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RESEARCH

Evaluating the implementation of energy efficiency measures from article 8 and the path to article 11 compliance

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Abstract Energy audits (EAs) and Energy Management Systems (EnMS) are crucial instruments for companies to identify and implement energy efficiency measures (EEMs), thereby contributing to the EU's climate and energy objectives. The updated Energy Efficiency Directive (EU/2023/1791) strengthens the role of these tools and introduces new provisions under Art. 11. Among these, the directive establishes specific consumption thresholds, requiring the adoption of EnMS for businesses with high energy usage and mandating EAs for other energy-intensive entities. Companies subject to EAs must develop annual implementation plans to systematically adopt the EEMs identified. This paper investigates how EEMs have been implemented under Art. 8 of the Energy Efficiency Directive (2012/27/EU) in ten European countries and explores how existing practices can inform the upcoming obligations introduced by Art. 11 of the revised Directive (EU/2023/1791). The primary aim is to assess the effectiveness of national data collection systems, evaluation methods, and policy tools in supporting the adoption of EEMs by companies. To this end, in 2024, national experts from ten EU member states responded to a targeted questionnaire focused on methodologies and practices related to the implementation of EEMs under the obligations of Art. 8. The study identifies current data availability and transparency practices, evaluates existing indicators and the role of EA guidelines, implementation plans, and facilitating factors. Good practices in the 10 European countries under analysis are also identified and described. Findings show significant variation in how countries collect and publish data, with some demonstrating advanced practices such as centralised databases or audit follow-up requirements. The paper identifies a set of good practices and emphasises the value of stronger coordination and more standardised approaches, particularly in view of the new obligations under Art. 11. By providing insights into current framework, the paper aims to support policymakers and energy agencies in enhancing the effectiveness of EAs and EnMS in driving the implementation of EEMs, thereby contributing to improved energy policy outcomes across Europe.

Keywords Energy audits · Energy management systems · Energy efficiency directive · Energy policy evaluation

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Introduction

The correlation between the increase of energy efficiency and economic growth has been demonstrated since the transposition of Energy Efficiency Directive (EED) in the EU Member States (MS) (Pehlivanoglu et al., 2021). Looking at the productive sectors, the implementation and monitoring of Energy Efficiency Measures (EEMs) play a crucial role in achieving energy savings and sustainability goals in Europe. Art. 8 of the Energy Efficiency Directive (European Commission, 2012) requires large enterprises to conduct Energy Audits (EAs) or adopt Energy Management Systems (EnMS), which serve as a foundation for identifying and implementing EEMs.

The revised EED modifies the existing approach to the EA obligation for non-SMEs, introducing consumption thresholds for the mandatory adoption of EnMS and EAs in Art.11. Specifically, enterprises with an average annual consumption exceeding 85 TJ must implement a certified EnMS, while those consuming more than 10 TJ are required to undergo an energy audit. For companies subject to these obligations, Art. 11 requires information on energy and water consumption, as well as information on the implementation of EEMs and the development of Action Plans. This underscores the critical importance of obtaining reliable data from businesses regarding both implemented and recommended EEMs.

However, despite of the maturity of the energy audits policies and the notable efforts from EU MS there is still a notable lack of public available information (Herce et al., 2024a), a low harmonisation on the data management and use contained in the audits (Johnsson et al., 2025), and a heterogeneity on the evaluation of the energy efficiency programmes (Andersson et al., 2017). Therefore, the creation and analysis of policies for industrial energy efficiency is still a challenging task (Andrei et al., 2021), particularly for small- and medium-sized enterprises (Herce et al., 2024b). Abeelen et al. (2019) claim that the first problem to harmonize the analysis of the policies is the selection of indicators (based on primary or final energy savings and in economic or physical production). The selection of the metrics is directly linked to the availability of data and should be focused on supporting the targets of policymakers with continuous monitoring.

Nabitz and Hirzel (2019) analysed the transposition of Art. 8 in the 2012 EED, that was delayed in half of the EU countries, suggesting that the continuous sharing of experiences between policy practitioners is the best approach to promote good practices and avoid bad practices. Similarly, Liberova et al. (2025) studied the implication of the energy audits from EED, highlighting the importance of standardising energy auditing practices, promoting information sharing across national borders, and overcome barriers such as public resistance and budgetary limitations.

The transposition of other articles such as Art. 5 ("Exemplary role of public bodies' buildings") and Art.7 ("Energy efficiency obligation schemes") were analysed in detail between 2013 and 2018, observing that an increase in target ambition was necessary to reach the objectives of the EED at EU level, with very different success as function of the sector and country analysed (Zangheri et al., 2019). This increase of ambition has been faced in the recast, driven by the Fit-for-55 and REPowerEU policies (European Commission, 2021, 2022).

Another important novelty of the EED recast is the "Energy Efficiency First" principle, that was postulated in 2015 (Rosenow et al., 2017) but not effectively addressed up to the recast of the directive, due to a lack of common understanding of the principle's implications for energy-related planning, investment, and policymaking (Mandel et al., 2022).

EnMS and EAs are widely recognised as a key driver for energy performance enhancement in industrial and commercial sectors (Backlund et al., 2012). Despite their central role in Europe's strategy to achieve energy savings targets, there is a lack of comprehensive studies assessing how these obligations drive the implementation of EEMs. Furthermore, although data is collected within national policy frameworks, it is often underutilised and rarely disseminated through academic literature. While national reports exist, the absence of internationally published studies limits the replicability of effective policy approaches and the establishment of benchmarks. Some studies are focused on the different approaches to collect and use the information from energy audits (Hirzel et al., 2016; Johnsson et al., 2025; Serrenho, 2019) without presenting quantitative information about EEMs. Partial data of the first cycle of EED mandatory EAs at European level is

available in (Ricardo Energy & Environment, 2018), however strongly differences with quality of data between first and subsequent cycles allows a limited analysis of these data. Information of the EEMs databases is available for some EU countries such as Italy (Salvio et al., 2024), Latvia (Kubule et al., 2020), and Germany (Kulkarni & Rau, 2024). However, these studies usually analysed the EAs programme under a stand-alone perspective, without connections to other national or international mechanisms, or the EnMS certification data and policies.

The novelty of this study lies in providing an updated overview of data collection on EEMs under EED Art.8 across ten MS, considering the ongoing transposition process of the revised EED and comparing with other pieces of policies and programmes at national and European levels.

This paper, developed within the EU-funded LEAPto11 project, provides an overview of data collection practices related to EEMs across 10 MS, partners of project, highlighting the different systems in place for monitoring, reporting, and publishing relevant data. Additionally, it presents a series of good practices that facilitate the implementation of EEMs and exploit EEMs related data. Ten MS are involved in this study: Croatia, Germany, Greece, Ireland, Italy, Lithuania, Malta, the Netherlands, Portugal, and Slovakia. This group is representative of different countries' sizes in terms of the number of enterprises and productive specialisation, reflecting the presence and significance of various sectors. In these ten countries, the management of EED Art. 8 has followed different paths, and the transposition of the revised EED (European Commission, 2023), issued in 2023, will do so as well.

The paper is structured with a methodology section that gives details about the approach chosen to collect the information presented. Then, a section is devoted to the discussion on results, relative to different interconnected aspects, which can be divided into three main topics. First, the current status of the management of Art.8 in examined MS is analysed, focusing on EEMs data collection, structure of available data from EAs, and information on EEMs from EnMS. Second, facilitating factors for the implementation of EEMs, good practices under Art.8 and other relevant programmes beyond Art.8 are identified and commented. Finally, the evolution of the implementation of EEMs and data collection under Art. 8 is summarised, in light of analysing the new requirements of Art.11 on the obligation to implement the recommended EEMs and action plans. The conclusions include the main findings and highlights.

Methodology and data collection approach

As part of this study, a structured questionnaire was developed to collect detailed and comparable information from ten EU MS regarding the implementation of EEMs under Art. 8 of the EED. This approach was intended to ensure a comprehensive and participatory assessment, and to provide a representative picture of the national implementation features.

Stakeholder engagement and participatory approaches have been widely recognised as essential for policy assessment and implementation in the energy sector (Matschoss et al., 2022; Rosenow et al., 2016).

