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Energy & Environment

Development of recommendations on the implementation of certain aspects of Article 8 and Annex VI of the Energy Efficiency Directive

Final Report for DG ENERGY
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The logo graphic for DNV-GL features three horizontal bars: a light blue bar on top, a green bar in the middle, and a dark blue bar at the bottom.

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Executive summary

This document is the final report for the DG Energy study 'Preparation of common guidelines and recommendations to improve the consistency of the implementation of certain aspects of Article 8 and Annex VI of the Energy Efficiency Directive'.

Article 8 places an obligation on Member States to promote the availability to final customers of high quality cost effective energy audits and includes the requirement that such audits for enterprises that are not SMEs be carried out every four years (within Article 8(4)). Annex VI contains minimum criteria for these energy audits. Since the introduction of these requirements, and the first round of mandatory audits concluding in December 2015, some Member States have been seeking further guidance on how they should be applied. The European Commission has also been keen to ensure consistency in the interpretation and application of the requirements.

Consequently, this study was commissioned to develop improved guidelines for Article 8 implementation. A scoping paper for these guidelines had previously been prepared by DG Energy, and discussed with National Authorities (NAs). This final project report builds upon that work and brings together information and evidence gathered from stakeholders concerning the guidelines. The main outputs of this work are the Guidelines presented in Annex 1.

The guidelines are framed in support of the current legal requirements of the Article 8 and they focus on supporting cost-effective, proportionate and representative audits. In particular, the project has developed guidelines regarding the options for and selection of de minimis, clustering and sampling methods.

Information/data collection and engagement with National Authorities, auditors and companies in scope, has been aimed at understanding actual audit experience in relation to interpretation and implementation of Article 8 (and Annex VI) of the Energy Efficiency Directive. Engagement with the National Authorities has been directed through DG Energy to ensure that all requests for information have been appropriate and aligned to existing interactions, particularly the NA Committee. Information has been gathered from auditors and companies through interviews and supplemented by survey data. Interviews have also been conducted with some National Authorities to further understand the underlying methodologies and evidence used to establish their interpretation and implementation of Article 8 requirements, in particular regarding the selection of de minimis, clustering and sampling methods.

This project builds on previous work undertaken in 2014 (commissioned by DG Energy) which assessed the policy measures and methodologies put in place by those Member States which had transposed the requirements of Article 8 into national law by 5 June 2014. Chapter 2 of this report provides an update on implementation practices and experience within different MS up to early 2018. This has been generated from a review of public literature and other information sources to give an assessment of the current approach and status of Article 8 implementation in each Member State.

Stakeholders feedback is summarised in Chapter 3 and Chapter 4 introduce the process and logic of the guidelines development.

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1. Introduction

This document is the final report for the DG Energy study 'Preparation of common guidelines and recommendations to improve the consistency of the implementation of certain aspects of Article 8 and Annex VI of the Energy Efficiency Directive'.

1.1 Project Background

Article 8 places an obligation on Member States to promote the availability to final customers of high quality cost effective energy audits and includes the requirement that such audits for enterprises that are not SMEs be carried out every four years (within Article 8(4)). Annex VI contains minimum criteria for these energy audits. Since the introduction of these requirements, and the first round of mandatory audits concluding in December 2015, some Member States have been seeking further guidance on how they should be applied. The European Commission has also been keen to ensure consistency in the interpretation and application of the requirements.

Consequently, this study was commissioned to develop improved guidelines for Article 8 implementation. A scoping paper for these guidelines had previously been prepared by DG Energy, and discussed with National Authorities (NAs). This final project report builds upon that work and brings together information and evidence gathered from stakeholders concerning the guidelines. It is provided for discussion with NAs in the context of the wider dialogue on the future assessment and review of the scope of application of Article 8(4).

1.2 Project purpose and scope

The purpose of this project has been to develop guidelines focussed on points raised by the National Authority Committee, in particular, to support cost-effective, proportionate and representative audits. The guidelines which have resulted and are included in this report do not cover other areas, such as energy auditor qualifications, timelines for implementation or transport (as standalone topics).

The areas that the National Authorities stated they wished to see in the guidelines included:

1. A positive definition for large enterprises.
2. Audit methodologies, including sampling and clustering approaches.
3. Options for using a de minimis threshold.
4. The idea of setting a threshold, to help identify those sites where it would be economically viable to undertake audits.
5. Approach to leased assets: How to deal with situations where an enterprise consumes energy at a site, but does not have final responsibility for a building e.g. rented offices etc.
6. Interactions between energy audits and energy performance certification for buildings.

