

# Catching Added Energy Efficiency Benefits

**Revealing the hidden value of NEBs**

The KNOWNNEBs provides methods, tools, and training that help energy experts and companies apply the NEB approach in practice.

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# Welcome, dear reader

This report provides a concise yet comprehensive summary of the main results of the LIFE Programme co-financed project KNOWnNEBs.

Within these pages, we present the project's methodological approach and demonstrate how it can support energy experts worldwide in enhancing their energy auditing practices. At the same time, it can help companies make better-informed and more effective decisions regarding the implementation of energy efficiency measures. We will uncover the added value of non-energy benefits (NEBs) and share the first testing and evaluation results of the proposed methodology. We also designed training and seminar formats to speed up adoption in practice.

Finally, you will find lessons learned from pilot actions, which you can compare with your own experience, as well as insights into the future of energy efficiency policy—where rethinking approaches and elevating NEBs in decision-making will play a key role.

Together towards smarter and more sustainable energy decisions,  
The KNOWnNEBs team



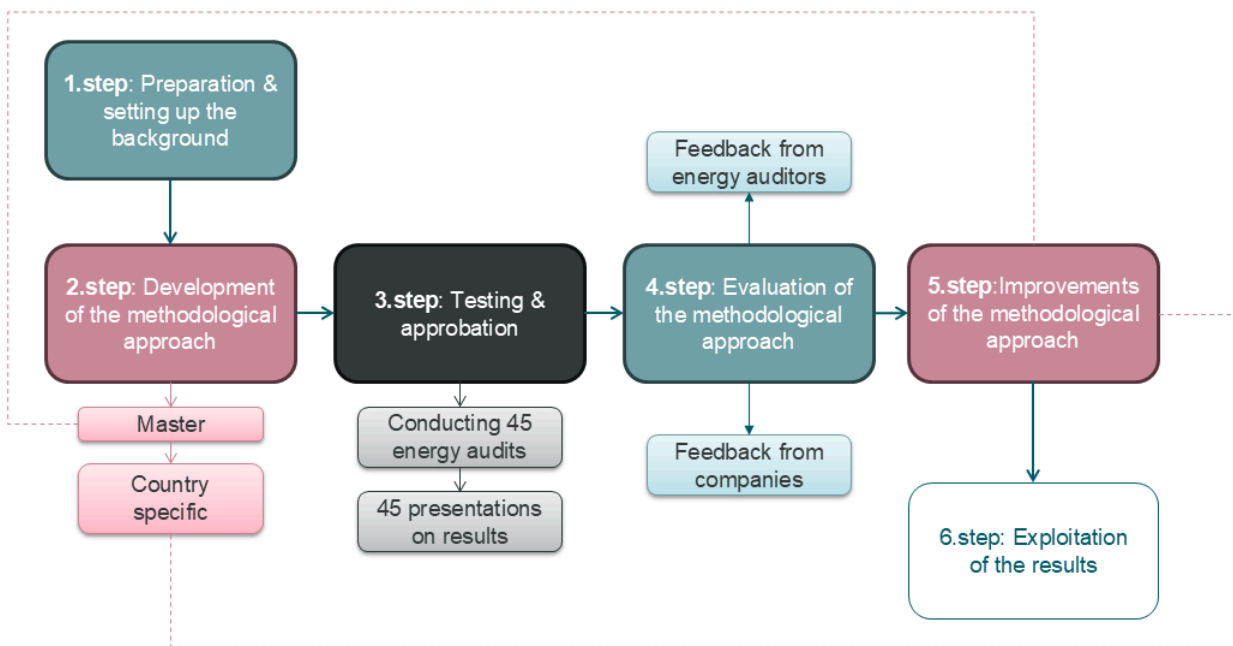
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# Introduction

An energy efficiency project can generate a range of effects beyond direct energy savings, commonly referred to as non-energy impacts or non-energy effects. For non-energy-intensive companies – where energy costs typically represent less than 10% of total expenses – these additional impacts often play a decisive role in investment decisions related to energy efficiency measures. Depending on the project's scope and nature, non-energy impacts may be either positive or negative. The positive effects are referred to as non-energy benefits (NEBs).