The methodological approach followed a four-phase structure:

1. Development of the questionnaire
2. Questionnaire design
3. Implementation and data collection
4. Data analysis and processing

The questionnaire was developed through an iterative co-design process. The authors prepared an initial draft based on previous policy reviews, academic literature, and official documentation on Art. 8 and Art. 11 of the EED. This draft was then shared with designated experts from national energy agencies for feedback. Feedback loops were conducted via email and virtual meetings, allowing national experts to propose clarifications, rephrase questions, and highlight national specificities. This ensured that the questionnaire was tailored to relevant national contexts and supported consistency in data collection across countries.

Relative to questionnaire design, the final questionnaire included 12 core questions, each with multiple sub-items, grouped into three thematic areas: implementation of EEMs under Art. 8 of the EED, identification of good practices to support EEMs implementation, overview of additional national programmes related to EEMs. Questions addressed both qualitative and quantitative aspects, including the structure,

availability, and accessibility of EEM-related data; the role of EnMS; and the evolution of Art. 8 implementation since its introduction. The identification of good practices was conducted by the national agencies themselves, using predefined criteria: documented impact on energy savings or uptake, existence of structured data collection processes, or recognition by national experts as exemplary for boosting EEMs' implementation. A final section of the questionnaire focused on policy measures beyond Art. 8, including national programmes, funding schemes, and databases. In this section, countries conducted additional desk research and, when necessary, contacted relevant ministries to gather updated data. The assessment of national-language documentation and grey literature was explicitly encouraged to fill gaps often left in international assessments. These consultations involved various institutions and policy databases. For information collection, data were gathered from several sources, including current and completed national energy efficiency policies and programmes, reports, statistical data from National Energy Efficiency Plans, and direct contact with policymakers involved in energy efficiency governance. The use of both publicly available and national-language resources was encouraged to ensure the inclusion of data available at the national level but often underrepresented in international assessments. The questionnaire was distributed in June 2024 and remained open until October 2024. Each of the ten participating countries appointed a focal point within the national energy agency to coordinate the response. Data collection was conducted through internal expertise from energy agencies; desk research, including national policy documents, programme reports, and databases; targeted consultations with relevant ministries (carried out by the national focal point). In four countries, follow-up interviews were held to clarify responses, involving the same experts responsible for the questionnaire, and no external stakeholders. To ensure national representativeness, replies were compiled at country level by experts with institutional knowledge and access to national data and were internally validated before submission. All ten countries submitted complete responses (100% response rate).

In the last phase, responses were checked after collection, for consistency and completeness. Any unclear or missing information was verified via email or short calls with the national focal points. Further details on the questionnaire design, including the full list of questions and methodological notes, are available in Martini et al. (2024). The questionnaire findings are presented in the next section: despite the number of responding countries is limited, they provide direct insight into policy implementation and practical experience at the national level. As a result, the data should be interpreted as indicative rather than representative of the EU. The selected countries represent a variety of regulatory approaches and geographical contexts, but generalisation is constrained. Nevertheless, the involvement of institutional experts ensures a high level of relevance and reliability in terms of policy insights and implementation practices.

Results and discussion

In this section the findings from the questionnaire relative to EEMs data collection, the structure of available data from EAs and the information on EEMs from EnMS are presented and discussed. The evolution of the implementation of EEMs and data collection under Art. 8/11 in time are also described, to summarize how the different MS improved their EA and EEMs framework in the different EA obligation periods since the introduction of the obligation in 2015. This overview constitutes the basis to assess the new Art.11 provisions in the revised EED, specifically relative to the obligation to implement the recommended EEMs and role of action plans.

An important finding from this study is that the availability and accessibility of data on EEMs vary significantly across countries. This variation has a considerable impact on policy evaluation and makes cross-country comparisons more challenging. Several good practices on data collection and implementation of EEMs exist under Art. 8 and, in some countries, additional programmes and frameworks, such as mandatory reporting formats, centralised databases, or financial support schemes, contribute to improved data availability, more systematic follow-up on audit results, and higher rates of implementation of recommended measures.

EEMs data collection

The first aspect analysed through the questionnaire was related to the collection and digitisation of data,

specifically the existence of structured databases for collecting data on EAs or EnMS and associated EEMs. A structured and searchable database of EEMs under Art. 8 exists in Italy, Portugal, and Ireland, while other countries store data in internal databases or repositories. The existing database are not publicly accessible and are primarily intended for the internal use of the national Energy Agencies responsible for managing them.

Table 1 summarises the availability of data in the examined countries, relative to the data collection method and data publication. Differences in data collection approaches impact data publication. While some countries, such as Italy and Portugal, have developed structured databases that allow access to EEMs' data through dedicated web portals and reports, others have only partial or summary data available. Ireland's system, for instance, functions as a compliance notification system, but does not publicly release detailed information. Germany and Greece publish only limited data, often in aggregated form, while remaining countries still rely on EAs reporting not centrally managed or accessible. The lack of harmonisation in data collection and publication practices implies a significant gap in transparency and policy evaluation across the examined MS.

The country-specific data collection practices on EEMs data also vary widely among MS, in terms of method and variable focus. Italy has a well-established system, where companies submit data on investments, savings, and payback times through an online portal. These data, after internal check for consistency, correction and outlier verification, are included in an annual report for the Ministry of Environment and Energy Security, ensuring a high level of accessibility and providing disaggregated sectoral and regional information. Similarly, Portugal's Intensive Energy Consumption Management System (SGCIE) platform, devoted to EAs collection, centralises EEMs data collection and provides detailed data on achieved energy savings, CO_2 emissions reductions, and financial returns. According to Ireland's approach, companies report the top five energy-saving recommendations per EA. In Germany, data are collected through mandatory self-declarations but are not systematically analysed or published, while Greece's reporting practices include partial publication. In the remaining countries data are stored in a repository and not published.

The variation in data collection practices directly affects the ability to assess EEMs implementation across different countries. In Italy and Portugal, where structured databases exist, the implemented and recommended EEMs can be tracked, as well as associated savings. Conversely, in countries like Ireland and Germany, where data are partially available for evaluation. This discrepancy has significant implications for policy evaluation, as the lack of standardised reporting frameworks makes it challenging to assess the real impact of EA obligation, and to develop comparative analyses of EEMs implementation.

The comparison between achieved and potential final energy savings across selected Member States should be interpreted in light of the four-year

Table 1 Availability of data on EEMs in 10 EU MS

Country	EEMs collection method	Publication
Croatia	Stored in a EAs repository	Data not published
Germany	Recommended EEMs stored in EAs internal database	Data not published
Greece	Recommended EEMs stored in EAs internal database	Data partially published
Ireland	EA compliance notification system	Data not published
Italy	EAs web portal	Data published in reports, documents and scientific papers
Lithuania	Stored in a EAs repository	Data not published
Netherlands	Stored in a EAs repository	Data not published
Malta	Stored in a EAs repository	Data not published
Portugal	SGCIE web portal	Data published in SGIE portal, reports and documents
Slovakia	Stored in a EAs repository	Data not published

Source: own elaboration of data collected by the survey illustrated in Martini et al. (2024)

cycle of mandatory energy audits under Art. 8 of the EED. In this framework, year-by-year comparisons are not always meaningful, as energy savings tend to be concentrated in the first year of the obligation period, when most companies are required to carry out audits and implement measures. For this reason, in Fig. 1 achieved and potential yearly energy savings are shown as a percentage of total energy consumption of audited companies. The analysis of national data collection systems in ten MS made it possible to retrieve achieved and potential final energy savings for only four countries, for the years shown in the figure. It is important to note that the two saving indicators generally refer to different timeframes: achieved savings are associated to the EEMs implemented in the four years before the EA; in contrast, potential savings refer to the EEMs recommended in the same EA for implementation in the coming years. Potential savings should be considered as a potential and a maximum threshold because not all recommended EEMs will be implemented, and their execution will be spread out over time. The data, collected through the questionnaire, comes from national energy efficiency reports and databases, with each country providing data according to its specific reference period for EAs. The time span varies by country depending on the availability of quantitative data. The indicators exhibit significant variation depending on sectoral composition and national reporting practices, due to differences in how EEMs are recorded and categorised in each country. A direct comparison across all countries is therefore not feasible, due both to the limited availability of data and to differences in the way savings are collected and reported.

