiator or active proponent of energetically ambitious renovations. With the exception of energy/sustainability management, other internal actors were expected to take a passively positive or neutral position regarding the issue of energy-related renovations. Active opposition or a passively negative attitude were not generally expected. Except for the controlling department (3.0 %), logistics/warehousing (1.8 %),

Table 1. Independent/dependent variables of the analysis.

Item text[a]	Mean (standard dev.)
Dependent variable: I would actively advocate that an energy refurbishment is carried out instead of simple repair work.	4.7 (1.4)
Independent variables: Through energy-related renovation, my company would …	
... contribute to *climate protection*.	4.7 (1.4)
... make a good impression on customers and visitors.	4.7 (1.4)
... ensure a *future-proof solution* (avoid/anticipate future renovations).	4.6 (1.4)
... underscore the values of our company.	4.6 (1.5)
... on balance, save money.	4.5 (1.3)
... improve the indoor climate.	4.3 (1.4)
... elicit *positive reactions from employees*.	4.3 (1.4)
... ensure the adherence of voluntary commitments (compliance).	3.9 (1.7)
... gain access to funding.	3.8 (1.6)
... make the *practical implementation* of the conversion more complicated.	3.6 (1.5)
... increase employee productivity.	3.5 (1.6)

[a] *Answer options: 1=applies not at all; 2=mostly not applies; 3=rather not applies; 4=rather applies; 5=mostly applies; 6=applies totally.*

middle management (0.8 %) and the purchasing department (0.7 %), none of the internal actors were mentioned as active opponents.

The expected influence of intermediaries as external actors who might influence the decision whether or not to conduct an energetically ambitious renovation reported in Figure 9 was measured using Likert scales that range from one (applies not at all) to six (applies totally). In this regard, master craftsmen and energy consultants are the intermediaries whose advice is most trusted by the respondents. Similarly, the advice of project planners, architects and experts from a guild or the chamber of commerce is considered as (rather) reliable, while tax consultants and bank advisors received less positive evaluations.

FACTORS THAT PROMOTE OR HINDER ENERGY RENOVATIONS (RQ4 AND 5)

In the third part of the questionnaire, the respondents were asked about the results they expect from an energy-related renovation compared to simple repair work. The formulation of these items was informed by qualitative interviews (cf. Arning et al. 2020) and additional desk research. The results are reported in Table 1 – again, the answer options ranged from one (applies not at all) to six (applies totally). The short names of the variables that turned out to have significant effects in the regression analysis are highlighted as underscored italic text.

Seven of the eleven statements regarding expected results received evaluations between 5 (mostly applies) and 4 (rather applies) on average, with standard deviations that ranged from 1.3 to 1.5. Four of the statements were evaluated between 4 and 3 (rather not applies) on average and had slightly higher standard deviations of between 1.5 and 1.7. The effect of the reference measure most expected by respondents is a contribution to climate protection, while an increase in employee productivity is the least expected one, although the average rating is at the neutral point (3.5) of the Likert scale.

The regression analysis to evaluate the relevance of the potential barriers and drivers depicted in Table 1 consisted of three steps. In step one, a basic model was created, which contained the eleven possible consequences of an energy-related refurbishment as independent variables. To account for possible differences between respondents, a second step tested whether there are interactions between the eleven independent variables of the basic model and three moderator variables[5]. For this purpose, 33 interaction terms were formed (three moderator variables × eleven independent variables). Subsequently, we tested for significant interaction for each of the three moderator variables. In other words, a model was tested for each of the moderator variables, which contained the eleven independent variables, the respective moderator variable and its eleven interaction terms. In this step, only the moderator variable "middle management" showed significant interactions (with the variables "climate protection" and "practical implementation"), while the other two moderators did not.