The KNOWnNEBs project promotes energy audits and efficiency measures through a new methodology that incorporates non-energy benefits (NEBs). Developed in six steps, the project included a literature review, surveys, and SME interviews to build a methodological base and NEBs database. This informed the KNOWnNEBs master methodology – featuring a guide, two calculation tools, and a results template, tailored to each partner country. Energy audits were carried out under national legislation using the new approach. Feedback from auditors and companies refined the methodology, which was then shared with energy experts, companies, and policymakers to support broader uptake.



*“Including non-energy impacts (particularly NEBs) in energy efficiency assessments provides a more comprehensive understanding of the overall value of such measures, as demonstrated by the KNOWnNEBs methodology. The effectiveness of this approach depends on how results are presented, the characteristics of the company (size, financial situation, and management’s perception of NEBs), and the quality of the data provided. Companies should regard energy audits not as formalities, but as strategic tools for enhancing overall production efficiency. We hope this information helps readers better understand the role of NEBs in encouraging greater adoption of and investment in energy efficiency measures.”*

The KNOWnNEBs Team

# 1. NEBs as part of energy audit practice

## The KNOWnNEBs methodology

The methodology consists of two main parts: (1) methodology for NEBs inclusion and (2) decision-making approach. The part on NEBs inclusion consists of two calculation tools in MS Excel format:

- **TOOL1 for identifying and quantifying the NEBs** associated with implementing energy efficiency measures (EEMs)
- **TOOL2 for evaluating the monetary effects of NEBs on EEMs**

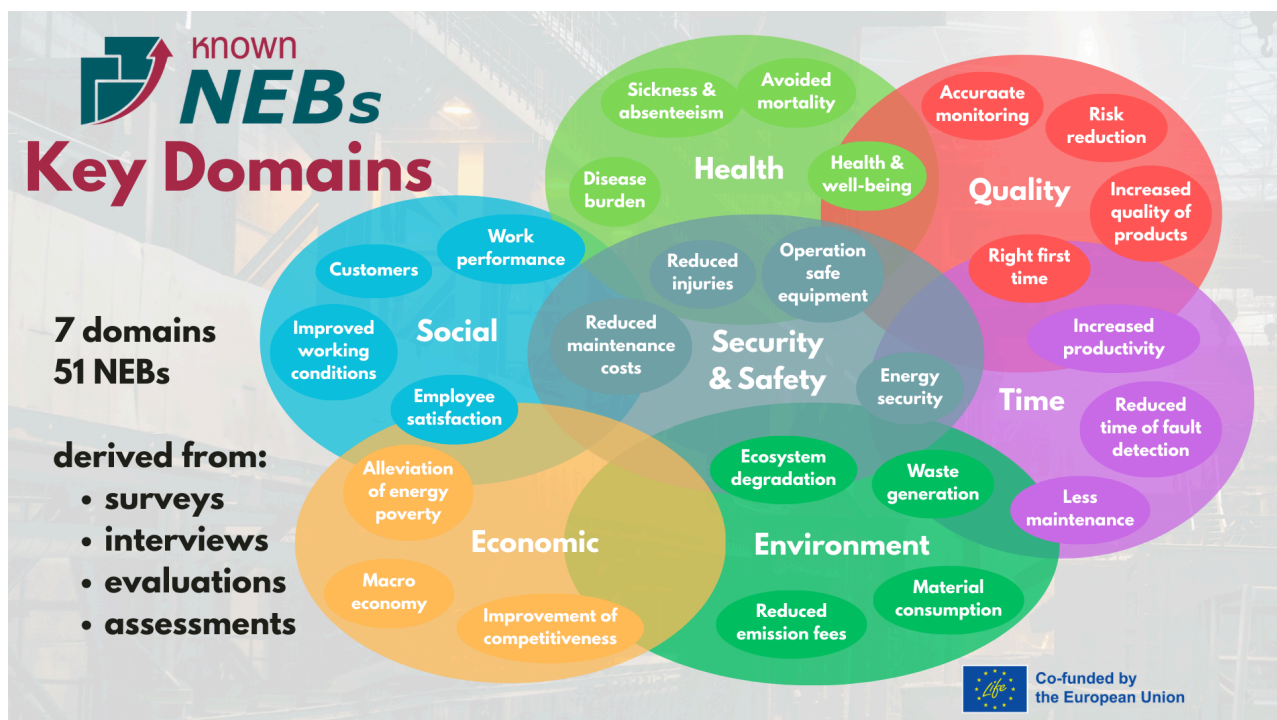
The decision-making approach provides guidance on how to communicate and demonstrate the numerical values of TOOL2 to the management board of the company to facilitate investments in energy efficiency measures.

