



AUDIT2MEASURE

D2.1 Report of state-of-the-art auditing system and ESM implementation

A comparative analysis of the implementation of audit obligations across six Member States



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ABOUT

Industry is a key player in energy consumption and economic impact in the European Union (EU) and energy audits represent an important tool to improve energy efficiency in the sector; despite both the spread of energy audits and the knowledge of their benefits, the actual implementation rate of the Energy Savings Measures (ESM) proposed by energy audits is relatively low. **The main aim of the AUDIT-TO-MEASURE (Leading businesses towards climate neutrality by speeding up the uptake of energy efficiency measures from the energy audits) project is to support enterprises in the uptake of audits measures necessary to reduce the energy consumption supporting their energy transition.** AUDIT-TO-MEASURE will develop and implement a new engagement strategy (called “Audit2Action”) to put into action the opportunities emerging from energy audits.

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ABBREVIATIONS

CEN	European Committee for Normalisation
CENELEC	European Committee for Standardization
EED	Energy Efficiency Directive of the European Union
EMAS	Eco-Management and Audit Scheme
EMS	Energy Management Systems
ESM	Energy Saving Measures
ISO	International Organization for Standardization
NECP	National Energy and Climate Plan
SME	Short and Medium size Enterprises (EU definition)

INTRODUCTION

The impact of energy management on the environment has captured relevant attention because of the acceleration of climate change effects on human beings and environment. In this context, it is vital to find economically and environmentally sustainable routes in the industrial sectors for the sustainable production of material goods. The replacement of fossil fuel dependency is essential for the geopolitical independence of Europe from natural gas sources and for reaching the European Green Deal climate targets of 2030 (CO₂ emission reduced of 45%) and of 2050 (net zero of CO₂ emission). In this regard, energy saving measures (ESM) play a central role towards the change of energy paradigm from fossil to renewable fuels and in reducing the greenhouse gas emissions through the implementation of processes which are still relying on fossil fuel energy. ESM implementation in industry remains very low in most EU Member States. Despite the energy audit obligation for large enterprises, which has been in place since 2012 and is laid out in Article 8 of the European Energy Efficiency Directive (EED). Yet, despite mandatory energy audits result in ESM recommendations, often only few ESM are implemented.

A consortium of ten partners (RSE, IEECP, ESCAN, NTUA, HERA, ENVIROS, AEDHE, POVAS, CCIK and ADELPHI) from six EU countries (Czech Republic, Germany, Greece, Italy, Netherlands and Spain) joined forces in the context of the AUDIT-TO-MEASURE project. The main goal of AUDIT-TO-MEASURE is to identify barriers to the implementation of ESM in enterprises and to develop a strategy to overcome them. Industrial enterprises are to be accompanied from the audit process to the implementation of ESM.

In order to achieve the targets established by the Green Deal, efforts should be closely coordinated and developed in synergy among European countries. If, on one hand, the outcome of such coordinated work can potentially lead to various advantages, such as a decreased polarization in the implementation of ESM in industrial sector, on the other hand, it might face several challenges, given the current in-homogenous audit systems and related ESM implementation scenarios between the partner countries. For instance, the implementation of audit and ESMs in each country is ruled out by different laws and has to follow different bureaucratic pathways in order to be implemented. Therefore, gathering data and literature to clear outline and compare national audit systems among partner countries is an essential step for the successful development and outcome of the project. The following report aims provide a comparative overview of current audit systems and related ESM implementation scenarios. This will constitute a common basis and reference point for the following research, engagement and dissemination activities foreseen under AUDIT-TO-MEASURE.

METHODOLOGY AND STRUCTURE

This report aims to present the current state of national audit systems and the related legislative framework. It draws information from desk research and input evaluations from AUDIT-TO-MEASURE partners. For this purpose, a template was created by the German project partner ADELPHI, that included questions on the most important industrial sectors in the European Union and their energy consumption, the existing audit systems and policy frameworks, the national audit reporting standards and guidelines, national audit evaluation systems and results, and the regulations for auditors. ADELPHI, the partner responsible for the analysis of the state of the art of the European audit system (Work Package 2) under AUDIT-

TO-MEASURE, created the templates based on experience from previous projects on national audit systems. The template was forwarded to the partners of the consortium, who filled them based on desktop research and pre-existing knowledge. Overall, in-depth information was collected on the audit systems of the six partner countries.

The following chapters cover the above-mentioned topics addressed in the survey templates. The aim is to adequately present the status quo of the national audit systems and their legal frameworks and to highlight differences and similarities among countries. In addition, the report provides initial insights on the actual effectiveness of the audit systems based on existing national evaluations. An important part of the report is the identification of gaps in the respective systems. An important aspect of the report is identifying gaps in the respective systems. For each country, each topic of the audit system template is examined, enabling a comparison between the six different countries for each part of the audit system.

The report is the first of three deliverables under Work Package2. The two upcoming studies will use stakeholder questionnaires to assess the actual implementation of audits and energy savings measures in the selected industries. They will in particular analyse enterprises' strategies and decision-making processes, as well as the informational, behavioural, organizational and economic barriers affecting the uptake of energy saving measures.

1. MANUFACTURING INDUSTRIES AND ENERGY DEMAND IN EUROPE

The European Union is one of the world's largest producers and exporters of manufacturing goods. The sector is a crucial lever to achieve the EU's climate and energy targets. In fact, in the third quarter of 2022, the manufacturing sector was responsible for the larger share of the EU's greenhouse gas emissions at about 23%¹. This section provides general information on the significance of the manufacturing sector in terms of turnover and energy consumption. It highlights which industries are most relevant for EU energy efficiency targets and thus national audit systems. It also justifies the project's focus on some of the strongest economies in the European Union.

1.1. Weight of surveyed countries in EU industrial production

The six countries surveyed in the context of this report represent a significant share of the European Union's industrial production value (see Figure 1) and include some of its largest producers of manufactured goods, with Germany, Spain and the Netherlands accounting for more than 50% of the EU's industrial production alone. The implementation of energy audit systems for this sector in the considered countries may therefore significantly contribute to the EU's climate and energy targets. This justifies not only the relevance of examining the current status of implementation of national audit policies, but also assess the decision-making processes and the barriers that affect the implementation of energy efficiency projects in large manufacturing enterprises.

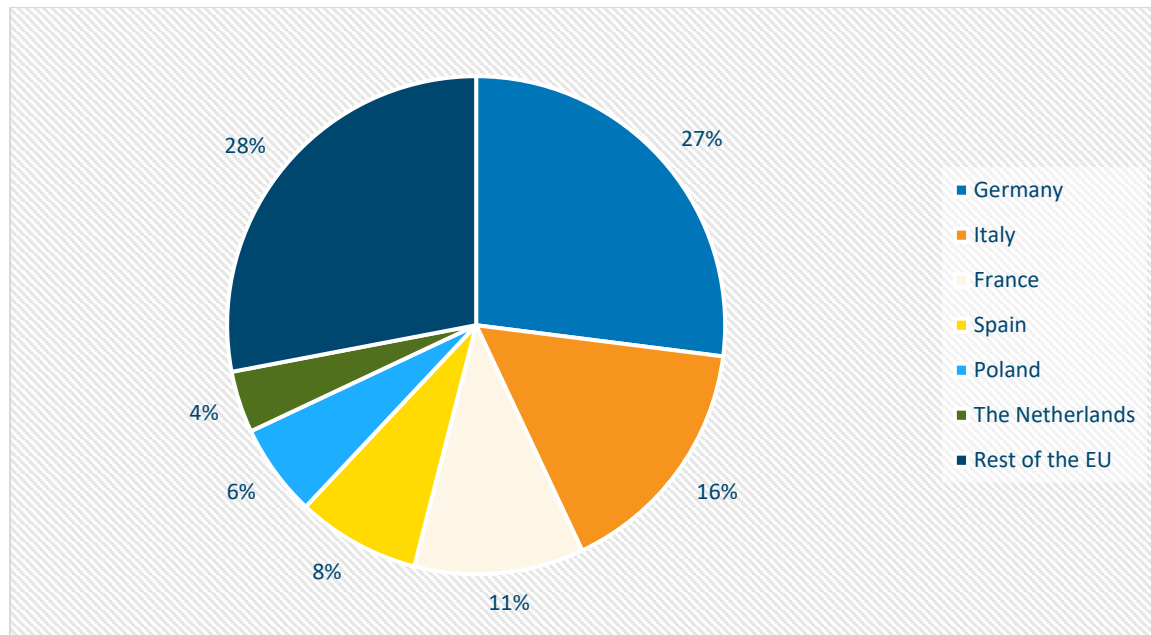


Figure 1: National share in value (EUR) of sold industrial production (NACE Code C) in the EU in 2021 (Source: Eurostat 2022²).

¹ Eurostat 2023. EU economy greenhouse gas emissions in Q3 2022. Retrieved 30.03.2023 from <https://ec.europa.eu/eurostat/web/products-eurostat-news/w/DDN-20230215-1>

² Eurostat 2022 (online data code: DS-o66341). Retrieved 30.03.2023 from <https://ec.europa.eu/eurostat/web/prodcom/data/database>.

1.2. Main European industries by turnover and energy consumption

The share of EU production sold by each industrial sector, shown in Figure 2, indicates the EU's strongest sectors. These include food, beverages and tobacco, basic metal and fabricated metal products, motor vehicles and other transport equipment, machinery and equipment, chemicals and rubber, plastic and other non-metallic mineral.

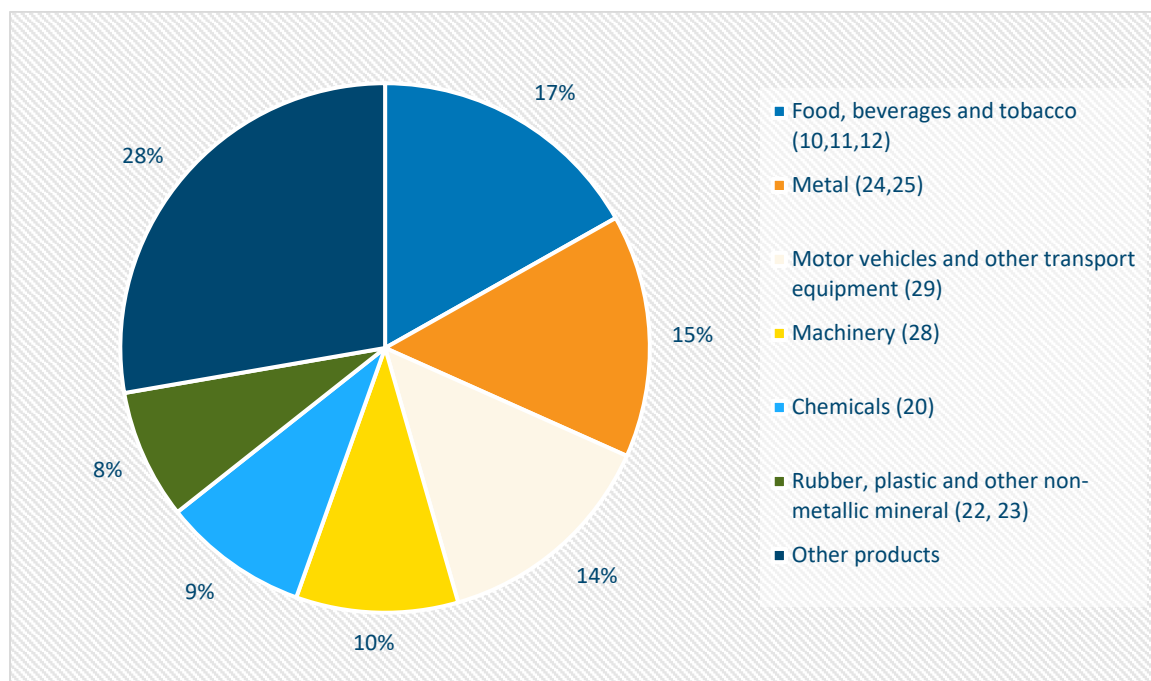


Figure 2: Value of sold production by industrial manufacturing sectors (NACE Code C) in the EU in 2021 (Source: Eurostat 2021³).

If we compare the share of the top-selling industries in Europe with the energy consumption per industrial sector in the same year, we can see that the top-selling industries are also responsible for a high share of industrial energy consumption in the EU. Even if, for example, the sectors "motor vehicles and other transport equipment" and "machinery" do not belong to the most consuming industries, the chemical industry, the metal production sector and the food sector have very high energy consumption rates. This shows in which industrial sectors it is particularly important to implement energy efficiency measures in order to reduce the high energy consumption of industry in the EU.

³ Eurostat 2021 (online data code DS-066341). Retrieved 01.03.2023 from <https://ec.europa.eu/eurostat/web/prodcom/data/database>.

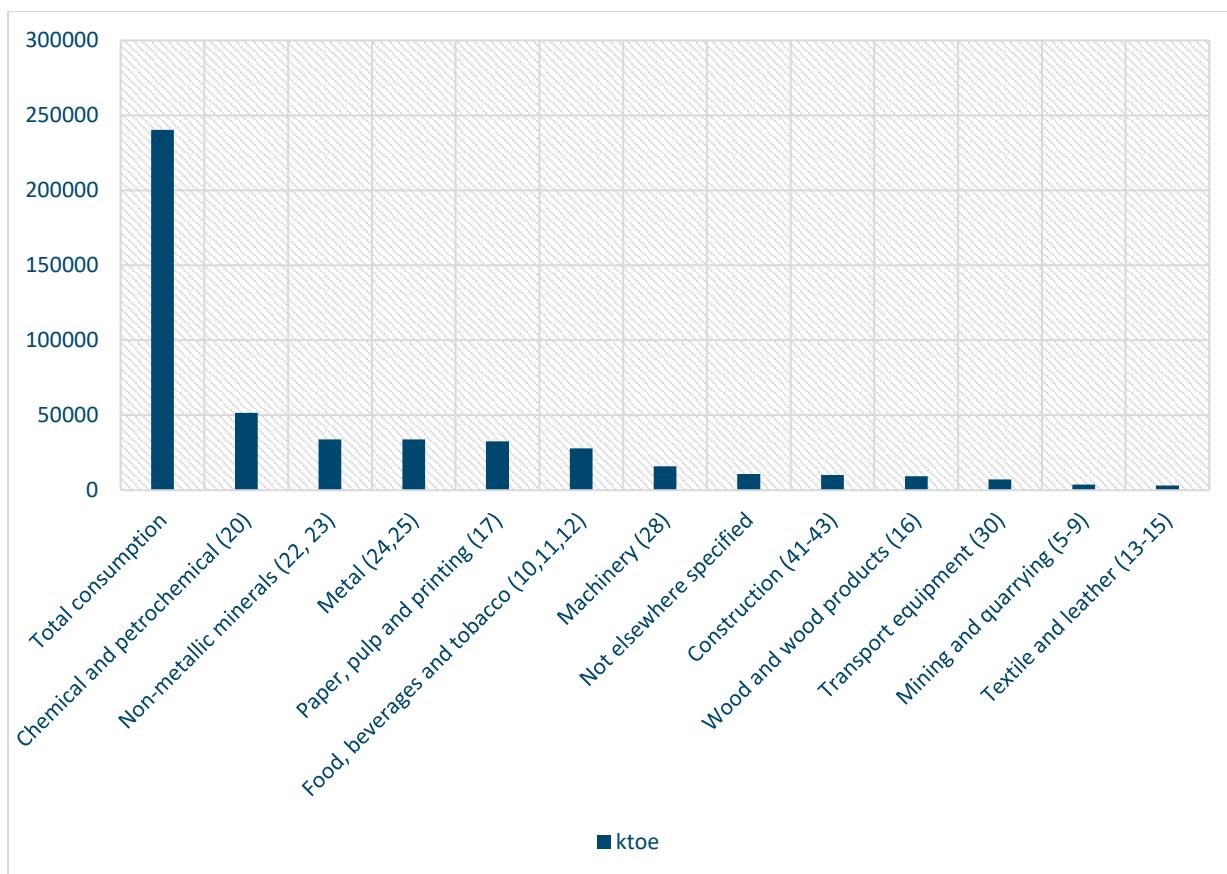


Figure 3: Final energy consumption per industry (Source: Eurostat 2023⁴).

