INTEGRATION OF NON-ENERGY BENEFITS INTO ENERGY AUDIT PRACTICES TO ACCELERATE THE UPTAKE OF RECOMMENDED MEASURES

OVERVIEW OF ENERGY AUDITING PRACTICES AT ENTERPRISES (D2.1)

06th December 2023

KNOWnNEBs has received funding from the European Union's LIFE21-CET-AUDITS programme under grant agreement no. 101076494.

Start Date	01/11/2022	Duration	36 months
Project URL	https://webgate.ec.europa.eu/life/publicWebsite/project/details/101076494		
Deliverable	D.2.1 – Overview of energy auditing practices at enterprises		
Work Package	2		
Nature		Dissemination Level	*Public (D.2.1)*
Lead Beneficiary	BME (WP2)		
Author	Miklós Horváth, Tamás Csoknyai (BME)		
Co-authors	Gatis Žogla (Ekodoma), Aiga Barisa (Ekodoma) Paula Fonseca (ISR), Pedro Moura (ISR), Margarita Puente (ESCAN), Francisco Puente (ESCAN), Georg Benke (E7), Corina Maria Stanese (E7), Nina Nikolova (CISB), Mihael Deliyski (CISB), Vladimir Tsankov (CISB), Marta Mazurkiewicz (KAPE), Andreas Androutsopoulos (CRES), Laura Bano (SOGESCA), Andrea Cervato (SOGESCA)		

DISCLAIMER

The KNOWnNEBs project has received funding from the European Union's LIFE21-CET-AUDITS programme under grant agreement no. 101076494. The sole responsibility for the content of this document lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the CINEA nor the European Commission is responsible for any use that may be made of the information contained herein.

EXECUTIVE SUMMARY

Objective of task: Summary of outcomes from T.2.1 and T.2.3. (pdf., EN, national language - LV, HU, BG, GR, IT, PT, ES, PL, AT)

Introduction:

The main objective of this deliverable is to gather and organise information regarding current practices of energy auditing and NEBs associated with measures recommended within the energy audits. This document summarises the outcomes of WP2 of the KNOWnNEBs project. In the first part the current auditing practices are reviewed on European and national levels. Firstly, the legislative background based on the EED was collected and the national implementations are shown. The second part gathers and shows the existing calculation methodologies, standards and available tools existing calculation methodologies, relevant European and international standards such as EN 16247 family standards as well as calculation methodologies and approaches used in energy audits of enterprises. In the third part the implementation strategies are explored in the target sector, which is based on face-to-face interviews and online surveys. This part aims to gather information regarding the actual experiences in companies which includes the whole process from energy audit to implementation of measures. The main outcome of this task will be information on considerations and barriers which companies face to uptake the recommendations from energy audits and the list of suggested energy efficiency measures which are implemented most frequently.

Co-funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.

CONTENTS

1. EU LEVEL REVIEW ON ENERGY AUDIT PRACTICES

1.1. The energy efficiency directive (EED)

Introduction

The directive 2012/27/EU of the European parliament and of the council of 25 October 2012 on energy efficiency (amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC) describes the definition and objectives of energy audits. There was another amendment in 2018 (Directive (EU) 2018/2002) with no important changes related to energy audits.

Most requirements have already been implemented by the member states since 2012.

Definition and objectives of an audit

According to the directive an 'energy audit' means a systematic procedure with the purpose of obtaining adequate knowledge of the energy consumption profile of a building or group of buildings, an industrial or commercial operation or installation or a private or public service, identifying and quantifying cost-effective energy saving opportunities, and reporting the findings. Energy audits are an essential tool to achieve energy savings. They are necessary to assess the existing energy consumption and identify the whole range of opportunities to save energy. This should then result in proposals of concrete saving measures for the management, public authorities or home owners. Furthermore, energy audits allow the identification and prioritization or ranking of opportunities for improvement. In this way, energy audits tackle the information gap that is one of the main barriers to energy efficiency. Through the identification of energy saving possibilities and proposed recommendations for follow-up, audits are also the basis for the development of a market for energy services.

The result of an energy audit may be, for example, a recommendation for window replacement in a household, for insulation of piping in a factory or for setting up a comprehensive energy management system in commercial buildings, among other recommendations. Furthermore, energy audits are not only centered on technical solutions such as replacements or retrofits, as significant opportunities for improvement may also exist in connection to the operation, both industrial and commercial, for example the more efficient operation and continual optimization of operating procedures, control parameters, logistic and layout optimization and maintenance planning.

Energy audits may also be part of a broader environmental audit that considers storage possibilities, connection to district heating and cooling networks or potential for demand response in industries and commercial buildings. A private or

public service, e.g. city public transport system, may also be subject to an energy audit that results in the identification of cost-effective energy saving opportunities.

Having an energy management system in place requires enterprises to carry out detailed energy review processes, which also result in the systematic identification and reporting of energy saving opportunities. This may also be the case for enterprises implementing environmental management systems.

Main pillars of the EED related to energy audits

The directive and its recasts have set up the following main requirements to build up the auditing scheme for the member states:

1. Energy audits should be mandatory and regular for large enterprises, as energy savings can be significant. Energy audits should take into account relevant European or International Standards, such as EN ISO 50001 (Energy Management Systems), or EN 16247-1 (Energy Audits), or, if including an energy audit, EN ISO 14000 (Environmental Management Systems).
2. The EED prescribed for the member states to set up a network of reliable professionals competent in the field of energy efficiency to ensure the effective and timely implementation, for instance as regards compliance with the requirements on energy audits and implementation of energy efficiency obligation schemes.
3. Member States are obliged to promote the availability to all final customers of high-quality energy audits which are cost-effective and:
   3.1. carried out in an independent manner by qualified and/or accredited experts according to qualification criteria; or
   3.2. implemented and supervised by independent authorities under national legislation
4. Member States are obliged to develop programmes to encourage SMEs to undergo energy audits and the subsequent implementation of the recommendations from these audits.
5. Member States may set up support schemes for SMEs, including if they have concluded voluntary agreements, to cover costs of an energy audit and of the implementation of highly cost-effective recommendations from the energy audits, if the proposed measures are implemented.
6. Member States are obliged to bring to the attention of SMEs, including through their respective representative intermediary organisations, concrete examples of how energy management systems could help their businesses. The Commission assist Member States by supporting the exchange of best practices in this domain.
7. Member States are obliged to also develop programmes to raise awareness among households about the benefits of such audits through appropriate advice services.

8. Member States are obliged to encourage training programmes for the qualification of energy auditors in order to facilitate sufficient availability of experts.
9. Member States are obliged to ensure that enterprises that are not SMEs are subject to an energy audit carried out in an independent and cost-effective manner by qualified and/or accredited experts or implemented and supervised by independent authorities under national legislation by 5 December 2015 and at least every four years from the date of the previous energy audit.
10. Energy audits may stand alone or be part of a broader environmental audit. Member States may require that an assessment of the technical and economic feasibility of connection to an existing or planned district heating or cooling network shall be part of the energy audit.
11. Where a Member State had to build up by 31 December 2014, certification and/or accreditation schemes and/or equivalent qualification schemes, including, where necessary, suitable training programmes, become or are available for providers of energy services, energy audits, energy managers and installers of energy-related building elements.
12. The data used in energy audits have to be stored for historical analysis and tracking performance.

Minimum criteria for energy audits

According to the directive an energy audit needs to be

1. based on up-to-date, measured, traceable operational data on energy consumption and (for electricity) load profiles;
2. comprise a detailed review of the energy consumption profile of buildings or groups of buildings, industrial operations or installations, including transportation;
3. build, whenever possible, on life-cycle cost analysis (LCCA) instead of Simple Payback Periods (SPP) in order to take account of long-term savings, residual values of long-term investments and discount rates;
4. be proportionate, and sufficiently representative to permit the drawing of a reliable picture of overall energy performance and the reliable identification of the most significant opportunities for improvement

1.2. European audit standards

1.2.1. EN 16247-1 – General requirements:

This standard defines the attributes of a high-quality energy audit. It states the requirements for energy audit and corresponding obligations within the energy auditing process. The standard applies to commercial, industrial, residential, and public-sector organizations, all forms of energy and energy uses. It does not deal

with energy audit program/ scheme properties (such as program administration, training of energy auditors, quality control issues, and energy auditors` tools, etc.). In other words, it covers the general requirements common to all energy audits.

1.2.2. EN 16247-2 - Buildings

The scope of the standard is energy audit of buildings covering the usage and operation, the provision of services such as heating, cooling, humidification, dehumidification, ventilation, lighting, domestic hot water, transportation systems (e.g. elevators, escalators, and moving walkways) in buildings, information systems, including building automation and control systems, and processes. In addition, energy is used by appliances within the building. This information can be used in the analysis to provide comparative energy performance evaluation. Energy performance indicators (benchmark values, if available) or average statistical specific energy consumption data are usually published nationally for different building types and ages. In addition, the energy audits covered under the standard are usually independent from building energy performance certification and other legislative requirements.

1.2.3. EN 16247-3 - Processes

This standard applies to sites or parts of sites where a significant part of the energy use is due to processes. There are various sectors with important differences in processes and utilities and many types of processes in industry and commerce, with important differences in energy use and energy consumption. A process can also include one or more production lines or services, offices, laboratories, research centres, packaging and warehouse sections with specific operational conditions and site transportation.

1.2.4. EN 16247-4 – Transport

This standard is intended for the energy auditing of mobile assets e.g. vehicles, railways, marine, vessels, aircrafts, as well as mobile plants. Due to the mobility of the assets in transport, energy auditing in this area is especially challenging. For example, the meeting is harder to organize, the activities involved are harder to inspect. The first part of the document harmonizes the procedures for energy auditing in transport systems. On the other hand, there are certain aspects which are particular to every transport mode. Finally, the possibility of planning and selecting the mode of transport (and sometimes using different modes for a unique transport service) is also a specific aspect of the transport activity. Therefore, this standard takes special attention to this topic.

1.2.5. EN 16247-5 – Competence of energy auditors

This standard specifies the competence requirements of the energy auditors. Competence applies to an individual but would also apply to a team or a group of auditors where a wide range of skills is needed. Where the energy auditor is not an individual, a member of the energy auditing team needs to be nominated as lead energy auditor. This document can be used to specify energy auditor qualification schemes at a national level; used by organizations undertaking energy audits to appoint a suitably competent energy auditor and used by organizations, to ensure a good level of quality of the energy audits. According to this standard, the energy auditor's skills, experience and attributes are personal. However larger sites, installations and more complex organizations may need the skills of a variety of technical experts working together. If an energy audit team is appointed, it should be composed of a lead auditor and technical experts, as necessary, to meet the technical competence requirements. The requirements included in this standard help the energy auditor to understand the organization's aims, needs and expectations concerning the energy audit.

1.2.6. EN ISO 14001 – Environmental management systems

The purpose of this standard is to provide organisations a framework to protect the environment and respond to changing environmental conditions in balance with socio-economic needs. It specifies requirements that enable an organization to achieve the intended outcomes to set up an environmental management system, which provide value for the environment, the organization itself and interested parties. A systematic approach to environmental management can provide top management with information to build success over the long term and create options for contributing to sustainable development. This standard, like other standards, is not intended to increase or change an organization’s legal requirements. Consistent with the organization’s environmental policy, the intended outcomes of an environmental management system include; enhancement of environmental performance, fulfilment of compliance obligations, achievement of environmental objectives. It is applicable to any organization, regardless of size, type and nature, and applies to the environmental aspects of its activities, products and services that the organization determines considering a life cycle perspective. It gives a framework, but does not state specific environmental performance criteria.

1.2.7. EN ISO 16001 – Energy management systems

This standard specifies requirements for establishing, implementing, maintaining and improving an energy management system. Such a system takes into account legal obligations the organization must comply with. It enables the organization to take a systematic approach to the continual improvement of its energy efficiency. It lays down requirements in the form of more efficient and more sustainable energy use, irrespective of the type of energy. However, this standard does not

itself state specific performance criteria with respect to energy. It is applicable to any organization that wishes to ensure that it conforms to its stated energy policy and to demonstrate such conformance to others. This can be confirmed by self-evaluation and self-declaration of conformance or by certification of the energy management system by an external organization.

1.2.8. EN ISO 50001 – Energy management systems

This standard provides organizations to establish the systems and processes necessary to continually improve energy performance, including energy efficiency, energy use and energy consumption. It specifies the energy management systems (EnMS) requirements for an organization. Successful implementation of an EnMS supports a culture of energy performance improvement that depends upon commitment from all levels of the organization, especially top management. In many instances, this involves cultural changes within an organization. This standard applies to the activities under the control of the organization. Its application can be tailored to fit the specific requirements of the organization, including the complexity of its systems, degree of documented information and available resources. It does not apply to product use by end- users outside of the scope and boundaries of the EnMS, nor does it apply to product design outside of facilities, equipment, system or energy-using processes within the scope and boundaries of the EnMS.