In 2023, Ireland reported achieved energy savings equal to 1.1% of final energy consumption, while the potential was estimated at 1.5%. In Italy, is also observed a higher value of potential savings when compared to achieved ones. In Portugal, full implementation is observed, and achieved and potential savings reach 3.5% in 2023. Germany only reported potential savings, equal to 0.6%. The observed gap between achieved and potential savings suggests the presence of untapped energy efficiency opportunities. These could be identified by monitoring EEMs' implementation rate and analysing the role of existing support policies. While the data presented in the figure could be valuable to enable policymakers to plan, assess, and adjust energy efficiency policies and programmes, it highlights a critical issue: without harmonised data collection and reporting methodologies, drawing meaningful cross-country comparisons

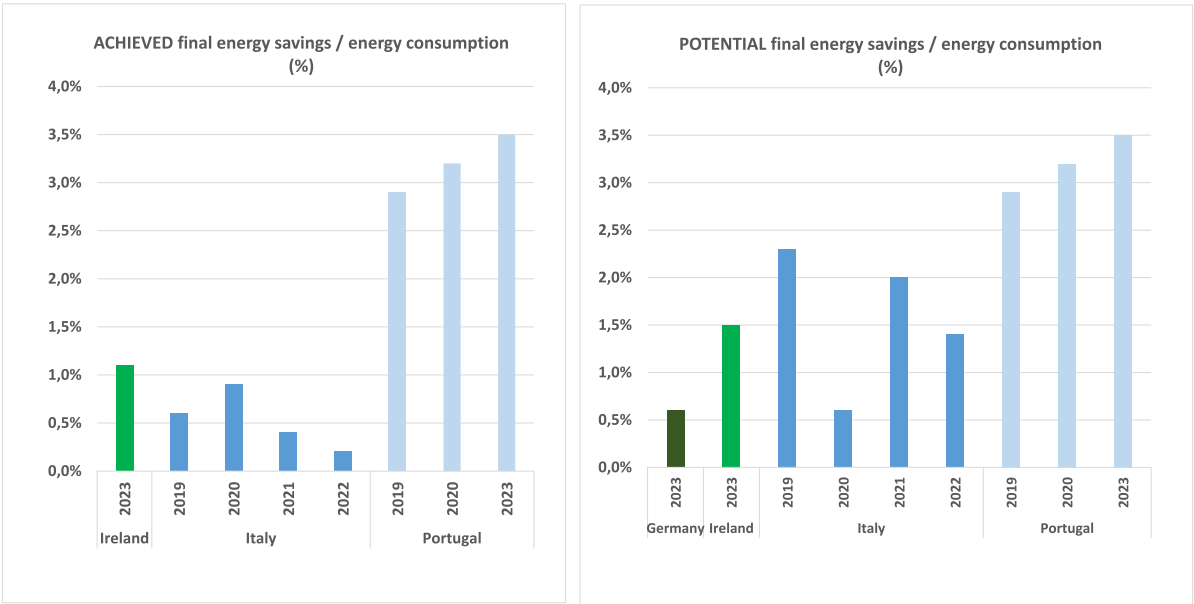

Fig. 1 Achieved and potential savings relative to energy consumption from EAs. Source: own elaboration of data collected by the survey illustrated in Martini et al. (2024)

remains challenging. This highlights the importance of consistency in data collection, as differences in reporting years and methodologies can significantly affect the comparability of the results.

Structure of available data from EAs

As mentioned in the previous section, the questionnaire did not only focus on collecting quantitative data but also investigated the structure of the available data in terms of the indicators and metrics gathered. The first step was to understand how data collection on EEMs is defined by the EAs guidelines, which are non-binding guidance and standardisation documents. In fact, the way data is structured and collected is closely linked to the specific framework of the EAs and the associated guidelines that specify their implementation (Serrenho, 2019). EA guidelines exist in nine out of ten examined MS, with Croatia the EA mandatory contents regulated by law. Guidelines exhibit significant variations in the way they address the reporting of both recommended and implemented EEMs. Table 2 provides a comparative overview of the EEMs reporting metrics as outlined in EA guidelines. The countries differ in the metrics they use to report on implemented and recommended EEMs, reflecting varying national practices and priorities. All MS request information for recommended EEMs, while a lower number – seven out of ten – on already implemented ones. When reporting formats are not specified and their choice is left to the energy auditor, the table classifies this case as "free format"; this does not imply that the information is not available, but that no specific metrics are required.

In a first group of countries, including Italy, Malta, Ireland, Lithuania, the Netherlands and Portugal, a comprehensive reporting on implemented and recommended EEMs is in place. The guidelines encourage or require energy auditors to report on both the measures implemented since the previous audit and those recommended in the current EA. In Portugal, the guidelines require reporting on EEMs implemented after the previous EAs, as these measures are mandatory under the SGCIE system. Relative to recommended EEMs, the metrics applied are like those for implemented EEMs, namely investment, energy and economic savings, and payback time. Ireland's online notification system requires reporting on both "Project-specific details completed since the last audit" and "Energy project details identified in the current audit.". The Netherlands has also taken steps to standardize reporting by encouraging companies to summarize implemented EEMs with investment figures, energy savings, and payback periods, with Net Present Value (NPV) analysis recommended. In Malta, information on both implemented and recommended EEMs is collected not only in terms of energy savings but also relative to water, and savings are also monetised; for recommended EEMs the investment cost is also available. In Italy and Lithuania, EA guidelines specify that EA reports should include a description of the most significant implemented EEMs; however, no specific metrics are mandated for implemented EEMs. In both countries specific metrics are employed for recommended EEMs, namely energy and CO_2 savings, and PBT. In Italy also investment costs are required, as well as indicators for economic evaluation, such as NPV and Internal Return Rate (IRR); water savings, where applicable, recently started to be monitored.

In a second group of countries – Greece, Germany, and Slovakia – the guidelines focus primarily on recommended EEMs. They concentrate on the technical and economic feasibility of recommended measures without explicitly require reporting on previously implemented measures, which is limited or optional. In these countries, EA guidelines recommend economic and technical feasibility analysis of each EEM, covering the total cost, energy savings, and simple payback period. In Germany CO_2 potential savings are also covered and NPV and IRR evaluation methods are applied. Although no guidelines exist in Croatia, the EA contents are regulated by law and the country belongs to this second group. Auditors are not required to report on implemented measures but must include proposals for cost-effective EEMs, evaluated through investment cost, energy savings, CO_2 reduction, and return on investment.

Despite these disparities, a general trend towards enhanced reporting is emerging, relative to higher information on implemented measures. For instance, in Malta, information on implemented EEMs is collected for obligated companies, while SMEs only report such data if they are conducting a follow-up audit under the "Promotion of Energy Audit Scheme". In Germany, while direct reporting on implemented measures is not required, guidelines emphasize structured reporting formats that could facilitate tracking.

Table 2 Implemented and Recommended EEMs reporting metrics in EA guidelines

Country	Implemented EEMS				Recommended EEMS			
	Investment costs	Energy / CO_2 / Water savings	Economic savings	Economic performance indicators	Investment costs	Energy / CO_2 / water savings	Economic savings	Economic performance indicators
Germany	✗	✗	✗	✗	✓ [€]	✓ [energy, CO_2]	✓ [€ / year]	✓ [NPV, IRR, economic efficiency]
Greece	✗	✗	✗	✗	✓ [€]	✓ [energy]	✓ [€ / year]	✓ [PBT]
Ireland	✗	✓ [energy]	✗	✗	✗	✓ [energy]	✗	✗
Italy	✓	✓	✓	✓	✓ [€]	✓ [energy]	✓ [€ / year]	✓ [NPV, IRR, PBT]
Lithuania	✓	✓	✓	✓	✗	✓ [energy, CO_2]	✗	✓ [PBT]
Netherlands	✓ [€]	✓ [energy]	✗	✓ [PBT]	✓ [€]	✓ [energy]	✗	✓ [NPV, PBT – company's calculation method]
Malta	✗	✓ [energy, water]	✓ [€ / year]	✗	✓	✓ [energy, water]	✓ [€ / year]	✗
Portugal	✓ [€]	✓ [energy]	✓ [€ / year]	✓ [PBT]	✓ [€]	✓ [energy]	✓ [€ / year]	✓ [PBT]
Slovakia	✗	✗	✗	✗	✓ [€]	✗	✓ [€]	✓ [NPV, IRR, PBT]

✓ included in guidelines with a specific indicator; ✗ not included in guidelines; ✓ included with free format.

NPV Net Present Value

IRR Internal Return Rate

PBT Payback time

Source: own elaboration of data collected by the survey illustrated in Martini et al. (2024).