Considering the industrial sectors which generate the highest turnover in the studied countries - Czech Republic, Germany, Greece, Italy, the Netherlands and Spain - we can see similarities to the EU industrial sectors with the highest turnover (see Figure 3). The food sector is one of the top-selling industries in all of them. The same applies to the chemical industry, although not in Greece compared to other industries. Other top-selling industries in the surveyed countries are metal production, machinery, the automotive industry, non-metallic minerals, rubber and plastic and pulp and paper.

In Germany and the Netherlands, the chemical industry is the largest energy consuming industry. In Czech Republic, Greece, Italy and Spain the non-metallic mineral industry sector is responsible for the highest energy consumption. Other high energy consuming industries in the examined countries are the metal production industry, the food sector, the pulp and paper industry and the coking plant and mineral oil processing industry.

⁴ Eurostat 2023 (online data code NRG_BAL_S). Retrieved 01-03-2023 from https://ec.europa.eu/eurostat/databrowser/view/NRG_BAL_S_custom_5452291/default/bar?lang=en

2. EUROPEAN AND NATIONAL POLICY ECOSYSTEMS

This chapter describes the evolution and current status of European and national regulatory frameworks which underly national energy audit and ESM obligations.

2.1. European policy context

2.1.1. Evolution of previous European policies and targets until 2020

In 2007, the European Commission issued its action plan for an Energy policy in Europe⁵ which targeted 20% reduction in greenhouse gas emissions by 2020 as compared to 1990 levels. The action plan involved increasing the share of renewable energy use to 20% and improving energy efficiency by 20% in 2020 as compared to business-as-usual projections.

The European Union adopted the first Energy Efficiency Directive (EED) in 2012 (Directive 2012/27/EU)⁶ to set a series of measures supporting the EU's goal of saving 20% primary energy by 2020. The provisions included the development of national policies and schemes to increase energy savings, accelerate energy efficient renovations of building stocks, set minimum energy performance standards for household appliances and increase awareness on the individual energy consumption of households and enterprises. Member States implemented these provisions through transposition of the directive in national legislations. To monitor and report action to the EU, the Directive required to update National Energy Efficiency Action Plans (NEEAPs)⁷ every 3 years, specifying national energy consumption estimations, planned energy efficiency measures and national contribution targets to the EU's 2020 energy efficiency objective. It is worth noting that the 2020 energy consumption targets were overachieved, with the economic slow-down induced by the Covid19 pandemic positively influencing the results.

2.1.2. Current and upcoming European policies and targets until 2030

Article 8 of the EED⁸ set the first energy audit obligation for enterprises and defined compliance criteria for energy audits and auditors drawing on European and international standards such as EN 16247 and ISO 50001. Obligated enterprises must carry out a valid energy audit at least every 4 years. The EED loosely defined the target group for the audit obligation using the phrase "large enterprises", which gave room for varying interpretations

⁵ European Commission 2007. An Energy Policy for Europe. Retrieved 01.03.2023 from <https://eur-lex.europa.eu/EN/legal-content/summary/an-energy-policy-for-europe.html>

⁶ European Parliament and the Council of the European Union 2012. Directive 2012/27/EU on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC. Official Journal of the European Union. Retrieved 01.03.2023 from <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32012L0027&from=ES#d1e40-1-1>.

⁷ European Parliament and the Council of the European Union 2012. Chapter V – Final Provisions, Article 24 – Review and monitoring of implementation. In: Directive 2012/27/EU on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC. Official Journal of the European Union. Retrieved 01.03.2023 from <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32012L0027&from=ES#d1e40-1-1>.

⁸ European Parliament and the Council of the European Union 2012. Chapter II – Efficiency and energy use, Article 8 – Energy audits and energy management systems. In: Directive 2012/27/EU on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC. Official Journal of the European Union. Retrieved 01.03.2023 from <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32012L0027&from=ES#d1e40-1-1>.

in national regulations drawing both on the EU definition of non-SMEs but also on energy intensity criteria. Under Article 24 of the first EED, NEEAPs had to indicate the number of energy audits carried out in the previous 3-year period, including the number of energy audits carried out by large enterprises, as well as the number of large enterprises concerned by the obligation.

In 2018, the European Commission elaborated the “Clean energy for all Europeans” package, adopted in 2019, overhauling the EU’s former energy policy framework⁹. In this context, the EED was amended (Directive (EU)2018/2002)¹⁰ to set a new energy efficiency target of 32.5% reduction in primary energy consumption by 2030 as compared to business-as-usual projections modelled in 2007. Although the 2018 amendment of the EED encourages Member States to make better use of energy audits under Article 8 to influence decision-making, it did not include significant changes to the original audit obligation from 2012.

Among this package, the Regulation on the governance of the energy union and climate action (Regulation (EU)2018/1999)¹¹ requires Member States to establish National Energy and Climate Plans (NECPs) for the 2021-2030 period, integrating energy efficiency, renewable energy and GHG emissions reduction targets for 2030. NECPs demand a closer interconnection and coordination of purpose across national government bodies and encourage long-term planning. NECPs are closely scrutinised by the European Commission, which provided standard templates to ease cooperation and efficiency gains among countries, reviewed final NECP drafts in 2020 and requests Member States to report on progress every 2 years.

In 2021, the European Commission released a Proposal for a recast energy efficiency directive¹² as part of the package Delivering on the European Green Deal¹³. The ambitious proposal raises targets to 39% primary energy reduction and 55% GHG emissions reduction by 2030 as compared to the reference scenario projection updated in 2020. This would mean a near doubling of the annual energy savings obligation set in the new Article 8, which is binding for Member States, between 2024 and 2030.

The recast proposal suggests changing the definition of the target group for mandatory energy audits from employer-size-based criteria (drawing on the EU definition of SMEs) to an energy intensity threshold. The proposal also includes an obligation to implement an energy management system by default for highly energy-intensive enterprises. The proposal

⁹ European Commission, Directorate-General for Energy 2019. Clean Energy for all Europeans. Retrieved 01.03.2023 from <https://data.europa.eu/doi/10.2833/9937>

¹⁰ European Parliament and the Council of the European Union 2018. Directive (EU) 2018/2002 amending Directive 2012/27/EU on energy efficiency. Retrieved on 01.03.2023 from <http://data.europa.eu/eli/dir/2018/2002/oj>

¹¹ European Parliament and the Council of the European Union 2018. Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council. Retrieved 01.03.2023 from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2018.328.01.0001.01.ENG.

¹² European Commission 2021. Proposal for a Directive of the European Parliament and of the Council on energy efficiency (recast). Retrieved 01.03.2023 from [EUR-Lex - 52021PC0558 - EN - EUR-Lex \(europa.eu\)](EUR-Lex - 52021PC0558 - EN - EUR-Lex (europa.eu)).

¹³ European Commission 2021. Delivering the European Green Deal. The Decisive Decade. Retrieved 01.03.2023 from https://commission.europa.eu/publications/delivering-european-green-deal_en.

for the EED recast is currently in the last phase of negotiations among European institutions and is expected to come into force by 2024.

An obligation to implement energy saving measures for energy-intensive enterprises following a mandatory energy audit is not part of the new EED proposal. However, Member States have started making the uptake of energy saving measures in the industry a part of their primary energy and GHG emissions reduction strategies laid out in their NECP¹⁴.

2.2. Development and status of national audit policies

2.2.1. General trends among surveyed countries

All surveyed countries have policies addressing energy audits and the implementation of energy saving measures for the industry which set obligations for enterprises falling into certain categories. These obligations do not differ among regions within surveyed countries. National policies have evolved over time towards a harmonisation with the European Energy Efficiency Directive and international standards such as EN16247, ISO50002 etc. National audit obligations have come into effect between 2015 and 2019 in most of the countries, although they have already existed in the Netherlands since 2008 and in Czech Republic since 2000.

Frequency of mandatory audits

In accordance with EED, all surveyed countries require mandatory audits from all obligated enterprises every 4 years. However, the Czech Republic foresees an exemption for enterprises with an annual energy consumption lower than 5,000 MWh/a. Enterprises falling in that category only have to be audited every 10 years, if their consumption profile has not significantly changed during that period¹⁵.

Target groups of mandatory audits

Although non-SMEs are the main target group, audit obligations criteria differ from one country to another. Energy intensity is often used as a criterium in addition to the number of employees. In the Netherlands¹⁶, audits are mandatory for all enterprises with an annual energy consumption above 50 MWh, regardless whether they are an SME or not. In Czech Republic and in Italy¹⁷, all non-SMEs as well as energy-intensive SME are obligated to carry out energy audits, while in Germany, only energy intensive non-SMEs with an annual energy consumption above 500 MWh are obligated.¹⁸ The definition criterium for energy intensiveness

¹⁴ See 2.3 Link with National Energy and Climate Plans

¹⁵ Parliament of the Czech Republic 2000. §9, letter 6. In: Act on energy management No. 406/2000 Coll. Retrieved 30.03.2023 from <https://www.mpo.cz/assets/dokumenty/26676/28754/313830/priloha002.pdf>

¹⁶ Rijksdienst voor Ondernemend 2023. Energiebesparingsplicht. Retrieved 30.03.2023 from <https://www.rvo.nl/onderwerpen/informatieplicht-energiebesparing/energiebesparingsplicht>

¹⁷ Governo Italiano 2020. Decreto Legislativo 73/2020. Gazzetta Ufficiale. Retrieved 23.03.2023 from <https://www.gazzettaufficiale.it/eli/id/2020/07/14/20G00093/sg>

¹⁸ Deutsche Bundesregierung 2010. § 8 Verpflichtung zur Durchführung von Energieaudits; Verpflichtungsbefreiung. In: Gesetz über Energiedienstleistungen und andere Energieeffizienzmaßnahmen (EDL-G). Retrieved 30.03.2023 from https://www.gesetze-im-internet.de/edl-g/_8.html.

varies among countries (see Table 1). Greece¹⁹ and Spain²⁰ have not set any obligation criteria for energy-intensive SMEs. Table 1 provides an overview of the above-mentioned dates for the introduction of the audit commitment, the frequency of repetition and the target group²¹.

Table 1: Overview of general audit obligation criteria

	CZ	DE	GR	IT	NL	ES
Energy audit obligation since	2000	2015	2015	2015	2008	2016
Criteria for audit obligation for non-SMEs (MWh/a)	>200	>500	All	>581.5	> 50	All
Criteria for audit obligation for SMEs (MWh/a)	>5,000	-	-	>1,000	-	-
Frequency of mandatory audits (years)	4 (10)	4	4	4	4	4

2.2.2. National evolution of audit systems

This part summarises the evolution of mandatory audit policies in each of the six surveyed countries.

Czech Republic

In 2000, the Act. 406/2000 first introduced an energy audit obligation for non-SMEs. Since, the Decree 182/2012 Coll. and the Decree 140/2021 Coll. updated the national audit system. The most important changes regard the differentiation of the target groups. The threshold for mandatory audits was lowered from 9,722 MWh/a to 5,000 MWh/a for SMEs, while non-SMEs with an energy consumption below 200 MWh/a are exempt. Enterprises with a large energy consumption (above 5,000 MWh) only have carry out mandatory audits every 10 years, if they can prove that changes in their energy management do not exceed more than 25% of their total energy consumption. Other changes addressed requirements for the audit report structure (aligned to ISO 50002) and the proposed energy saving measures, which must reach at least 10% of the actual total energy consumption of the enterprise. Enterprises

¹⁹ Government of the Greek Republic 2015. Law N° 4342 of 2015 introducing adjustments related to retirement and incorporating into Greek Law the European Parliament and Council Directive 2012/27/EU of 25 October 2012 "on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC", as amended by the Council Directive 2013/12/EU of 13 May 2013 "adapting Directive 2012/27/EU of the European Parliament and of the Council on energy efficiency, by reason of the accession of the Republic of Croatia". Retrieved 30.03.2023 from <http://www.ilo.org/dyn/natlex/docs/ELECTRONIC/102300/123598/F-411544808/GRC102300%20Grk.pdf>.

²⁰ Ministerio de Industria, Energía y Turismo 2016. Real Decreto 56/2016, de 12 de febrero, por el que se transpone la Directiva 2012/27/UE del Parlamento Europeo y del Consejo, de 25 de octubre de 2012, relativa a la eficiencia energética, en lo referente a auditorías energéticas, acreditación de proveedores de servicios y auditores energéticos y promoción de la eficiencia del suministro de energía. Retrieved 30.03.2023 from <https://www.boe.es/buscar/doc.php?id=BOE-A-2016-1460>.

²¹ NB: A cross-country overview of the number of obligated enterprises and audits carried out in a 4 year period is not currently possible, as the information is not uniformly available in all countries. Generally, institutions in charge in most countries only have partial estimates of the total number of enterprises falling under the obligation at their disposal. Compliance checks and national evaluations are usually carried out using samples.

with an ISO 50001 certified EMS are exempted from the audit obligation. In the past, EMAS certified entities used to benefit from the same exemption, but this provision was subsequently removed from the law.

Germany

After the implementation of the "Energiedienstleistungsgesetz - EDL-G"²² in 2010, there have been some additional changes in 2015, that included the audit obligation. Since 2015 German non-SMEs were obliged to carry out an energy audit in accordance with DIN EN 16247-1 and to repeat that every 4 years, while enterprises with an energy management system (ISO50001 or EMAS) were excluded. In 2019, the federal office for economic affairs and export control (BAFA) updated the audit regulations, which now required a more in-depth energy analysis, a more detailed evaluation of the measured consumption data and more detailed documentation of the data. Also, there were more limited regulations on location clusters. Sites with different types of energy infrastructure could not form clusters anymore. Enterprises were also required to submit an online declaration on the implementation of the audit two months after the audit. Alternatively, they can state that they fall under the introduced de minimis threshold, which is below 500 MWh/a. Since October 2022, the new regulation on energy security (Mittelfristenergieversorgungsmaßnahmenverordnung - EnSimiMaV)²³ obliges enterprises with a total energy consumption of more than 10 GWh/a to implement economically viable energy efficiency measures²⁴ within 18 months.