In step three, the final model was created by excluding statistically non-significant variables. To do so, the basic model was supplemented by the moderator "middle management", the interaction terms that showed significant effects in step two. Subsequently, all independent variables were excluded that had neither significant direct effects nor significant interaction effects. Deviating from this procedure, the variable "positive reactions of employees" remained in the model, although it had not displayed a significant effect so far. The reason is that the p-value of this variable in the base model and the various interaction models was close to the threshold of significance and, at the same time, there is a strong correlation with other independent variables (in particular "indoor climate", "productivity" and "company values"). After excluding the other non-significant variables, we found a significant effect for "positive employee reactions". In contrast, the interaction effect between "middle management" and "climate protection" is not included in the final model, as it was no longer significant after excluding the non-significant variables.

The final model has an R^2 of .391 (R = .625; p = .000), i.e. the independent variables explain 39.1 % of the variance in the intention to champion an ambitious energy renovation instead of simple repair work. Table 2 reports unstandardised and standardised effects of the variables in the final model.

5. "Executive management" and "middle management" were included as the first and second moderating variable, as these were the most frequently held positions of the respondents (cf. Figure 5). In addition, we included the ownership structure "owner-managed company" (Figure 4b) as the third moderating variable, as it can be important for the decision-making scope of executive management.

The willingness of the respondents to champion ambitious energy renovation increases, if they expect it to contribute to climate change mitigation efforts (climate protection: .325), avoid future renovations (future-proof solution: .273) and result in positive reactions from employees (.144). In addition, respondents from middle management are generally more willing to champion ambitious energy renovations (.343). The expectation that an ambitious energy renovation will be more complicated than simple repair work has no significant influence on the general willingness to champion the former (-.096). However, for respondents from middle management, the negative effect is stronger due to an interaction effect (increased by -.307). For these respondents, the expectation of more complicated implementation significantly decreases the willingness to champion an ambitious energy renovation (-.403**).

Discussion and conclusions

In the context of our five research questions, the findings can be summarised as follows. While energy saving was most frequently mentioned as the main trigger for investment measures, a wide range of other reasons for refurbishment activities exist that might represent (missed) occasions for EE measures. In particular, construction works due to aesthetic reasons, damages and business changes occur almost as often as deliberately planned EE measures. Taking into account that the rate of energy renovations in the building stock needs to increase substantially to meet CO_2 emission targets, even less frequent triggers for construction works like new regulations on fire safety, hazardous substances or barrier-free accessibility could probably make an important contribution if these occasions are also used to implement ambitious EE measures. More generally, these findings underline that energy and energy savings are not the only topics that can be addressed to enhance energy efficiency in companies, but that many other occasions could be used. However, the chances of EE measures actually being implemented on such occasions depend on them getting onto the organisation's agenda. Therefore, we also analysed who is involved in these types of decisions.

If energy/sustainability management exists in a company, it is likely to use such occasions to champion solutions that are ambitious in terms of energy efficiency. However, many of the companies that participated in our survey did not have such a position. This might be because the issue of energy consumption and energy savings is not seen to be of strategic importance, or because the companies here were too small to have assigned it a dedicated role. The same applies to facility management (cf. Figure 10). However, to make the most of occasions for EE measures, it is necessary that someone champions ambitious EE measures within the company. In this regard, it could be promising to persuade actors from middle management to act as innovation champions, as middle management exists relatively often and usually already has a positive attitude towards EE measures. External actors could play an important role here. Our findings show that, in addition to energy consultants, craftsmen, technical project planners/architects but to some extent also representatives from associations like the chamber of commerce are trusted in this regard. This means if these groups actively promoted the topic of energy efficiency investments, it is very likely that more companies would consider them should an occasion arise.

For such advice to be implemented in reality via the decision-making process in the company, it is crucial that internal actors are willing to champion ambitious EE measures. Our results indicate that the expectations that the investment will lead to climate protection, the implementation of future-proof solutions and positive reactions from employees have a positive influence in this regard. In the case of middle managers, we also identified the fear that ambitious energy renovations will be more complicated to implement than simple repair works as a relevant barrier. Thus, energy and climate issues could be strong arguments to promote the measures, but are not likely to be sufficient on their own. Here, offers such as contracting could have a positive influence, because they mitigate the risk for the company, free middle managers from having to deal with the implementation themselves, and guarantee successful results. In addition, trusted groups of intermediaries could also credibly illustrate the longevity of energy-efficient solutions and dispel concerns about too complex implementation.