## Theoretical aspects of NEBs

Non-Energy Benefits (NEBs) refer to the additional advantages derived from implementing energy efficiency measures, beyond direct energy cost savings. These benefits may include improved indoor air quality, enhanced employee health and comfort, reduced maintenance requirements, and a strengthened corporate reputation. NEBs are often specific to the type of measure implemented and the circumstances of each organization, as their perception and significance may vary. They can be categorized as either quantitative, those that can be monetized, such as decreased maintenance expenses or increased equipment resale value, or non-quantitative, such as improved working conditions or higher employee satisfaction.



Quantitative NEBs may manifest at various points in time—immediately upon implementation, on an annual basis, or for a defined duration—which influences how organizations assess and incorporate their value. Recognizing and accounting for NEBs is essential for capturing the full value proposition of energy efficiency investments.



## How to look for NEBs?

At present, NEBs must be individually quantified (monetized) for each proposed energy efficiency measure (EEM). Due to the significant variability of NEBs across different organizations, technologies, and operational contexts, it is not yet feasible to apply standardized or default values. Each case requires a tailored evaluation. However, as a larger body of quantified NEB data accumulates across sectors and use cases, the development of reliable default values may become possible in the future. Until then, NEB assessment remains a case-specific task.

How to proceed in practice. First, define candidate energy-efficiency measures (EEMs) based on your processes and assets. Next, use TOOL1 to screen each measure for likely NEBs and structure the data collection. Finally, use TOOL2 to quantify monetizable NEBs and integrate them into the financial analysis.

Nevertheless, the success of this process ultimately depends on the energy expert. The tools provide guidance and support but do not substitute the expert's experience, analytical skills, and professional judgment. Quantifying NEBs remains an expert-driven endeavor.

## TOOL1: Identification of NEBs

TOOL1 helps identify and structure NEBs linked to each EEM, drawing on a NEBs matrix (~130,000 data points) developed by the project consortium.

|                                         |                                      |      |      |      |      |       |
|-----------------------------------------|--------------------------------------|------|------|------|------|-------|
| Energy efficiency measure category      | Production line                      | EEM1 | EEM3 | EEM5 | EEM7 | EEM9  |
| Energy efficiency measure from category | Optimization of motor driven systems |      |      |      |      |       |
| Sort by                                 | Top management                       | EEM2 | EEM4 | EEM6 | EEM8 | EEM10 |