Whilst EN 16001 addresses the purchase of equipment, raw materials and services, ISO 50001 refers to an energy measurement plan.

1.3. Review on precedent projects on energy audit methods and practices

During the previous audit project reviews 9 distinct projects have been evaluated, which are withing the time period of 2015 to 2023. The projects provide valuable insights, collectively advancing energy audit methods and practices. Key themes include capacity building, SME targeting, integrated approaches, policy influence, industry-specific solutions, standardization, technological innovation, policy analysis, data compilation, and renewable energy integration. The projects highlight the importance of tailored and standardized solutions for sustainable energy efficiency goals. While acknowledging non-energy benefits, only a few projects explicitly mention quantification, underscoring the significance of assessing and communicating these benefits for project attractiveness and impact.

2. SUMMARY OF IN-DEPTH ANALYSIS ON ACTUAL ENERGY AUDIT PRACTICES IN ENTERPRISES IN PARTNER COUNTRIES

Document T2.1 describes in detail the audit schemes established in the 9 countries of the project partners. In this chapter only a short summary is presented about the key findings. An overview table can be found in Annex 1 with cross country comparison. A detailed review of the current audit practices for each country are summarised in the Supporting document of D2.1.

In general, it can be concluded that the energy audit systems in all partner countries are well established, following the requirements of the EED Directive. National implementations have resulted in similar solutions, but with some minor differences. Many similarities can also be identified with regard to the operational shortcomings of the audit system.

For this project, the most important identifiable gap is the complete absence of a non-energy benefit indicator system, with the exception of carbon dioxide emissions, which is generally applied in all but one partner country.

Starting with the positive aspects, all partner countries have a well-established institutional framework, and the formal implementation of legislation is almost complete. Only in Austria there is a temporary gap in the functioning of the system due to the revision of the legislative background, but this is expected to be resolved soon.

The licence to audit is usually linked to a degree in engineering, but the range of qualifications allowed is quite wide. In some countries, separate qualifications are required for buildings, processes and transport; in others, the same licence may be used for all three. A specific exam is always required to get the licence.

In general, there is a specific methodology that needs to be followed to issue the certificates, but for the field work, the auditors have freedom to use the methods they want. They are mostly restricted to general guidelines to carry out the audits based on European audit standards. Although the application of standards and methods is mostly optional, each framework provides a list of minimum requirements and a data template to be filled in an online system that is stored by a central (national or regional) supervising institution.

There are no official software tools for energy audits, but in 5 countries there are official tools for issuing Energy Performance Certificates of buildings that can be optionally used for the building domain. Dynamic simulation tools for modelling buildings can be used in 8 countries, but they are rarely applied in practice, except for large complex buildings in Portugal. For industrial processes and transport, professionals or companies make their own tools, usually in MS Excel, but in some countries more complex tools have been developed as well, which are not always

publicly available. Neither questionnaire data collection nor in-depth interviews with building users are common during audits, although project partners would consider this useful and important. This is probably because such data collection is not a mandatory element of the audit protocol.

The quality check systems are working in the majority of the countries with check rates of 3-8% (in one country 68%), however, in 3 partner countries there is no protocol established for the audit procedure nor for the quality control of the data collected. In spite of the working compliance and control systems, they have limitations and often there is no assurance of the robustness of reporting data, as there is often no detailed template for reporting, nor requirements for granularity of data or for detail of the analysis. In two countries there is even no register for energy auditors, only the obligated companies are checked.

Access to the data collected during the audit is generally highly restricted, although in many countries information is provided upon request, with certain limitations. Public data transparency is therefore not common.

Only one country has an audit requirement for SMEs, and only two partner countries have to implement any of the measures recommended by the audit, and even there only a minimum effort is expected.

It can be considered as a general problem that auditors who are very highly skilled and diligent usually practice at higher rates (which is completely legitimate and reasonable), but unless the company decision makers are well aware of the effort a good energy audit requires, those auditors are at a competitive disadvantage in the market. Therefore, the robustness of the audits is not always of high confidence. Many companies do not see the added value of a good and detailed audit and therefore their concern is just about complying with the legal framework. However, the impact of the energy crisis seems to have turned the tide in all partner countries: the perception of the usefulness and necessity of audits seems to be improving.

3. SUMMARY OF INTERVIEWS WITH ENTERPRISES

3.1. Introduction

The aim of the interview campaign in the KNOWnNEBs project was to understand the importance and view of non-energy benefits regarding energy efficiency measures. When designing the questionnaire survey, the aim was to conduct on-site interviews with 2 people in 5 companies per country, one with a top manager and the other with a technical manager or energy expert. An important criterion for the selection of companies was that they had carried out an energy audit in the last few years. In total, 83 interviews were conducted in 47 companies in 9 countries. Of the companies, 38 were in the food sector and 40 were SMEs. The interviews took place from May to September 2023. Interviews lasted 1-2 hours per subject and were conducted in person or online. Below we go through the main outcomes question by question, the interview questionnaire can be found in Annex 2. The in-depth interviews also included actions taken so far in companies that can be linked to audits that can be found in the country reports.

3.2. Reason for performing the energy audit

Three main reasons can be identified with roughly equal weighting as the reasons for conducting the audit:

- The first is the need to reduce energy costs, the increased energy prices and the need to find the most efficient technical solution.
- The second main reason was the intention to get an EU fund or to take part in a tender to obtain investment funds.
- The third main reason was the legal obligation, which obviously applies to large companies in all countries. Several here noted that these companies perceived the audit as a compulsory nuisance.

In several cases, the owner or another department, or even the management board, was cited as the reason, i.e. the real reason was not revealed.

In interviews the following reasons were given one or two times:

- the audit was part of an ongoing project
- to improve company image or to attract multinational corporate clients
- it is important for food safety measures
- part of the savings was tax refundable
- to maintain job sustainability
- environmental protection and CO_2 savings were cited as a reason

There was not a notable difference between the answers of the top manager and the technical person, except that in some cases the latter said that the top manager's decision was the reason.

3.3. Who in the company made the decision that energy audit is necessary?

In most interviews the top manager, the management board, the owner or the head of a department (e.g. production manager, technical manager, environmental manager) made the decision. In one case the maintenance department favoured the audit, management just approved it. There was one case where it was mentioned that junior colleagues had encouraged it due to environmental awareness reason.

3.4. What is the prior knowledge regarding energy efficiency measures of the person who decided that an energy audit is needed?

The vast majority of interviewees lack even fundamental energy competences. In some cases they have acquired basic knowledge because of their interest. In some other cases, they were familiar with technological processes, but not about buildings. In one single case the top manager reported many years of experience in energy and environment.

3.5. How was the energy auditor selection carried out?

In most cases, they chose an auditing company on the basis of personal acquaintance or the recommendation of a friend. This was followed by cases where they were unable to answer. In a good number of cases there was some previous cooperation with the auditing company, e.g. a monitoring system or other equipment had been installed. In several cases, a firm was selected from a directory or market by request for proposal. In one case the audit was part of a project and the audit was carried out by a project partner.

3.6. How was the auditing process, how were the results of the energy audit presented to the company?

The process of the audits was very similar, but respondents did not always emphasize the same thing. In many cases, they did not follow the process, they only saw the report. The first step of the audit was always the negotiation of the task, which was followed by the provision of data (measured consumption data based on utility bills, technical data, transfer of design documentation). Some people complained that meeting the data requirements involved a lot of work.

This was typically followed by several on-site inspections. In many cases, this was supplemented by on-site measurements, and in one case a questionnaire had to

be filled out. The next step was the handing over of the documentation in the form of a report. In one case, it was noted that it was a very short report. Quite a few times, in addition to the report, a presentation or a consultation between the company and the auditor took place. One company mentioned that the report was reviewed in several departments. In two cases it was also mentioned that some of the proposed measures had been implemented (although it is not relevant for this question).

3.7. Which results of the audit surprised you or were not expected?

More than half of the respondents were not surprised by the audit results. Several people indicated that the audit indicated greater savings potential than they had expected. The results regarding the modernization of the lighting were generally not surprising, but several people were surprised by some of the proposed options (solar collector, heat exchanger replacement, building a monitoring system). It should also be mentioned here that there was a respondent who was surprised that there is still potential for savings in the operational side of the otherwise modern system. Among those who received the expected result, several indicated that the audit was nevertheless useful because it strengthened their position. One respondent indicated that he was surprised by the high consumption of technology, and another by the significant consumption outside working hours.

3.8. Has the attitude towards the energy audit changed due to the crisis?

The vast majority of those interviewed reported a very significant impact as a result of the energy crisis. There was practically no one who said that saving energy costs was not important. However, about a quarter of the respondents said that this was a very important issue for the company even before the crisis, so the crisis itself did not bring any significant changes.

Some pointed out that since the crisis, it is much easier to convince decision-makers about these types of issues, especially energy audits. At the same time, several people pointed out that their focus was not primarily on energy efficiency, but on the production of energy from renewable energy sources, the diversification of energy sources, or the development of processes. However, the majority emphasized energy efficiency.

3.9. Which part of the energy audit results was the most important?

Three-quarters of the respondents considered the processes more important, and a quarter considered the buildings more important. Only one respondent voted for

transport. As the reason for this, several people pointed out that the processes are responsible for the majority of the company's energy consumption. At the same time, there were cases where there was no substantial savings potential on the process side due to technological reasons, therefore they turned to buildings. It is interesting that several times it happened that the manager and the technical person selected different area within the same company.

3.10. How the decision process of implementing energy efficiency measures is made in the company?

In most cases, the proposals come from lower level, usually from the technical department, or an external energy advising company. The final decisions are made by the owner, the manager, a department head, or the management board. Some pointed out that the recommendations of the audit were taken into account. Four interviewees tied the decision to the payback period, defining the acceptable limit at 2-3 years in all cases, noting that low-cost measures are accepted immediately, longer ones with a longer process. In one case, an amount was given, below 50,000 euros, they will decide immediately, and it will be included in the annual budget. In another case, it was also indicated that there is a decision-making event on investment issues once a year.

3.11. Are there any drawbacks of implementing energy efficiency measures because of which you do not implement these measures?

Financial aspects can be mentioned as the very first reason. The high investment cost, the long payback period, and the lack of funding applications are cited by many respondents as reasons. Almost as many indicated that there was no problem and that the proposed measures had been implemented. In many cases, technical or organizational reasons were pointed out, such as the large space requirement of the new equipment, the long time required for the investment, the noise associated with the investment and other disturbing factors, or the need to interrupt the production to implement certain measures. Some highlighted the lack of labor in the construction industry or its high price.

3.12. What dynamics were triggered by the energy audit?

More than half of the respondents did not report this. Those who reported, however, mentioned the following:

- Many experienced a positive effect on the employees' energy- and environment-conscious attitude, one respondent also highlighted the team-building impact
- Similarly, some people indicate an increase in the staff's energy-related competence or a better understanding of the processes
- There were some who highlighted the fact that they understood that it is worthwhile to regularly monitor the development of energy consumption
- There was also someone who highlighted other additional effects regarding the better functioning of certain machines.

3.13. Non-energy benefits

Most of the respondents listed several non-energetic advantages, those who considered only cost savings to be important were in the minority. The mentioned advantages - in order of number of respondents - are the following:

- Most of them emphasized the positive effect on the company's efficiency. This includes fewer breakdowns, optimization and better monitoring of production processes, higher profits resulting from better productivity, resulting in more employable workers and higher productivity.
- Many people highlighted the importance of a green image, environmental awareness, some also mentioned the contribution to meeting climate goals. One respondent highlighted that the solar panels improve the corporate image.
- Several people mentioned the positive effects on the work environment, such as better lighting comfort, lower noise level, better air quality.
- Two mentioned saving water and reducing the amount of waste water.
- Someone also mentioned the improvement in product quality due to better cooling technology.
- One respondent experienced more effective cooperation with suppliers by improving the efficiency of the technological chain.
- Someone mentioned the improvement of the staff's energy awareness as a positive.
- According to one respondent, getting to know new technologies is also a positive side effect.

3.14. Future interest in the project?

Nearly 90% of those interviewed indicated that they were interested in further participation in the project.

3.15. Conclusion

The insights gathered from interviews with enterprises regarding energy audits provide valuable information on the motivations, decision-making processes, and

outcomes of energy efficiency initiatives within these organizations. Here is a summary of the key findings:

- Reasons for Performing Energy Audits: The primary motivations for conducting energy audits included the need to reduce energy costs, access EU funds or investment opportunities, and legal obligations.
- Auditor Selection: The selection of auditing companies was often based on personal acquaintances, recommendations, or previous collaborations.
- Audit Results: Process improvements were considered more important by three-quarters of the respondents, with one quarter emphasizing buildings. Transport was considered least significant. More than half of the respondents were not surprised by the audit results. The audit results were considered useful, even when aligned with expectations, as they strengthened the company's position.
- Impact of Energy Crisis: The energy crisis significantly influenced attitudes toward energy audits, with nearly all respondents emphasizing the importance of saving energy costs.
- Decision-Making Process for Implementing Measures: Lower-level
- Drawbacks to Implementation: Financial constraints, including high costs and long payback periods, were the primary obstacles to implementing energy efficiency measures. Technical and organizational challenges, such as space requirements, production interruptions, and labor shortages, were also mentioned.
- Dynamics Triggered by Energy Audits: While many did not report significant changes, some mentioned positive effects on employee attitudes, energy-related competence, and a better understanding of energy consumption. Some experienced team-building effects and improved machine performance.
- Non-Energy Benefits: Respondents frequently highlighted non-energy advantages, with the most common being increased company efficiency, cost savings, a green image, environmental awareness, improved work environments, and better product quality.