It is important to note the relevance of social components here, i.e. the reactions of other employees. Earlier studies of company investments in EVs found evidence of this (Globisch et al. 2018). It is difficult for policy measures to target the specific social climate within a company, but this is likely to be related to the general societal climate and awareness of climate protection measures. People are more likely to support climate measures at their places of work or even request them if society as whole recognises the need to spend money on climate mitigation.

We should also point out the limitations of our methodology. First, to obtain a viable research design, we restricted our empirical study to buildings and refurbishments. However, it would be important to research whether our findings are also valid for other fields, e.g. investments in green IT and other

Table 2. Results for the final model.

Variable	Unstandardised coefficients (standard error)	Standardised coefficients
Climate protection	.308 (.050)	.325***
Future-proof solution	.263 (.051)	.273***
Positive reactions from employees	.143 (.051)	.144**
Practical implementation	-.089 (.045)	-.096
Main job in middle management	1.287 (.495)	.343**
Middle management × practical implementation	-0.277 (.120)	-.307*

****p<.001; **p<.010; *p<.050*

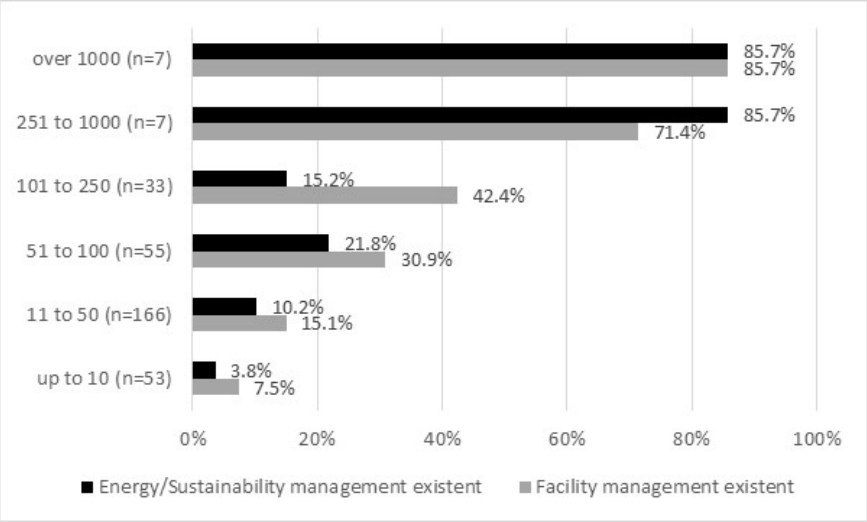

Figure 10. Existence of energy/sustainability or facility management.

office equipment or company mobility. Furthermore, with regard to the generalisability of the results, it should be noted that our sample is one of convenience. This is particularly evident in the high discrepancy between the gross and net sample. With regard to the question of (dis)use of opportunities for ambitious energy renovations, it is difficult to define the relevant population of decision makers and internal actors ex ante, which makes it challenging to collect representative samples. One major reason for this is the complexity and heterogeneity of possible constellations of actors and decision situations. Future studies could focus on specific target groups (e.g. middle management) and/or refurbishment scenarios with the potential for implementing EE measures (e.g. construction measures for aesthetic reasons). Future research could also take a closer look at the advisory and supply behaviour of intermediaries.

Overall, our findings are useful for policies aiming to trigger company investments in energy efficiency measures. They highlight the relevance of intermediary actors as a target group, which could be addressed, as these are relevant gatekeepers. Thus, policies offering incentives to craftsmen or planners to promote energy efficiency could make a significant contribution to achieving decarbonisation goals. Additionally, in line with the currently emerging stream of research on the co-benefits or multiple benefits of energy efficiency (Reuter et al. 2020), we found there are multiple occasions that can lead to investments in buildings. It therefore seems very promising to link this variety of occasions with a variety of benefits, something that has so far been neglected when designing policies (Fawcett and Killip 2019).

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