The guidelines which are included in Annex I are framed in support of the current legal requirements of the Article 8 and this constrained the extent to which the various areas above could be considered. Therefore the guidelines mainly focus on providing recommendations in relation to the aspects which relate to improving audits cost-effectiveness.

Development of the guidelines needed to progress within a timeframe compatible to facilitate early feedback from National Authorities but also needed to be underpinned by an evidence base. The core tasks of the project have therefore been to:

- Draft practical guidelines, drawing on existing information collated through a literature review for consultation with the National Authorities and to stimulate their provision of data from the first Article 8 compliance cycle and evidence supporting the implementation methodologies they have developed.
- Gather data and information from companies and auditors through interviews regarding energy audits and their associated costs and benefits.
- Analyse the evidence provided by National Authorities and data provided by companies and auditors to develop understanding of the factors affecting cost-effectiveness, representativeness

and proportionality and enable the provision of advice on the selection of suitable de minimis, clustering and sampling criteria.

2. Review of EED Article 8 implementation

This review covers a number of topics which include cost-benefit of audits, de minimis, clustering, sampling, and the treatment of leased assets. It also summarises the present status¹ across all Member States with respect to the provision and implementation of a de minimis and sampling approaches.

2.1 Cost-effectiveness of audits

2.1.1 General aspects and literature review

The requirements in Annex VI of the Energy Efficiency Directive (EED) set out that energy audits must be proportionate and sufficiently representative, without giving the detail on what this means in practice. In response, several Member States have included in their national legislation a “de minimis” energy consumption that must be covered by audits, as well as clustering/sampling approaches, small site thresholds and other cost-benefit measures.

“Energy audits need to be proportionate and sufficiently representative to permit the drawing of a reliable picture of overall energy performance and the reliable identification of the most significant opportunities for improvement.” (Annex VI, EED)

It should be noted that if the cost-effectiveness of energy audits becomes the primary driver of the process, it could have inter alia a negative impact on audit quality. The requirement for Member States to develop transparent and non-discriminatory national minimum criteria based on Annex VI should prevail over the requirement to ensure that energy audits are solely cost-effective, so as to facilitate high quality energy audit processes and outcomes. Member States should seek to strike a balance between the cost-effectiveness of energy audits and their quality. Various options to make energy audits cost-effective for all final customers are described below.

A report on the implementation of national minimum criteria for energy audits in line with Annex VI of the EED, which formed part of a study for the European Commission (Ricardo/DNV GL/Fraunhofer, 2015) provides insight and recommendations in relation to the cost-effectiveness of energy audits in large enterprises. These include:

- Exploring synergies between the transposition and implementation of Article 8 of the EED and existing national legal provisions, such as for the transposition and implementation of the ESD and/or the EPBD.
- Independent national supervisory authorities.
- Permitting and defining, within the national minimum criteria, acceptable energy audit sampling levels for final customers with multiple assets and/or activities. By reducing the number of audits that are required to be carried out, cost-effectiveness will be improved.
- Sampling and clustering approaches for final customers with multiple assets and/or activities with outstanding similarities in their energy profiles. By reducing the number of audits that must be carried out, cost-effectiveness would be improved. This option is of particular interest for companies with several sites within a country or also in different Member States.

In addition, a further report—which also formed part of the above study for the European Commission (Ricardo/DNV GL/Fraunhofer, 2016a)—on the fulfilment of audit obligations upon large enterprises, the encouragement of SMEs and good practice provides the following insight:

- Certain sectors (such as the food and drink industry) are highly price-sensitive and this may influence the price of energy auditing services provided. Other sectors (such as the chemical industry) are more concerned about quality and process safety, and therefore may value a more comprehensive (i.e. more detailed and hence more expensive) set of energy audit services.

¹ The review was completed in October 2017

- Large energy audit service providers often need to recover relatively large overhead costs, resulting in higher billing rates, whereas smaller companies or independent energy auditors can offer similar services at a lower cost.
- Across MS, other aspects – such as tax laws, the general cost of living, energy costs, reporting requirements, auditor qualifications, etc. will also vary. For example, an energy audit in Germany, the UK or the Benelux is expected to cost more than an audit in Eastern Europe MS. Similarly, when the organisation requesting energy audits is a multinational company, the costs of providing energy audits across borders may be higher than for single-country organisations, although for multinational companies there may be economies of scale from taking a coordinated approach to audits rather than a bespoke approach for each country in which it operates.