Similarly, Dutch guidelines have recently introduced a structured reporting format where implemented measures are documented similarly to proposed ones, using energy savings and payback time as key metrics.

Even in the case of existing EA guidelines a need for harmonisation across MS emerge. Some countries employ detailed economic assessments, including NPV and IRR analyses, while others focus mainly on payback periods. Furthermore, consideration of incentives in the evaluation of EEMs remains inconsistent, potentially leading to underestimation of the economic feasibility of certain interventions. Prior research has emphasised the role of standardised reporting in energy efficiency monitoring (Bertoldi & Mosconi, 2020; Fleiter et al., 2012c), underscoring the potential benefits of a more uniform approach. By addressing these discrepancies and harmonising guidelines, the role of EAs in driving energy efficiency improvements across the EU could be enhanced, supporting the broader climate and energy objectives. To date, however, this potential has not been fully realised, as each Member State has transposed Art. 8 in line with its national circumstances and without a coordinated EU-wide implementation framework. While harmonisation could offer clear benefits in terms of comparability, transparency, and policy learning, it also presents challenges. These

include the complexity of aligning diverse national systems and practices, as well as potential drawbacks such as a loss of flexibility for Member States. Even with a set of minimum harmonised outputs, national systems would need to adapt, and this could add to the implementation burden and require careful balancing to preserve the relevance and effectiveness of domestic approaches.

Information on EEMs from EnMS

The questionnaire also aimed to assess the data collection on EEMs for companies that comply with the Art.8 obligation through the implementation of EnMS. In the case of EnMS, the extent to which EEMs are reported varies significantly across the participating countries.

A small group of countries—including Ireland, Malta, and Portugal—have established more detailed reporting requirements for both implemented and recommended EEMs within their EnMS frameworks. In Ireland, for instance, ISO 50001 is strongly encouraged as a compliance route, and companies using EnMS must report up to five implemented and five recommended EEMs. Malta mandates the reporting of cost savings, energy and water savings, and expected lifetime for implemented measures, alongside detailed information on recommended measures, including cost projections and potential savings. These approaches allow to monitor the impact of EnMS-driven EEMs more effectively.

By contrast, countries such as Greece and Slovakia mandate the reporting of recommended EEMs but do not require companies to disclose information on those implemented. The remaining countries, including Croatia, Germany, Italy, Lithuania, and the Netherlands, do not systematically collect data on EEMs through EnMS compliance. In these countries, the reporting on EEMs in the context of EnMS is either limited or almost absent. In Germany, for example, companies only need to self-declare that the audit obligation has been met via an EnMS, without submitting details on EEMs. Similarly, in the Netherlands, EnMS certification does not include a requirement to track past or recommended EEMs, limiting the availability of quantitative data on the effectiveness of such measures. In Italy, certified companies can compile a voluntary simplified template ("matrice di sistema") that includes sections for implemented and recommended EEMs, yet detailed data on investments and savings are rarely provided. This variability might be partly explained by the higher administrative complexity in larger countries, where the higher number of companies makes systematic data collection more challenging. Conversely, smaller countries may find it easier to implement more ambitious tracking mechanisms, possibly due to a more manageable industrial base or stronger institutional coordination on energy efficiency policies.

These differences reflect broader debates in the literature on the role of EnMS in driving energy efficiency improvements. Studies have shown that while the implementation of ISO 50001-certified EnMS can lead to significant energy savings (McKane et al., 2017), the actual quantification and reporting of EEMs remain challenging due to the voluntary nature of many reporting schemes (Brunke & Blesl, 2014). Countries with mandatory EEM reporting requirements tend to have better data on energy savings, which can inform policy adjustments and incentive programmes (Thollander et al., 2015). This analysis confirms that while EnMS is widely accepted as a compliance route, a high heterogeneity in reporting practices is observed, with only a few countries requiring detailed tracking of implemented and recommended EEMs. Aligning with the results of existing literature contributions, it seems that structured reporting mechanisms could play a crucial role in determining the effectiveness of EnMS-based compliance strategies. This highlights the existence of opportunities for policy refinement, harmonisation and knowledge exchange, as consistent monitoring of EEMs could enhance the overall effectiveness of the adoption of EnMS across different national contexts. Indeed, the increased knowledge of energy consumption and company processes associated to the adoption of EnMS can be associated to an improved identification and planning of EEMs, better tailored on the specific company needs and more effective in terms of associated savings.

Facilitating factors, good practices and other programmes

Expert responses also addressed facilitating factors for driving the implementation of EEMs; their percentage distribution is presented in Fig. 2. Among these, incentives are the most frequently emphasised

across MS, with financial support mechanisms identified as crucial drivers for EEMs adoption. While obligations are generally viewed as effective in driving energy efficiency, enforcement and compliance remain challenges. Some countries advocate for mandatory adoption of cost-effective EEMs; this is consistent with existing good practices in IEA member states (IEA, 2025; Tanaka, 2011). The survey also shows that awareness campaigns and informational tools are also important for overcoming knowledge gaps and promoting EEMs adoption. Capacity-building initiatives are also essential, particularly for SMEs, to facilitate EEMs implementation. The promotion of standardisation, such as ISO 50001 and International Performance Measurement and Verification Protocol (IPMVP), is considered moderately important, to simplify decision-making and access to incentives, but high costs and administrative burdens may limit adoption. Experts' opinion on one-stop shops for EEMs are mixed, highlighting their importance but also the role of proper design and scalability in determining their effectiveness. This is in line with the focus of Art.11 on the creation of energy audit centres for not obligated companies, conceived as one-stop-shops dedicated to supporting the implementation of EAs. Such structures could be an effective tool as they centralize information, offer technical guidance, collect data, and facilitate coordination between enterprises, authorities, and service providers.

Finally, experts emphasize that quantifying the multiple benefits of EEMs and assessing additional resource efficiencies can enhance overall cost-effectiveness of EEMs. However, developing a unified methodology for such assessments remains a significant challenge.

The views expressed by experts are in line with previous literature contributions, highlighting that targeted financial mechanisms, such as subsidies and tax incentives, can significantly enhance energy efficiency uptake (Fleiter et al., 2012a). Moreover, it has been found that awareness campaigns and informational tools can be usefully complemented by

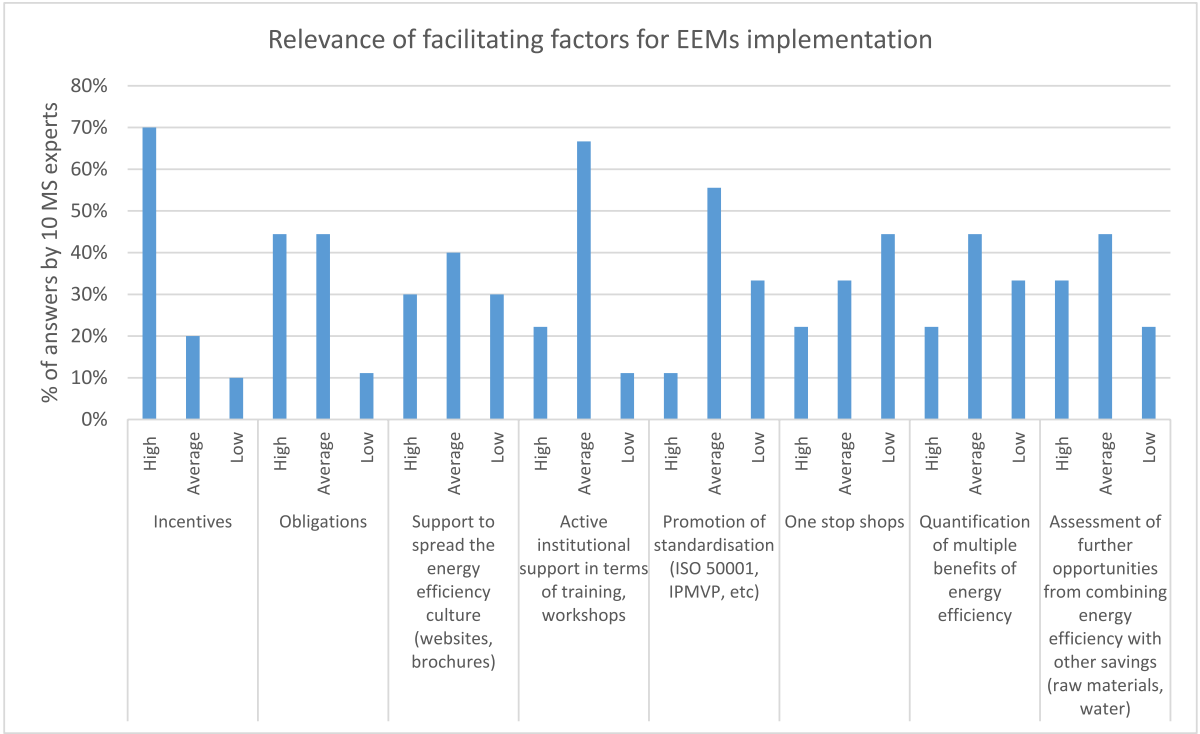

Fig. 2 Relevance of facilitating factors for EEMs implementation. Source: own elaboration of data collected by the survey illustrated in Martini et al. (2024)

financial or regulatory support (Cagno & Trianni, 2014; Rohdin et al., 2007).