Greece

As per Article 10 of Law 4342/2015, which transposes the EED 2012/27 into Greek law, non-SME (large) enterprises are required to conduct energy audits every four years. The mandatory energy audits were first implemented in 2018. In 2021, Law 4843/2021 was introduced to transpose the amended EED 2018/2002 into Greek law. The updated law provides further details and specifications on the obligations and procedures for auditors and enterprises to comply with the acceptable Energy Audits (EAs).

Italy

On the legislative level, Italy has introduced a decree titled 102/14 for the implementation of EU legislative standards on energy efficiency 2012/27/UE in 2014. One of the major consequences of this decree has been the obligation for energy-intensive industries to undergo to specific energy audits every 4 years. The implementation of the Italian Legislative Decree n. 73/2020, which has been issued on 29/07/2020, acts as transposition of Directive 2018/2002/EU and modifies the Legislative Decree 102/14. A key aspect of the performed modifications was that the EMAS and ISO14001 certified energy management systems are no longer exempt from the energy audit obligation. Other important changes include exemption from the audit obligation for enterprises with an energy consumption below 50 toe (581.5 MWh) and an obligation for energy-intensive enterprises to carry out at least one of

²² Deutsche Bundesregierung 2010. Gesetz über Energiedienstleistungen und andere Energieeffizienzmaßnahmen (EDL-G). Retrieved 30.03.2023 from https://www.gesetze-im-internet.de/edl-g/_1.html.

²³ Deutsche Bundesregierung 2022. § 4 Umsetzung wirtschaftlicher Energieeffizienzmaßnahmen in Unternehmen. In: Verordnung zur Sicherung der Energieversorgung über mittelfristig wirksame Maßnahmen (Mittelfristenergieversorgungsmaßnahmenverordnung - EnSimiMaV). Retrieved 30.03.2023 from https://www.gesetze-im-internet.de/ensimimav/_4.html.

²⁴ Measures are economically viable if they reach a positive net present value within 20% of the maximum useful life of 15 years.

the energy saving measures identified in the audit or adopt a management system certified with the ISO50001 standards. To enforce these changes, it also introduced new fines in the case of non-compliance or inadequate performance.

Netherlands

In the Netherlands the audit obligation for large enterprises was introduced in 2008. In 2015 an information requirement was added that regulated that, all enterprises with an energy consumption of more than 50 MWh/a or 25,000 m³ natural gas equivalent had to provide insights on their energy use. In 2019, the Dutch Energy Use Reduction Requirement (Energiebesparingsplicht) was introduced in alignment with the EED. Enterprises that consume more than 50 MWh of electricity or 25,000 m³ of natural gas per year must implement all energy-saving measures with a positive return on investment within five years and report on the measures they have taken. Enterprises with an EMS certified according to ISO 50001 are exempt from the obligation, as well as those that participate in the Emissions Trading Scheme (ETS). In addition, the Netherlands have developed a parallel energy audit obligation which is overseen by the municipalities. If an enterprise consumes more than 200,000 kWh of electricity or 75,000 m³ of gas, the municipal authorities may require the enterprise to carry out an energy audit.

Spain

In Spain the Real Decreto 56/2016 introduced mandatory audits for non-SMEs. Since then, there have been some changes due to RD 390/2021 of 1st June²⁵. There has been a modification of the template with the required audit information that must be reported to the ministry. The RD also mentions that results of energy audits might be used by public administration to provide incentives for the implementation of energy saving measures. Additionally, there have been some changes of the qualifications (education degree or similar) that are required to become energy auditor.

3. NATIONAL AUDIT AND ESM REQUIREMENTS

This chapter describes national requirements, main parameters and exemptions for the mandatory implementation of energy audits and energy saving measures across the six surveyed countries.

3.1. Audit categories

Most surveyed countries do not distinguish between different types of energy audits in the context of their energy audit obligation policies. Only a complete audit in accordance with the European standard EN 16247 (see 4.1. European and international standards) ensures compliance. So-called preliminary or walk-through energy audits methodologies are recognised in most surveyed national normative frameworks; however, they are insufficient to comply to the audit obligations.

²⁵ Ministerio de la Presidencia, Relaciones con las Cortes y Memoria Democrática 2021. Real Decreto 390/2021, de 1 de junio. Retrieved 30.03.2023 from <https://www.boe.es/buscar/act.php?id=BOE-A-2021-9176#:~:text=Ayuda-Real%20Decreto%20390%2F2021%2C%20de%201%20de%20junio%2C%20por,de%2002%2F06%2F2021.>

By contrast, Greece and the Czech Republic both distinguish between 3 energy audit categories that all comply with EN 16247 and suffice to comply with national audit obligation policies.

In Greece, there are three categories of energy audits that apply to different types of buildings and industries:

- Category A covers residential and office buildings, as well as retail shops with an area of up to 2,000 m²;
- Category B applies to office, commercial, and other tertiary sector buildings with an area of more than 2,000 m², industrial facilities with a total power of up to 1,000 kW or less, and transportation (vehicles);
- Category C pertains to industrial installations with a total installed power of more than 1,000 kW. The categorisation is based on the total final consumption and the size of the production facility or building.

In Czech Republic, the Decree No. 140/2021 Coll. allows for 3 types of energy audits in accordance with international standards:

- Type 1 applies for smaller enterprises that seek to fulfill the legislative requirement. The outputs are information on the energy consumption of the site, the identification and basic evaluation of low-cost and simple to implement ESM.
- Type 2 is aimed at enterprises having a basic understanding of their energy consumption through energy bills and monthly measurements to fulfill the legislative requirements and improve their energy savings. The outputs are a detailed understanding of the energy consumption and the identification of ESM.
- Type 3 addresses enterprises with a detailed understanding of their energy use. The consumption is analysed frequently using specific energy performance indicators, focused sub metering and regular monitoring of variables. The aim is to fulfill legislative requirement and requesting subsidies for the implementation of high-cost ESM.

The cost of energy audits varies widely depending on the size and the complexity of the site to be audited. Indicatively, the minimum cost of an energy audit for a simple site or a building ranges from 5,000 EUR and 10,000 EUR across all surveyed countries.

3.2. Auditing scopes

General boundaries

Generally, only energy directly consumed by the enterprise within national borders is considered in mandatory audits. For example, in Germany, this means that following energy consumptions are excluded:

- Energy that is not used by the enterprise but is merely supplied to third parties;
- Aircraft fuels and bunker oils for maritime shipping;
- Energy consumption outside the Federal Republic of Germany;

- Energy consumption of international transports which neither start nor end in Germany (unless the enterprise wishes to include this energy consumption).²⁶

The same applies for the rest of the surveyed countries.

Temporary and third-party sites

In Czech Republic, Germany²⁷, Greece²⁸, Italy and the Netherlands energy consumption that occurs on temporary sites where operations are only carried out for a limited period of time (e.g. less than 6 months in Germany) or on sites that are leased to third parties are not accounted in energy audits. In Germany, energy consumption in the home office is also excluded from the energy audit.

Transportation and transport facilities

The surveyed countries take different approaches regarding energy consumption from transportation and transport facilities such as delivery or transfer points, bus stops, regulating or filling stations, etc. In all of them, transportation is generally included, though with multiple exceptions. Third party transportation services, waterborne, air and train transportation are excluded from energy audits in every surveyed country, while transport inside the enterprise's facilities and the enterprise's vehicle fleet is included. In Greece, only road transport is accounted. Italy and Spain consider leased vehicles, while they are excluded in all other surveyed countries.

The Italian auditing methodology additionally offers the possibility to bundle energy consumptions related to transportation activities that cannot be directly attributed to an actual site into a "virtual site" subject to its own audit. Transport facilities that are not affected to an actual site can also be included in this virtual site.

3.3. Exemptions from the audit obligation

Exempted sectors

In four of the surveyed countries certain types of enterprises and activities are exempt from the audit obligation. In the Czech Republic, intelligence and defence sectors are exempt, while public and municipal enterprises and enterprises with predominantly sovereign activities are exempt in Germany. Similarly, in Italy, all public administration is exempted. Greece excludes foreign enterprises as well as joint ventures.

Exemption through energy management systems

As already mentioned above, an ISO50001 certified energy management system exempts enterprises from the audit obligation in all surveyed countries. Only in Germany enterprises with an EMAS certified EMS and in the Netherlands with an ISO 14001 certified EMS are additionally exempted from the audit obligation.

²⁶ Bundesamt für Wirtschaft und Ausfuhrkontrolle 2020. Leitfaden zur Erstellung von Energieauditberichten Stand 30.1.2020. Retrieved 15.03.2023 from

https://www.bafa.de/SharedDocs/Downloads/DE/Energie/ea_leitfaden.html

²⁷ Ibid.

²⁸ Government of the Greek Republic 2018. Presidential Decree 175275/2018. In: Gazette 1927/B/30-5-2018.

Retrieved 30.03.2023 from https://ypen.gov.gr/wp-content/uploads/2020/11/Systhmata_Pistpoihshe_elegktwn_klp.pdf

Figure 4 shows the number of ISO 50001 certified management systems in 2021 in all of the surveyed countries. Furthermore, it provides information on the number of ISO14001 certificates in the Netherlands in 2021 and on EMAS certified systems in 2022. The figure differs between the number of certificates per country and the number of certified sites per country.

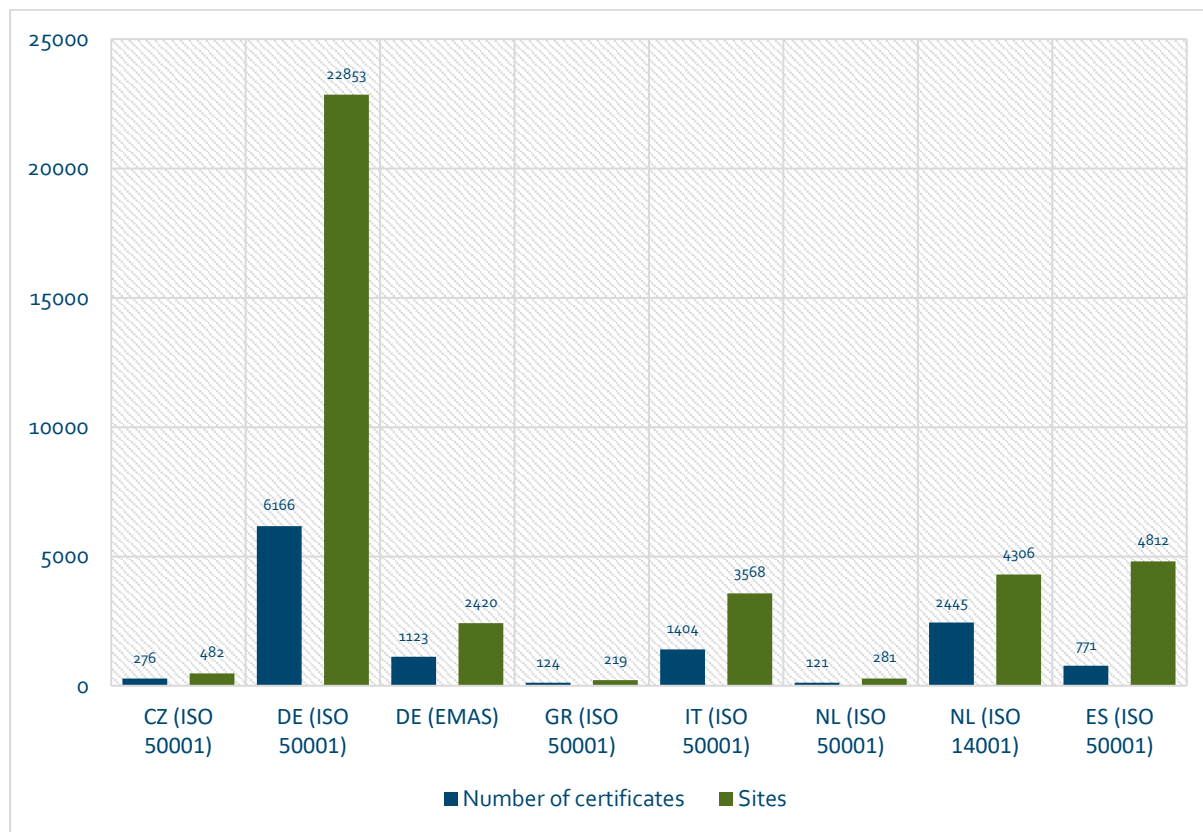


Figure 4: Number of ISO certified energy management systems in 2021/EMAS 2022 (Source: ISO 2021²⁹, EMAS 2023³⁰).

In the Netherlands there are some additional certifications that are equivalent to an EED energy audit, approved and provided by the Dutch Ministry of Economic Affairs and Climate (EZK), that exempt enterprises from conducting energy audits.

3.4. ESM implementation obligations

Germany, Italy and the Netherlands have developed an obligation to implement ESM following a mandatory energy audit. However, the definition criteria and the target groups for this obligation vary between the three countries.

From October 2022 to September 2024, Germany's temporary regulation concerning energy security (Mittelfristenergieversorgungsicherungsmaßnahmenverordnung - EnSimiMaV)³¹

²⁹ International Standard Organization 2021. The ISO Survey of Management System Standard Certifications 2021. Retrieved 30.03.2023 from [ISO - ISO/CASCO - Committee on conformity assessment](#).

³⁰ EMAS Statistics 2023. Auswertungen nach Bundesländern, Zeitreihen, Branchen etc. in Deutschland/EU. Retrieved 30.03.2023 from [Zahlen, Daten, Fakten: Umweltmanagementsystem EMAS](#).

³¹ Deutsche Bundesregierung 2022. § 4 Umsetzung wirtschaftlicher Energieeffizienzmaßnahmen in Unternehmen. In: Verordnung zur Sicherung der Energieversorgung über mittelfristig wirksame Maßnahmen

makes the implementation of economically viable ESM mandatory for energy-intensive enterprises within 18 months after their mandatory audit. More specifically, non-SMEs with an energy consumption of more than 10 GWh per year must implement all ESM assessed with a positive Net Present Value after a maximum of 20 percent of the ESM's considered lifetime, which cannot be longer than 15 years. Effectively, this means that energy-intensive enterprises must implement with 1.5 years all measures that are economically viable within 3 years according to the European standard DIN EN 17463:2021 "Valuation of energy related Investments" (VALERI). Alternatively, they can put in place an energy management system according to ISO or EMAS.