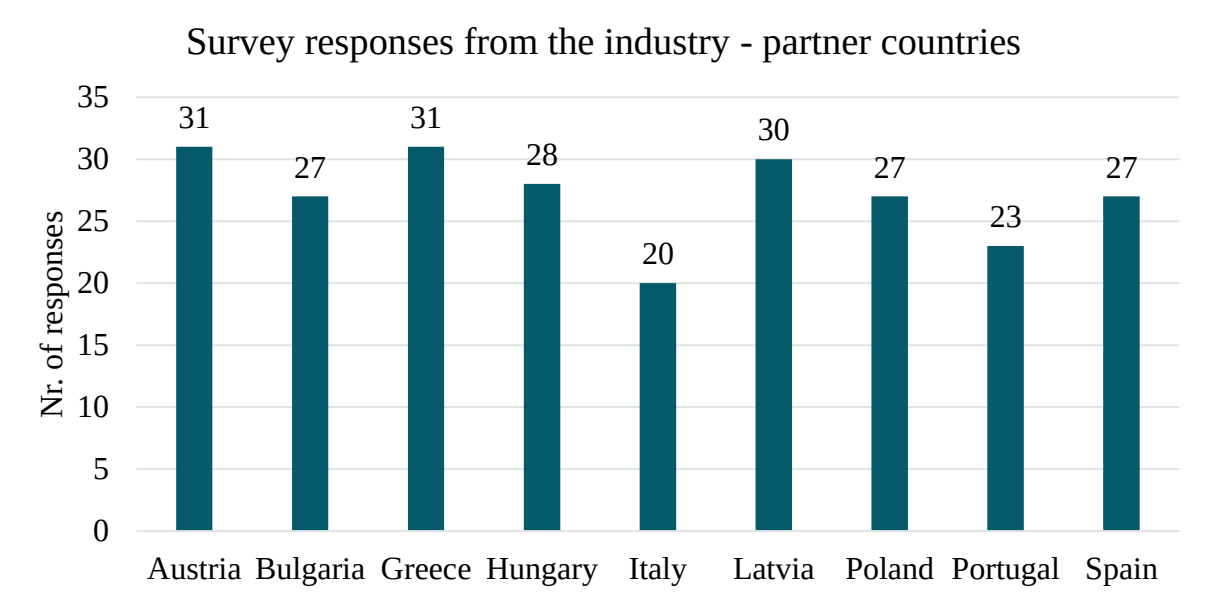
In conclusion, the results of these interviews provide a comprehensive view of the motivations, processes, and impacts of energy audits within various enterprises. These insights can inform future energy efficiency initiatives and help organizations make informed decisions to optimize their energy consumption and realize non-energy benefits.

4. SUMMARY OF QUESTIONNARE SURVEY

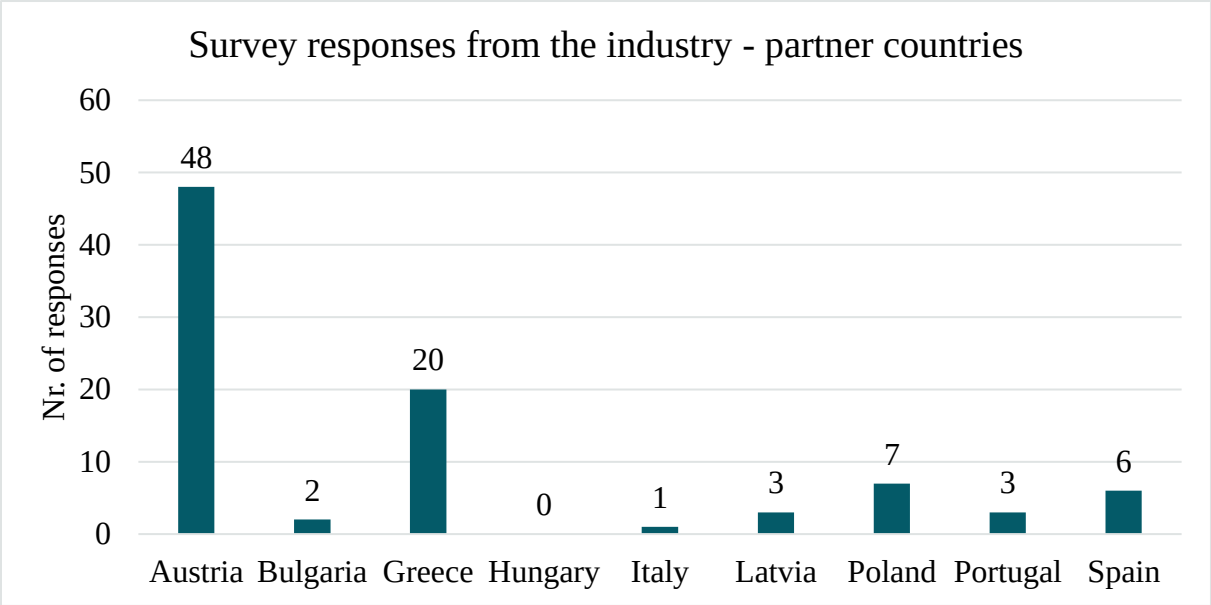
4.1. Introduction

The aim of the survey in the KNOWnNEBs project was to understand the importance and view of non-energy benefits regarding energy efficiency measures. The created online survey was circulated in the partner countries among target sector companies and other stakeholders during the period from August to November 2023. The survey was built up to receive responses from companies and other stakeholders separately. For the companies the respondents are grouped into three main categories: top management, energy manager and employee. The other stakeholder group includes four distinct stakeholder types (policy makers, energy experts, industry sector associations and the chamber of commerce) and the other category.

The main target group for the survey was the companies thus distributing it was optional for other groups. For the company sector, the focus was both on implemented energy efficiency measures and the key factors influencing the decision for implementing the energy efficiency measures (payback time and level of co-financing) and how the non-energy benefits are perceived by the stakeholder groups. For the other non-company stakeholders only the deciding factor of payback time and co-financing was measured along with their view on non-energy benefits. The survey was distributed by the project partners via different channels including e-mail lists, personal contacts, and social media platforms. A total of 363 responses were received, of which 244 were from company representatives and 90 were typically from energy auditors. The number of responses from each country is presented in the following figures:

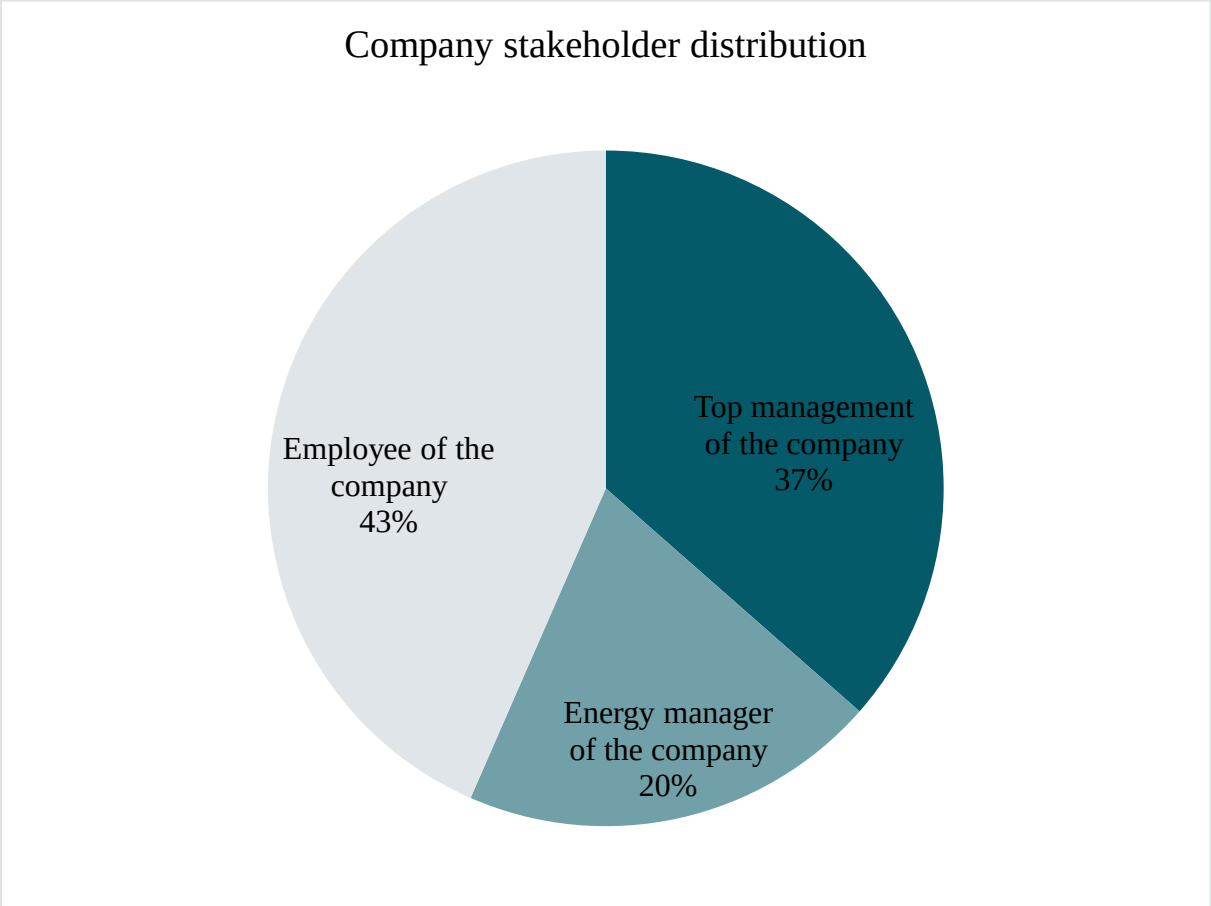


The distribution of other respondents by country was rather uneven, due to the fact that this was an optional target group. 54% of completions came from Austria, 23% from Greece and the remaining 23% were shared between the other seven countries. The evaluation of other respondents is therefore given less emphasis in this summary than the industry side.

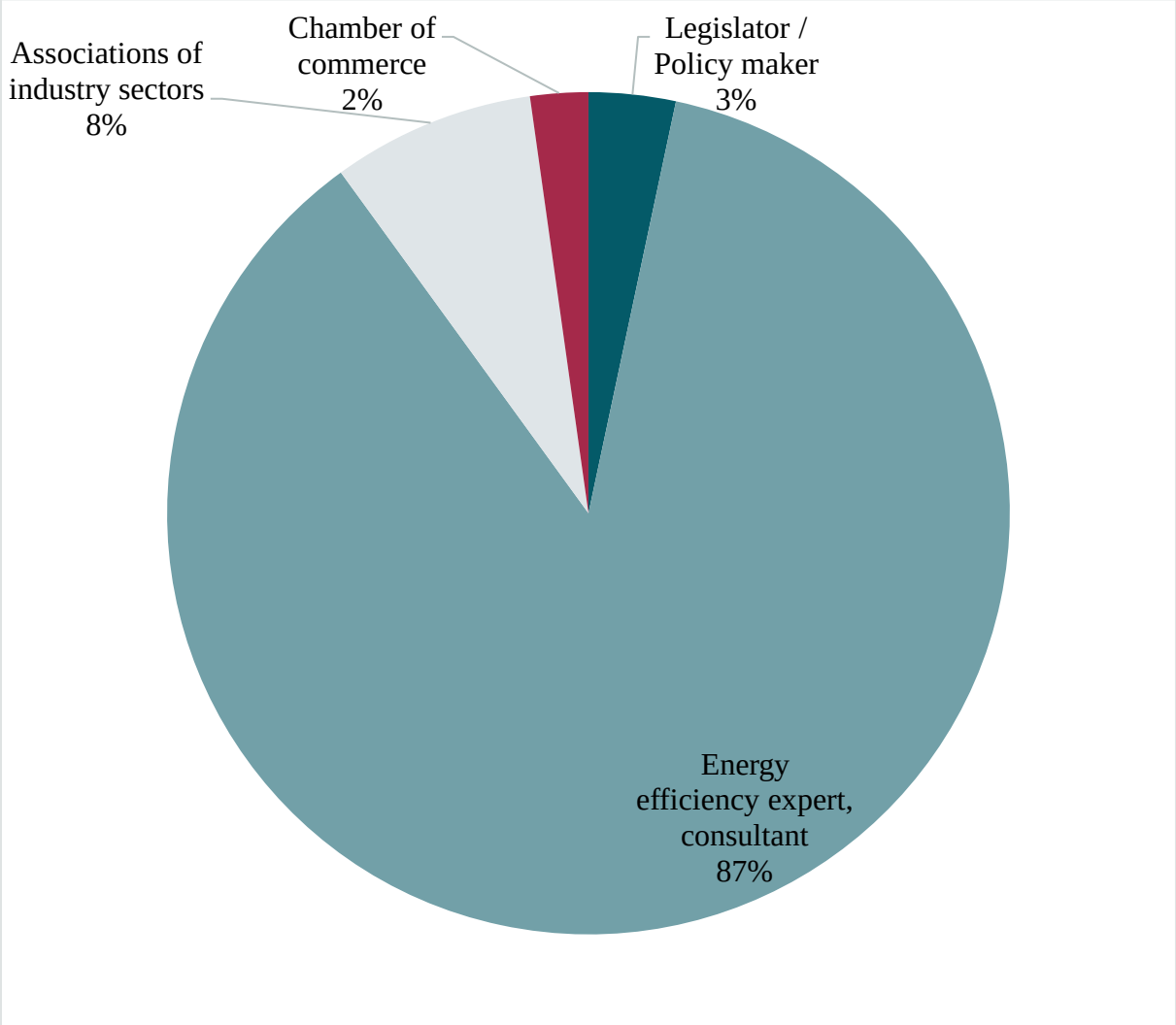


4.2. Stakeholder distribution

From company side, the questionnaires were filled by top managers, energy managers at the company and employees. Their distribution is rather balanced as follows.