| NEB category      | NEB                                           | Top management | Employee | Legislator | Description of the NEB                                            | Examples of quantification                             |
|-------------------|-----------------------------------------------|----------------|----------|------------|-------------------------------------------------------------------|--------------------------------------------------------|
| Environment       | Emission reduction                            | 7              | 4        | 5          | Emissions related to any impact categories - climate change,      | 1. Quantitative - M Number of particles /m2 (example)  |
| Economic          | Improvement of compatitiveness                | 7              | 0        | 5          | Improved image of a region/ country; can also be a quantified     | #NV                                                    |
| Economic          | Reduction of (operating) costs                | 7              | 3        | 4          | Reduction of cost due to increased efficiency, productivity and   | #NV                                                    |
| Environment       | Reduced emissions (dust, CO2, chemical agents | 6              | 3        | 3          | The harmful emissions of the processes and/or HVAC systems        | 1. Quantitative - M Number of particles /m2 (example)  |
| Economic          | Reduction of emission or disposal fees        | 5              | 0        | 6          | Reduction of emission or disposal fees.                           | #NV                                                    |
| Security & Safety | Energy security                               | 5              | 0        | 5          | Reduced import dependency, impact on RES integration,             |                                                        |
| Environment       | Reduced use of non-renewable resources        | 4              | 1        | 4          | Reducing the non-renewable energy use in processes/building       | #NV                                                    |
| Economic          | Reduction of (maintenance) costs              | 4              | 1        | 4          | Reduction of maintenance costs. Avoided breakdowns due to         | 1. Quantitative - Number of breakdowns/defects         |
| Economic          | Increased real estate value                   | 4              | 0        | 1          | Spending money on energy efficiency measures can increase the     | Quantitative - Assets value                            |
| Time              | Increased productivity                        | 4              | 0        | 5          | Higher outputs (n° of finished products) / a certain period of    | #NV                                                    |
| Time              | Increased equipment lifetime                  | 4              | 1        | 4          | Increased equipment lifetime due to better operating conditions/  | Quantitative - Cost of equipment - spending delayed    |
| Health            | Reduced noise                                 | 3              | 3        | 1          | Reduced (maximum) noise pollution in dB at the workspace,         | Quantitative - Decibels x time of exposure             |
| Economic          | Shorter production cycle                      | 3              | 0        | 3          | The production chain is optimised resulting in shorter production | Shorter production cycle (shorter process cycle time)  |
| Economic          | Increased production yields                   | 3              | 2        | 4          | Increased income due to better productivity.                      | 1. Quantitative - (nr/yr) * price (EUR/product)        |
| Quality           | Increased quality of products                 | 3              | 0        | 1          | Eg. Increased life cycle of batteries.                            | Quantitative - Reduction of production losses - redo   |
| Time              | Reduced time of fault detection               | 3              | 0        | 1          | Reduced time of fault detection.                                  | #NV                                                    |
| Health            | Health and well-being                         | 2              | 0        | 4          | Reduction of health-related emissions - such as nitrogen oxide,   | Quant./qualitative - Well-being                        |
| Environment       | Impact of EE on RES target achievement        | 2              | 0        | 3          | Energy savings allow to reach RES targets more easily             | #NV                                                    |
| Environment       | Reduced noise pollution                       | 2              | 1        | 1          | Reducing the noise from the processes/building systems            | #NV                                                    |
| Economic          | Macro economy                                 | 2              | 0        | 4          | Impact on national GDP and other economic indicators.             | #NV                                                    |
| Economic          | Turnover of energy efficiency goods           | 2              | 0        | 2          | Macro-economic indicator representing the turnover of EE          | #NV                                                    |
| Economic          | Impact on public budgets                      | 2              | 0        | 3          | Macro-economic indicator showing changes in public budgets        | #NV                                                    |
| Security & Safety | Security of supply / self sufficiency         | 2              | 0        | 4          | Security of supply / self sufficiency                             | electricity supply disruption rate                     |
| Security & Safety | Operation safety of equipment                 | 2              | 1        | 3          | Improving the safety of the equipment.                            | 1. qualitative - Number of accidents / year            |
| Security & Safety | Less maintenance                              | 2              | 1        | 2          | Reduced malfunctions.                                             | 1. Quantitative - E-M % default pieces/pieces produced |
| Security & Safety | Electrical safety                             | 2              | 1        | 2          | Improving the electrical safety for the process equipments and    | #NV                                                    |
| Quality           | Accurate monitoring                           | 2              | 0        | 1          | Improved fault detection and measurement systems to allocate      | #NV                                                    |
| Quality           | Increased corporate image                     | 2              | 0        | 3          | By better corporate image new customers can be reached and        | #NV                                                    |

## TOOL2: How to analyze the NEBs?

TOOL2 - based on EN 17463:2021 (VALERI) - integrates quantified NEBs into cash-flow, sensitivity, scenario and CAPEX analyses, and supports “what-if” testing when some NEBs are not yet monetized. TOOL2 consists of analysis of cash flow with and without NEBs, sensitivity, scenario and CAPEX analysis. In TOOL2 it is possible to analyze the effects of quantified and not quantified NEBs. This is especially important in cases where the selected EEM is not feasible even including the quantifiable NEBs. By evaluating the not-quantifiable NEBs it is possible to say according to what circumstances (monetary value of initial not-quantified NEBs, level of co-financing, amount of investment costs) the selected EEM will be feasible for the company.