Similar to Germany, the mandatory implementation of measures in the Netherlands is also linked to a positive return on investment of the measure within a certain period of time³². Here the return on investment must be positive within 5 years. EU ETS and ISO 15001 or equivalent certified enterprises are exempt from ESM implementation obligation, although with the planned expansion of the Dutch "Energiebesparingsplicht", which will come into force in July 2023, these enterprises will not be exempted anymore³³.

The situation is different in Italy, where the obligation of ESM implementation is not connected to the economic impact indicators. Since 2020, energy intensive enterprises are obligated to set up an ISO50001 certified energy management system or to implement at least one energy saving measure in the 4 years following their mandatory energy audit. The enterprise can freely choose which ESM to implement³⁴.

Table 2: Overview of general exemptions and ESM implementation obligations

	CZ	DE	GR	IT	NL	ES
ESM implementation obligation since	-	2022	-	2020	2019	-
Criteria for ESM implementation obligation (MWh/a)	-	>10,000	-	>1,000	>10,000	-
Selection criteria for mandatory ESM implementation	-	NPV >0 in 3 years	-	1 ESM	ROI >0 in 5 years	-
Period for mandatory ESM obligation (years)	-	1.5	-	4	4	-

In the rest of the surveyed countries there are no similar obligations to implement energy

(Mittelfristenergieversorgungssicherungsmaßnahmenverordnung - EnSimiMaV). Retrieved 30.03.2023 from https://www.gesetze-im-internet.de/ensimimav/_4.html.

³² See Table 3: Obligatory (O) and recommended (R) economic impact indicators in mandatory energy audits by country in 4.2.2. Assessment of energy saving measures.

³³ Rijksdienst voor Ondernemend Nederland 2023. Energiebesparingsplicht vanaf 2023. Retrieved 30.03.2023 from <https://www.rvo.nl/onderwerpen/energiebesparingsplicht-2023>.

³⁴ Governo Italiano 2014. Decreto Legislativo 102/2014. Gazzetta Ufficiale. Retrieved 30.03.2023 from <https://www.gazzettaufficiale.it/eli/id/2014/07/18/14G00113/sg>.

saving measures after an obligatory audit. Table 2 summarises the key parameters of national ESM implementation obligations.

3.5. Incentives for non-mandatory audits and ESM implementation

One strategy to promote non-mandatory audits and ESM implementation in enterprises that do not fall under the national audit obligations is public funding. In most of the countries analysed in this article there exists some sort of public funding for either non-mandatory audits or ESM implementation. Two exceptions are the Czech Republic and Italy, where there is no financial support for non-mandatory audits, whereas support is provided for the implementation of energy management systems.

In Germany, BAFA supports 80% of the cost of non-mandatory audits up to a certain limit. This limit is 6,000 EUR if annual energy expenses of an enterprise exceed 10,000 EUR. If annual energy expenses stay below this threshold, subsidies go up to 1,200 EUR. Furthermore, it is possible to receive funding for the introduction of sensor technology and energy management software from BAFA. There are several subsidies provided by BAFA and KfW³⁵ that support ESM implementation in the industry. These exist independently from energy audits.

Currently in Greece, there are not financial incentives for conducting energy audits, either by the government or by EU-funded Programmes. However, financial support is expected for SMEs to perform energy audits, through a programme which will probably start later in 2023.

In the Netherlands, various financial incentives schemes encourage the implementation of ESM in enterprises. Among them, the Energy Investment Deduction (Energie-investeringsaftrek – EIA) scheme³⁶ can, under certain circumstances, also cover the cost of energy audit.

In Spain, similar to the implementation of sample checks on the audit obligation in enterprises, the funding of non-mandatory audits is also dependent on Spanish regional authorities. However, most incentives target the implementation of energy saving measures rather than energy audits. The financial support covers improvements of industrial processes, replacements of equipment and the implementation of an energy management system in the enterprise. The subsidy ranges from 30% up to 65% depending on the enterprise's region, its size and the specific measure being implemented.

³⁵ Kreditanstalt für Wiederaufbau is the German state-owned investment and development bank.

³⁶ Rijksdienst voor Ondernemend Nederland 2017. Energie-investeringsaftrek (EIA) voor ondernemers. Retrieved 13.04.2023 from [Energie-investeringsaftrek \(EIA\) voor ondernemers \(rvo.nl\)](https://www.rvo.nl/nl/onderzoek-en-ontwikkeling/energie-investeringsaftrek).

4. AUDIT PROCESS AND REPORTING

This chapter reviews European and national standards, requirements and further guidance that are relevant to the adequate implementation and reporting of energy audits in the surveyed countries.

4.1. European and international standards

4.1.1. Evolution of international energy audit standards

EN 16247-1 was published by the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC) in 2012³⁷. It is the first international standard providing general requirements on how to carry out energy audits. It formulates general quality requirements for the auditor and the auditing process, describes the auditing process and provides a structure for the deliverable. Until 2015, four additional parts were added to EN 16247 to set specific requirements for auditing buildings, industrial processes and transport and to detail the competences of auditors. EN 16247 is translated into national standards in all European Member States, with little to no significant variations in terms of process and reporting requirements. This facilitates the uniform implementation of Article 8 of the EED in national legislations across the EU.

EN 16247 is not be confused with the international standard ISO 50001 published in 2011 which sets requirements for the implementation of energy management systems. However, EN 16247 is compatible and complementary with ISO 50001, as it defines a process to initiate energy data collection and analysis, and recommend first improvement measures³⁸.

In 2014, the International Standard Organisation published its own energy audit standard ISO 50002. ISO 50002 extensively draws on EN 16247-1 with adjustments to fit the wider international context³⁹. ISO 50002:2014 also put a stronger methodological focus on measurement, data collection and analysis than EN 16247-1:2012. However, the updated version EN 16247-1:2022 closes this gap. ISO 50002 has not been translated into national standards in the EU, as the two norms are deemed too similar.

The 2022 update of EN 16247-1 also adds a new chapter enabling sampling procedures in the case where comprehensive data collection over the scope and timeframe of the energy audit is not possible⁴⁰. The sampling approach draws on ISO 19011:2018 guidelines for auditing management systems. This disposition is so far missing in ISO 50002.

³⁷ European Committee for Standardization and the European Committee for Electrotechnical Standardization 2012. EN 16247-1:2012 Energy audits - Part 1: General requirements. Retrieved 14.03.2023 from https://standards.cenelec.eu/dyn/www/f?p=CEN:110:0:::FSP_PROJECT:35014&cs=137C8A1860E9043392DE02CC90409B9B8

³⁸ Barckhausen et al., 2020. Energy management systems in practice. From energy auditing to an ISO 50001 management system: Guide for enterprises and organizations. Umweltbundesamt. Retrieved 14.03.2023 from [Energy management systems in practice | Umweltbundesamt.](#)

³⁹ International Standard Organization 2014. ISO 50002:2014(en) Energy audits — Requirements with guidance for use. Retrieved on 14.03.2023 from [ISO 50002:2014\(en\), Energy audits — Requirements with guidance for use.](#)

⁴⁰ Deutsches Institut für Normung e.V. 2022. DIN EN 16247-1:2022-11 Energy audits - Part 1: General requirements; German version EN 16247-1:2022. Retrieved 14.03.2023 from [DIN EN 16247-1 - 2022-11 - Beuth.de.](#)

4.1.2. Audit process according to EN 16247-1

The chapter 5 of EN 16247-1:2012 defines the following methodological steps to carry out an energy audit⁴¹:

1. Initial contact:

- Agree on goals, requirements and expectations, considered scope and timeframe, level of thoroughness, audit timeline etc.
- Collect information regarding audit context and statutory conditions, potential changes and planned developments, existing management systems, technical constraints and ambitions, expect results etc.
- Inform about technical dispositions needed for the audit and on potential conflict of interest of the auditor.

2. Kick-off meeting:

- Inform all interested parties about the objectives, the scope, the timeframe and the thoroughness of the energy audit.
- Coordinate the practical implementation of the energy audit by nominating a referee within the enterprises, identifying impacted staff and potential interferences with ongoing activities.
- Set confidentiality and security agreements and practical arrangements for site access and special measurements.

3. Data collection:

- Collect detailed characteristics of energy consuming systems, processes and equipment, historical data, operational changes over the considered timeframe, design and operation documents, previous audits, management systems, relevant economic data etc.

4. Field work:

- Inspect audited objects and their energy consumption.
- Understand the work processes, user behaviour, and their impact on energy use and efficiency.
- Formulate first suggestions for energy efficiency improvement opportunities.
- Identify areas and processes for which additional quantity-based data are needed for subsequent analyses.

5. Analysis

- Determine the reference situation in terms of energy consumption and supply, detailing the energy balance of each audited object, energy demand patterns, adjustment factors and energy performance indicators.
- Compare opportunities for improving energy efficiency based on their financial impact (energy cost savings, required investments and return on investment), productivity and maintenance gains and technical interactions between opportunities.
- Specify if additional data collection and analysis is needed.

⁴¹ ibid.

6. Report:

- Ensure that the energy audit requirements agreed with the organization have been met.
- Summarise the data collection and analysis, detailing the assumptions and the methods used.
- Address the limitations of the accuracy of estimates of savings and costs.
- Rank the opportunities for improving energy efficiency by order of priority.

7. Final meeting:

- Hand over the energy audit report.
- Present and explain the results in order to facilitate management decision making.

From 2022 onward, the updated standard includes two additional methodological steps before the field work to better address measurement plans and sampling methods in the audit process.

4.1.3. Audit report according to EN 16247-1

The chapter 5 of EN 16247-1:2012 also specifies minimum content requirements for the energy audit reports:⁴²

1) Summary:

- A ranking of suggested ESM;
- The proposed implementation programme.

2) Background:

- general information about the audited enterprise, the energy auditor, and the audit methodology;
- Context of the energy audit;
- Description of the audited object(s);
- Relevant standards and regulations.

3) Energy audit:

- Description of the energy audit, scope, objective and thoroughness, timeframe and limitations;
- Information on data collection:
 - o measurement setup (current situation);
 - o statement of which values were used (and which values are measured and which are estimated are);
 - o Copy of key data used and calibration certificates, where applicable.
- Analysis of energy consumption;
- Criteria for ranking energy efficiency improvement measures.

4) Opportunities to improve energy efficiency:

- Suggested ESM, recommendations, plan and schedule for implementation;
- Assumptions used to calculate savings and the resulting accuracy of the recommendations;

⁴² *ibid.*

- Information on applicable grants and subsidies;
- adequate economic viability assessment;
- potential interactions with other recommendations;
- measurement and verification methods to be used to estimate savings after implementation of the suggested ESM.

5) Conclusions.

The exact content of the report must correspond to the scope, objective and thoroughness of the energy audit. Most countries will provide additional guidance and templates further specifying the content of the audit report in accordance with national legislations.

4.2. National guidance and specificities

All surveyed countries have developed national standards, guidance and templates for the implementation and reporting of energy audits. These guidance documents all draw on the European standard EN 16247-1 translated by the respective national standardisation organisations.

Thus, process methodologies and reporting structures do not vary significantly among surveyed countries. The following sections highlight national specificities in terms of additional guidance and requirements.

4.2.1. Guides and reporting templates

Institutions in charge of national audit systems often provide additional instructions in the form of guides or templates to support compliance with national energy efficiency policies and EN 16247-1.

The Czech Decree No. 140/2021 Coll. and Plan for Energy Audits specifies the content and the structure of energy audits, distinguishing between 3 types of audits (see 3.1. Audit categories).

In Germany, the Federal Office of Economics and Export Control (BAFA) developed a guideline for the preparation of energy audit reports in accordance with the requirements of the German Energy Services Act (EDL-G) and the DIN EN 16247-1.⁴³ It supports energy experts and obligated enterprises in the implementation and documentation of audits and set content and quality requirements for the audit report.

In Greece, the Ministry of Environment and Energy publishes a detailed “Guide for Energy Audits in Buildings, Industry, and Transport”, aiming to facilitate energy auditors to follow the national energy efficiency laws (L.4342/2015 & L.4843/2021). The purpose of the technical manual-which is supported by Excel (.xls) files for the calculation of the Energy Baseline-is to support enterprises and energy experts, inform on audit processes and requirements in accordance with EN 16247 and provide guidance for the identification, evaluation, planning and verification of energy efficiency projects.

⁴³ Bundesamt für Wirtschaft und Ausfuhrkontrolle 2020. Leitfaden zur Erstellung von Energieauditberichten Stand 30.1.2020. Retrieved 15.03.2023 from https://www.bafa.de/SharedDocs/Downloads/DE/Energie/ea_leitfaden.html.

In Italy, the National Energy Agency (ENEA) provides both general and sector-specific guidelines for the audit report, the monitoring plan and site clustering⁴⁴. In addition, templates for mandatory reporting documents are available on the online portal of ENEA. They consist of a site listing and clustering spreadsheet, in order to support the identification of sites subject to the audit obligation and the audit report template specifying qualitative and quantitative information requirements.

The Netherlands Enterprise Agency (RVO) provides guidance and awareness raising for obligated enterprises as well as templates for standard and group audits on its online portal⁴⁵.

In Spain, federal agencies do not provide further instructions beside UNE-EN 16247. However, regional governments have developed additional guides and templates to support local enterprises.

4.2.2. Assessment of energy saving measures

Requirements for the assessment of energy saving measures vary among countries. EN 16247-1 prescribes the estimation of investment costs, energy and CO₂ savings, and an economic viability assessment using net present value. However, the standard leaves room to define other financial and non-financial impact indicators to assess and prioritise recommended ESMs.

Table 3: Obligatory (O) and recommended (R) economic impact indicators in mandatory energy audits by country

	CZ	GR	DE	IT	NL	ES
Simple Payback Period (SPP)	O	O		O		O
Return on Investment (ROI)					O	
Internal Rate of Return (IRR)	O		O	O		R
Net present value (NPV)	O		O	O		R
Net present value on investment ratio (NPV/I)				O		
Life Cycle Cost Analysis (LCCA)		O				

Most commonly requested economic assessment indicators include simple payback period (SPP), net present value (NPV) and internal rate of return (IRR). Greek legislation, however, strongly recommends to use Life-Cycle Cost Analysis (LCCA) approach where possible, instead of a simple payback calculation, in order to take account of long-term savings, residual values of long-term investments and discount rates⁴⁶. Table 3 presents an overview of obligatory or recommended economic performance indicators among surveyed countries.

In all countries except Italy, the impact assessment of recommended energy saving

⁴⁴ Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA), Dipartimento Unità per l'Efficienza Energetica 2022. Linee Guida Enea E Indicazioni Operative. Retrieved 31.03.2023 from <https://www.energiaenergetica.enea.it/servizi-per/imprese/diagnosi-energetiche/indicazioni-operative.html>

⁴⁵ Rijksdienst voor Ondernemend Nederland 2023. EED-auditplicht. Retrieved 15.03.2023 from <https://www.rvo.nl/onderwerpen/eed/eed-auditplicht#publicaties>.