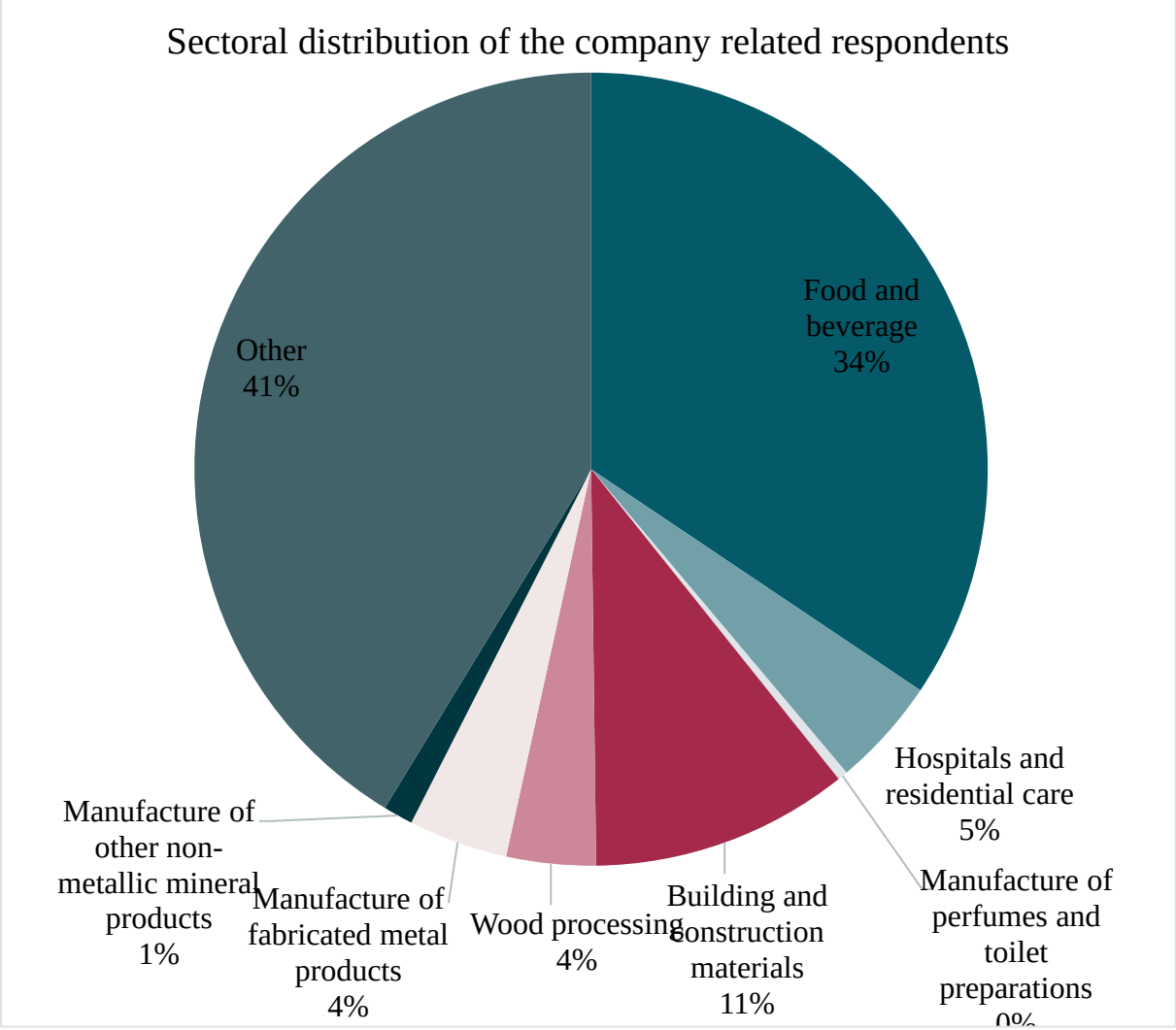
The vast majority (87%) of the other respondents were energy experts. The remaining small number of respondents came from professional organisations, industrial chambers and policy makers.



4.3. Sectoral distribution of the company stakeholders

The project distinguishes between primary and secondary sectors. The main project focus is the food and beverages sector, which is considered as primary. In addition, partners were given the opportunity to identify secondary sectors, the choice of which varied from country to country.

One third of the questionnaires were completed by companies from the food and beverage sector (primary sector). Among the secondary sectors, the highest number of responses came from the 'Building and construction materials ' and 'Wood processing' sectors, followed by several other sectors covering a wide range of areas.

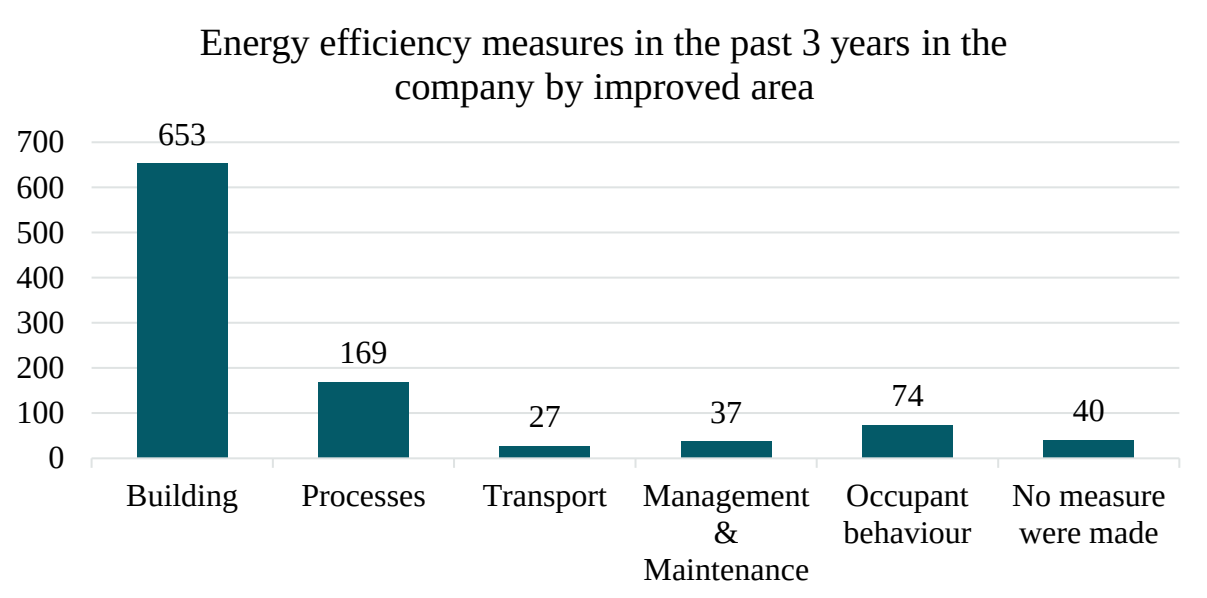


4.4. Implemented EE measures in the companies

Although the interview analysis (chapter 3) showed that the majority of respondents consider process efficiency improvements to be more important than building efficiency, the summary of the questionnaire survey shows that in the past 3 years most actions had a focus on buildings, however it can be different for the countries. This could be explained by several reasons. First, technological shifts can involve greater investment and longer time horizons for decision-makers. Second, building-related subsidies were more available. Third, the measures for buildings are very broad and range from the envelope to the heating, but often also include peripheral processes for processes (cooling, ventilation, heating). Changes to processes are also much more complex. And fourth, production machines are only renewed for around 10 years and require many years of planning.

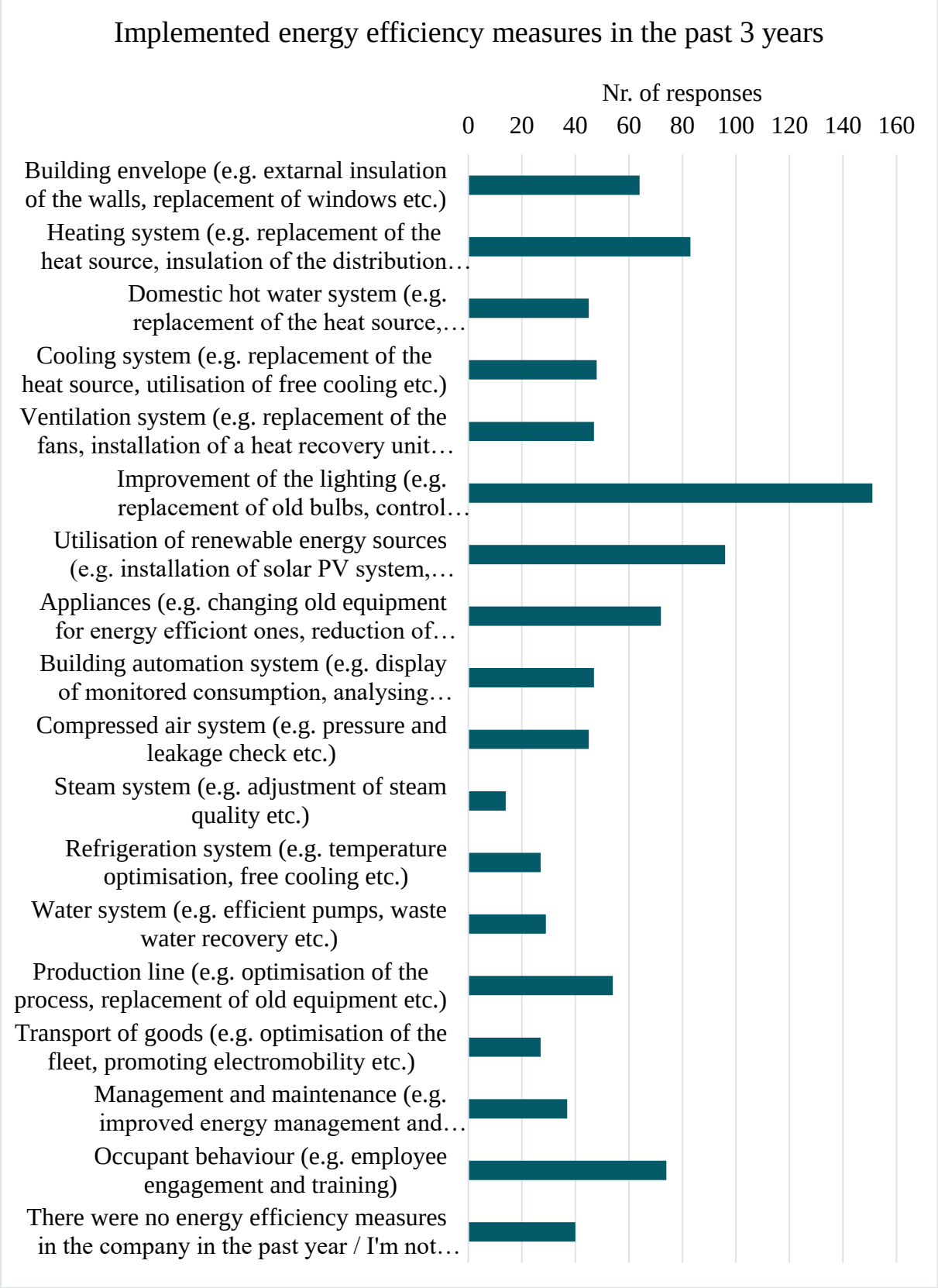
Indeed, in the last three years, around two thirds of modernisation activities have been focused on buildings, followed by processes. The share of measures to improve occupant behaviour was also worth noting. Energy efficiency improvements in transport accounted for only a small proportion of measures which coincides with the results from the surveys.