2.1.2 Member States' approaches

Without being a complete review, this paragraph includes a collection of national measures which could make energy audits more effective and lower their costs, building on the specific implementation measures in place in some countries.

Most Member States have introduced measures which indirectly aim at transposing the cost-benefit requirement of the EED's Article 8 into concrete national legislation. Among those that have, in Belgium (Wallonia) if the energy audit cost together with the investment cost of all measures (with a maximum payback period of five years) is equal to or higher than the savings from these measures for five years, a company is exempt from the next audit obligation (Moniteur Belge, 2016) and it would only be obliged to carry out a new energy audit within eight years (UWE, 2016). By way of another example, for the first Article 8 audit compliance period (by 5 December 2015) all large enterprises in Portugal have needed to carry out the mandatory audit. But if they can prove it to be non-profitable, they can wait eight years to carry out the next audit.

Interestingly, a study in Denmark has indicated that larger companies and companies with low energy consumption have the most difficulty balance with respect to the cost-benefit of audits (Danish Energy Agency, 2017). An analysis of Danish energy audits shows that on average the cost of the energy audit is almost equal to the potential first year savings for a company with an annual energy consumption of less than 2 GWh, while for a company with an annual energy consumption between 5-10 GWh the cost is only 20% of the savings. At the same time, the most energy consuming companies (>20 GWh annual consumption) also show elevated relative costs (60%) compared to the potential first year savings. The study points out that this phenomenon can be due to complex energy structures, challenging businesses and the already existing focus on energy saving projects which results in more complex remaining energy saving measures compared to the available low-hanging fruit in lower energy consuming companies.

The cost-effectiveness of the energy audit process can be enhanced with **qualified/accredited auditors**, because the audit outcomes should be higher quality and the audit process more standardised and streamlined. However, such practice is not in place in all Member States such as, e.g. the Netherlands where no auditor accreditation is required. However, in setting accreditation requirements for their expert auditors, some Member States (in, e.g. Belgium (Wallonia)) have demonstrated good practice by defining **separate scopes of accreditation applicable** to different audit types – including for buildings, industrial processes/facilities and transport. As such, energy auditors in Belgium (Wallonia) must be accredited against the appropriate scope for the audit type that they are undertaking. Somewhat in line with the above, Ireland has created a competence assessment template to assist enterprises in selecting suitable auditors. A registered energy auditor in Ireland has been required to complete this template and then share it as needed with a prospective client. This approach aims to help enterprises choose the right auditor and at the same time help auditors to sell their expert services in a more effective way (Ricardo/DNV GL/Fraunhofer, 2015).

Another element which can make audit more cost-effective are guidelines to assist companies and professionals and, to a lesser extent, reporting templates. While some Member States assist companies by publishing detailed guidelines on the audit requirements (e.g. Ireland, Germany, Belgium (Brussels), Czech Republic), other Member States such as Wallonia provide **tools** to check the size of the company (i.e. non-SME or SME) or **publish a list of companies** that fall under the audit obligation, which reduces the time spent for a company in determining its compliance requirement and the chance of it being subjected to subsequent penalties (e.g. Hungary, Estonia). The Sustainable Energy Authority of Ireland (SEAI) has developed an **Energy Audit Handbook** as a comprehensive best practice

manual to support business & industry². Furthermore, Italy is developing specific guidelines for energy audits in collaboration with stakeholders, ESCOs, sector associations, etc. (ENEA, 2017). These guidelines cover (as of June 2017) the following sectors: plastic, rubber, iron metallurgy, glass, supermarkets, metallurgy, ceramic, paper and private healthcare. The following sectors are under development: transport, food industry, banks and telecommunications.

RVO in the Netherlands has developed an energy **audit report template**, requiring information (amongst others) on the current energy situation (buildings, facilities, processes, transport and organisation), procurement of energy, factors influencing the energy consumption, energy consumption, and defined energy saving measures. This template indicates which information is mandatory and which is optional, and makes a distinction between reports for licensed establishments and for enterprises containing several licensed establishments: enterprises need to submit a summary report for their different establishments, whereas establishments need to submit more detailed reports (RVO, 2016b). Using this template will ensure meeting the audit requirements, but it is not mandatory. Other Member States have also developed a **template to communicate compliance** to their National Authorities (e.g. Spain, Slovakia) which could overall reduce audits costs by making the requirements clearer and simpler.