⁴⁶ Government of the Greek Republic 2018. Presidential Decree 175275/2018. In: Gazette 1927/B/30-5-2018. Retrieved 30.03.2023 from https://ypen.gov.gr/wp-content/uploads/2020/11/Systhmata_Pistpoihshe_elegktwn_klp.pdf

measures must include a calculation of avoided greenhouse gas emissions or CO₂ savings. In the Netherlands, in particular, the avoided cost of greenhouse gas emissions must be included in the calculation of the return on investment, based on national carbon tax rates. In Czech Republic, recommended energy saving measures must minimally achieve 10% of savings either in terms of energy consumption or CO₂ emissions. No other of the surveyed countries sets similar quantitative requirements in terms of energy and climate mitigation targets for recommended energy saving measures.

4.3. Procedures for multi-site enterprises and groups

4.3.1. Determination of the energy consumption

The energy consumption of an enterprise comprising several sites is assessed by summing up the energy consumption of all its individual sites. This reasoning also applies for groups of enterprises majority-owned by a single corporation and thus legally and financially linked. In this case, audit obligations apply to the smallest legally and financially independent entity.

In most surveyed countries, this sum must include the energy consumption of sites disposing of certified energy management systems. In Czech Republic, however, there is no official resolution regarding the inclusion of EMS certified sites in multi-site enterprise audits; in some cases, site certified according to ISO 50001 may be excluded from the energy audit.

In Germany, Greece, Italy and Spain, sites which in total represent a marginal part of the enterprise's energy consumption may not be audited. The conditions and thresholds vary among countries. In Italy, sites may be excluded if their individual annual primary energy consumption is below 100 toe (1,162.8 MWh) and their cumulative consumption represents less than 20% of the enterprise's total. In both Greece and Germany sites that in total account for less than 10% and in Spain for less than 15% of the enterprise's energy consumption do not have to be audited. In Czech Republic and the Netherlands, sites with marginal energy consumptions cannot be excluded from mandatory energy audits.

4.3.2. Clustering and sampling approaches for multi-site enterprises

Several surveyed countries allow for so called clustering and sampling procedures to simplify the auditing of enterprises or corporations with a very large number of distinct sites. In this approach, the auditor identifies and clusters similar sites based on suitable comparison criteria. Only a representative number of sites within a cluster then needs to undergo a complete analysis. This sampling approach reduces the number of auditing operations and field visits, though ultimately the total energy consumption of the clustered sites is to be assessed. Results from representative sample sites can only be transferred and scaled to the whole of a cluster, if the audit is considered proportional and representative. In Germany, Greece, Italy and the Netherlands, legislation provides methodological guidance for the clustering and sampling procedure.

In Germany and Greece, clustered sites must be similar and comparable in terms of energy consumption, operations and structure and the number of sites selected for analysis corresponds to the square root of the total number of sites within the cluster. For complex and differentiated technical infrastructure, such as hospitals or certain production sites, the application of a multi-site procedure is only permissible in exceptional cases.

In Italy and the Netherlands, although the clustering approach is similar, the sampling methodologies depend on consumption ranges. In Italy, samples must be proportional and representative within comparable consumption ranges: sites with higher energy consumptions should be more represented than sites which are less energy intensive. Further, sites with annual primary energy consumptions exceeding certain thresholds (10,000 toe/a (116,300 MWh/a) for industrial sites, and 1,000 toe/a (1,1630 MWh/a) for primary and tertiary sites) are obliged to undergo an energy audit. Similarly, in the Netherlands, different sampling rules apply for different consumption ranges: sites with large annual energy consumptions (above 75,000 m³ of natural gas or 200,000 kWh of electricity) must complete individual energy audits, while clustered sites with lower energy consumptions require at least three sample audits⁴⁷.

Czech and Spanish legislations do not feature any clustering and sampling provisions. However, the 2022 update of the European standard EN 16247-1 includes a chapter on the sampling of energy audits, which will enable a harmonisation of multi-site audit procedures among Member States.

5. COMPLIANCE, QUALITY CONTROL AND ENFORCEMENT

This chapter focuses on the monitoring, control and enforcement mechanisms that national governments have put in place to ensure that national energy audit requirements are adequately applied, both by obligated enterprises and by energy auditors.

5.1. Enterprise compliance

In most surveyed countries, a national agency or a ministry is in charge of setting up and carrying out the monitoring and enforcement to control the execution and, in some cases, the quality of mandatory audits.

5.1.1. Responsible institutions

In Czech Republic, it is the State Energy Inspection (SEI), overseen by the Ministry of Industry and Trade.

In Germany, it is Federal Office for Economic Affairs and Export Control (BAFA), on behalf of the Federal Ministry of Economic Affairs and Climate Protection.

In Greece, the Department of Energy Policy and Energy Efficiency/Energy Efficiency Unit of the Ministry of Environment and Energy is responsible for the energy audits' policy and legislative framework, whereas the Body of Inspectors and Auditors (Inspection Bodies of Northern and Southern Greece) is in charge of maintaining, controlling and managing the Energy Audit Record and the on-line Energy Audit Registry.

In Italy, the responsible institution is the National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), supervised by the Ministry of Economic Development.

⁴⁷ Behling et al. 2018. Development of recommendations on the implementation of certain aspects of Article 8 and Annex VI of the Energy Efficiency Directive. DG ENER, European Commission. Retrieved 21.03.2023 from [final_report - development of guidelines and recommendations on the implementation.pdf\(europa.eu\)](https://ec.europa.eu/energy/electricity/energy_efficiency/docs/final_report_-_development_of_guidelines_and_recommendations_on_the_implementation.pdf).

In the Netherlands, it is the Netherlands Enterprise Agency (RVO), which is part of the Dutch Ministry of Economic Affairs and Climate Policy.

In Spain, however, the regional governments are primarily in charge of compliance control and enforcement. They, in turn, report collected information to the Administrative Register of Energy Audits (RAAE) managed by the Spanish Ministry of Industry, Trade and Tourism.

5.1.2. Reporting procedures

In all surveyed countries, obligated enterprises must report energy audit results to the institutions in charge of controlling. In some cases, the task of transmitting audit results is delegated to the energy auditor. The information is usually transmitted in electronic form through dedicated online platforms managed by the responsible institutions. These databases are not publicly accessible.

In Czech Republic, the audit reports must be uploaded by a certified energy auditor to the ENEX database run by the Ministry of industry and Trade.

In Germany, the legislation stipulates that obligated enterprises must proactively submit proof of the execution of their audit through an electronic template feeding into the OREA database managed by BAFA. Italy, obligated enterprises are required to send their energy audit reports to ENEA.

In Greece, the energy auditors must submit their results and general information to an on-line Energy Audit Record, via an online database, along with energy audit report and the Excel (xls) of the Energy Baseline and the collected monthly energy consumption data of the audited facility.

In the Netherlands, obligated enterprises are responsible for submitting their audit reports to RVO and their local municipality. The task can be delegated to the energy auditor with the submission of an additional information form in complement to the audit report.

In Spain, obligated enterprises report on their audit through a national energy data template to their regional governments, which in turn forward the audit information to the national register of the Ministry of Industry, Commerce and Tourism.

5.1.3. Compliance control

In most surveyed countries, the institutions in charge rely on sample checks to control the adequate execution of mandatory energy audits.

In Czech Republic, SEI carries out sample checks usually representing 20% of the mandatory audits submitted each year. The procedure contains elements of quality control, with SEI verifying if the audit report has the right structure and was signed by a certified energy auditor.

In Germany, BAFA carries out random checks to control whether energy audits have been carried out. The random samples cover 20% of the mandatory audits. A quarter of these 20% also goes through a random quality sample. BAFA requires selected enterprises to submit their full energy audit report within a month. The reports are checked for completeness and some parts of the report are qualitatively assessed using a point-based system. Particular emphasis is placed on the analysis of the enterprise's current situation. In addition, the over-

all quality of the reports is evaluated. If a minimum number of points is not reached, enterprises are requested to improve their audit report⁴⁸.

In Greece, the Energy Inspection Departments of the Inspection bodies of Northern and Southern Greece check at least 5% of all energy audits, submitted to the on-line database, either randomly or in response to a complaint. Extra required information is provided by the energy auditor(s), upon request by the Ministry.

The Italian Agency ENEA carries out sample checks for mandatory audits carried out by external auditors, the number of samples representing at least 3% of obligated enterprises. In addition, ENEA collects the entirety of audits performed by enterprise internal auditors.

In the Netherlands, RVO controls all mandatory energy efficiency reports. When elements of the report are missing, RVO contacts obligated enterprises to request additional information.

In Spain, regional governments are responsible for compliance control. There is no national information available on the control procedure.

5.1.4. Enforcement

In all surveyed countries, financial penalties apply to obligated enterprises which do not execute an energy audit. The amount of the fines however varies significantly among countries and depending on the circumstances. Some countries also have fines for non-compliance, such as flawed execution of the audit or delayed submission of the report.

In Czech Republic, the penalty for non-performance and non-compliance of mandatory energy audits can reach up to CZK 5 million (about 210,000 EUR) to be paid to the State Energy Inspection.

In Germany, obligated enterprises that do not carry out an energy audit, do not carry it out correctly, do not carry it out on time or do not fully comply with the reporting obligations, face a fine of up to 50,000 EUR. In addition, a fine may be imposed on an enterprise that falsely claims to be an SME. In the case of persistent non-compliance, multiple fines may be imposed on the same enterprise.

Similarly, in Italy, enterprises which do not perform the energy audits are subjected to an administrative fine ranging from 4,000 to 40,000 EUR. While non-compliance may expose the enterprise to an administrative fine of 2,000 to 20,000 EUR. In case, enterprise do not submit audit results within 90 days following the first complaint, fines ranging from, 1,500 to 15,000 EUR apply.

In Greece, obligated enterprises face fines varying from 5,000 EUR to 100,000 EUR, for non-compliance with audit obligations. In practice, during the first 4-year period of energy audit obligation, the Ministry typically sends a warning letter to enterprises, which have not performed an audit, giving them a deadline of 1 month to fulfil the obligation; failure to comply will result in a financial penalty. Any financial penalty for flawed execution of an energy audit

⁴⁸ Mai et al. 2017. Analyse der Entwicklung des Marktes und Zielerreichungskontrolle für gesetzlich verpflichtende Energieaudits. Schlussbericht an das Bundesamt für Wirtschaft und Ausfuhrkontrolle (BAFA). Retrieved 29.03.2023 from [Analyse der Entwicklung des Marktes und Zielerreichungskontrolle für gesetzlich verpflichtende Energieaudits - Google Search](#).

applies to the responsible energy auditor and not to the obligated enterprise.

In the Netherlands, financial penalties are determined on a case-by-case basis. In the case of missing audits reports, enterprises first receive a warning and an extension of the original submission. If elements are missing after the second deadline, RVO will take legal action.

In Spain, Law 4/2018, of 15th October, the Article 81 establishes that failure to carry out the energy audit within the legally required timeframe constitutes an offence, entailing 3 types of fines ranging from 1,000 EUR to a maximum of 60,000 EUR depending on the extent of the offense.

5.1.5. Control and enforcement of ESM implementation

Germany, Italy and the Netherlands have developed requirements for the implementation of ESM following a mandatory energy audit⁴⁹; however, dedicated control and enforcement measures are largely missing.

In Germany, enterprises obligated to implement ESM or an EMS within 18 months must verify their own compliance by mandating an energy auditor or an ISO 50001 or EMAS certifier. BAFA is not responsible for the verification. To date, no financial penalties apply for the non-implementation of mandatory energy saving measures under EnSimiMaV⁵⁰.

In Italy, energy-intensive enterprises which fail to implement either at least one ESM or an EMS compliant with ISO 50001 before the subsequent mandatory audit (i.e. in a period of 4 years), expose themselves to a fine of 1,000 to 10,000 EUR⁵¹. The control of the implementation is de facto carried out as part of their next mandatory audit.

Similarly, in the Netherlands, the implementation of ESM is only controlled when the next mandatory energy audit takes place. If elements of proof are missing, RVO may take legal action. The amount of the fines is determined on a case by case basis. There are currently no dedicated control and enforcement measures for ESM implementation.

5.2. Auditor compliance

5.2.1. European and international standard requirements for auditors

EN 16247-1 and ISO 50002 provide general quality requirements regarding the competences of energy auditors as well as their attitude towards the mandating enterprise. According to these standards, auditors must:

- Comply to local guidelines and recommendations in terms of their qualifications and experiences;
- Treat all information provided by the enterprise or produced in the course of the audit with confidentiality;
- Prioritise the interests of the enterprise and address them with objectivity;
- Disclose any conflict of interest in a transparent manner;

⁴⁹ See 3.3 ESM implementation obligations

⁵⁰ Die Wohnungswirtschaft Deutschland 2022. GdW-Information 166 zur Umsetzung der Verordnung zur Sicherung der Energieversorgung über mittelfristig wirksame Maßnahmen (EnSimiMaV). Retrieved 31.03.2023 from https://www.gdw.de/media/2022/09/22_10_05_gdw_info_ensimimav_3_ueberarbeitung.pdf

⁵¹ Governo Italiano 2020. Decreto Legislativo 73/2020. Gazzetta Ufficiale. Retrieved 23.03.2023 from <https://www.gazzettaufficiale.it/eli/id/2020/07/14/20G00093/sg>

- Ensure that their subcontractors equally comply to the above requirements.

EN 16247-5 addresses the competences of energy auditors in further details.

5.2.2. National auditor requirements and quality control

In all surveyed countries except the Netherlands, some national requirements for energy specialists apply in order to be able to execute energy audits as per national and European standards.

In Czech Republic, Act No. 406/2000 Coll. on energy management defines the competences and activities of energy auditors, sets professional requirements and provides a list of registered auditors. Auditors must pass a professional expert exam overviewed by the Ministry of Industry and Trade. There is no direct quality control for auditors but sample checks of mandatory audit reports enable SEI to verify the name and registration of the auditor and charge and the general compliance of the audit.

In Germany, energy auditors must fulfil the requirements of EDL-G (Article 8b, Article 13) which are:

1. relevant training, evidenced by:
 - a. a degree from a university or university of applied sciences in a relevant subject area;
 - b. a professional qualification as a state-certified technician or a master craftsman's qualification or equivalent further training qualification in a relevant field;
2. at least three years of full-time work including practical knowledge of operational energy consulting;
3. specialist knowledge of audit process in accordance with DIN EN 16247-1;
4. BAFA registration prior to the first energy audit;
5. obligation to provide proof of further trainings on energy efficiency (since 2022).

The Greek Ministry of Environment and Energy maintains, on its specialised database - platform, a registry of all energy auditors distinguished in three classes:

- Class A: are those with an engineering degree allowing them to perform and sign audits by default. Experts that have either received specialised energy auditing training courses, or have;
- Class B: includes those who have demonstrably carried out at least 5 A-class energy audits;
- C Class includes B-class Energy Inspectors if they have demonstrably carried out at least five (5) B-class energy audits.