The following chart shows all the measures that have been taken at the companies, so in many cases, there were several measures at one company.



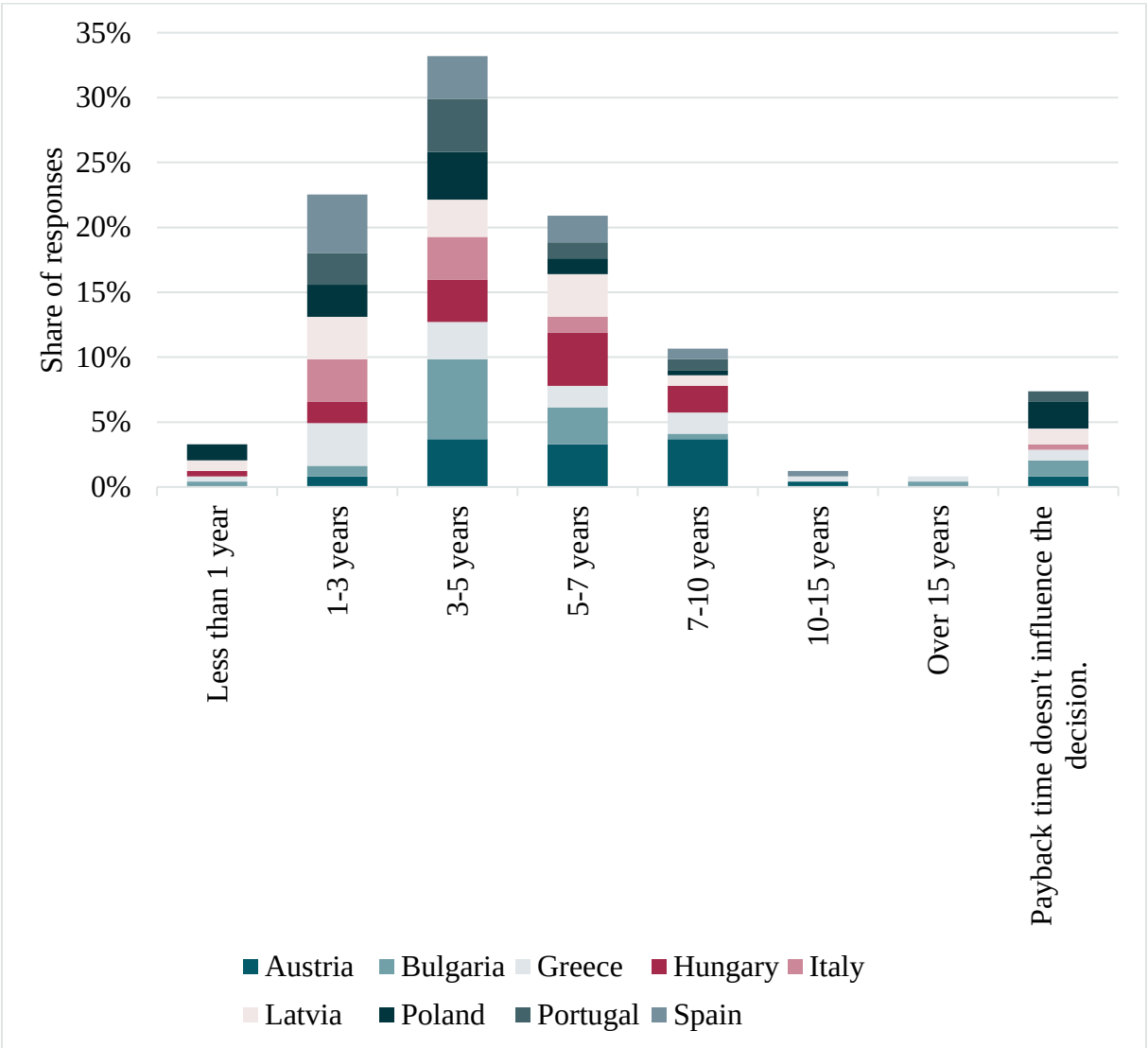
Specific measures include modernisation of lighting, followed by the integration of renewable energy sources, heating modernisation, improvement of user behaviour, followed by replacement of appliances (e.g. office equipment) and reduction of stand-by consumption. This is followed only by insulation, process

efficiency improvements, modernisation of space cooling and ventilation, and building automation.



4.5. Maximum payback time for considering the implementation of an EE measure

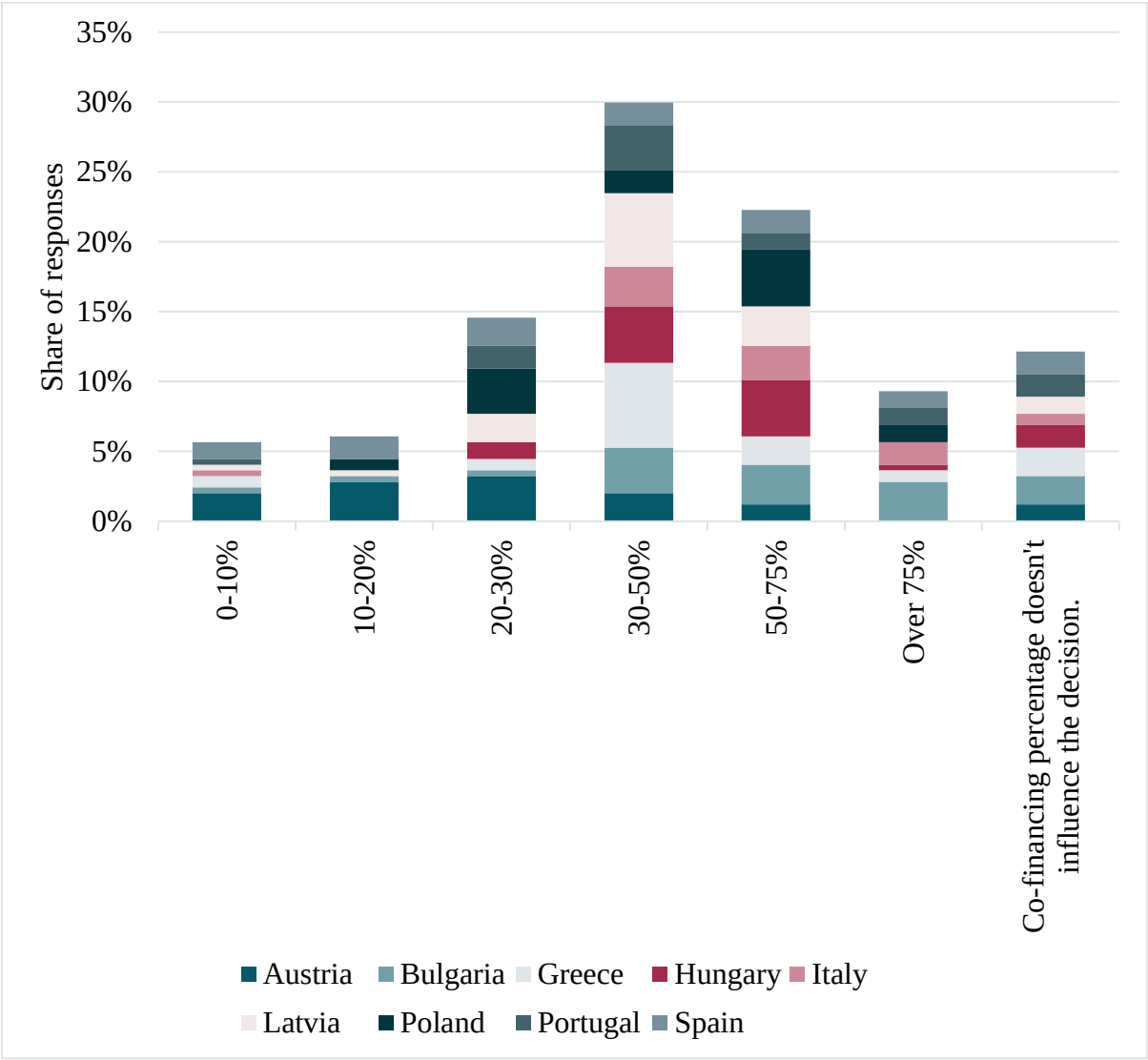
Most respondents from company side consider a payback period of a maximum of 3-5 years to be acceptable, slightly fewer 5-7 years and almost as many 1-3 years. Very few respondents consider a payback period longer than 10 years to be acceptable. It is interesting to note that the proportion of respondents whose decision would not be influenced by the payback period is not negligible. Differences between countries are not significant.



4.6. Influence of co-financing for implementing EE measures

Less than a third of those surveyed would start an investment with less than 30% co-funding. At around 50% co-financing rate, almost two thirds of respondents from company side would be positive about modernisation. Only one fifth of those surveyed would not even go ahead with a co-financing rate over 75%. On the other hand, over 10% said that the availability of co-funding does not influence their decision.

However, it is to be noted that there are significant differences between countries. In Austria lower co-financing rates are already acceptable, but in Poland followed by Hungary respondents voted for higher rates. In Spain, the distribution of answers was rather balanced.



4.7. Evaluation of non-energy benefits

Non-energy benefits were rated by respondents on a scale of one to five, with five being very important. The different benefits were grouped into 7 categories, as follows:

- Social
- Health
- Environment
- Economic
- Security & Safety
- Quality
- Time

There was a significant variation in the scores between countries, but this also depends on the type of respondents. Among the top managers, the lowest scores were given by the Austrians. In contrast, the Portuguese scored the highest, followed by Polish respondents. For the other respondent types, the order was different, but the lowest scores were always given by the Austrians.

An explanation for the high scores in Portugal can be that there is a good awareness on the part of top management regarding the impacts of energy efficiency, triggered by national campaigns and support by national the Energy Agency and the Regulatory Authority. There are also several environmental regulations that give importance to energy efficiency.

The following table shows the top 15 indicators by the three categories of respondents, where score could be given in a range of 0 to 5, where '5' meant the highest importance. Higher scores are highlighted with a darker blue colour. It can be seen that the following 5 indicators were in the top 15 for all three respondent types:

- Improved lighting
- Reduction of operating costs
- Emission reduction
- Reduced emissions (dust, CO_2, chemical agents etc.)
- Increased corporate image

The following 8 indicators were ranked in the top 15 by at least two types of respondents:

- Energy security
- Reduction of maintenance costs
- Improvement of competitiveness
- Improved air quality
- Increased productivity
- Operation safety of equipment
- Reduction of emission or disposal fees
- Security of supply / self sufficiency

Top managers		Energy managers		Employees		Company respondents	
Improved lighting	4.63	Emission reduction	4.43	Reduction of maintenance costs	4.52	Emission reduction	4.51
Reduction of operating costs	4.57	Reduced emissions (dust, CO2, chemical agents etc.)	4.42	Emission reduction	4.51	Reduction of operating costs	4.45
Emission reduction	4.56	Increased corporate image	4.35	Reduction of operating costs	4.44	Reduced emissions (dust, CO2, chemical agents etc.)	4.45
Reduced use of non-renewable resources	4.52	Improvement of competitiveness	4.33	Reduced emissions (dust, CO2, chemical agents etc.)	4.42	Improved lighting	4.44
Improvement of competitiveness	4.51	Health and well-being	4.32	Improved lighting	4.41	Reduction of maintenance costs	4.42
Reduced emissions (dust, CO2, chemical agents etc.)	4.51	Energy security	4.31	Reduction of emission or disposal fees	4.41	Improved air quality	4.37
Reduction of maintenance costs	4.50	Reduction of operating costs	4.27	Improved air quality	4.40	Increased corporate image	4.36
Improved air quality	4.47	Accurate process monitoring	4.22	Security of supply / self sufficiency	4.37	Energy security	4.36
Energy security	4.47	Electrical safety	4.21	Reduced noise	4.35	Reduced use of non-renewable resources	4.34
Increased corporate image	4.43	Operation safety of equipment	4.19	Increased equipment lifetime	4.33	Improvement of competitiveness	4.34
Increased production yields	4.42	Improved lighting	4.18	Reduced water use	4.31	Security of supply / self sufficiency	4.31
Work performance	4.41	Sickness & absenteeism	4.16	Increased corporate image	4.31	Reduction of emission or disposal fees	4.29
Increased productivity	4.39	Security of supply / self sufficiency	4.15	Ecosystem degradation	4.31	Increased productivity	4.28
Health and well-being	4.37	Work performance	4.13	Increased productivity	4.30	Health and well-being	4.26
Operation safety of equipment	4.37	Reduced material consumption	4.13	Reduced use of non-renewable resources	4.30	Reduced material consumption	4.25

LEGEND:

	The indicator was ranked in the top 15 by four types of respondent
	The indicator was ranked in the top 15 by three types of respondent
	The indicator was ranked in the top 15 by two types of respondent
	The indicator was ranked in the top 15 by one type of respondent

