Enhancing Energy Audits: Improving Data Quality and Including Non-Energy Benefits to Promote Energy Efficiency in Industry

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EXTENDED ABSTRACT

Energy audits are critical for evaluating energy consumption, identifying inefficiencies and uncovering opportunities for cost savings. In the context of the latest Omnibus simplification package[1], the trade-off between the importance of detailed energy data collection and its quality for medium-sized and non-energy-intensive industries is obligatory for energy audits. Specifically, research indicates that energy audits are beneficial even when energy expenditures account for only 2% of a company's total expenses, making them valuable for non-energy-intensive companies as well.[2]

Introduction / background

Comprehensive audits require detailed data on energy usage, equipment characteristics and operational practices, which can be time-consuming and costly.[3]. When audits rely on limited data collection they can lead to superficial and generic recommendations, such as basic improvements for industrial cross-cutting technologies (e.g., changing lighting fixtures or replacing individual electric motors) and modest energy savings compared to more holistic approaches that consider the entire system—including the demand for services in which the lighting or motors are used. Moreover, the past scientific literature underscores that identifying and integrating Non-Energy Benefits (NEBs) or Multiple Benefits, such as improved productivity or reduced maintenance costs, can significantly enhance the appeal of these measures to corporate decision-makers.[4] Our objective is to answer the following research question: *How effective and well-structured- data collection for energy audits should be to motivate energy efficiency investments and ensure quality in policy design and evaluation?*

Methodology

The EN 16247-1 standard, updated in 2022, sets international guidelines for energy audits, including methods for when direct measurements are impractical. It also covers various audit types, from industrial process audits to transport assessments, and emphasises auditor competency. On the other hand, national frameworks in EU Member States about energy audits vary in methodologies. Thus, in the framework of the

[1] Omnibus package - European Commission
[2] J. Fresner et al., Energy efficiency in small and medium enterprises: Lessons learned from 280 energy audits across Europe, Journal of Cleaner Production, Vol 142, pp 1650-1660, 2017
[3] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023L1791
[4] E. Cagno, D. Moschetta, and A. Trianni, 'Only non-energy benefits from the adoption of energy efficiency measures? A novel framework', Journal of Cleaner Production, vol. 212, pp. 1319–1333, 2019
T. Nehler, 'A Systematic Literature Review of Methods for Improved Utilisation of the Non-Energy Benefits of Industrial Energy Efficiency', Energies, vol. 11, no. 12, p. 3241, Nov. 2018, doi: 10.3390/en11123241.
C. Wagner, M. Obermeyer, and R. Lüchinger, 'A methodology for the assessment of multiple benefits of industrial energy efficiency measures', SN Appl. Sci., vol. 2, no. 2, p. 270, 2020

Audit-2-Measure[5] case studies, a combination of national frameworks along with the standard was chosen in order to succeed a comprehensive methodology for examining the balance between data quality and data collection simplification in energy audits.

Results

The Audit2Measure result provided an overview of the data quality in audits in different EU countries highlighting multiple challenges. Specifically, the five project partner countries' national laboratories *(DE, IT, ES, EL, NL)* were established with the aim of analysing the top-management decision-making process. The national laboratories primarily comprise medium-sized and non-energy-intensive industries, as the local partners are mainly enterprise associations. The results highlighted how low-quality audits with insufficient energy data and inaccurate facility descriptions could lead to reports that lacked in-depth analysis and, thus, simplistic measure recommendations. Those, in turn, can reduce the interest of companies' decision-makers in implementing energy efficiency measures. Additionally, the high volume of data requests, as local partner companies have stated, creates an "administrative burden" and may demotivate them from participating in energy efficiency and sustainability efforts. For example, in the Italian study case, incomplete descriptions of processes, incorrect or missing load profiles, and inadequate breakdowns of energy consumption have been observed. In 2024, 31.4% of audits were non-compliant, with 31.3% compliant after requested updates.[6] In another study case, in Germany in 2017, an evaluation found mixed quality in audits, with internal audits typically of higher quality than external ones. Key issues included insufficient data collection, lack of detailed analysis, and minimal compliance with requirements[7]. In the case of Croatia, there is also a lack of uniformity in data and focus on simple energy efficiency measures.[8] All in all, ongoing audits from Audit2Measure show significantly shorter repayment periods for customised measures compared to standard measures. For instance, optimising combustion and heat usage during the grain drying phase requires thorough auditing and data collection, resulting in a payback period of approximately 1.5 years. In contrast, standardised actions, such as changing lighting fixtures, have much longer repayment periods.Finally, concerning Non-Energy Benefits (NEBs),such as improving employee comfort through better HVAC systems or reduced noise, they have also appeared to play a role in decisions on energy efficiency measures.

Conclusion and further research

Incorporating comprehensive data collection on current equipment and internal energy streams into streamlined energy audit processes is essential for enhancing energy efficiency measures in medium-sized and non-energy-intensive industries. Detailed energy data mining enables the precise identification of inefficiencies, reduces administrative burdens[9] and allows auditors to focus on specific process improvements. When the suggested energy efficiency measures are combined with the NEBs, such as employee comfort, the company's profitability, financial payback period, and positive impact on key performance metrics (like reduced energy consumption) can be improved[10]. Concluding, mandatory audits driven by compliance obligations, along with significant knowledge of the specific processes, can lead to industry energy efficiency and quality check.[11]

[5] https://ieecp.org/projects/audit-to-measure/

[6] https://www.eventi.enea.it/images/presentazioni2024/2024_05_09_diagnosi_energetica_webinar/09_05_2024_De_Santis.pdf

[7] Schlussbericht-Evaluierung-Energieauditpflicht.pdf

[8] https://leapto11.eu/wp-content/uploads/2024/11/Igor-Hegedis-EIHP.pdf

[9] Audit 2 Measure Standardised measures database

[10] https://www.nrel.gov/manufacturing/non-energy-benefits

[11] https://www.odyssee-mure.eu/publications/policy-brief/networks-energy-efficiency.pdf