In the UK, different energy streams can be audited at different times so the **workload can be spread better** to suit business needs. Audits for the second compliance period can hence be done between December 2014 and December 2019 to optimise costs (ESOS Newsletter, 2017).

Voluntary agreements with national or regional authorities related to energy efficiency exist in several countries, and it has been observed that in some cases they could help reducing the overall cost effectiveness of audit activities (e.g. in Belgium (Wallonia), Finland, Ireland, Netherlands, UK). Often voluntary agreements in fact offer companies financial benefits (e.g. tax exemptions, lower energy fees) on one hand and on the other hand, give governments the opportunity to oblige companies to execute cost-effective measures identified in an energy audit in order to achieve a certain increase in energy efficiency in a certain period³.

The cost effectiveness of energy audits would be reduced if the enterprises were not to implement identified savings because of financial constraints. Financial support is therefore a complementary measure which could make energy audits more effective in realizing energy efficiency investments. For instance, in Belgium, Flanders region has in place the “‘imitatieve technologieënlijst’ instrument, with subsidies of up to 12.5% in 2014 and the Brussels region has foreseen under the ‘Premie A1’ program subsidies of up to 50%. In France the white certificate scheme foresees specific financial support while in Malta this was granted through ERDF and in Spain thanks to the national programme for Energy efficiency.

In Estonia a financial support scheme exists to help overcome the barriers to carrying out audits that some companies face. By providing audit cost support the cost effective benefits arising from the audits could be realised. The box below provides more details.

Box 2.12.2. Estonia financial support scheme.

The Ministry of the Environment in Estonia runs a financial support scheme called Corporate Energy and Resource Efficiency in the context of the Multiannual Financial Framework 2014-2020 (Ettevõtete ressursitõhususe meede).

The total amount of available budget is €220.7 million, of which €110.35 million was made available by the EU. This funding is used to raise awareness, train professionals, conduct resource utilisation analyses and do energy audits in SME's and the processing industry. A company participating in this programme and following the requirements of the programme receives financial support up to €7,500 or 50% of eligible costs. The support for non-SME's is smaller than for SME's. A company that is part of one of the five specified priority sectors (NACE B, C10 or C11, C16, C17 and C23)

² The SEA handbook can be used by both auditors and organisations of all sizes having audits undertaken or as a guide to identifying opportunities for improved energy efficiency (NEEAP Ireland, 2017)

³ It should be noted that a more detailed evaluation of these practices in some Member States (e.g. Denmark) are being investigated by the National Authorities on whether there is any conflict with State Aid rules.

may receive financial support for implementing the improvement actions up to 50% of eligible cost or €2 million (Ettevõtete ressursitõhususe meede, 2017). Non-SME's receive a smaller financial aid than SME's who participate in the scheme. The energy efficiency measures identified in the energy audit need to be implemented. The audit requirements follow Annex VI of the EU EED (Requirements for resource audits, Annex to Regulation No. 17 of the Minister of the Environment, Estonia 2017).

Besides direct financial support to implement audit recommendations, favourable financial conditions for company invest can be considered as framework conditions positively addressing cost-effectiveness. According to the Income Tax Act from 2000 in Estonia, companies can be **exempted from corporate income tax for profit that is reinvested within the company**. That means only distributed profit (e.g. to owners) is subject to taxation, but not reinvested profit. This generally creates favourable conditions for investments in new and energy efficient technologies (Ricardo/DNV GL/Fraunhofer, 2016). In Austria, there are a number of regional programmes with different types of funding. The Austrian Energy Agency has published detailed guidelines which cover the different regional programmes and its framework conditions for applicants (Ricardo/DNV GL/Fraunhofer, 2016).

Two other factors that have been indirectly affecting audits' effectiveness are the involvement of internal auditors and the presence of an energy monitoring process within the company. A study by the National Energy Efficiency Monitoring Agency in Austria has shown that energy saving measures identified by internal auditors were 20% more likely to be implemented as compared to measures identified by external auditors (National Energy Efficiency Monitoring Agency, 2017).