The following table shows the 10 lowest rated indicators. Lower scores are highlighted with a darker red colour. Here again, there is considerable overlap between the types of respondents. The lowest rated indicator is clearly the 'Impact on public budget'. Furthermore, the following 6 indicators were ranked in the least important 10 by all three types of respondents:

- Positive impact on macro economy
- Alleviation of energy poverty
- Increased real estate value
- Improved supply chain relationships
- Impact on public budgets
- Supplier diversity

The following 5 indicators were rated among the 10 least important ones by at least 2 types of respondents:

- Customers (new, satisfaction, etc.)
- Reduced litigations risks
- Turnover of energy efficiency goods
- Employment effects
- Shorter production cycle

Top managers		Energy managers		Employees		Company respondents	
Employment effects	3.97	Shorter production cycle	3.69	Alleviation of energy poverty	3.85	Usage of waste streams	3.85
Alleviation of energy poverty	3.96	Employment effects	3.67	Employment effects	3.85	Shorter production cycle	3.83
Supplier diversity	3.93	Improved supply chain relationships	3.63	Positive impact on macro economy	3.85	Alleviation of energy poverty	3.82
Usage of waste streams	3.93	Usage of waste streams	3.62	Increased real estate value	3.83	Positive impact on macro economy	3.79
Positive impact on macro economy	3.89	Supplier diversity	3.53	Supplier diversity	3.78	Supplier diversity	3.79
Reduced litigations risks	3.82	Positive impact on macro economy	3.48	Shorter production cycle	3.76	Reduced litigations risks	3.75
Increased real estate value	3.82	Alleviation of energy poverty	3.45	Reduced litigations risks	3.72	Turnover of energy efficiency goods	3.74
Turnover of energy efficiency goods	3.77	Turnover of energy efficiency goods	3.36	Customers (new, satisfaction, etc.)	3.68	Increased real estate value	3.72
Improved supply chain relationships	3.61	Increased real estate value	3.29	Improved supply chain relationships	3.61	Improved supply chain relationships	3.62
Impact on public budgets	3.28	Impact on public budgets	3.23	Impact on public budgets	3.59	Impact on public budgets	3.40

LEGEND:

	The indicator was ranked among the 10 least important ones by four types of respondent
	The indicator was ranked among the 10 least important ones by three types of respondent
	The indicator was ranked among the 10 least important ones by one type of respondent

The tables in Annex 3 detail the results of the questionnaire survey by respondent type, where 'average' means the average of the country scores.

4.8. Barriers to modernisation

Asked about the barriers to modernisation, most respondents indicated the followings three main reasons:

- Energy efficiency measure not reaching the energy saving goal,
- Downtime in production during the execution of the measures,
- Additional cost of maintenance (e.g. for planning).

Detailed results are presented in the tables of Annex 4.

4.9. Other considerations of energy efficiency planning

When planning and implementing energy efficiency measures, several crucial factors must be taken into consideration to ensure successful outcomes, which were the results of a free text question.

First, amortisation calculations may not provide a meaningful assessment; instead, a comprehensive life cycle assessment should be conducted. If an energy-efficient system proves to be competitively priced, within a 10% margin of a standard solution over its useful life, customers are more likely to choose the energy-efficient option. It's imperative to calculate co-financing for any additional investment costs, as customer apprehension often stems from concerns about higher initial investments. Public-Private Partnership (PPP) models could alleviate these concerns, fostering greater acceptance.

Addressing environmental concerns is paramount, emphasizing the decarbonization of CO2 as an air pollutant. High energy prices serve as a powerful incentive for implementing energy efficiency measures, highlighting the importance of market dynamics in driving such initiatives.

Furthermore, the implementation of energy efficiency measures reflects high management quality and should be communicated effectively to both managers

and staff. Overcoming scepticism and convincing stakeholders of the long-term benefits is a critical aspect of successful implementation.

It is essential to ensure that energy efficiency measures do not compromise product quality, customer satisfaction, economic efficiency, or general framework conditions. Simplifying subsidy processes is also crucial, as the bureaucratic burden can deter potential projects. The funding criteria should align with economic viability, avoiding scenarios where higher investment costs negate the profitability of subsidies.

Consideration should be given to potential additional work for employees, such as duplicate processes, and the necessity of a more predictable legal regulatory system. The timing of implementation is equally important, with an emphasis on immediate benefits and the adaptability of employees to the new measures.

Further considerations include an analysis and forecast of energy prices, legislative stability, and the estimated lifetime of the proposed energy-efficient solutions. By taking these factors into account, a more comprehensive and effective approach to planning and implementing energy efficiency measures can be achieved.

4.10. Conclusions

The questionnaire survey conducted as part of the KNOWnNEBs project aimed to gain insights into the significance and perspectives of non-energy benefits (NEBs) in relation to energy efficiency measures. The survey was distributed in partner countries among target sector companies and stakeholders, resulting in 363 completed surveys.

The respondents represented a diverse range of stakeholders, including top managers, energy managers, and employees. Food and beverage companies constituted a significant portion of the respondents, followed by the 'building and construction materials' and 'wood processing' sectors, with various other sectors also participating.

Interestingly, the survey results diverged from previous interview analyses, indicating that in the past three years, a substantial portion of modernization efforts focused on buildings rather than processes, in contrast to perceived priorities. The most popular specific measures implemented included the modernization of lighting, the adoption of renewable energy sources, heating upgrades, and efforts to modify consumer behaviour.

The survey revealed that most respondents (33%) from the industry considered a payback period of 3-5 years to be acceptable for energy efficiency measures, with a notable proportion (7%) indicating that payback time did not significantly influence their decision. Concerning the influence of co-financing on decision-making, the survey found that less than 27% of respondents would commence an investment with less than 30% co-funding, and around 50% co-funding was seen as a favourable threshold for 56% of respondents.

The evaluation of NEBs was conducted through a rating scale, with the benefits categorized into areas like social, health, environment, economic, security, quality, and time. The top 15 NEB indicators included improved lighting, reduction of operating costs, emission reduction, energy security, and increased corporate image. Conversely, the 10 lowest-rated indicators encompassed categories like the positive impact on macro economy, alleviation of energy poverty, increased real estate value, improved supply chain relationships, impact on public budgets, and supplier diversity.

In the tables below, respondents rated the with the highest scores are marked in green and those rated lowest in red. It can be seen that social aspects are rated least important in most countries. It is particularly surprising that this is most pronounced among employees. Environmental and time efficiency aspects were generally rated as the most important.

As far as differences between countries are concerned, the most important NEB category is Environment in Austria, Greece, Italy, Portugal and Spain. Time efficiency was prioritised as top in Bulgaria, Latvia and Poland, while health was selected in Hungary. By contrast, social aspects were selected as least important in Austria, Greece, Hungary, Latvia and Poland. Economy aspects were rated least important in Bulgaria, Portugal and Spain, while Time efficiency was awarded in Italy with lowest score.

Company respondent average										
NEB Category	Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
Social	3.89	3.26	4.32	3.90	4.01	3.97	4.04	4.15	4.10	3.83
Health	4.18	3.56	4.55	4.31	4.46	4.23	4.43	4.66	4.28	3.86
Environment	4.19	3.60	4.35	4.31	4.20	4.50	4.22	4.42	4.41	4.15
Economic	3.95	3.45	4.21	4.10	4.11	4.02	4.19	4.26	4.04	3.82
Security & Safety	4.18	3.52	4.52	4.27	4.38	4.15	4.46	4.60	4.18	4.07
Quality	4.15	3.40	4.54	4.15	4.22	4.15	4.42	4.55	4.20	4.12
Time	4.17	3.29	4.67	4.19	4.39	3.89	4.58	4.68	4.18	4.04

Top management of the company										
NEB Category	Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
Social	4.04	3.30	4.32	4.04	3.87	3.82	3.87	4.25	4.27	4.07
Health	4.30	3.82	4.48	4.36	4.43	4.01	4.39	4.49	4.30	4.17
Environment	4.31	3.65	4.30	4.26	4.26	4.23	4.29	4.46	4.66	4.20
Economic	4.07	3.62	4.21	4.23	3.87	3.70	4.25	4.15	4.22	3.96
Security & Safety	4.28	3.68	4.43	4.27	4.45	3.96	4.53	4.46	4.29	4.12
Quality	4.23	3.54	4.52	4.17	4.11	4.05	4.44	4.45	4.10	4.17
Time	4.30	3.50	4.59	4.33	4.40	4.00	4.41	4.39	4.33	4.28

Energy manager of the company										
NEB Category	Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
Social	3.82	3.38	4.01	4.00	4.23	4.00	4.37	4.40	4.08	3.76
Health	4.08	3.56	4.46	4.39	4.76	4.14	4.50	4.86	4.49	3.74
Environment	4.01	3.71	4.00	4.42	4.00	4.50	4.08	4.60	4.38	4.08
Economic	3.76	3.41	3.76	4.13	4.37	4.23	4.05	4.50	3.98	3.66
Security & Safety	4.07	3.63	4.33	4.55	4.33	4.29	4.32	5.00	4.26	3.97
Quality	4.04	3.55	4.33	4.32	4.17	4.17	4.38	4.92	4.40	3.97
Time	3.94	3.23	4.71	4.00	4.33	3.33	4.92	5.00	4.20	3.73

Employee of the company										
NEB Category	Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
Social	3.82	3.11	4.63	3.67	3.91	4.10	3.87	3.79	3.95	3.66
Health	4.16	3.31	4.71	4.16	4.19	4.55	4.39	4.62	4.05	3.66
Environment	4.24	3.46	4.75	4.26	4.33	4.77	4.29	4.19	4.20	4.16
Economic	4.02	3.32	4.66	3.94	4.08	4.14	4.25	4.12	3.93	3.84
Security & Safety	4.18	3.24	4.81	3.97	4.35	4.19	4.53	4.35	4.00	4.11
Quality	4.18	3.12	4.76	3.96	4.39	4.22	4.44	4.28	4.10	4.22
Time	4.25	3.15	4.71	4.25	4.44	4.33	4.41	4.66	4.00	4.11

The survey also explored barriers to modernization, with most respondents identifying factors such as energy efficiency measures falling short of energy-saving goals, production downtime during measure execution, and additional maintenance costs as significant obstacles.

In summary, the questionnaire survey in the KNOWnNEBs project provides valuable insights into the preferences and perceptions of non-energy benefits in energy efficiency measures, shedding light on priorities, investment considerations, and potential barriers faced by companies and stakeholders in various sectors and countries.

The results of the questionnaire survey will be used in the next phase of the project to develop a system of indicators for non-energy benefits. This will be the main output of the project. We expect the questionnaire evaluation to be very useful in defining the final list of indicators, priorities and weightings. The developed indicator system will also be tested, where possible involving the companies that have participated in the survey.

ANNEX 1: CROSS COUNTRY COMPARISON - IN-DEPTH ANALYSIS ON ENERGY AUDIT PRACTICES

	LV	***HU***	***PT***	***SP***	***AT***	***BG***	***PL***	***GR***	***IT***
	EKO	***BME***	***ISR-UC***	***ESCAN***	***E7***	***CISB***	***KAPE***	***CRES***	***SOG***
Population	*1.9 million*	*9.7 million*	*10.3 million*	*47.4 million*	*9.0 million*	*6.9 million*	*37.8 million*	*10.6 million*	*59.1 million*
No. of large companies	*276*	*cca. 5,200*	*13,603*	*4,977 (2022)*[1]	*2,702*	*754*	*cca 3,600*	*cca. 1,200*	*cca. 3,600 (latest official statistics of 2016)*
No. of audits so far	*457 (officially registered)*	*2,722 (till end 2022)*	*551 (last three years)*	*10,600 every year*	*1,910*	*3,950*	*Not known*	*900 (till end 2022)*	*812 (till end 2021)*
No. of SMEs	*108 160*	*884 476*	*1314944*	*2,923,729 (2022)* [2]	*385.000*	*411 246*	*cca 2,2 million*	*712.060*	*Almost 3.8M*
No. of auditors	*7 accredited energy audit companies*	*Licenced persons: 170 Licenced companies: 86*	*213*	*Not known*	*614*	*Licensed persons: 924 Licensed companies for processes: 52 Licensed companies*	*Not known*	*Licenced persons: 1423 Licenced companies: 18*	*Licenced almost 3100 Licenced companies (ESCOs): 350*

[1] Source: http://www.ipyme.org/Publicaciones/CifrasPYME-enero2022.pdf
[2] Source: http://www.ipyme.org/Publicaciones/CifrasPYME-enero2022.pdf