In the following, the translation of facilitating factors into concrete policy measures and tools available to businesses will be examined. Looking at the implementation of EEMs, the experts identified both the good practices under EED Art. 8 and other relevant programmes beyond Art.8, specifically focusing on the availability of EEMs data. Other relevant programmes explore the implementation of EEMs beyond the scope of EED Art.8/11, focusing on broader national and regional policies, programmes, and practices, selected by Partner Countries are particularly effective. To be selected as good practice, a policy programme needs to be both effective and properly monitored. Specifically, it should demonstrate a significant impact in terms of energy savings and business participation, while also including an effective data collection mechanism for EEMs under Article 8. Alternatively, the programme should be exemplary practice in exploiting the information on EEMs collected under Art.8. The same criteria apply for the identification of other relevant programmes, except for the reference to Art.8. The experts from the ten energy agencies concentrated on recent actions and policies, most of which are still in force.

The programmes adopt diverse approaches, including economic, prescriptive, supportive and R&D policies and can be grouped basing on sub-categories, adopting and integrating the classification proposed by (Tanaka, 2011). Table 3 shows the categories observed in the collection of good practices and other relevant programmes, providing a description of each and highlighting their presence in both cases. A subsidy may be considered a good practice under Art.8 if it supports the implementation of EEMs identified in the energy audit. Conversely, it would be classified as another relevant programme if it supports the adoption of EEMs identified outside the Art. 8 framework—for example, measures introduced for environmental obligations that also have an impact on energy efficiency. In this regard, cap-and-trade mechanisms are never developed within the Art. 8 framework in any of the ten countries surveyed.

Table 4 lists the eighteen good practices collected, indicating the category and type and the reference period. The table shows that in some countries EEMs data collection and implementation is characterised by a more regulated approach (Portugal and the Netherlands), with long-established prescriptive measures. In other countries (Germany, Italy, Lithuania, and Malta), the implementation of EEMs relies more on economic incentives, such as tax incentives and subsidies, to promote EAs, the identification of EEMs, and related investments. Networks are less widespread but have been developed in Germany and Ireland to help achieve energy savings targets and support the adoption of ISO 50001 certification. Finally, in some countries (Croatia, Italy, and Portugal), the focus has also been placed on analysing data from EAs and EEMs to provide the industrial sector with insights that can guide business decisions. Long-standing measures may represent a well-established strategy and a stable reference point for the productive sectors. At the same time, initiatives with a shorter duration suggest approaches tailored to specific sectors and linked to the availability of funding.

Figure 3 illustrates how the good practices are related to EAs or EnMS, and which is the link with the implementation of EEMs. The most common strategy, with five occurrences, is requiring an EA as a prerequisite to apply for incentives or grants, indicating a strong link between financial support and energy assessment. The support for implementing the EEMs identified in the EA follows in terms of relevance. EA and EEMs obligations and EA data elaboration are equally represented, showing that regulatory requirements and data analysis are key aspects. Financial incentives for EAs appear less frequently. Networks supporting large enterprises in obtaining ISO 50001 certification and lists of EEMs to be included in EAs are the least common practices.

Other relevant programmes beyond Art.8 but related to the implementation of EEMs were also identified, focusing on the availability of indicators to assess programme outcomes in terms of EEMs' adoption. A list of 35 collected programmes, together with their category, type and link, is provided in Table A1 included the Annex. Figure 4 shows the distribution of the programmes by category type. The histogram presents the frequency with which specific policy instruments have been identified by national experts as successful in supporting the implementation of EEMs and in enabling the collection of related data. The higher diffusion of a given instrument across countries is interpretable as a proxy for both its performance in facilitating EEM uptake and its potential contribution to data availability, bearing in mind

Table 3 Good practices under Art.8 and beyond: categories and types supporting EEM implementation

Category	Type	Description	Art.8 good practices	Relevant programmes beyond Art.8
Economic policy	**Cap and trade scheme**	Cost compensation for companies involved in a cap-and-trade system on total emissions or energy use		X
	Loan	Financial support through low-interest or zero-interest loans, to reduce upfront investment costs		X
	Tax incentive	Tax breaks for business investing in EEMs	X	X
	Subsidy	Direct financial support to promote the adoption of EEMs	X	X
Prescriptive policy	**Law obligation**	Regulations or standards requiring businesses to adopt specific energy-efficient practices or technologies	X	X
Supportive policy	**Awareness-raising campaign**	Initiatives to inform and educate businesses on energy efficiency benefits through media campaigns and workshops		X
	Energy-saving agreement	Voluntary agreements between governments and businesses, where companies commit to specific energy-saving targets in exchange for financial incentives or technical support		X
	Information system	Development of centralised platforms or tools to track, monitor, and share energy consumption and EEMs data, enabling businesses to benchmark performance and identify saving opportunities		X
	Network	Collaborative frameworks connecting stakeholders, such as businesses, governments, and experts, to share knowledge and resources while achieving energy efficiency targets	X	X
R&D	**Data elaboration**	Research and development to analyse data collected from EAs, evaluate the effectiveness of EEMs, identify sectoral and overall trends, and inform future policy design	X	X
	Tool development	Development of specialised tools, models, or software to assist businesses in analysing energy use, optimising operations, and designing effective EEMs		X

Source: own elaboration of data collected by the survey illustrated in Martini et al. (2024)

national differences in governance structures and production sector contexts. Economic policies based on subsidies represent the most widespread type, with 17 programmes in seven countries. This suggests that the main tool for encouraging the implementation of EEMs – and collecting the related data – is direct financial support. This reflects not only their ability to trigger investments in energy efficiency, but also their frequent link to monitoring and reporting mechanism, especially where funding is conditional on the implementation and documentation of EEMs. Other economic instruments, though less commonly used, include loans, present in one country with three programmes, as well as tax incentives and compensations in carbon and trade schemes, each adopted in two countries. Regulatory obligations are less widespread than direct incentives, as well as support policies based on information systems, awareness campaigns, and voluntary agreements. However, these latter instruments could play a key role in overcoming

Table 4 Description of good practices

Country	Good Practice	Category/Type	Reference period
Croatia	Regulation on the criteria for the payment of reduced fees for RES and highly efficient CHP	Economic policy/Tax incentive	2020—ongoing
	Analysis of Data Management from Large Enterprise EAs Reports	R&D/Art.8 data elaboration	Analysis conducted in 2024
Germany	Regulation on measures for avoiding carbon leakage caused by the national ETS for fossil fuel combu stion in heat and transport	Economic policy/Tax incentive	2019—ongoing
	IEEKN Initiative for energy efficiency and climate action networks	Supportive policy/Network	2014—ongoing
Greece	Athens Business Green Toolkit	Economic policy/Subsidy	2021—2023
Ireland	LIEN Large Industry Energy Network	Supportive policy/Network	1995—ongoing
	Energy Efficiency Grant	Economic policy/Subsidy	2023—ongoing
Italy	Energy Intensive Industries support programme	Economic policy/Tax incentive	2015—ongoing
	Subsector guidelines	R&D/Art.8 data elaboration	2019—ongoing
Lithuania	Relief for industrial enterprises	Economic policy/Tax incentive	2021—ongoing
	Improving energy efficiency in enterprises	Economic policy/Subsidy	2021—2024
Malta	MERCA – Managing Essential Resources in Retail through Consumption Analysis	Economic policy/Subsidy	2022—ongoing
	GUEST—Guesthouse owners and Users Embarking on a Sustainable Transition	Economic policy/Subsidy	2023—2024
Netherlands	Energy saving obligation – Recognised Energy savin g Measures List	Prescriptive policy/Law obligation	2015—ongoing
Portugal	SGCIE – Management System for Intensive Energy Consumption	Prescriptive policy/Law obligation	2008—ongoing
	Energy Consumption Management Regulation for the Transport Sector	Prescriptive policy/Law obligation	1990—ongoing
	Subsector notebooks	R&D/Art.8 data elaboration	2018—ongoing
Slovakia	Reduction of energy intensity and increased use of renewable energy sources in businesses (national except Bratislava region)	Economic policy/Subsidy	2019—2021