In Italy, since 2016, energy audits can only be carried out by certified energy management experts (Esperti Gestione Energia – EGE) according to UNI CEI 11339 or by energy service enterprises (ESCo) according to UNI CEI 11352. Energy management experts must provide information on yearly progress in their working experience through the submission of specific documents to the certifiers. In the case of energy service enterprises (ESCOs), the certification must be renewed every four years and checks are carried out every year.

In the Netherlands, the practice of energy auditors is unregulated and does not require any

form of certification. Nevertheless, general guidelines and best practices exist in alignment with EN 16247. As opposed to other surveyed countries, all submitted audit reports are controlled by the relevant competent government agencies, who can notify the energy expert or enterprise for incompetence.

In Spain, RD 56/2016 sets some minimum requirements for energy auditors. The auditor must either have a degree or accredited theoretical and practical knowledge about energy or be a qualified technician who work in the enterprise but has no direct relation with audited activities. Spanish legislation does not foresee any quality checks for energy auditors.

5.2.3. Auditor data, registries and organisations

Czech Republic, Germany, Greece and Italy maintain official registries of accredited auditing entities (both for auditors and energy management enterprises). The Netherlands do not have an official and comprehensive registry; however, RVO provides guidance and lists the contact details of energy experts and enterprises which are deemed competent. In Czech Republic, Germany, Italy and Spain, energy experts and enterprises are organised through trade associations. Table 4 compares how the national ecosystems of energy auditors and energy enterprises are organised.

Table 4: Overview of national auditors and ESCOs ecosystems

	CZ	DE	GR	IT	NL	ES
National registries or contact lists	ENEX	BAFA	MEE	ACCREDIA	RVO	-
Number of registered auditors (status 2022)	526	8,000	1,466	1,600	1,500	-
Number of registered ESCOs (status 2022)	10	-	18	900	-	-
Self-organisation of auditors	AEM / AEA	DEN e.V. / GIH	-	AssoEGE	-	-
Self-organisation of ESCOs	APES	-	-	AssoESCO	-	AMI / ANESE

6. IMPACT OF NATIONAL AUDIT POLICIES

This chapter initiates a first comparative assessment of the impact of national audit policies, drawing on existing national evaluations and data from the surveyed countries. This assessment will be completed by additional primary research to be presented in two following reports addressing the gaps and barriers in the implementation of energy saving measures in the manufacturing industry.

6.1. National evaluations and reporting to the European Union

The European EED sets reporting requirements for Member States on the implementation

of their national energy efficiency and climate targets. Until 2020, countries had to update their National Energy Efficiency Action Plans (NEEAPs) every three years and report their progress annually. For the 2021 to 2030 period, countries must report on the progress on their National Energy and Climate Plans (NECPs) every two years. The European Commission provides templates and guidelines to fulfil the reporting requirements which also address the implementation and progress on Article 8 of the EED⁵². As part of their reporting to the European Union, Member States are expected to carry out evaluations of the impact of their mandatory audit policies. However, to date, of the six countries we focus on, only Germany and Italy have carried out national evaluations of their audit systems.

In Germany, the Federal Office for Economic Affairs and Export Control (Bundesamt für Wirtschaft und Ausfuhrkontrolle – BAFA) has published an evaluation report of the national auditing system in 2017. The report was based on statistical data and anonymous surveys of 10,500 obligated enterprises. It covers the following topics⁵³:

- Target achievement monitoring;
- Collection of information on affected enterprises;
- Fulfilment of the requirement of DIN EN 16247-1 in the energy audit;
- Effects and consequences of the energy audit;
- Administration/enforcement by BAFA;
- Market analysis for energy services.

To date, BAFA has not published more recent evaluations of the German audit system.

The Italian National Energy Agency (ENEA) produces a Yearly Energy Efficiency Report (Rapporto Annuale Efficienza Energetica – RAEE) of the mandatory auditing system and submits it on 30th of June to the Ministry of Economic Development. It is solely based on statistical analyses of the mandatory audit data submitted by the obligated enterprises; no additional surveys are carried out. The evaluation includes updated information on geographical distribution, enterprise typologies and the type of energy saving measures or interventions carried out.

The Spanish Ministry of the Environment is currently working on a national analysis report that will compile data from mandatory energy audits and is expected to be published in 2023.

6.2. Key findings from Germany and Italy

Publicly available data and evaluations on the impact of audit systems, in the six countries studied, are only available in Germany and Italy. This section summarises some of the key findings from the two countries. The results are indicative and cannot be generalised to the other considered countries. However, they can provide first insights and working hypotheses for following research and stakeholder engagement activities under AUDIT-TO-MEASURE.

⁵² European Commission, 2013. Guidance for National Energy Efficiency Action Plans accompanying the document Commission Implementing Decision establishing a template for National Energy Efficiency Action Plans under Directive 2012/27/EU of the European Parliament and the Council. Retrieved 24.03.2023 from <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52013SC0180&from=EN>

⁵³ Mai et al. 2017. Analyse der Entwicklung des Marktes und Zielerreichungskontrolle für gesetzlich verpflichtende Energieaudits. Schlussbericht an das Bundesamt für Wirtschaft und Ausfuhrkontrolle (BAFA). Retrieved 29.03.2023 from [Analyse der Entwicklung des Marktes und Zielerreichungskontrolle für gesetzlich verpflichtende Energieaudits - Google Search](#).

Compliance to the audit obligation

The German national evaluation indicated that BAFA assumed approximately 61,000 enterprises fell under the audit obligation in 2015. In 2023, the BAFA database contained information from 23,857 obligated enterprises transmitted between December 2019 to February 2023 (almost 4 years). Enterprises complying to their obligation through a certified EMS were not included in the database, which explains part of the gap with the previously identified obligated enterprises. During this period, only 11,570 enterprises submitted a full set of audit results as required⁵⁴.

In Italy, over the four-year period between 2015 and 2019, ENEA counted 16,105 audits carried out by 8,871 obligated enterprises. Complete data for the following period (2019 to 2022) is not fully available yet, but the figures over the three first years indicate a decrease in the number of audits and in the number of enterprises submitting them. The annual evaluations show that the sector which has performed the highest number of audits corresponds to manufacturing activities (NACE sector C), representing approximately 62% of all audits received by ENEA during 2021⁵⁵.

Prevalence of EMS among obligated enterprises

The German evaluation carried out in 2017 showed which type of enterprises carried out energy audits and which implemented energy management systems. Enterprises were examined on the basis of certain parameters such as number of employees, energy consumption, area of impact and later also industrial sector. It was found that around 80% of enterprises with an annual turnover below 50 million EUR conducted an energy audit. This proportion decreases as annual turnovers increase, falling to less than 60 percent among enterprises with a turnover above 1 billion EUR⁵⁶. The evaluation also found that the larger the geographical area in which enterprises operate, the greater the number of enterprises with energy management systems and the lower the number of enterprises carrying out energy audits.

ESM recommendations from mandatory audits

In Germany, energy saving measures were recommended in 98% of mandatory audit reports in 2017. In 2023, among the 11,570 enterprises that submitted full audit results to the BAFA database, over 99% received ESM recommendations. 38,727 measures were recommended in total, which represents an average of about 3.5 measures per audit-obligated enterprise. According to the new German ESM implementation self-obligation for energy-intensive enterprises, 1,987 enterprises would fall under this obligation. The number of economically viable ESM recommended to these enterprises accounted for 4,322 measures, which represents an average of about 2.2 mandatory ESM per obligated enterprise⁵⁷.

⁵⁴ Anonymised data provided by BAFA to adelphi research.

⁵⁵ Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA), Dipartimento Unità per l'Efficienza Energetica 2022. Rapporto annuale sull'efficienza energetica 2022. Retrieved 29.03.2023 from <https://www.energiaenergetica.enea.it/pubblicazioni/rapporto-annuale-sull-efficienza-energetica-2022.html>.

⁵⁶ Ibid.

⁵⁷ Anonymised data from enterprises falling under the audit obligation (status February 2023), provided by BAFA to adelphi research.

Both in Germany⁵⁸ and in Italy⁵⁹, most frequently recommended measures across sectors were high performance lighting and general organisational and process improvements (EMS, user behaviour, etc.). They are the most widely applicable measures across sectors, although they might not necessarily have the highest impact. ESM with higher energy saving potentials are usually found in the areas of heating, cooling, compressed air and motors. However, such systems are usually process specific and strongly depend on the considered sector.

In Germany, further analysis of recent data provided by BAFA provides statistics on the nature of ESM suggested in mandatory audits between 2019 and 2023. Figure 5 illustrates what the most frequently recommended ESM are in the manufacturing industry (NACE Code C): lighting, followed by compressed air, heat and renewable energy production are the most prevalent across all manufacturing sectors.

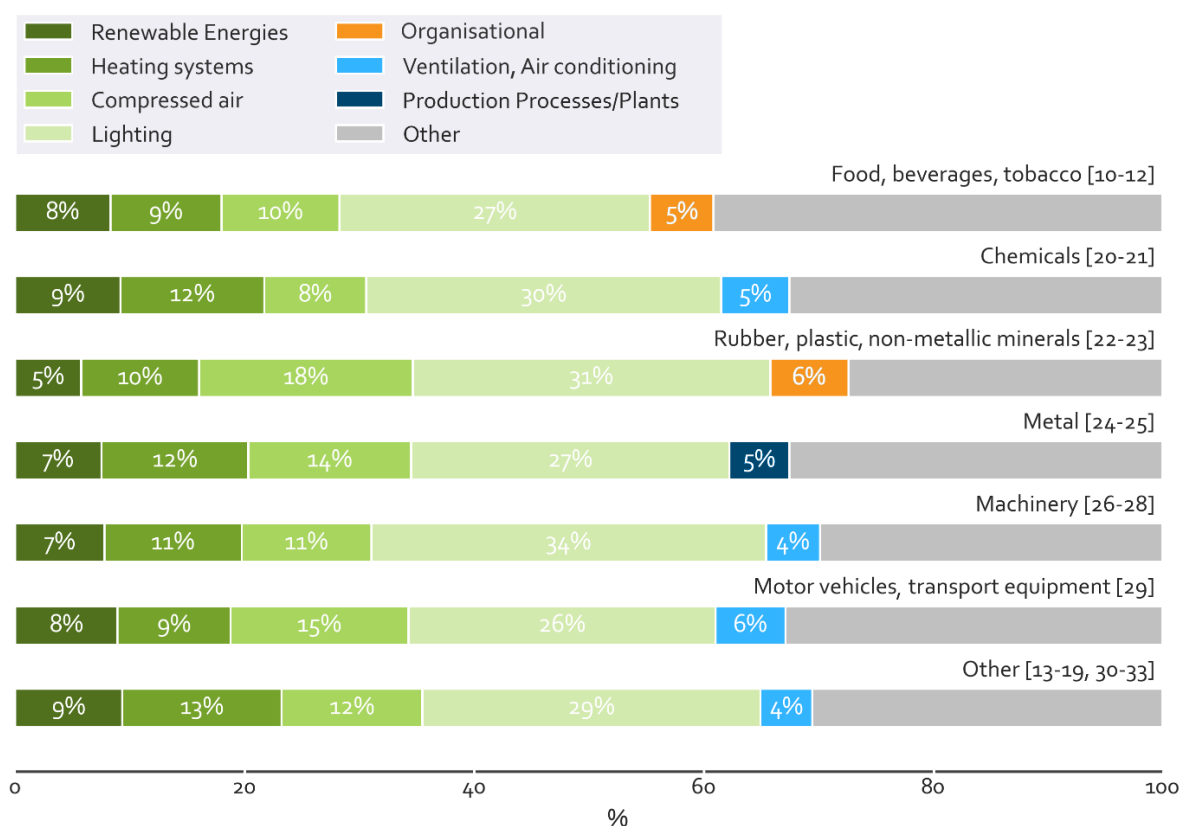


Figure 5 : Most recommended ESM in mandatory audits by manufacturing sector in Germany between 2019 and 2022

Implementation of recommended ESM after mandatory audits

In Germany's 2017 evaluation, most measures were implemented in the area of lighting, followed by heating systems, ventilation and air conditioning, as well as user behaviour. It is

⁵⁸ Mai et al. 2017. Analyse der Entwicklung des Marktes und Zielerreichungskontrolle für gesetzlich verpflichtende Energieaudits. Schlussbericht an das Bundesamt für Wirtschaft und Ausfuhrkontrolle (BAFA). Retrieved 29.03.2023 from [Analyse der Entwicklung des Marktes und Zielerreichungskontrolle für gesetzlich verpflichtende Energieaudits - Google Search](#).

⁵⁹ Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA), Dipartimento Unità per l'Efficienza Energetica 2022. Rapporto annuale sull'efficienza energetica 2022. Retrieved 29.03.2023 from <https://www.energiaenergetica.enea.it/pubblicazioni/rapporto-annuale-sull-efficienza-energetica-2022.html>.

currently too early to assess the impact of the ESM implementation obligation for energy-intensive enterprises (EnSimiMaV), which came into force in October 2022.

Nevertheless, an analysis of a BAFA survey carried out in 2021 on enterprises which declared using energy services can provide indicative statistics on the nature of ESM implemented following a mandatory energy audit. Figure 6 illustrates what the most frequently implemented ESM are among obligated enterprises using energy services in the manufacturing industry (NACE Code C): renewable energy and heat production, building envelope retrofits, cooling systems and production process improvements were the most commonly implemented ESM among surveyed enterprises⁶⁰.

In Italy, in 2021, the most implemented measures were predominantly in the area of lighting as well. Other often implemented measures were production line improvements, compressed air systems and renewable energy production⁶¹.