## Benefit indicator

The benefit indicator, developed entirely within the framework of the KNOWN NEBs project, is a novel approach that had not been previously used. Its creation was essential to provide companies with a clear and comprehensible method for assessing whether a proposed EEM is advantageous to implement. The indicator is based on a multi-dimensional evaluation that includes financial performance, investment level, risk, uncertainty, and non-energy impacts. These factors are combined into a single numerical value, scored on a scale from –3 to +3. The result is visually presented through TOOL2, enabling decision-makers to interpret the outcome quickly and effectively. Based on the final score, companies receive one of three actionable recommendations:

- Invest (+1 to +3): All scenarios indicate a positive Net Present Value (NPV) with low associated risk.
- Invest After Review (–1 to +1): The outcome is uncertain and requires further analysis based on company-specific factors.
- Pass (–3 to –1): The measure is unlikely to be economically viable under current assumptions.

This structured approach enhances transparency and supports well-informed decision-making for energy efficiency investments.



## Assessment of the KNOWnNEBs methodology performance

Insights from the evaluation conducted by 21 energy auditors involved in the pilot audits indicate that TOOL1 and TOOL2 are fundamentally valuable and timely. However, to reach their full potential, both tools require a series of practical enhancements, methodological refinements, and user-focused improvements. By addressing technical limitations, usability challenges, and communication gaps, while also planning for broader scalability and dissemination—they can become key instruments in advancing energy audit practices across Europe.



**MSc. Eng.**  
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**Senior Energy Expert**

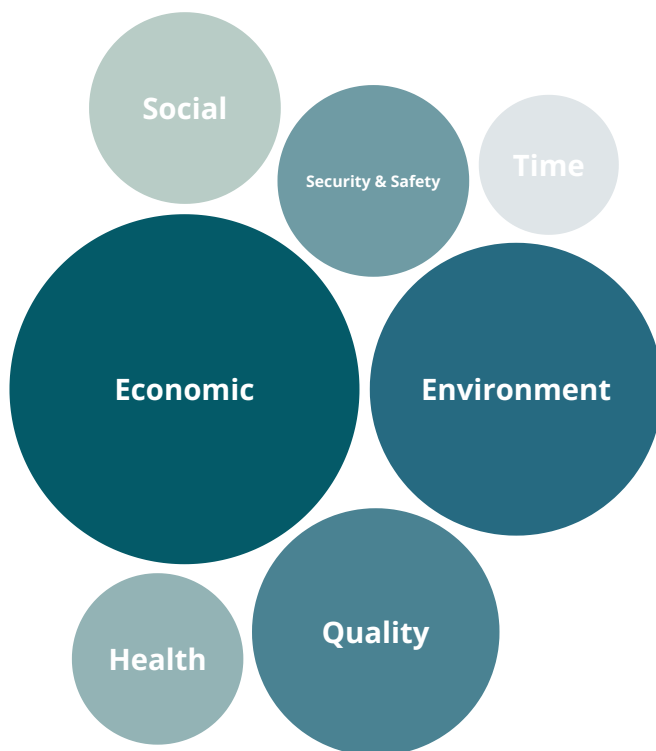
*"The assessment of non-energy benefits should be an important part of an energy audit, but it is often overlooked and undervalued in energy auditing practice. However, the identification of non-energy benefits can have a significant impact on a company's decision-making regarding energy efficiency measures, even if they are not explicitly identified. The tool paves the way for change. It provides a process to help fully quantify the benefits of a company's energy efficiency measures. It would also effectively support the spread of a new approach to energy auditing among energy auditors."*

The evaluation activities conducted with management boards from 45 companies revealed several key findings:

- **Tool usability and accessibility** require improvement: While the tools are considered comprehensive and valuable for economic evaluation, users—particularly from smaller enterprises—reported challenges related to complexity and time investment. Enhancements such as simplified data input, improved interface navigation, and the inclusion of tailored, sector-specific examples would significantly improve user experience and accessibility.
- **Alignment with real-world financial and operational contexts** is needed: To increase practical relevance, the tools should better reflect real-world conditions, including delayed funding availability, internal personnel costs, and operational priorities such as safety. Incorporating these elements into the financial modelling would enhance credibility and support wider adoption.
- The methodology is **recognized as valuable** but needs stronger support mechanisms: The NEBs-based approach is well regarded for its potential to inform strategic decision-making. However, users expressed the need for greater support through clearer guidance, targeted training, and flexible scenario analysis. Further development, including the addition of practical examples and more robust risk assessment features, would enhance the methodology's effectiveness and uptake.

## 2. Role of NEBs

During the project a qualitative and quantitative analysis was conducted across 45 energy audits, encompassing a total of 161 energy efficiency measures. In total 593 NEBs were recognized for selected energy efficiency measures in the energy audits.



Distribution of recognized NEBs by dimension (economic, environmental, quality, social)

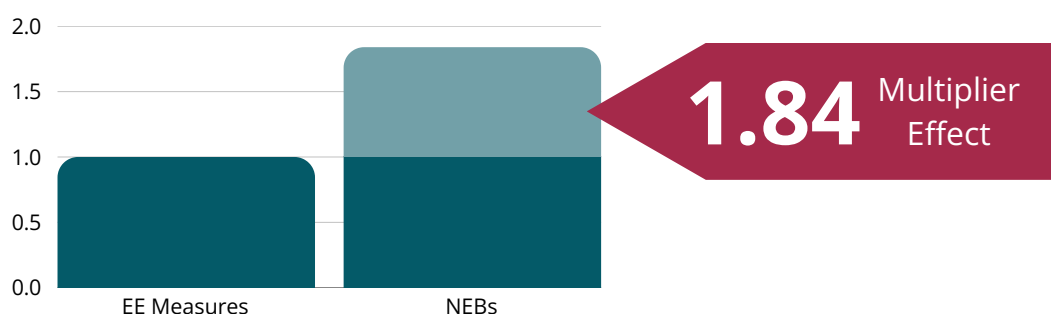
### What is associated with NEBs?

Companies often recognize NEBs even before placing a value on energy savings, particularly in sectors where energy consumption is not the most significant operating cost. In such contexts, productivity, product quality and worker well-being weigh more in decision making. Often, NEBs are considered based on perceptions or practical experience, without the attribution of a concrete economic value. TOOL2 has proven to be very useful to add value to NEBs. Benefits such as improved working conditions, reduced operational risks, enhanced product quality, have been particularly valued by the companies.

When counting the number of NEBs, the most widely recognized are related to economic, environmental and quality dimensions, followed by social considerations.

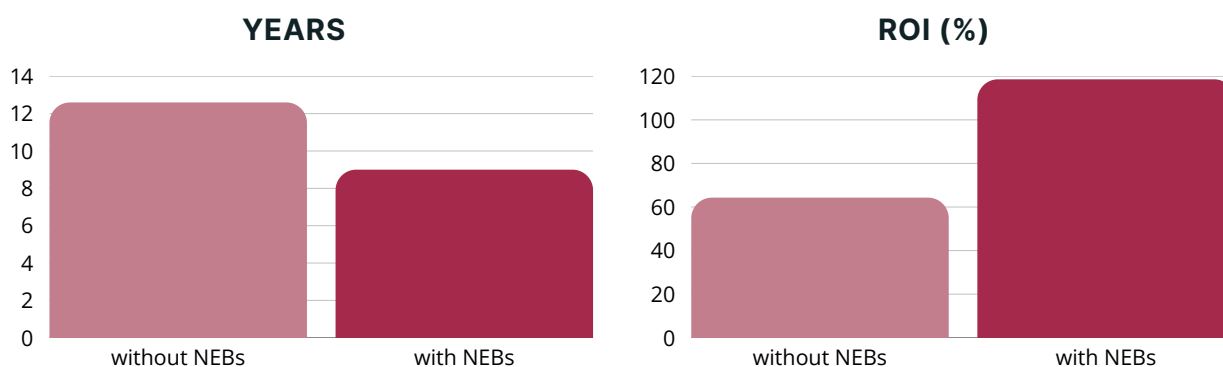
## What is the impact of NEBs?