In Germany, a comparative study has evaluated the level of implementation of recommendations from energy audits with an energy management system ISO 50001⁴. At first sight more recommendations from energy audits were implemented than in companies with a certified energy management system (BMW, 2017). In France, support is provided to implement ISO 50001 via a programme called Pro-SME, where the support, from EDF Energy, covers 20% of the companies' energy consumption in the preceding year (limited to €40,000 excluding VAT). An evaluation of EED and the implementation of Article 8 in France has suggested that there is a great tendency to apply technical energy saving measures instead of management or Measurement and Verification (M&V). Organisations have favoured isolated actions rather than a global energy management approach, which lowers profit. In addition, there is a shortage of know-how on the added value of the monitoring of the actions results supported by a M&V plan. However, to move from an objective of means (energy audit, actions on equipment, etc.) to an objective of results (improvement of energy performance), a jump is needed that only M&V and/or energy management system implementation can help to achieve (AFNOR, 2017).

2.2 Clustering

2.2.1 General (nature of issue)

Clustering (and sampling, see next section) are most effective in combination and not as standalone approaches. Clustering, or grouping, of similar activity types together is generally seen as a precursor to sampling. It can provide a cost-effective approach towards identifying energy saving measures from each type of activity for large enterprises that undertake a diverse range of activities either on multiple sites or on the same site. This is due to similar activities having similar energy use characteristics (e.g. using energy in similar ways or in similar technologies), and therefore an audit of part of the cluster may enable the identification of energy efficiencies with multiple applications across the wider group. It should be noted that some enterprises may have activities that cannot be clustered as they are unique in character.

2.2.2 Member States' approaches

Most Member States allow a clustering approach under their rules for excluding energy from audits or reporting, or both. France, however, is a special case since a group is not defined on partner and linked

⁴ The EED has led to an increased use of ISO 50001 since companies with an ISO 50001 certificate are under certain conditions exempted from the energy audit obligation under EED Article 8. The energy management system requires regular energy reviews and continual energy performance improvement. Some Member States actively support the implementation of ISO 50001 (e.g. Germany, France and Sweden).

enterprises definition but on a national statistical code (i.e. SIREN)⁵. The non-SME threshold is evaluated at SIREN level, which comprises a group of sites with different SIRET numbers (e.g. all Carrefour stores have different SIRET numbers but are part of one group with the same SIREN number).

In Bulgaria, sites need to be 100% identical before a clustering approach can be considered. In other Member States, the ‘de minimis’ can be applied on group basis and therefore follow the clustering approach, but each legal entity will still need to report individually on its compliance (e.g. Hungary). In other words, the clustering approach is not applicable overall for compliance. In Croatia, reporting can also be done on group level, but each legal entity still needs to show its compliance by indicating which identified energy saving measures from the group report apply to which company (CEI, 2016). In Denmark, an SME can be excluded from the group audit scope by applying the clustered de minimis (i.e. an SME representing less than 10% of the Danish annual energy consumption).

In Italy, clustering is done based on yearly energy consumption expressed in Toe (Tons of oil equivalent) and it is used to determine the sampling approach. The energy thresholds used for clustering in Italy’s industrial and tertiary sectors are shown below in Figure 2.1, in the left-hand and right-hand figures respectively.