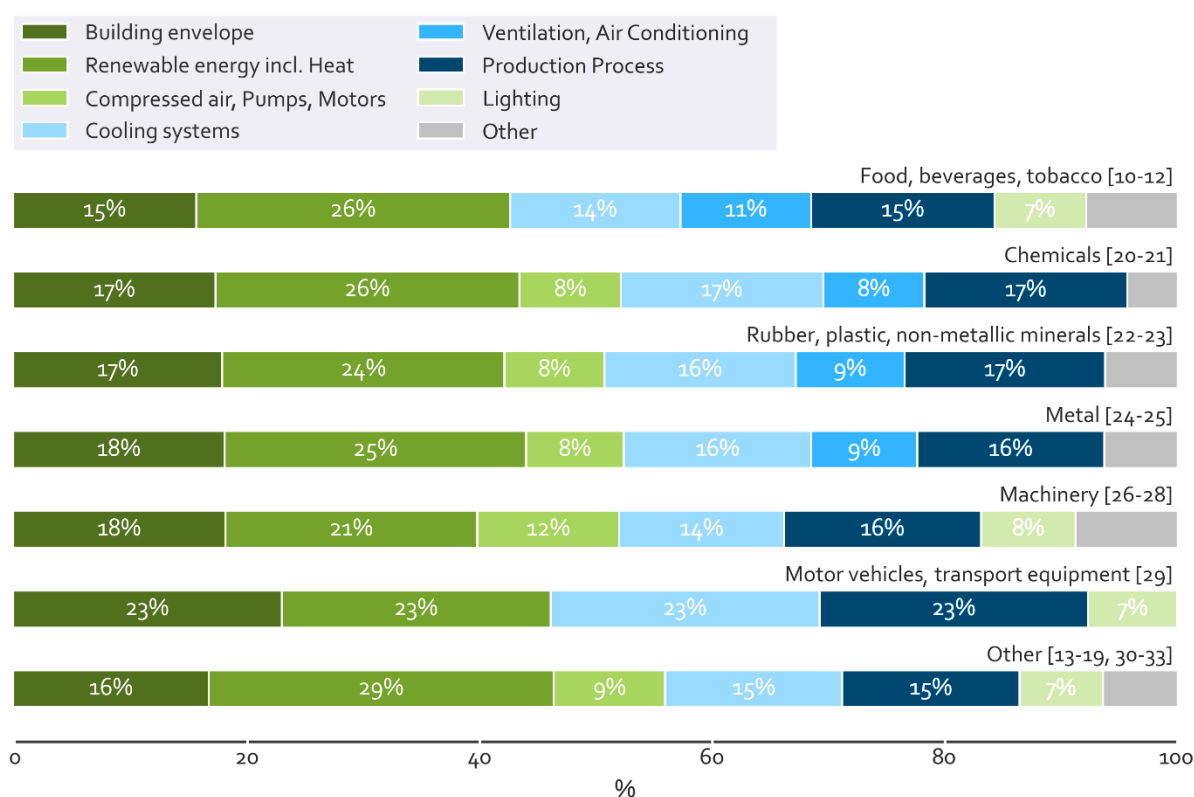


Figure 6: Most implemented ESM after mandatory audits by manufacturing sector in Germany in 2021

Barriers to the implementation of measures

According to the evaluation report of Germany's mandatory audit system, main cited reasons for not implementing energy saving measures in 2017, were:

- Wait for the appropriate time;

⁶⁰ NB: Data presented in Figure 5 and Figure 6 shall not be directly compared, as the data collection methods vary significantly. Figure 5 draws on a database of 23857 obligated enterprises (incl. NACE C), while Figure 6 draws on a sample survey of 2752 enterprises (incl. NACE C obligated enterprises) which declared using energy services.

⁶¹ Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile (ENEA), Dipartimento Unità per l'Efficienza Energetica 2022. Rapporto annuale sull'efficienza energetica 2022. Retrieved 29.03.2023 from <https://www.energiaenergetica.enea.it/pubblicazioni/rapporto-annuale-sull-efficienza-energetica-2022.html>.

- Other investment priorities;
- Measures are not economically feasible;
- Investments are too high.

A market study ordered by BAFA Bureau for Energy Efficiency (Bundesstelle für Energieeffizienz – BfEE) in 2021 confirms the main barriers⁶². After the rise in energy prices over the Covid-19 pandemic and the war in Ukraine, it is likely that the barriers to the implementation of ESM will be reevaluated by enterprises, as the economic viability of ESM has generally increased. However, data to confirm this trend is currently unavailable.

In Italy, a market study carried out in 2021 reveals less than 30% of envisaged energy efficiency projects are actually implemented. Following reasons were most cited to justify missing ESM implementation⁶³:

- Economic barriers: financial risks and too long payback time;
- Regulatory barriers: legislations on energy efficiency are constantly evolving;
- Informational barriers: lack of knowledge and awareness about energy efficiency.

In fact, less than 18% of surveyed enterprises had an Energy Manager and only 30% of enterprises are aware of energy service enterprises.

⁶² Bundesamt für Wirtschaft und Ausfuhrkontrolle (BAFA), Bundesstelle für Energieeffizienz (BfEE) 2021. Empirische Untersuchung des Marktes für Energiedienstleistungen, Energieaudits und andere Energieeffizienzmaßnahmen im Jahr 2021, Endbericht 2021. BfEE 20/04. Retrieved 31.03.2023 from https://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKewiUjpygslb-AhWG-aQKHUUYAfEQFnoECAsQAQ&url=https%3A%2F%2Fwww.bfee-online.de%2FSharedDocs%2FDownloads%2FBfEE%2FDE%2FEnergiedienstleistungen%2Fedl22_endbericht_2021.pdf%3F__blob%3DpublicationFile%26v%3D2&usg=AOvVaw2ihStQ-H8sm8xBg8sHLPig

⁶³ Maggiore et al. 2021. «Energy Efficiency in Industry 4.0: Assessing the Potential of Industry 4.0 to Achieve 2030 Decarbonisation Targets». In: Energy and Sustainability. Retrieved 30.03.2023 from <https://www.witpress.com/elibrary/eq-volumes/6/4/2841>

CONCLUSION AND KEY FINDINGS

This report provides a comprehensive overview and comparison of national audit systems, policies and guidelines of six countries, which represent the bulk of the EU industrial manufacturing production and related energy consumption: the Czech Republic, Greece, Germany, Italy, the Netherlands and Spain.

The comparative analysis identifies key differences among these countries in the implementation of the Article 8 of European EED, in terms of ambitions, requirements, guidelines and verification measures. A summary of key parameters and features of the national audit policies is provided in Table 5.

- Audit obligations according to EED Article 8:** All surveyed countries have implemented the audit obligation in their policy frameworks in accordance with the EED. However, the target groups vary significantly among surveyed countries. Although EED currently targets large enterprises, most countries have progressively introduced energy-intensiveness thresholds for the application of the audit obligation. These criteria vary significantly among countries, sometimes including SMEs with high energy consumptions as well (see Table 5). In all countries, ISO certified EMS exempt from audit obligation. Germany is the only remaining country where EMAS certification also exempts from the audit obligation. Each country appointed a ministry or a national agency to oversee the audit systems and apply financial penalties in case of non-compliance. However, enforcement is lagging as verification is only carried out through sampling in most countries. Only the Netherlands currently have the capacity to control all audits carried out annually.
- ESM implementation obligations:** Half of the countries surveyed (Germany, Italy and the Netherlands) have set ESM implementation obligations in addition to audit obligations for energy-intensive enterprises (see Table 5). Germany and the Netherlands have set economic viability criteria for the mandatory energy saving measures, while Italy only requires the implementation of one measure. Monitoring and enforcement of this obligation is limited as, apart from self-regulation, national institutions lack the capacity to verify implementation and apply adequate sanctions.
- Audit process and reporting methodologies** do not vary significantly among surveyed countries, as they mostly rely on the guidelines of EN 16247. Most countries provide additional guidance documents and templates for reporting and data submission to the relevant entities, except in Spain where regional governments are in charge of providing guidance to enterprises. Most countries, namely Greece, Germany, Italy and the Netherlands, have provisions that allow clustering and sampling approaches to assess the energy performance of large groups or multi-site enterprises. However, the parameters for defining the clusters and determining the representativeness and proportionality of the samples vary between the countries surveyed.
- Requirements for ESM recommendations:** National requirements and guidelines for the assessment and prioritisation of ESM vary significantly among surveyed countries. In most countries, the assessment mainly relies on economic viability criteria (see Table 5), although the Czech Republic, Germany, the Netherlands and Spain also expect

greenhouse gas emissions accounting as part of ESM assessments. In Czech Republic, notably, recommended ESM must minimally achieve 10% of savings either in terms of energy consumption or CO₂ emissions. In the Netherlands, return on investment calculations must factor in the national carbon tax rates.

- **National audit system evaluations:** The European EED sets reporting requirements for Member States on the implementation of their national energy efficiency and climate targets. To date however, only Germany and Italy have carried out national evaluations. Italy carries out a statistic evaluation every year, while the only comprehensive evaluation in Germany dates back to 2017. Spain is currently carrying it out its first national evaluation.

Table 5: Summary of the main characteristics of national audit and ESM obligation policies

	CZ	DE	GR	IT	NL	ES
Energy audit obligation since	2000	2015	2015	2015	2008	2016
Criteria for audit obligation for non-SMEs (MWh/a)	>200	>500	All	>581.5	> 50	All
Criteria for audit obligation for SMEs (MWh/a)	>5,000	-	-	>1,000	-	-
Frequency of mandatory audits (years)	4 (10)	4	4	4	4	4
Mandatory economic criteria for ESM recommendations	IRR, NPV	IRR, NPV	LCCA	IRR, NPV	ROI	SPP
Exemption through certified Energy Management Systems	ISO	ISO, EMAS	ISO	ISO	ISO	ISO
ESM implementation obligation since	-	2022	-	2020	2019	-
Obligation criteria for ESM implementation (MWh/a)	-	>10,000	-	>1,000	>10,000	-
Selection criteria for mandatory ESM implementation	-	NPV >0 in 3 years	-	1 ESM	ROI >0 in 5 years	-
Period for mandatory ESM implementation (years)	-	1.5	-	4	4	-

This comparison of the national audit system is particularly relevant in the light of the European Commission's proposal for a recast of the energy efficiency directive⁶⁴ that is currently being negotiated among European institutions and the recent update of the European energy audit norm EN 16247-1. National policies appear to precede certain updates proposed by the Commission such as the introduction of energy-intensiveness thresholds for the application of the audit obligation; while some national initiatives such as the introduction of ESM obligations will likely not be included in the EED recast. The new chapter on clustering and sampling of the EN 16247-1:2022 will help harmonise multi-site audit methodologies among Member States once translated into national standards.

National evaluations and publicly available data on the impact of the audit policies are largely missing, are carried irregularly or differ too much in their scope to enable a meaningful comparative analysis among the surveyed countries. Especially sector-specific data on recommended and implemented ESM is lacking. Comprehensive data on compliance to the obligation and prevalence of energy audits by sectors is not uniformly available in surveyed countries. A cross-country assessment of the enterprises' readiness and the identification of implementation gaps in the manufacturing industries is currently not possible with secondary research.

Two reports will follow aiming to complement this first analysis by providing further insight into the actual implementation of audits and ESM in the selected industries across five countries. The analysis will be based on information gathered from questionnaires filled in by enterprise decision makers, management, operational staff and auditors. The reports will analyse enterprise strategies and top management decision-making processes as well as the informational, behavioural, organizational and economic barriers affecting the uptake of energy saving measures in the manufacturing industry.

⁶⁴ European Commission 2021. Proposal for a Directive of the European Parliament and of the Council on energy efficiency (recast). Retrieved 01.03.2023 from <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021PC0558>

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ANNEX: NATIONAL FACTSHEETS ON ENERGY AUDIT SYSTEMS IN THE EUROPEAN UNION

This section provides a summary overview of national energy audit policies across the European Union in the form of national factsheets specifying key aspects and parameters of the audit systems as well as links to the relevant national institutions and databases. The factsheets summarise following aspects previously discussed in this report:

- Parameters of the audit obligation;
- National audit process and report requirements and guidance;
- Quality and compliance control of the audit obligation;
- National auditor requirements and compliance;
- Parameters of the ESM implementation obligation (if applicable).

NB: The factsheets represent the current level of information of the project consortium. They will be regularly completed and updated in the course of the AUDIT-TO-MEASURE project. To date, the countries covered in this annex are:

- Bulgaria
- Cyprus
- Czech Republic
- Greece
- Germany
- Italy
- Latvia
- Lithuania
- Netherlands
- Poland
- Spain

BULGARIA – ENERGY AUDIT POLICY⁶⁵

Audit obligation		
If yes, since? / If no, planned for?	Name of relevant policies	Mandatory audit frequency
2015	Energy Efficiency Act	4 years or 1 year after major technical changes
Target group		Number of obligated enterprises (in 2019)
Non-SMEs and SMEs above 3 GWh/a		Approx. 350
Exempted sectors of activity		Exemption through EMS (which standards)
No		Yes, if certified energy management
Audit scope and boundaries		
Energy directly consumed by the enterprise, within national borders.		
Process and reporting		
Applicable standards	National guidance, templates	Possible simplifications
DIN EN 16247	Yes, guidelines in Ordinance No. E-PД-04-05	No
Quality and compliance		
Relevant Authority	Data collection method	Data collection frequency
Sustainable Energy Development Agency (SEDA)	Energy audit summary template	14 days after the audit
Quality control		Fines (please indicate maximum amount)
Sample checks		Yes, up to 5,000 EUR
Existence of a national evaluation of the audit policy framework (please link if available)		
N/A		
Auditors		
Accreditation / requirements	National registry / Database	Trade organisations
Yes, requirements set in the Energy Efficiency Law	SEDA register of auditors	
Quality control		Fines (please indicate maximum amount)
No, only control of auditor accreditation		No
Obligation to implement energy saving measures (ESM)		
If yes, since? / If no, planned for?	Name of relevant policies	Implementation time window
No, not planned		
Target group		ESM selection criteria
ESM implementation control		Fines (please indicate maximum amount)

⁶⁵ Information provided by the Bulgarian Sustainable Energy Development Agency (SEDA) in April 2023.

CYPRUS – ENERGY AUDIT POLICY⁶⁶

Audit obligation		
If yes, since? / If no, planned for?	Name of relevant policies	Mandatory audit frequency
2015	K.D.P. 184/2012	4 years
Target group		Number of obligated enterprises (in 2019)
Non-SMEs with an annual energy consumption above 500 MWh.		N/A
Exempted sectors of activity		Exemption through EMS (which standards)
No		Yes, if energy management is ISO50001 or ISO 14001 certified.
Audit scope and boundaries		
Energy directly consumed by the enterprise: buildings, processes, fleet.		
Process and reporting		
Applicable standards	National guidance, templates	Possible simplifications
DIN EN 16247	N/A	N/A
Quality and compliance		
Relevant Authority	Data collection method	Data collection frequency
Energy Service of the Ministry of Energy Commerce and Industry	Submission template to the Energy Service	Yearly
Quality control		Fines (please indicate maximum amount)
Sample checks		Yes, up to 350,000 EUR
Existence of a national evaluation of the audit policy framework (please link if available)		
N/A		
Auditors		
Accreditation / requirements	National registry / Database	Trade organisations
Yes, accreditation by the Energy Service	National Register of Energy Auditors (Energy Service)	
Quality control		Fines (please indicate maximum amount)
No, only control of auditor accreditation		No
Obligation to implement energy saving measures (ESM)		
If yes, since? / If no, planned for?	Name of relevant policies	Implementation time window
2022	K.D.P. 522/2022	N/A
Target group		ESM selection criteria
Non-SMEs		Recommended ESM that are viable and listed in K.D.P. 522/2022
ESM implementation control		Fines (please indicate maximum amount)
Yes, according to K.D.P. 522/2022		N/A

⁶⁶ Information provided by the Cyprus Energy Agency in April 2023.