Source: own elaboration of data collected by the survey illustrated in Martini et al. (2024)

non-financial barriers to the implementation of EEMs identified through audits, such as a lack of information or technical capacity. Indeed, these tools, while not directly financial, play an essential role in enabling environments conducive to EEMs and in some cases contribute to structured data collection efforts, especially when embedded in broader governance or digitalisation strategies. Networks and the development of R&D tools are relatively scarce, suggesting limited attention to systemic and long-term solutions for enhancing the capacity to implement EEMs, while also addressing organisational and behavioural barriers. Overall, while the most widespread instruments are economic in nature, the diversity of approaches confirms that successful implementation of EEMs and effective data collection are closely linked to national policy mixes, institutional capacities, and industrial structures. The limited presence of regulatory obligations and fiscal instruments may indicate potential for strengthening policies to ensure a higher implementation rate of the identified measures and greater availability of related data. The diversity of approaches adopted by MS demonstrates how EEMs are embedded in wider energy efficiency and sustainability frameworks (Cagno et al., 2019; Nehler, 2018; Worrell et al., 2003).

Evolution of the implementation of EEMs and data collection under Art. 8/11

After examining the status of the implementation of EEMs under Art.8, and the existing good practices

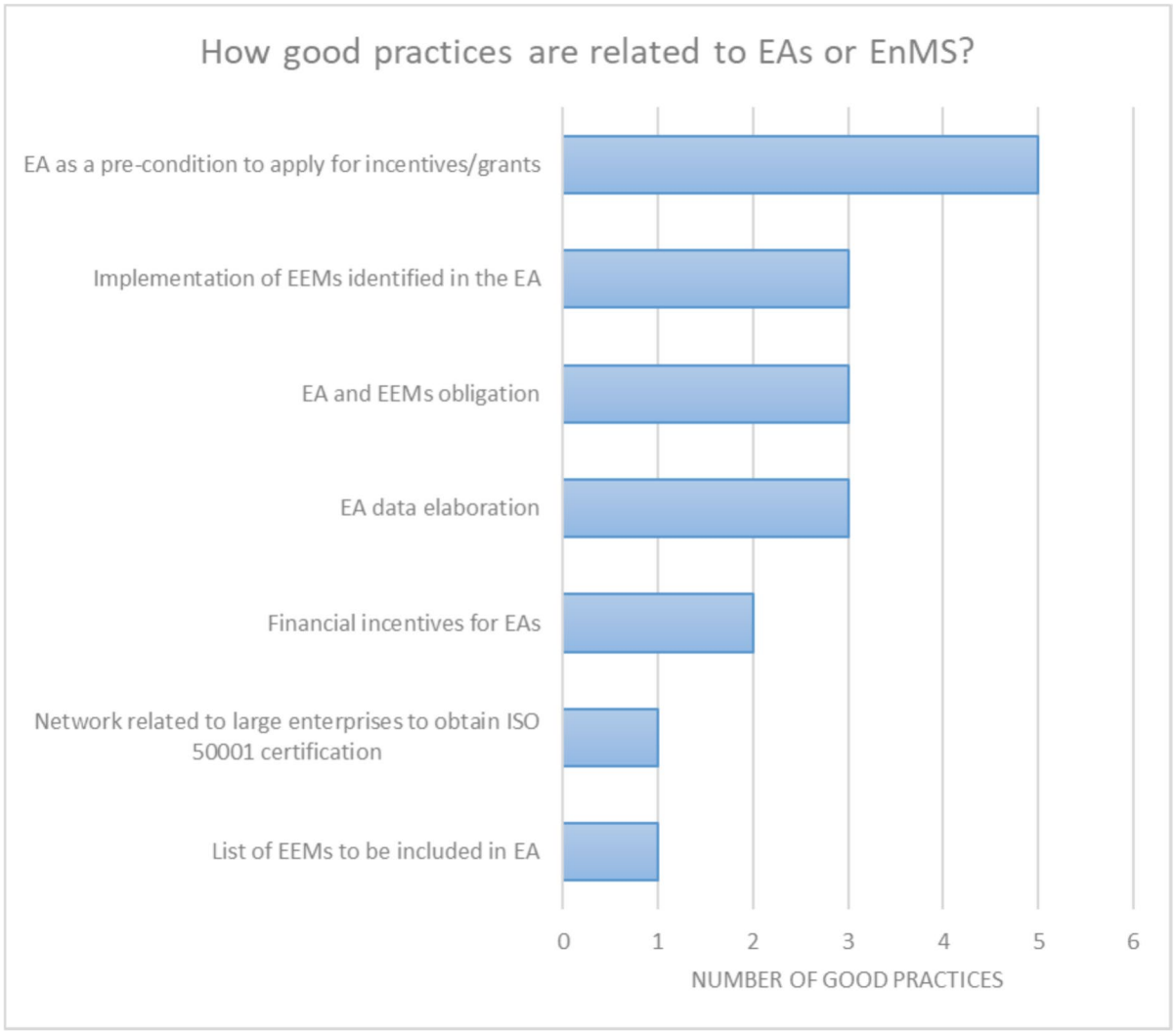

Fig. 3 Link of good practice with EED Art.8. Source: own elaboration of data collected by the survey illustrated in Martini et al. (2024)

and other relevant programmes, this section provides an overview of how national frameworks have evolved over different compliance phases. Understanding these adaptations is essential for identifying the challenges in transposing the revised EED.

The questionnaire also covered a comparative analysis of the evolution of national frameworks to transpose Art. 8 across MS highlights several recurring trends. First, obligations for energy-intensive companies were strengthened, in response to growing policy focus on energy efficiency. Several countries – Italy, Croatia, and the Netherlands – have introduced obligations for large or energy-intensive enterprises to implement EEMs with a payback period below a certain threshold, typically 3–5 years. These modifications are in line with new EED Art.11 introducing consumption thresholds for EnMs and EAs obligation. Second, minimum energy consumption thresholds were introduced. Some countries have revised their criteria for defining obligated companies, introducing energy consumption thresholds that exempt large enterprises with relatively low energy use from EA obligation. While this approach reduces administrative burdens, it could impact the scope of data collection and the ability to assess energy efficiency improvements at an aggregate level (Fawcett et al.,