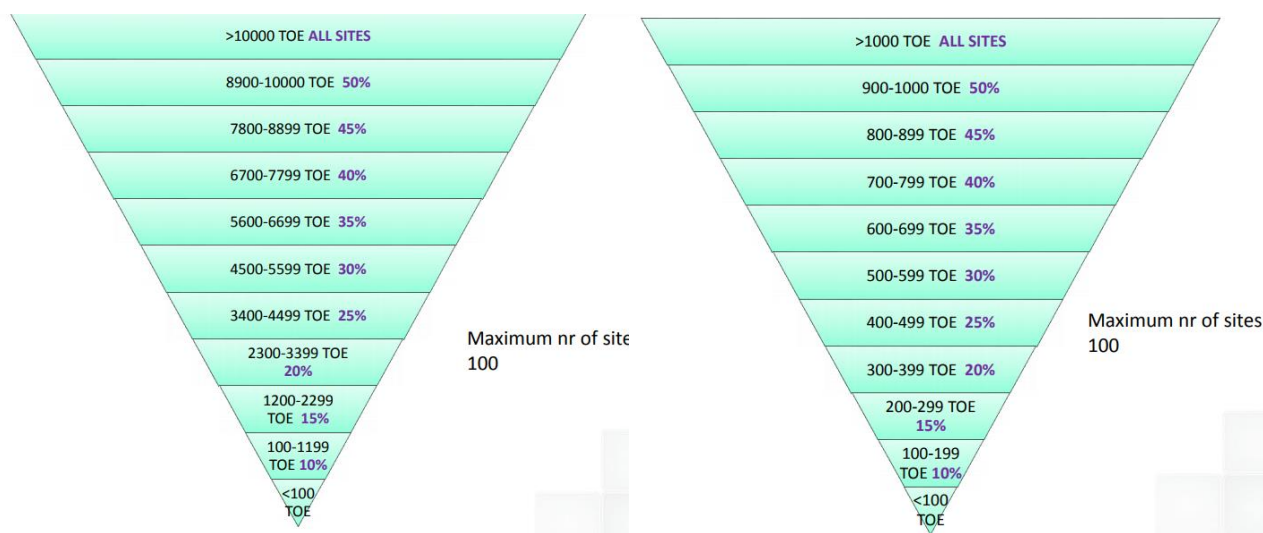


Figure 2.1. Energy thresholds used for clustering in Italy’s industrial (left-hand figure) and tertiary (right-hand figure) sectors (ENEA, 2017).

In Malta, companies can take a clustering approach for the energy audit, if the companies being grouped have the same board of directors and management. If not, the clustering approach is not allowed and the legal entities need to show compliance individually (Maltese Ministry for Energy and Health, 2015).

2.3 Sampling

2.3.1 General (nature of issue)

Enterprises may have several identical or largely similar assets or undertake similar operations in differing geographical locations. Member States may therefore wish to consider putting in place guidelines regarding how sampling assets or operations as part of an energy audit, or number of audits, can be used to ensure that the energy audit(s) are representative of the overall energy performance of the enterprise through the extrapolation of the audit findings and recommendations.

⁵ <https://www.insee.fr/en/metadonnees/definition/c2047>

Using sampling, an energy audit may include a statistically significant and representative number of detailed audits of the sampled assets/operations (including or excluding a visit to the asset) and a high-level overview of all the assets or the full scope of the operation. Determining if a sample size is statistically significant for a given population will depend on the desired confidence level and the tolerable margin of error. In line with Article 8(1) paragraph 2, if Member States deem it appropriate to select a sample of energy audits undertaken by in-house experts or energy auditors for quality review, the selection should be random. (Ricardo/DNV GL/Fraunhofer, 2015)

2.3.2 Member States' approaches

In some MS, such as Denmark and Croatia, sampling is allowed but specific guidelines are missing: it is up to the auditor to decide on a representative and proportional sample. In other Member States, sampling is not officially allowed but can be accepted and will be formalised in the coming periods (e.g. Estonia). In other Member States, like Czech Republic, sampling is not allowed.

A sampling or multi-site approach is mostly allowed, if the audit is proportionate and representative (see Figure 2.2 for a summary of Member States' sampling approaches). It is at the discretion of the qualified auditor to decide which locations must be considered to ensure this representativeness and proportionality. The same applies to the clustering of companies. The process of selecting locations within sampling must be documented and justified (as also for clustering). In Belgium (Wallonia) the sampling approach requires that the specific energy consumption of similar sites or buildings does not differ more than 20% of the representative site or building and that similar activities are carried out. Other Member States like Finland specify that the audit should, where reasonable, include items of different types (building, process, etc.), but the emphasis should be on those items with the highest energy consumption (Energiatehokkuuslaki, 2014). In Germany, different sites need to be selected when after four years a new audit needs to be carried out (BAFA, 2015). In Italy, the methodology states that all sites with an energy consumption higher than 10,000 toe (for the industrial sector) or 1,000 toe (for the tertiary sector) do need to be audited for 100% in the sampling (Ministero dello Sviluppo Economico, 2015). In Romania, although sites consuming more than 1,000 toe need to be audited individually, similar sites than consume less can follow a sampling approach which needs to be approved by ANRE on a case-by-case basis (ANRE, 2015).

The Netherlands has a different approach. A sampling approach for both buildings and processes is allowed for uniform sites (such as retail chains, supermarkets, fast-food chains, etc.) that are not big energy consumers⁶: three sites from the group of small energy consumers and three sites from the group of medium energy consumers need to be audited; the low-energy consumers need to be audited in less detail⁷ than the medium-energy consumers; and the sample within each group needs to include a leading, average and lagging site with regards to energy efficiency⁸ (RVO, 2016b).

Other Member States have published a detailed sampling methodology or specific case studies to show best practices concerning sampling. These are typically not mandatory but provide guidelines around appropriate approaches to sampling.