CZECH REPUBLIC – ENERGY AUDIT POLICY

Audit obligation		
If yes, since? / If no, planned for?	Name of relevant policies	Mandatory audit frequency
2000	Decree 140/2021 Coll	4 years
Target group	Number of obligated enterprises (in 2019)	
Non-SMEs with an annual energy consumption above 500 MWh.	N/A	
Exempted sectors of activity	Exemption through EMS (which standards)	
Enterprises involved in intelligence services, states defence and classified information.	Yes, if energy management is ISO50001 certified.	
Audit scope and boundaries		
Only energy directly consumed by the enterprise, within national borders. Temporary, leased or third-party facilities and vehicles are excluded.		
Process and reporting		
Applicable standards	National guidance, templates	Possible simplifications
DIN EN 16247 / ISO 50002	Yes	3 types of energy audits depending on size and complexity of the site
Quality and compliance		
Relevant Authority	Data collection method	Data collection frequency
State Energy Inspection (SEI), overseen by the Ministry of Industry and Trade	ENEX e-form	Every two years
Quality control		Fines (please indicate maximum amount)
Sample checks		Yes, up to 210,000 EUR
Existence of a national evaluation of the audit policy framework (please link if available)		
No		
Auditors		
Accreditation / requirements	National registry / Database	Trade organisations
Yes, accredited by the Ministry of Industry and Trade	ENEX online registry	AEM, AEA
Quality control		Fines (please indicate maximum amount)
No, only control of auditor accreditation		No
Obligation to implement energy saving measures (ESM)		
If yes, since? / If no, planned for?	Name of relevant policies	Implementation time window
No, not planned		
Target group	ESM selection criteria	
ESM implementation control	Fines (please indicate maximum amount)	

GERMANY – ENERGY AUDIT POLICY

Audit obligation		
If yes, since? / If no, planned for?	Name of relevant policies	Mandatory audit frequency
2015	EDL-G	4 years (10 in some cases)
Target group	Number of obligated enterprises (in 2019)	
Non-SMEs above 200 MWh/a and SMEs above 5,000 MWh/a	N/A	
Exempted sectors of activity	Exemption through EMS (which standards?)	
Public enterprises and enterprises predominantly engaged in sovereign activities.	Yes, if at least 90% of the energy consumption if covered by an EMAS or ISO50001 certification.	
Audit scope and boundaries		
Only energy directly consumed by the enterprise, within national borders. Temporary, leased or third-party facilities and vehicles are excluded.		
Process and reporting		
Applicable standards	National guidance, templates	Possible simplifications
DIN EN 16247	Yes, provided by BAFA	multi-site audits allowing a clustering by typology and sample assessments
Quality and compliance		
Relevant Authority	Data collection method	Data collection frequency
BAFA	data submission template	Yearly
Quality control	Fines (please indicate maximum amount)	
Sample checks	Yes, up to 50000EUR	
Existence of a national evaluation of the audit policy framework (please link if available)		
National evaluation in 2017		
Auditors		
Accreditation / requirements	National registry / Database	Trade organisations
Yes, EDL-G requirements and accreditation by BAFA.	BAFA online registry	DEN e.V., GIH
Quality control	Fines (please indicate maximum amount)	
BAFA accreditation and further training obligation.	No	
Obligation to implement energy saving measures (ESM)		
If yes, since? / If no, planned for?	Name of relevant policies	Implementation time window
2022 to 2024	EnSimiMaV	Within 18 months after audit.
Target group	ESM selection criteria	
Non-SMEs with an annual energy consumption above 10 GWh.	All economically viable ESM (NPV positive within less than 20% of use life, with 15 years maximum use life.	
ESM implementation control	Fines (please indicate maximum amount)	
Through next energy audit	No	

GREECE – ENERGY AUDIT POLICY

Greece – Energy Audit Policy		
If yes, since? / If no, planned for?	Name of relevant policies	Mandatory audit frequency
2015	Law 4342/2015 (Art. 10 & 17) Law 4843/2021 (Art. 9)	4 years
Target group		Number of obligated enterprises (in 2019)
Non-SMEs		N/A
Exempted sectors of activity		Exemption through EMS (which standards?)
Branches of foreign enterprises that are not identified as a legal entity, joint ventures.		Yes, if energy management is ISO50001 certified.
Audit scope and boundaries		
Only energy directly consumed by the enterprise, within national borders. Temporary, leased or third-party facilities are excluded.		
Process and reporting		
Applicable standards	National guidance, templates	Possible simplifications
DIN EN 16247 / ISO50000	Yes, guideline for Contents of the Energy Audit Results Report	multi-site audits, and three categories of audits depending on size and complexity of the site
Quality and compliance		
Relevant Authority	Data collection method	Data collection frequency
Energy Inspection Departments of the Ministry of Environment and Energy	Online submission to the Ministry's database	N/A
Quality control		Fines (please indicate maximum amount)
Sample checks representing 5% of total audits		Yes, up to 100,000EUR
Existence of a national evaluation of the audit policy framework (please link if available)		
N/A		
Auditors		
Accreditation / requirements	National registry / Database	Trade organisations
Yes, according to Decree 99/2018 (Art. 187)	Yes, Registry of Energy Auditors	N/A
Quality control		Fines (please indicate maximum amount)
Energy Inspection Departments of the Inspection Bodies of Northern and Southern Greece		Yes, up to 10,000 EUR
Obligation to implement energy saving measures (ESM)		
If yes, since? / If no, planned for?	Name of relevant policies	Implementation time window
No, not planned		
Target group		ESM selection criteria
ESM implementation control		Fines (please indicate maximum amount)

ITALY – ENERGY AUDIT POLICY

Audit obligation		
If yes, since? / If no, planned for?	Name of relevant policies	Mandatory audit frequency
2015	Italian Legislative Decree n. 73/2020	4 years
Target group		Number of obligated enterprises (in 2019)
Non-SMEs above 50 toe/a (581.5 MWh/a) and SMEs above 1 GWh/a		Approx. 6,434
Exempted sectors of activity		Exemption through EMS (which standards?)
No		Yes, if energy management is ISO50001 certified.
Audit scope and boundaries		
Only energy directly consumed by the enterprise, within national borders. Temporary, leased or third-party facilities and vehicles are excluded.		
Process and reporting		
Applicable standards	National guidance, templates	Possible simplifications
DIN EN 16247 / ISO 50002	Yes, ENEA guidelines	Multi-site audits allowing a clustering by typology and sample assessments
Quality and compliance		
Relevant Authority	Data collection method	Data collection frequency
National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), supervised by the Ministry of Economic Development.	Send energy audit reports to ENEA	Yearly
Quality control		Fines (please indicate maximum amount)
Sample checks (3% of obligated enterprises)		Yes, up to 40,000 EUR
Existence of a national evaluation of the audit policy framework (please link if available)		
Annual evaluation carried out by ENEA		
Auditors		
Accreditation / requirements	National registry / Database	Trade organisations
Yes, certification	ACCREDIA	AssoEGE, AssoESCO
Quality control		Fines (please indicate maximum amount)
Yes, auditors must provide information on yearly progress, ESCO certificate renewal every 4 years.		No
Obligation to implement energy saving measures (ESM)		
If yes, since? / If no, planned for?	Name of relevant policies	Implementation time window
2020	Decree 73/2020	4 years
Target group		ESM selection criteria
Enterprises above 1 GWh		At least one recommended ESM
ESM implementation control		Fines (please indicate maximum amount)
No, self-control		No

LITHUANIA – ENERGY AUDIT POLICY⁶⁷

Audit obligation		
If yes, since? / If no, planned for?	Name of relevant policies	Mandatory audit frequency
2017	Energy Efficiency Law	4 years
Target group		Number of obligated enterprises (in 2019)
Non-SMEs		Approx. 490
Exempted sectors of activity		Exemption through EMS (which standards?)
N/A		Yes, if energy management is ISO50001 or EMAS certified.
Audit scope and boundaries		
N/A		
Process and reporting		
Applicable standards	National guidance, templates	Possible simplifications
DIN EN 16247	No	No
Quality and compliance		
Relevant Authority	Data collection method	Data collection frequency
Lithuanian Energy Agency	Online submission (link)	Continuous
Quality control		Fines (please indicate maximum amount)
Yes, samples (5% to 20% of submitted audits)		Yes, up to 0,5% of annual income
Existence of a national evaluation of the audit policy framework (please link if available)		
N/A		
Auditors		
Accreditation / requirements	National registry / Database	Trade organisations
Yes, accreditation by Lithuanian Energy Agency	Yes, Lithuanian energy agency online registry	No
Quality control		Fines (please indicate maximum amount)
Indirectly: through quality check of energy audits		No
Obligation to implement energy saving measures (ESM)		
If yes, since? / If no, planned for?	Name of relevant policies	Implementation time window
No		
Target group		ESM selection criteria
ESM implementation control		Fines (please indicate maximum amount)

⁶⁷ Information provided by EKOTERMIJA in April 2023.

LATVIA – ENERGY AUDIT POLICY⁶⁸

Audit obligation		
If yes, since? / If no, planned for?	Name of relevant policies	Mandatory audit frequency
2016	Energy Efficiency Law	4 years
Target group	Number of obligated enterprises (in 2019)	
Non-SMEs and SMEs above 500 MWh/a	Approx. 2000	
Exempted sectors of activity	Exemption through EMS (which standards?)	
State institutions, municipalities and other derived public entities	Yes, if energy management is ISO50001 or ISO 14001 certified.	
Audit scope and boundaries		
N/A		
Process and reporting		
Applicable standards	National guidance, templates	Possible simplifications
DIN EN 16247	Yes	N/A
Quality and compliance		
Relevant Authority	Data collection method	Data collection frequency
State Construction Control Bureau of Latvia	Online form in the Energy Resources Information System	Yearly
Quality control		Fines (please indicate maximum amount)
Yes		Yes, up to 10,000 EUR
Existence of a national evaluation of the audit policy framework (please link if available)		
National evaluation (2018)		
Auditors		
Accreditation / requirements	National registry / Database	Trade organisations
Yes, requirements set in Cabinet regulation No. 487	Yes, national auditor database	N/A
Quality control		Fines (please indicate maximum amount)
Latvian National Accreditation Bureau		No
Obligation to implement energy saving measures (ESM)		
If yes, since? / If no, planned for?	Name of relevant policies	Implementation time window
No, upcoming 2023		
Target group	ESM selection criteria	
ESM implementation control	Fines (please indicate maximum amount)	

⁶⁸ Information provided by EKODOMA in April 2023.

NETHERLANDS – ENERGY AUDIT POLICY

Audit obligation		
If yes, since? / If no, planned for?	Name of relevant policies	Mandatory audit frequency
2019	Energiebesparingsplicht	4 years
Target group	Number of obligated enterprises (in 2019)	
Non-SMEs above 50 MWh/a	N/A	
Exempted sectors of activity	Exemption through EMS (which standards?)	
EU ETS & ISO certified enterprises are exempt	Yes, if energy management is ISO50001 certified.	
Audit scope and boundaries		
Only energy directly consumed by the enterprise, within national borders. Temporary, leased or third-party facilities and vehicles are excluded.		
Process and reporting		
Applicable standards	National guidance, templates	Possible simplifications
DIN EN 16247	Yes, RVO guidelines	multi-site audits allowing a clustering by typology and sample assessments
Quality and compliance		
Relevant Authority	Data collection method	Data collection frequency
Netherlands Enterprise Agency (RVO)	Mandatory submission of audit reports	yearly
Quality control		Fines (please indicate maximum amount)
All submitted audit reports are controlled		Yes, depends on the offence
Existence of a national evaluation of the audit policy framework (please link if available)		
No		
Auditors		
Accreditation / requirements	National registry / Database	Trade organisations
No, unregulated	RVO contact list	
Quality control		Fines (please indicate maximum amount)
Indirectly: RVO controls all audit reports		Yes, depends on the offence
Obligation to implement energy saving measures (ESM)		
If yes, since? / If no, planned for?	Name of relevant policies	Implementation time window
2019	Energiebesparingsplicht	4 years
Target group	ESM selection criteria	
Enterprises above 10 GWh/a	All ESM with ROI > 0 within 5 years	
ESM implementation control	Fines (please indicate maximum amount)	
No, self-control	Yes, depends on the offence	

POLAND – ENERGY AUDIT POLICY⁶⁹

Audit obligation		
If yes, since? / If no, planned for?	Name of relevant policies	Mandatory audit frequency
2016	Energy Efficiency Act 2016	4 years
Target group	Number of obligated enterprises (in 2019)	
Non-SMEs	Approx. 3600	
Exempted sectors of activity	Exemption through EMS (which standards?)	
None	Yes, if energy management in accordance with national standard or EMAS certified	
Audit scope and boundaries		
N/A		
Process and reporting		
Applicable standards	National guidance, templates	Possible simplifications
DIN EN 16247	No	No
Quality and compliance		
Relevant Authority	Data collection method	Data collection frequency
Energy Regulator Agency (Urząd Regulacji Energetyki)	N/A	N/A
Quality control	Fines (please indicate maximum amount)	
N/A	Yes, up to 5% of annual turnover	
Existence of a national evaluation of the audit policy framework (please link if available)		
No		
Auditors		
Accreditation / requirements	National registry / Database	Trade organisations
No	No	No
Quality control	Fines (please indicate maximum amount)	
No	No	
Obligation to implement energy saving measures (ESM)		
If yes, since? / If no, planned for?	Name of relevant policies	Implementation time window
No, not planned		
Target group	ESM selection criteria	
ESM implementation control	Fines (please indicate maximum amount)	

⁶⁹ Information provided by the Polish National Energy Conservation Agency (KAPE) in April 2023.

SPAIN – ENERGY AUDIT POLICY

Audit obligation		
If yes, since? / If no, planned for?	Name of relevant policies	Mandatory audit frequency
2019	Real Decreto 56/2016, Real Decreto 390/2021	4 years
Target group		Number of obligated enterprises (in 2019)
Non-SMEs		N/A
Exempted sectors of activity		Exemption through EMS (which standards?)
None		Yes, if energy management is ISO50001 certified.
Audit scope and boundaries		
Energy directly consumed by the enterprise, within national borders. Regional differences may occur.		
Process and reporting		
Applicable standards	National guidance, templates	Possible simplifications
DIN EN 16247	Yes, Real Decreto 390/2021 Annex I	No, audit or ESM must cover at least 85% of energy consumption
Quality and compliance		
Relevant Authority	Data collection method	Data collection frequency
Regional governments	Submission to regional government	Yearly
Quality control		Fines (please indicate maximum amount)
Controls depend on regional governments		Yes, up to 60,000 EUR
Existence of a national evaluation of the audit policy framework (please link if available)		
Upcoming in 2023		
Auditors		
Accreditation / requirements	National registry / Database	Trade organisations
Yes, according to RD 56/2016	No, regional registries may exist	AMI/ANESE
Quality control		Fines (please indicate maximum amount)
No		No
Obligation to implement energy saving measures (ESM)		
If yes, since? / If no, planned for?	Name of relevant policies	Implementation time window
Target group		ESM selection criteria
ESM implementation control		Fines (please indicate maximum amount)