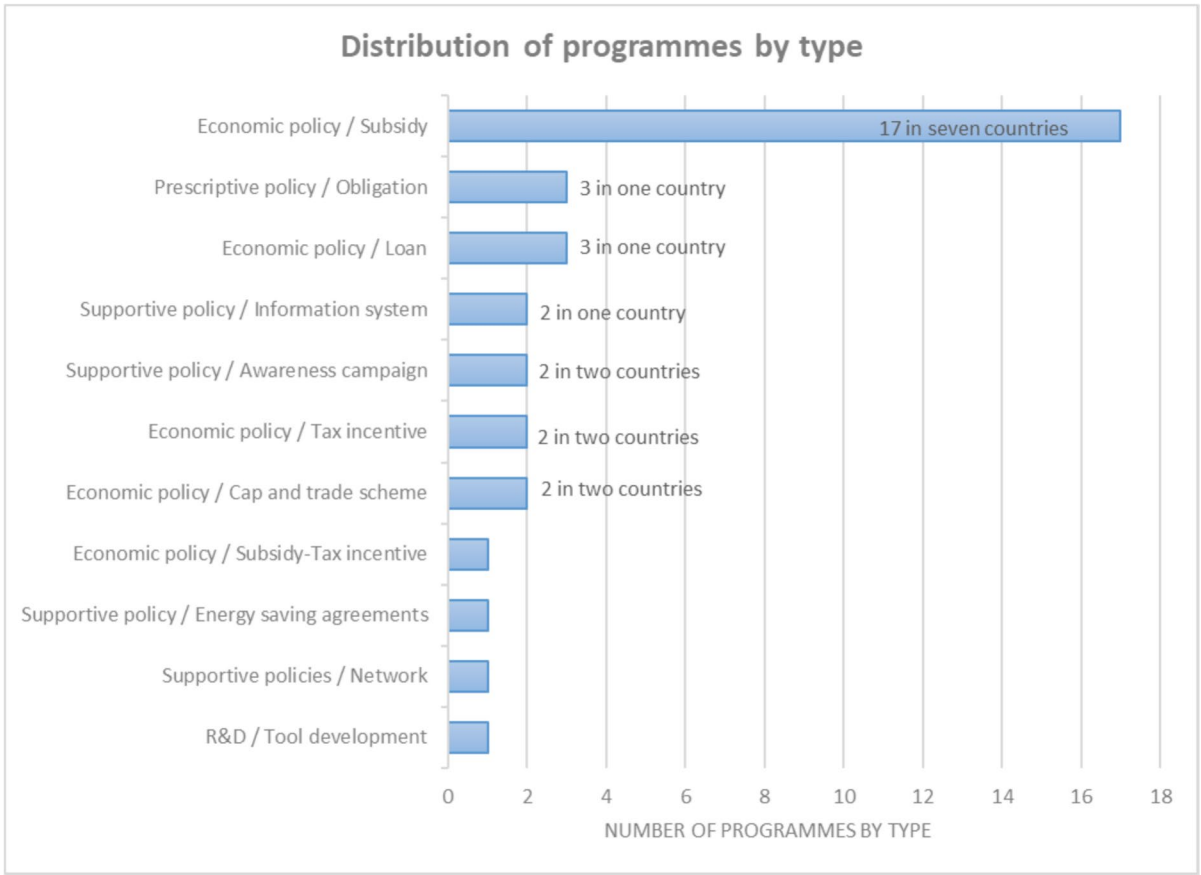

Fig. 4 Distribution of other relevant programmes by type. Source: own elaboration of data collected by the survey illustrated in Martini et al. (2024)

2019; Trianni et al., 2016). Third, enhancements have been related to data collection and digitalisation, recognising the limitations of manual and fragmented reporting systems. Multiple countries (e.g., Germany, Italy, Netherlands, Croatia) have transitioned from document-based collection (such as PDF reports) to digital databases and online platforms. These systems enable better tracking of energy consumption, EEM implementation, and benchmarking across industries, improving both policy evaluation and enforcement (Backlund et al., 2012; Fleiter et al., 2012b). Fourth, sector-specific adaptations were introduced. Some MS have tailored their frameworks to specific industrial or commercial sectors, aligning national energy efficiency policies with broader decarbonisation strategies. The Netherlands, for instance, has integrated EA obligation with sector-specific energy savings targets, while Italy has expanded monitoring to include water and CO_2 savings alongside traditional Energy Performance Indicators (EPIs).

These developments reflect a broader shift towards a more structured, data-driven approach to energy efficiency policy, with growing emphasis on compliance monitoring and impact assessment. Despite these advancements, significant challenges remain, including the variability in the scope and detail of reporting, the consistency in data formats and accessibility and the monitoring of EEM implementation. In general, the transition to digital platforms is uneven across MS, leading to limited data availability and comparability at the EU level. Moreover, the evolution in time shows that, while EAs successfully identify cost-effective EEMs, actual implementation rates remain uncertain due to insufficient follow-up mechanisms in several countries: this is confirmed also by existing studies (Rohde et al., 2015; Trianni et al.,

2019). Addressing these challenges will be crucial in the next phases of EED transposition, particularly relative to Art.11, which requires improved monitoring and tracking of the implementation of EEMs.

Obligation to implement the recommended EEMs and role of action plans

The implementation of EEMs following EAs is generally not mandatory by law, with different practices existing across examined MS. Few of them have established clear regulatory obligations, others rely on voluntary approaches, and in most MS the implementation is decided company by company without any obligation at national level. Studies have shown that without mandatory implementation, adoption rates tend to be low due to financial constraints, lack of awareness, or competing investment priorities (Backlund et al., 2012; Trianni et al., 2016).

Portugal is the only analysed country that explicitly mandates the implementation of EEMs as part of its transposition of EED Art. 8. The Energy Consumption Rationalisation Plan (PREn), developed based on mandatory EAs, sets out a structured implementation plan over a three-year period. Companies consuming more than 1,000 toe/year must implement all EEMs with a payback period of up to five years, while those below this threshold are required to implement measures with a payback period of up to three years. ADENE, the national agency responsible for energy efficiency, oversees monitoring through the SGCIE platform, reporting a nearly 100% implementation rate per company. This structured approach, with systematic monitoring and enforcement, represents a good practice in ensuring high implementation rates.

The Netherlands also enforces mandatory implementation of EEMs, but under national regulations rather than EED Art. 8. Companies must adopt measures with a payback period of five years, and implementation is monitored every four years. Shown in Table 4 as good practice, a predefined list of 120 standard EEMs facilitates tracking, but there is limited publicly available data on overall implementation rates. Sectoral reports provide some insights, though a comprehensive national database is lacking.

A second group of countries have partial or sector-specific obligations. In Italy an electricity and gas tariff relief is in force for energy-intensive companies exposed to risk of relocation, and to access the mechanism they are obligated to conduct an EA and, following Legislative Decree 73/2020, to implement at least one EEM between two consecutive audits. Recent changes introduced by Decree Law 131 (September 2023) have modified the policy framework, with the implementing Ministerial Decree published in September 2024. The obligation to implement at least one EEM from the EA has been changed to a requirement to implement all the EEMs with a payback period of less than three years. In addition, two additional green conditionalities have been introduced, allowing companies to either invest in renewable energy's guarantees of origin or reduce greenhouse gas emissions. Germany initially considered an obligation to implement cost-effective EEMs as part of the national transposition of Art. 8. However, this requirement was removed from the final version of the German Energy Efficiency Law, leaving implementation at the discretion of enterprises. Consequently, the collection of information on EEM implementation is limited to recommended measures rather than those adopted.

In the remaining countries, no implementation obligations exist. Ireland, Greece, Lithuania, Malta, and Slovakia do not require companies to implement EEMs following EAs. While Ireland mandates the identification of significant efficiency opportunities within EAs, there is no obligation to act on them, and only partial data on recommendations and potential savings are collected.

While Art.8 does not require the development of an implementation plan for EEMs, Art. 11 introduces the concept of Action Plans. These must be submitted by each company, include all technically and economically feasible recommendations, and be published in annual reports. This new requirement aims to increase transparency and improve the tracking of EEM adoption. Among MS, the Netherlands, Germany, and Portugal have formalised Action Plan requirements due to national regulations. Greece and Lithuania have voluntary practices for drafting and publishing Action Plans, particularly within specific projects or sectors. However, no country currently mandates the publication of implementation rates. The absence of implementation rate publication, even in countries with formal Action Plan requirements, presents a challenge in assessing policy effectiveness and in transposing revised EED. Greater transparency in reporting, potentially through standardised Action Plan formats,

could facilitate benchmarking and inform policy-making processes, improving policy design (Neri et al., 2018; Rohde et al., 2015). Additionally, linking Action Plans to existing sustainability reporting frameworks may enhance compliance and encourage voluntary adoption of EEMs (Hirzel et al., 2016).

Conclusions

This paper aimed to analyse how ten European countries have implemented EEMs under Art. 8 of the EED, with a particular focus on data collection practices, enabling conditions and good practices on policy tools. Rather than offering a country-by-country assessment, the study adopted a cross-country comparative approach to identify recurring patterns, divergences, and good practices, in view of the new obligations introduced by Art. 11 of the revised EED.

The analysis was based on a targeted questionnaire completed in 2024 by national experts from ten EU countries. The survey covered key aspects such as data availability and structure, the existence of reporting templates and follow-up tools, the use of indicators to monitor implementation, and the role of EnMS. This structured and participatory approach made it possible to combine qualitative and quantitative insights, despite significant differences in national data collection systems.

Findings highlight considerable variation across Member States. Some countries have introduced centralised systems and structured templates for collecting data on recommended and implemented EEMs, allowing for more effective monitoring and evaluation. Others rely on voluntary or fragmented practices, which hinder data comparability and limit the ability to assess the effectiveness of EAs and EnMS. These differences are shaped by national administrative capacities, regulatory traditions, and the degree of institutional commitment to energy efficiency.