Box 2.3. Italy sampling methodology (Ministero dello Sviluppo Economico, 2015).

In Italy, all sites belonging to a single company or group of companies must calculate the annual energy consumption of each site (including any means of transport if the enterprise is a shipping company) and convert this consumption to toe. Residential real estate assets belonging to the enterprise are excluded. If the enterprise is a transport company, it must be considered as a virtual site and has to carry out the energy audit according to EN 16247-4. Transport is defined as any movement of people or goods from point A to point B. The transport nodes (stations, ports, freight, etc.) should be treated as systems and therefore the audit must follow EN 16247-3. A detailed description of the audit approach for transport is provided in Annex II of the Clarification and

⁶ Energy consumers in the Netherlands are categorised as (i) small when annually consuming < 50,000 kWh and < 25,000 m³ natural gas (or equivalent), (ii) medium when annually consuming 50,000-200,000 kWh or 25,000-75,000 m³ natural gas, and (iii) big when consuming ≥ 200,000 kWh or ≥ 75,000 m³ natural gas (Infomil, 2016).

⁷ A high-level split of energy consumption is sufficient: lighting, ventilation, heating, other high-energy consumers, and other. Energy saving measures need to be identified, but an LCA is not needed.

⁸ The energy performance of a site can for example be evaluated by comparing the energy consumption per m².

Guidelines provided by the Ministry of Economic Development (Ministero dello Sviluppo Economico, 2015). The remaining sites, with consumption of less than 100 toe, if the number of sampled sites is less than 100, will be arranged into two additional groups: the first with energy consumption ranging from 1 to 50 toe, the other one from 51 to 99 toe and whose sampling rate will be 1% and 3% respectively (ENEA, 2017).

An energy audit needs to be carried out for all sites with an energy consumption exceeding 10,000 toe for the industrial sector and exceeding 1,000 toe for the service sector (these are the same thresholds for which a company is obliged to appoint an energy manager). Moreover, the enterprise needs to sort all sites in order of increasing consumption. The first m sites with lower energy consumption can be excluded from the audit, if the consumption at these sites individually does not exceed 100 toe, and the consumption at these sites collectively does not exceed 20% of the total energy consumption of the enterprise. The remaining sites need to be included in the audit, which can be done for each site separately or by clustering them by process, type, etc.

For the clustering approach, sites must be categorised according to different types of processes, products or services, and again sorted in order of increasing consumption. The end to higher consumption sites need to be represented by 50%, subsequent bands need to be represented by a percentage decreasing gradually by 5%, and the lower end consumption sites need to be represented by 10%. The sample can have a maximum of 100 sites, with at least one site for each type and band.

This methodology includes energy consumption of year “ $n-1$ ” at the different sites. If the enterprise does not have the energy data for this year, because the site did not exist or was owned by another company, the site can be excluded from the audit and does not contribute to the calculation of the total energy consumption of the enterprise.

MS	Sampling?	Specific guidance?
Belgium (Wallonia)	Yes	energy consumption = +/-20% of representative facility's consumption
Bulgaria	Yes	only if 100% identical sites/facilities proven
Finland	Yes	detailed definitions for sampling basis provided
France	Yes	definition based on SIREN number
Germany	Yes	detailed definitions for sampling basis provided
Ireland	Yes	to cover 70% of company's total energy consumption
Italy	Yes	annual consumption limits defined
Netherlands	Yes	detailed definitions on entity size/ consumption limit
Slovenia	Yes	at least 50% of consumption to be covered
Austria	Yes	
Croatia	Yes	
Cyprus	Yes	
Denmark	Yes	
Estonia	Yes	
Greece	Yes	
Hungary	Yes	
Latvia	Yes	
Luxembourg	Yes	
Malta	Yes	
Poland	Yes	
Romania	Yes	
Spain	Yes	
Sweden	Yes	
UK	Yes	
Belgium (Flanders)	No	
Belgium (Brussels)	No	
Czech Republic	No	
Lithuania	No	
Portugal	No	
Slovakia	No	

Figure 2.2. Overview of current sampling provisions/ approaches in MS.