The findings of our study show that on average NEBs create a multiplier effect of 1.84 on energy efficiency measure net present value. However, the differences between specific measures and countries are significant. In other words, incorporating NEBs into evaluations significantly enhances the economic attractiveness of these measures. Moreover, since many NEBs remain non-quantifiable, their untapped potential makes their overall value even greater.



Without accounting for NEBs (including only energy savings), 32% of the measures (51 out of 161) showed a negative net present value (NPV). When the impact of NEBs was included, this proportion decreased to 16% (26 out of 161).

The average time to achieve a positive NPV was 12.6 years without NEBs, compared to 8.9 years when NEBs were considered. This decrease in time to reach positive NPV is very important since the average calculation period was 13.2 years. Similarly, the return on investment (ROI) improved from 64.3% to 118.6% when NEBs were included.



Although it cannot be conclusively demonstrated that NEBs have a significant impact on the financial performance of energy efficiency measures, the evidence indicates that they meaningfully enhance the overall profitability of such measures for the company.



# 3. Perceiving NEBs

## Strategic value beyond energy savings

Lessons learned from pilot actions indicate that energy efficiency is generally not a top priority for companies. It is often perceived as part of broader growth and capacity-building strategies, with management typically focusing on overall process improvements rather than isolated technical upgrades. Key observations from the testing of the KNOWnNEBs methodology:

### **Company Size & Investment Willingness**

- Large companies are more proactive in implementing energy efficiency measures due to specialized staff, dedicated budgets, and strategic planning capacity.
- SMEs—especially those with stable cash flows or environmentally conscious leadership—are more likely to invest. In contrast, financially struggling businesses are typically unable to act, even when financial indicators are favorable.

### **Post-Russia-Ukraine War Shift**

- Perceptions are evolving energy-efficient technologies are increasingly viewed as obligations rather than assets, particularly among smaller firms.

### **Payback & Financial Viability**

- A short payback period remains a critical criterion for investment decisions.
- Renewable energy investments (e.g., heat pumps and PV systems) often achieve a positive net present value and acceptable payback times, even without accounting for NEBs.

### **Role of NEBs**

- NEBs—such as improved corporate image, risk reduction, and a better working environment—are highly valued by both policymakers and financial institutions.
- Including NEBs in audits and legislative frameworks would improve adoption, though policymakers are often hesitant to introduce such changes in short term.
- Financial institutions increasingly consider NEBs central to ESG-related financing, not optional extras.
- The KNOWnNEBs tools help quantify and communicate the broader value of energy efficiency and renewable energy investments, particularly for SMEs, by offering a consolidated benefit indicator.

## Audit Accuracy & Real-World Performance

- Companies often fail to understand the purpose and added value of energy audits, viewing them primarily as a regulatory requirement or a means to access funding.
- Data availability and quality strongly correlate with company size, the larger the enterprise, the higher the data quality and the better the understanding of energy audit needs and benefits.
- Pilot testing showed a 23% gap between estimate and outcome at measure level; realized payback differed by only ~6% on average—underscoring the value of conservative baselines and NEB sensitivity testing in TOOL2.

## Lessons from pilot actions



### Company Size & Willingness

- Large companies → proactive, resource available
- SMEs → selective, depend on finances/leadership



### Role of NEBs

- Corporate image, risk reduction, workplace quality
- Increasingly central to ESG finance



### Payback & Viability

- Short payback = key criterion
- Renewables often viable (heat pumps, PV)



### Audit Accuracy & Performance

- Perceived as regulatory formality
- Data quality scales with company size
- Pilot: 23% gap at measure level, ~6% on payback



### Post War Shift

- Energy efficiency = obligation, not asset

# 4. Rethinking policy

## Elevating NEBs in energy decisions

The actions outlined below represent a forward-looking agenda aimed at enhancing the role of Non-Energy Benefits (NEBs) within energy efficiency policy and practice considering energy audits enhancement and focused not only for industries but also for public bodies and national governments. They are designed to unlock additional value for businesses, society, and the environment, and are informed by the practical experience and insights gained through the KNOWnNEBs project consortium.