	LV	***HU***	***PT***	***SP***	***AT***	***BG***	***PL***	***GR***	***IT***
	EKO	***BME***	***ISR-UC***	***ESCAN***	***E7***	***CISB***	***KAPE***	***CRES***	***SOG***
						for buildings: 256			
Audit results availability	*No*	*Partly upon request*	*No*	*Depends on the region*	*No*	*No*	*No*	*Only upon request*	*Partly*
Mandatory tools	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*
Mandatory questionnaires	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*No*
Audit registry	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*N/A*
Proportion of checked audits	*Not known*	*7,9%*	*68%*	*Not known*	*4%*	*4%*	*No*	*5%*	*3%*
Cost of an audit (1000 euros)[3]	*2-5*	*4-6*	*5-10*	*Less than 15*	*6–8*	*6-8*	*2-3*	*3-5*	*3-10*
EPC included in an audit	*Optional (mostly not)*	*Optional (mostly)*	*Optional*	*No*	*No*	*Optional (mostly)*	*Optional (mostly not)*	*No*	*No*
EPB standards are used for building calculations	*Yes*	*Optional (mostly not)*	*Optional*	*No*	*No*	*Yes*	*Optional (mostly not)*	*No*	*No*
Dynamic simulation is used for calculations	*Optional (mostly not)*	*Optional (mostly not)*	*Under SCE, yes, for large buildings*	*Optional (mostly not)*	*Optional*	*Optional*	*Optional (mostly not)*	*Optional (mostly not)*	*No*

[3] Cost of a 5000 m^2 building with no special technology

	LV	***HU***	***PT***	***SP***	***AT***	***BG***	***PL***	***GR***	***IT***
	EKO	***BME***	***ISR-UC***	***ESCAN***	***E7***	***CISB***	***KAPE***	***CRES***	***SOG***
Questionnaires / interviews applied during audit	*Yes (no unified template available)*	*Optional (mostly not)*	*Optional*	*Optional (sometimes)*	*No*	*Yes*	*Yes*	*Optional (sometimes)*	*Optional. Interview at the beginning audit phase*
NEBs inclusion	*Only CO_2 emission*	*Only CO_2 emission*	*Only CO_2 emission*	*Only CO_2 emission*	*Only CO_2 emission*	*Only CO_2 emission*[4]	*Optional CO_2 (mostly not)*	*Only CO_2 emission*	*No*

[4] In some EU programmes: Increased productivity; Indoor climate condition; Level of energy efficiency in the building structures; Water treatment; Waste management

ANNEX 2: INTERVIEW QUESTIONS

1. General questions on the person being interviewed – time in the company, views on energy efficiency (is it needed or not)?
2. What is the prior knowledge regarding energy efficiency measures of the person who decided that an energy audit is needed?
3. Why did the company do an energy audit?
4. Who in the company decided that energy audit is needed?
5. How was the energy auditor selection carried out?
6. How the process of the energy audit goes?
7. How were the energy audit results presented to the enterprise?
8. Has the energy crisis changed your opinion about the importance of energy audits? How?
9. Which part of the audit you find most important: building / transport / process?
10. Which results of the audit surprised you or were not expected?
11. How the decision process of implementing energy efficiency measures is made in the company (who suggests them, who has the final saying for implementation, what is considered when deciding, how long does this process usually take)
12. Are there any drawbacks of implementing energy efficiency measures because of which you do not implement these measures (downtime of production during change of equipment, loud noises during construction, etc.)
13. Ask for each of the measures suggested in the energy audit if this measure has been implemented or not. For each of the measures, you should ask why it was implemented or why it was not implemented.
14. What dynamics were triggered by the energy audit?
15. Have you implemented any other energy efficiency measures which are not mentioned in the energy audit? How did you decide when to implement these measures?
16. Are you now planning any additional energy efficiency measures to be implemented?
17. Were there any other considerations for implementing energy efficiency measures than energy savings and energy cost savings?
18. Which are the most important additional benefits from energy efficiency measures that you consider when deciding to implement energy efficiency measures?
19. Would you be open to supporting the development of a non-energy benefit indicators evaluation scheme?

ANNEX 3: SURVEY RESPONSES ON NON-ENERGY BENEFITS

Top management of the company										
Non Energy Benefit		Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
Social	Employee satisfaction	4.17	3.50	4.62	4.82	4.17	3.69	4.23	4.17	4.00	3.67
	Alleviation of energy poverty	3.96	3.50	3.85	4.00	4.80	3.92	4.17	3.73	4.33	3.33
	Customers (new, satisfaction, etc.)	4.01	3.25	4.46	3.91	3.40	3.77	3.50	4.50	4.11	4.67
	Improved supply chain relationships	3.61	2.75	4.00	3.10	3.00	3.23	3.38	4.18	4.20	4.17
	Work performance	4.41	3.50	4.69	4.36	4.00	4.46	4.08	4.67	4.70	4.50
Health	Health and well-being	4.37	3.50	4.54	4.73	4.20	4.46	4.46	4.64	4.00	3.83
	Avoided mortality	4.04	3.50	4.42	3.50	4.33	3.77	4.30	4.40	4.00	4.17
	Disease burden - shortened lifespan	4.12	4.00	4.58	4.08	4.33	3.77	4.08	4.40	3.88	4.00
	Sickness & absenteeism	4.21	4.00	4.75	4.17	4.20	3.31	4.46	4.45	4.00	4.67
	Improved air quality	4.47	4.00	4.42	4.64	4.50	4.15	4.62	4.58	4.70	4.33
	Improved lighting	4.63	4.00	4.55	4.83	4.83	4.38	4.85	4.67	4.80	4.33
	Reduced noise	4.27	3.75	4.10	4.58	4.60	4.23	4.00	4.30	4.70	3.83
Environment	Emission reduction	4.56	4.25	4.50	4.50	4.33	4.69	4.38	4.67	4.80	4.67
	Impact of energy efficiency measures on renewable energy utilisation target achievement	4.26	4.25	4.17	4.17	4.33	4.31	4.33	4.00	4.50	4.33
	Ecosystem degradation	4.27	4.00	4.18	4.17	4.00	4.54	4.36	4.27	4.60	3.83
	Reduced water use	4.32	3.50	4.27	4.17	4.60	4.46	3.92	4.67	4.80	4.00
	Reduced material consumption	4.35	3.25	4.45	4.33	4.20	3.92	4.55	4.67	4.70	4.33
	Reduced emissions (dust, CO2, chemical agents etc.)	4.51	4.00	4.54	4.27	4.40	4.69	4.58	4.55	4.80	4.17
	Reduced noise pollution	4.20	3.25	4.36	4.42	4.00	4.00	4.31	4.27	4.60	3.67

Top management of the company											
Non Energy Benefit		Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
	Reduced use of non-renewable resources	4.52	3.50	4.67	4.58	4.33	4.38	4.62	4.64	4.80	4.33
	Reduced litigations risks	3.82	3.00	3.60	4.00	3.60	3.18	3.60	4.40	4.30	4.33
	Reduced waste	4.29	3.50	4.27	4.00	4.80	4.15	4.23	4.50	4.70	4.33
Economic	Improvement of competitiveness	4.51	3.50	4.92	4.45	4.67	4.23	4.54	4.58	4.70	4.33
	Innovation impacts	4.04	3.00	4.00	4.27	3.60	3.83	4.25	4.09	4.30	4.17
	Reduction of maintenance costs	4.50	3.75	4.69	4.64	4.33	3.92	4.85	4.75	4.70	4.17
	Reduction of emission or disposal fees	4.24	4.00	4.00	4.25	4.33	3.77	4.77	4.36	4.50	4.00
	Shorter production cycle	3.98	3.50	4.55	4.00	3.40	3.15	4.33	4.18	4.10	4.17
	Increased production yields	4.42	3.75	4.67	4.67	4.60	4.00	4.54	4.36	4.60	4.17
	Increased real estate value	3.82	3.75	3.69	4.09	3.67	3.92	3.54	4.33	3.70	3.33
	Reduction of operating costs	4.57	4.00	4.38	5.00	4.33	4.00	4.77	4.67	5.00	4.67
	Positive impact on macro economy	3.89	3.75	3.92	3.91	3.40	3.67	4.08	4.00	4.30	3.50
	Usage of waste streams	3.93	3.75	3.92	4.00	3.60	3.67	3.83	4.00	4.30	4.17
	Turnover of energy efficiency goods	3.77	3.25	4.23	4.45	3.60	3.42	3.82	3.45	3.50	3.67
	Employment effects	3.97	4.00	4.23	4.17	4.00	3.46	4.18	4.00	3.80	3.83
	Impact on public budgets	3.28	3.00	3.50	3.09	2.75	3.08	3.82	3.18	3.30	3.33
Security & Safety	Energy security	4.47	3.50	4.75	4.33	4.83	4.33	4.54	4.82	4.40	4.00
	Security of supply / self sufficiency	4.32	4.00	4.31	3.75	4.67	4.38	4.54	4.45	4.40	4.33
	Supplier diversity	3.93	3.75	3.77	4.17	3.80	3.31	4.25	4.55	4.00	3.50
	Operation safety of equipment	4.37	4.00	4.33	4.50	4.60	4.00	4.54	4.36	4.50	4.50
	Less maintenance	4.27	3.25	4.46	4.50	4.17	3.77	4.54	4.36	4.50	4.17
	Electrical safety	4.31	3.75	4.58	4.42	4.50	4.00	4.62	4.33	4.20	3.83
	Reduced injuries	4.32	3.50	4.82	4.25	4.60	3.92	4.67	4.33	4.00	4.50
Quality	Accurate process monitoring	4.13	3.25	4.69	4.00	4.00	3.92	4.42	4.30	4.10	3.50
	Decreased number of incorrectly manufactured products	4.09	3.00	4.58	4.17	4.50	3.62	4.40	4.30	3.70	4.33

Top management of the company										
Non Energy Benefit		Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
	Increased quality of products	4.31	3.00	4.83	4.50	4.00	3.85	4.75	4.45	3.90	4.50
	Increased corporate image	4.43	4.25	4.46	4.08	4.00	4.46	4.54	4.75	4.60	4.17
	Increased regulatory compliance	4.30	4.00	4.25	4.25	4.00	4.38	4.25	4.42	4.40	4.50
	Reduced risk of production disorganization	4.13	3.75	4.27	4.00	4.17	4.08	4.30	4.45	3.90	4.00
Time	Increased productivity	4.39	3.50	4.77	4.58	4.80	3.85	4.62	4.45	4.20	4.33
	Increased equipment lifetime	4.34	3.50	4.54	4.67	4.20	4.00	4.46	4.36	4.50	4.17
	Reduced time of fault detection	4.17	3.50	4.46	3.75	4.20	4.15	4.17	4.36	4.30	4.33

Energy manager of the company										
Non Energy Benefit		Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
Social	Employee satisfaction	3.92	3.78	4.33	3.75	4.00	4.00	4.25	4.00	4.00	3.60
	Alleviation of energy poverty	3.45	2.88	3.50	3.75	4.50	3.00	4.33	4.00	4.40	3.00
	Customers (new, satisfaction, etc.)	3.96	3.31	4.50	4.00	4.33	5.00	4.25	5.00	3.60	4.60
	Improved supply chain relationships	3.63	3.41	3.29	3.75	4.00	4.00	4.00	4.00	3.80	4.00
	Work performance	4.13	3.50	4.43	4.75	4.33	4.00	5.00	5.00	4.60	3.60
Health	Health and well-being	4.32	3.88	5.00	3.75	4.67	5.00	4.50	5.00	4.80	4.00
	Avoided mortality	3.95	3.08	4.83	4.67	5.00	3.00	4.75	5.00	4.00	3.60
	Disease burden - shortened lifespan	3.98	3.40	4.57	5.00	5.00	3.00	4.50	5.00	4.25	3.40
	Sickness & absenteeism	4.16	3.75	4.71	4.33	5.00	3.00	4.75	5.00	4.40	3.60
	Improved air quality	4.13	3.71	4.43	4.25	4.67	5.00	4.25	5.00	4.60	3.60
	Improved lighting	4.18	3.78	4.14	4.50	4.67	5.00	4.50	5.00	4.80	3.80
	Reduced noise	3.87	3.35	3.50	4.25	4.33	5.00	4.25	4.00	4.60	4.20
Environment	Emission reduction	4.43	4.39	4.43	4.50	4.33	5.00	4.25	4.50	4.60	4.40
	Impact of energy efficiency measures on renewable energy utilisation target achievement	3.98	3.89	3.57	4.67	3.33	5.00	4.00	4.50	4.60	3.80
	Ecosystem degradation	3.70	3.47	4.29	4.00	4.00	4.00	2.75	4.50	4.00	3.40
	Reduced water use	3.85	3.17	4.14	4.33	4.00	4.00	4.25	4.50	4.20	4.60
	Reduced material consumption	4.13	3.59	4.00	5.00	4.33	4.00	5.00	5.00	4.20	4.40
	Reduced emissions (dust, CO2, chemical agents etc.)	4.42	4.17	4.86	4.33	4.00	5.00	4.25	5.00	4.60	4.60
	Reduced noise pollution	3.77	3.44	3.71	4.33	3.67	4.00	4.00	4.50	4.40	3.60
	Reduced use of non-renewable resources	4.13	3.94	3.86	4.33	4.33	5.00	3.75	5.00	4.60	4.20
	Reduced litigations risks	3.71	3.41	3.14	4.33	4.00	4.00	4.75	4.50	4.00	3.60
	Reduced waste	3.96	3.61	4.00	4.33	4.00	5.00	3.75	4.00	4.60	4.20
Economic	Improvement of competitiveness	4.33	3.65	4.29	4.75	5.00	5.00	4.75	5.00	4.80	4.80
	Innovation impacts	3.85	3.44	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.20