The lack of harmonisation in reporting formats remains a major barrier to assessing and comparing the actual implementation of EEMs across the EU. Establishing a common EU-wide framework for collecting and publishing EEM data, aligned with the new provisions of Art. 11, would significantly enhance transparency, support data-driven policy decisions, and facilitate mutual learning. In parallel, the systematic collection of data on EnMS, currently absent in several countries, is crucial to evaluate their real impact, especially in energy-intensive sectors.

Strengthening the link between reporting obligations and policy instruments, such as incentives or compliance mechanisms, could improve follow-up on audit recommendations and increase the rate of implementation of recommended EEMs. These efforts should be accompanied by a greater exchange of good practices, particularly with respect to audit guidelines, implementation plans, and tools to support monitoring.

Finally, the implementation plans required by Art. 11 offer a valuable opportunity to enhance follow-up and accountability mechanisms. Future research should explore how national reporting frameworks influence EEM implementation and how the revised provisions will be translated into national practices. A harmonised, structured and transparent approach to EEM reporting is essential to unlock the full energy efficiency potential in Europe and to support the achievement of the EU's climate and energy.

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Data availability No datasets were generated or analysed during the current study.

Declarations

Competing interests The authors declare no competing interests.

Appendix

Table A1. Other relevant national programmes and instruments supporting the promotion and implementation of EEMs, beyond Article 8 of the EED (Martini et al., 2024)

Country	Programme	Category/Type	Link
Croatia	SMIV—National Monitoring, Measuring and Verifying Energy Savings System	Supportive policy/Information system	https://smiv.mzoe.hr/GIZ_MVP/Pages/Login/LoginUsernamePassword.aspx?RedirectUrl=%25GIZ_MVP/Insurance/Pages/EEPolicyPlansView.aspx
	ISGE—Energy Management System in the public sector	Supportive policy/Information system	https://apn.hr/gospodarenje-energijom-isge/informacijski-sustav-za-gospodarenje-energijom
Germany	Special Compensation Scheme within the Energy Finance Act	Economic policy/Tax incentive	https://www.bafa.de/DE/Energie/Besondere_Ausgleichsregelung/besondere_ausgleichsregelung_node.html
	Federal Funding for Energy and Resource Efficiency in the Economy	Economic policy/Subsidy	https://www.bfee-online.de/SharedDocs/Kurzmeldungen/BfEE/DE/Energiedienstleistungen/231212_evaluation_2022_eew.html
	Federal Funding for Buildings—Non-Residential Buildings	Economic policy/Subsidy	https://www.foerderdatenbank.de/FDB/Content/DE/Foerderprogramm/Bund/BMWi/bundesfoerderung-effiziente-nichtwohngebaeude.html
	SME-Innovative: Energy Efficiency, Climate Protection and Climate Adaptation	Economic policy/Subsidy	https://www.bmbf.de/bmbf/shareddocs/bekanntmachungen/de/2024/03/2024-03-01-Bekanntmachung-KMU-innovativ.html
	KFW Energy Efficiency Programme Production Facilities/Processes	Economic policy/Loan	https://www.foerderdatenbank.de/FDB/Content/DE/Foerderprogramm/Bund/KfW/kfw-energieeffizienz-produktionsanlagen-prozess.html
	Environmental Innovation Programme	Economic policy/Loan	https://www.umweltinnovationsprogramm.de/
	Federal Funding for Efficient Heating Networks	Economic policy/Subsidy	https://www.foerderdatenbank.de/FDB/Content/DE/Foerderprogramm/Bund/BMWi/bundesfoerderung-effiziente-waermenetze.html
	Climate Protection Initiative—Measures for Refrigeration and Air Conditioning Systems	Economic policy/Subsidy	https://www.foerderdatenbank.de/FDB/Content/DE/Foerderprogramm/Bund/BMWi/kaelte-und-klimarichtlinie.html
	Climate Protection Offensive for Companies	Economic policy/Loan	https://www.foerderdatenbank.de/FDB/Content/DE/Foerderprogramm/Bund/BMWi/kaelte-und-klimarichtlinie.html
	ÖKOPROFIT	Supportive policies/Network	https://www.oekoprofit.info/
	SME Energy Transition and Climate Protection Initiative of the Chamber of Skilled Crafts (MIE)	R&D/Tool development	https://www.mittelstand-energiewende.de/
Greece	Exoikonomo—Epichiro	Economic policy/Subsidy	https://www.nbg.gr/en/business/funding-programs/subsidized-programs-of-the-recovery-and-resilience-fund/action-exoikonomo-epichiro?_gl=1*g6edyg*_ga*MTI0MDk5NjE3OC4xNzI5Nzc2MzYy*_up*MQ
	Modern manufacturing	Economic policy/Subsidy	https://greece20.gov.gr/?calls=exypni-metapoiisi

Table A1 (continued)

Country	Programme	Category/Type	Link
Ireland	Non-Domestic Microgen scheme (NDMG)	Economic policy/Subsidy	https://www.seai.ie/grants/business-grants/commercial-solar-pv/
	EXEED Grant Scheme	Economic policy/Subsidy	https://www.seai.ie/grants/business-grants/exeed-certified-grant/exeed-certified-program/
	Support Scheme for Renewable Heat (SSRH)	Economic policy/Subsidy	https://www.seai.ie/grants/business-grants/support-scheme-renewable-heat/
	Energy Efficiency Obligation Scheme (EEOS)	Economic policy/Cap and trade scheme	https://www.seai.ie/about/regulatory-functions/energy-efficiency-obligation-scheme/
Italy	Regional incentives for SMEs Lombardy	Economic policy/Subsidy	https://www.bandi.regione.lombardia.it/servizi/servizio/bandi/ambiente-energia/efficientamento-energetico/incentivi-riduzione-consumi-energetici-imprese-l-installazione-impianti-fotovoltaici-eventuali-sistemi-accumulo-destinare-autoconsumo-RLT12020010303
	White Certificates Scheme	Economic policy/Cap and trade scheme	https://www.gse.it/servizi-per-te/efficienza-energetica/certificati-bianchi
	Transition 4.0 and Transition 5.0 Plans	Economic policy/Subsidy	https://www.italiadomani.gov.it/content/sogei-ng/it/en/Interventi/investimenti/transizione-4-0.html https://www.italiadomani.gov.it/content/sogei-ng/it/en/Interventi/investimenti/transizione-5-0.html
	Technology and innovation for savings and widespread energy efficiency (TREND)	Economic policy/Subsidy	https://www.ca-eed.eu/ia_document/trend-technology-and-innovation-for-energy-saving-and-efficiency-in-smes-italy/
Lithuania	NECP Measure EE4 – Agreements with energy suppliers on consumer education and advice	Supportive policy/Awareness campaign	https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/ef21fee29cac11e796fec328fe7809de?jfwid=nz8qn84ei
	NECP measure EE6 – Energy saving agreements with energy companies	Supportive policy/Energy saving agreement	https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/349bc9026b2b11e7aefae747e4b63286/asr
Netherlands	Energy saving obligation	Prescriptive Policies/Obligation	https://english.rvo.nl/topics/energy-saving-obligation
	Energy Saving Notification obligation	Prescriptive Policies/Obligation	https://english.rvo.nl/topics/energy-saving-obligation/energy-saving-notification-obligation
	Energy Saving Investigation obligation	Prescriptive Policies/Obligation	https://english.rvo.nl/topics/energy-saving-obligation/energy-saving-investigation-obligation
	Energy Investment Allowance (EIA)	Economic policy/Tax incentive	https://english.rvo.nl/subsidies-financing/eia/entrepreneurs
Malta	Investment Aid for Energy Efficiency Projects	Economic policy/Subsidy-Tax incentive	https://maltaenterprise.com/support/energy-efficiency-projects
	Smart and Sustainable Investment Grant	Economic policy/Subsidy	https://maltaenterprise.com/SmartandSustainableInvestment
Portugal	Energy Saving Plan	Supportive policy/Awareness campaign	https://planopoupancaenergia.pt/
	Energy Consumption Efficiency Promotion Plan (PPEC)	Economic policy/Subsidy	https://www.erse.pt/media/xwad4el5/regulamento-343_2021-ppec.pdf
	Environmental Fund	Economic policy/Subsidy	https://www.fundoambiental.pt/home.aspx
Slovakia	SlovSEFF sustainable energy financing facility	Economic policy/Subsidy	https://www.ebrd.com/home/work-with-us/projects/psd/44221.html

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