1

### **Integration of KNOWnNEBs methodology into energy audits and EU legislation:**

- Energy audits should be enhanced by incorporating a standardized methodology for the identification and quantification of NEBs. This approach aligns with the European standard EN standard 17463:2021 “Valuation of Energy Related Investments (VALERI)” which defines a structured framework for evaluating the broader impacts of energy efficiency measures.
- The next revision of the Energy Efficiency Directive (EED) should include the requirement to assess NEBs as part of mandatory energy audits. A benefit indicator should be introduced to complement existing financial metrics, ensuring a more holistic assessment of EEMs.

2

### **Development of financial instruments leveraging NEBs:**

- Financial schemes and white certificate mechanisms (e.g., Titres d'Économie d'Énergie – TEE) should be refined to incorporate NEBs as qualifying contributions to overall energy performance and societal value.
- Link grant schemes, incentive programs, and tax relief mechanisms to the NEB benefit indicator, encouraging companies to adopt measures with proven co-benefits such as reduced emissions, enhanced occupational safety, and improved productivity.

# 3

- Establish a revolving fund specifically designed to finance energy audits in SMEs that utilize the NEBs methodology. This would lower entry barriers and improve access to quality energy assessments in under-resourced sectors.

## **Strategic integration into national energy and climate frameworks**

- Include NEBs, related training for energy auditors, and promotional activities targeting industry within the National Energy and Climate Plans (NECPs) and National Recovery and Resilience Plans (NRRPs).
- Encourage national statistical offices to link energy audit data (including NEBs) to existing national datasets. This will facilitate benchmarking, data-driven policymaking, and sectoral performance analysis.

# 4

## **Funding and policy alignment at multiple governance levels**

- NEBs should be integrated into the design and eligibility criteria of European, national, and regional industrial funding mechanisms. Recognizing NEBs can drive investment in broader sustainability outcomes.
- Promote the inclusion of the NEBs methodology and indicators in setting national climate targets for 2030 and 2050, ensuring their contribution to long-term decarbonization goals is acknowledged and measured.

# 5

## **Mainstreaming NEBs in ESG and sustainability reporting**

- Incorporate NEBs into corporate Environmental, Social, and Governance (ESG) and sustainability reporting frameworks, particularly through expanded footprint assessments that go beyond energy to capture social and environmental impacts.



# 6

## **Data infrastructure and knowledge sharing**

- Establish and maintain an open-access national NEBs database (e.g., supported by TOOL1) hosted by National Energy Agencies or relevant Ministries. This database would support both benchmarking and policy development.

# 7

## **Promotion and capacity building**

- Promote the integration of NEBs into energy audits through awareness campaigns, capacity-building programs, and targeted guidance materials for both industry stakeholders and public institutions.
- Formally recognize and reference the European energy auditor profession in EU/national legislation and procurement to raise quality and consistency (linked to training/certification pathways).
- Ensure public bodies and national/regional governments incorporate NEBs in their procurement and sustainability policies, setting an example for the private sector.

# 8

## **Broadening the concept of Green Industry**

- The green industry concept should expand beyond energy savings to include the measurable value of NEBs—such as emissions reduction, enhanced health and safety, reduced material losses, and improved working conditions—thereby promoting a more comprehensive understanding of industrial sustainability.

Incorporating NEBs improves audit outcomes, strengthens policy design, and accelerates implementation of EEMs and renewables across industry and public bodies.

# AFTER WORD

Scan for website & materials.



- Project Newsletters
- Overview of energy auditing practices at enterprises
- KNOWnNEBs Master methodological approach (Guide for energy experts, TOOL1, TOOL2 and result presenting template)
- On site experiences energy audits towards carbon neutrality
- Recommendations on improvements for industrial energy audits in EU
- Package of KNOWnNEBs training materials: slides, exercises, and seminar formats

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Integration of non-energy benefits into energy audit practices to accelerate the uptake of recommended measures



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