Energy manager of the company											
Non Energy Benefit		Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
	Reduction of maintenance costs	4.06	3.50	4.14	4.67	4.67	5.00	5.00	5.00	4.00	4.20
	Reduction of emission or disposal fees	4.11	4.11	3.86	4.50	4.00	5.00	4.00	5.00	4.00	4.00
	Shorter production cycle	3.69	3.00	4.29	4.00	4.50	4.00	4.33	5.00	4.00	3.40
	Increased production yields	3.98	3.41	4.86	4.25	3.67	5.00	4.50	5.00	4.20	3.40
	Increased real estate value	3.29	3.12	2.33	2.50	3.67	4.00	4.50	4.50	3.60	3.20
	Reduction of operating costs	4.27	4.11	3.86	4.50	4.33	4.00	4.75	5.00	4.20	4.60
	Positive impact on macro economy	3.48	3.29	3.86	4.33	4.00	4.00	2.67	4.00	4.20	2.40
	Usage of waste streams	3.62	3.33	3.67	4.50	4.50	4.00	3.25	3.50	3.40	4.00
	Turnover of energy efficiency goods	3.36	3.06	3.00	4.67	5.00	4.00	3.33	3.50	3.60	3.00
	Employment effects	3.67	3.00	3.86	4.00	4.50	3.00	4.33	4.50	4.20	4.00
	Impact on public budgets	3.23	3.33	2.83	3.00	5.00	4.00	3.25	3.50	3.60	2.40
Security & Safety	Energy security	4.31	4.00	4.43	4.50	4.67	5.00	4.67	5.00	4.80	3.80
	Security of supply / self sufficiency	4.15	3.72	4.14	4.67	4.33	5.00	4.33	5.00	4.60	4.20
	Supplier diversity	3.53	3.18	3.43	4.00	4.50	5.00	3.00	5.00	3.80	3.40
	Operation safety of equipment	4.19	3.89	4.29	4.67	4.33	4.00	4.50	5.00	3.80	4.60
	Less maintenance	3.96	3.44	4.29	5.00	4.33	4.00	4.50	5.00	3.80	3.80
	Electrical safety	4.21	3.72	4.86	4.33	4.67	3.00	4.50	5.00	4.80	3.80
	Reduced injuries	4.11	3.47	4.86	4.67	3.50	4.00	4.75	5.00	4.20	4.20
Quality	Accurate process monitoring	4.22	3.69	4.86	4.67	4.33	5.00	4.50	4.50	4.60	3.80
	Decreased number of incorrectly manufactured products	3.85	3.19	4.14	4.33	3.67	4.00	4.75	5.00	4.00	4.00
	Increased quality of products	4.07	3.13	4.71	4.00	4.67	5.00	4.75	5.00	4.20	4.60
	Increased corporate image	4.35	4.17	4.29	4.75	4.00	4.00	4.50	5.00	4.60	4.40
	Increased regulatory compliance	4.04	3.94	3.43	4.50	4.00	4.00	4.00	5.00	4.80	3.80
	Reduced risk of production disorganization	3.74	3.19	4.57	3.67	4.33	3.00	3.75	5.00	4.20	3.20
Time	Increased productivity	4.04	3.24	5.00	4.33	4.33	3.00	5.00	5.00	4.20	4.00

Energy manager of the company										
Non Energy Benefit		Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
	Increased equipment lifetime	3.88	3.28	4.57	3.67	4.33	4.00	4.75	5.00	4.00	3.60
	Reduced time of fault detection	3.90	3.17	4.57	4.00	4.33	3.00	5.00	5.00	4.40	3.60

Employee of the company										
Non Energy Benefit		Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
Social	Employee satisfaction	3.86	3.44	4.43	4.07	3.29	4.33	4.23	3.69	3.88	3.93
	Alleviation of energy poverty	3.85	2.63	4.86	3.87	4.50	4.50	4.17	3.27	4.13	2.92
	Customers (new, satisfaction, etc.)	3.68	3.00	4.43	3.33	3.94	3.83	3.50	3.92	3.88	3.62
	Improved supply chain relationships	3.61	3.25	4.60	3.27	3.67	3.67	3.38	3.83	3.88	3.64
	Work performance	4.07	3.25	4.83	3.80	4.18	4.17	4.08	4.23	4.00	4.20
Health	Health and well-being	4.15	3.56	4.57	4.00	3.88	4.67	4.46	4.77	4.25	3.67
	Avoided mortality	3.86	2.38	4.71	3.71	3.77	4.33	4.30	4.38	3.63	3.64
	Disease burden - shortened lifespan	3.94	3.11	4.71	3.77	3.85	4.33	4.08	4.67	3.75	3.42
	Sickness & absenteeism	4.02	3.11	4.86	3.67	4.25	4.00	4.46	4.38	4.00	3.57
	Improved air quality	4.40	3.78	4.71	4.53	4.47	4.83	4.62	4.85	4.38	3.67
	Improved lighting	4.41	3.78	4.71	4.73	4.39	4.83	4.85	4.62	4.13	3.81
	Reduced noise	4.35	3.44	4.71	4.73	4.71	4.83	4.00	4.67	4.25	3.88
Environment	Emission reduction	4.51	3.78	4.71	4.60	4.61	4.83	4.38	4.62	4.50	4.53
	Impact of energy efficiency measures on renewable energy utilisation target achievement	4.27	3.67	4.86	4.27	4.47	4.83	4.33	3.92	4.25	4.13
	Ecosystem degradation	4.31	3.78	4.71	4.43	4.19	4.67	4.36	4.50	4.50	3.92
	Reduced water use	4.31	3.67	4.71	4.47	4.56	4.83	3.92	4.08	4.13	4.44
	Reduced material consumption	4.24	3.22	4.71	4.33	4.24	4.67	4.55	4.15	4.00	4.31
	Reduced emissions (dust, CO2, chemical agents etc.)	4.42	3.44	4.67	4.27	4.67	4.83	4.58	4.67	4.25	4.33
	Reduced noise pollution	4.16	3.22	4.83	3.93	4.31	4.83	4.31	4.46	3.63	4.13
	Reduced use of non-renewable resources	4.30	3.67	4.71	4.13	4.22	4.83	4.62	4.25	4.63	4.13
	Reduced litigations risks	3.72	2.78	4.67	3.87	3.57	4.67	3.60	3.58	4.00	3.53
	Reduced waste	4.21	3.33	4.86	4.33	4.44	4.67	4.23	3.70	4.13	4.19
Ec om	Improvement of competitiveness	4.19	3.22	5.00	3.80	4.44	4.00	4.54	4.00	4.38	4.38

Employee of the company										
Non Energy Benefit		Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
	Innovation impacts	4.00	3.00	4.86	3.93	4.31	4.50	4.25	4.08	4.00	3.27
	Reduction of maintenance costs	4.52	3.56	5.00	4.33	4.58	4.67	4.85	4.85	4.25	4.50
	Reduction of emission or disposal fees	4.41	3.89	4.67	4.27	4.56	4.50	4.77	4.62	4.25	4.13
	Shorter production cycle	3.76	2.88	4.57	3.54	3.60	4.00	4.33	3.83	3.63	3.69
	Increased production yields	4.04	3.25	4.71	4.08	3.88	4.00	4.54	4.17	3.88	3.88
	Increased real estate value	3.83	3.78	4.33	3.47	4.11	4.00	3.54	4.00	3.50	3.92
	Reduction of operating costs	4.44	3.67	4.71	4.33	4.68	4.67	4.77	4.46	4.13	4.38
	Positive impact on macro economy	3.85	2.88	4.67	3.85	3.71	4.00	4.08	4.15	3.88	3.55
	Usage of waste streams	3.89	3.11	4.67	4.27	3.94	4.00	3.83	3.75	4.13	3.57
	Turnover of energy efficiency goods	3.91	3.43	4.43	4.27	4.00	3.67	3.82	3.92	3.75	3.60
	Employment effects	3.85	3.22	4.57	3.60	3.69	4.00	4.18	4.00	3.88	3.83
	Impact on public budgets	3.59	3.22	4.33	3.50	3.50	3.83	3.82	3.77	3.50	3.18
Security & Safety	Energy security	4.29	3.44	4.71	4.33	4.56	4.00	4.54	4.38	4.13	4.13
	Security of supply / self sufficiency	4.37	3.78	5.00	4.36	4.50	4.00	4.54	4.42	4.13	4.40
	Supplier diversity	3.78	2.89	4.83	3.40	3.73	4.00	4.25	4.15	3.38	3.75
	Operation safety of equipment	4.17	3.33	4.71	3.67	4.44	4.17	4.54	4.31	4.00	4.27
	Less maintenance	4.28	3.33	4.86	4.00	4.50	4.50	4.54	4.46	4.13	4.19
	Electrical safety	4.23	3.25	4.86	4.00	4.47	4.50	4.62	4.31	4.25	3.87
	Reduced injuries	4.15	2.63	4.71	4.07	4.24	4.17	4.67	4.42	4.00	4.13
Quality	Accurate process monitoring	4.07	2.67	4.57	3.86	4.57	4.17	4.42	4.15	4.38	3.87
	Decreased number of incorrectly manufactured products	4.06	2.71	4.86	3.92	4.23	4.17	4.40	3.92	4.13	4.07
	Increased quality of products	4.20	2.88	5.00	3.85	4.41	4.17	4.75	4.33	3.88	4.25
	Increased corporate image	4.31	4.00	4.86	3.80	4.38	4.33	4.54	4.54	4.13	4.36
	Increased regulatory compliance	4.25	3.44	4.57	4.20	4.18	4.33	4.25	4.38	4.13	4.67

Employee of the company										
Non Energy Benefit		Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
	Reduced risk of production disorganization	4.18	3.00	4.71	4.15	4.56	4.17	4.30	4.33	4.00	4.08
Time	Increased productivity	4.30	3.13	4.71	4.38	4.44	4.17	4.62	4.67	4.25	4.06
	Increased equipment lifetime	4.33	3.44	4.86	4.36	4.53	4.67	4.46	4.64	3.88	4.13
	Reduced time of fault detection	4.13	2.88	4.57	4.00	4.35	4.17	4.17	4.67	3.88	4.13

ANNEX 4: SURVEY RESPONSES ON BARRIERS FOR IMPLEMENTING ENERGY EFFICIENCY MEASURES

Top management of the company										
Drawbacks of implementing energy efficiency measures	Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
Loud noises during construction	2.93	3.25	2.77	3.50	2.00	2.69	2.64	2.73	3.30	3.67
Downtime in production	3.82	3.25	3.67	4.00	3.20	3.69	4.17	3.91	4.00	3.83
Increase of production time	3.71	3.67	3.36	3.75	4.00	3.38	3.92	3.73	4.10	3.67
Energy efficiency measure not reaching the energy saving goal	3.91	3.50	3.42	4.08	3.67	3.69	4.27	4.18	4.10	4.00
Additional cost of maintenance (e.g. for planning)	3.73	3.50	2.82	3.83	3.00	3.23	4.25	4.09	4.30	4.50

Energy manager of the company										
Drawbacks of implementing energy efficiency measures	Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
Loud noises during construction	3.13	3.29	3.29	4.00	2.33	2.00	2.75	2.50	3.00	3.20
Downtime in production	3.73	3.38	3.57	5.00	2.67	5.00	3.67	4.00	4.00	4.40
Increase of production time	3.60	3.13	3.50	4.00	3.33	3.00	4.67	4.00	4.00	4.20
Energy efficiency measure not reaching the energy saving goal	3.56	3.28	3.29	4.33	2.67	4.00	4.33	5.00	3.33	4.00
Additional cost of maintenance (e.g. for planning)	3.53	3.39	3.57	5.00	2.33	2.00	3.50	3.00	3.75	4.20

Employee of the company										
Drawbacks of implementing energy efficiency measures	Average	Austria	Bulgaria	Greece	Hungary	Italy	Latvia	Poland	Portugal	Spain
Loud noises during construction	3.10	2.78	3.50	3.43	2.47	4.33	2.64	2.62	3.13	3.69
Downtime in production	3.73	2.38	4.00	4.14	2.38	4.50	4.17	3.38	4.38	4.38
Increase of production time	3.73	2.13	3.86	3.64	3.95	4.33	3.92	3.23	4.00	4.27
Energy efficiency measure not reaching the energy saving goal	3.99	3.11	3.33	4.00	3.95	4.50	4.27	4.23	3.75	4.33
Additional cost of maintenance (e.g. for planning)	3.71	3.11	3.43	3.67	2.78	4.50	4.25	3.85	3.75	4.47