The underlying detail in Figure 2.2 shows the degree of variation between Member States in their approaches, whereby for:

- Belgium (Wallonia): sampling approach can be applied if energy consumption of a facility is within +/-20% of a representative facility's consumption and if similar activities are carried out.
- Bulgaria: sampling approach cannot be applied unless 100% identical sites/facilities can be proven.
- Finland: definition of a sampling basis for multi-site companies is provided for, whereby: when a company has up to 15 sites/buildings, 1 site audit must be completed; for 16-100 sites/buildings, 10% of sites must be audited; for 101-400 sites/buildings, the square root of the target sites must be audited; for over 400 sites/buildings, 5% of total sites must be audited. The sites selected for audit should be those with the largest consumption and greatest potential energy savings. Sites that have under EUR 15,000 of annual energy costs with under 500m² of floor space do not have to be taken into consideration when determining the number of audits required.
- France: all sites with the same SIREN code can follow clustering approach. A sampling approach can be applied to similar sites. The sample size should be the square root (rounded to the nearest whole number) of the total number of sites of a given type, and at least 25% of the sample needs to be selected randomly. Industrial processes are not allowed to use a sampling approach.
- Germany: sampling approach can be applied to similar sites. A representative sample size is defined as the square root of the sum of all sites of each cluster (group of sites with similar processes), rounded up to the nearest whole number. Different sites must be selected in each

compliance cycle. The selected sites must also represent the potential differences between sites. Enterprises operating in different locations that use inter-linked processes (e.g. production of electronic components on site A and assembly of those components on site B) can also use the multi-site approach if at least one of each different process is covered in the sampling approach. The multi-site approach can also be applied to vehicles, and to delivery points with low energy consumption and no employees (e.g. street lights, pumping stations, etc.). In that case, the number of samples may be lower from the above mentioned square root formula if sufficiently representative vehicles or delivery points are selected.

- Ireland: while sampling approach can be applied to similar sites there are no specific guidelines and the auditor should confirm a representative sample. However, to be representative the sampling approach must cover 70% of a company's total energy consumption to be compliant.
- Italy: sampling approach can be applied to similar sites. However, all sites with an annual consumption above 10,000 toe (in the industrial sector) and 1,000 toe (in the service sector) must be audited, regardless of any similarity between them. Smaller sites may be covered with a sampling approach.
- Netherlands: sampling approach can be applied. However: large consumers (entities with energy consumption of >75,000 m³ of natural gas/year or >200,000 kWh electricity/year) must complete full energy audits; whereas, medium consumers (consuming between 25,000-75,000 m³ natural gas/year and 50,000-200,000 kWh electricity/year) must complete 3 full audits; and, low consumers (with a natural gas consumption of <25,000 m³/year and a power consumption of <50,000 kWh/year) must complete a sample of 3 simplified audits. A sampling approach for both buildings and processes is allowed for uniform sites (such as retail chains, supermarkets, fast-food chains, etc.) that are not big energy consumers⁹: three sites from the group of small energy consumers and three sites from the group of medium energy consumers must be audited; the low-energy consumers need to be audited in less detail than the medium-energy consumers; and the sample within each group needs to include a leading, average and lagging site with regards to energy efficiency.
- Slovenia: sampling approach can be applied to similar sites (but at least 50% needs to be covered).
- Malta: while sampling approach can be applied to similar sites, a statistically significant sample should be audited and the result reasonably extrapolated.
- Spain: while sampling approach can be applied to similar sites (under jurisdiction of the autonomous communities and autonomous) there are no specific guidelines and the auditor should confirm a representative sample.
- United Kingdom: large enterprises can undertake audits of a sample of their sites and do not need to audit every site/ activity/ facility. The sample must be representative of the business. Whilst 'representative' is not defined, a well-reasoned and documented justifications for the taken approach is required.
- Austria, Croatia, Cyprus, Denmark, Estonia, Greece, Hungary, Latvia, Luxembourg, Poland, Romania, Sweden: while a sampling approach can be applied to similar sites, there are no specific guidelines (the auditor should confirm a representative sample).
- Portugal: while sampling approach has not been provided for/ published officially, it is permitted in practice.
- Belgium (Flanders): multi-site companies must audit all sites.
- Belgium (Brussels), Czech Republic, Lithuania, Slovakia: a sampling approach cannot be applied.

⁹ Energy consumers in the Netherlands are categorised as (i) small when annually consuming < 50,000 kWh **and** < 25,000 m³ natural gas (or equivalent), (ii) medium when annually consuming 50,000-200,000 kWh **or** 25,000-75,000 m³ natural gas, and (iii) big when consuming ≥ 200,000 kWh **or** ≥ 75,000 m³ natural gas (Infomil, 2016).

2.4 De minimis

2.4.1 General (nature of issue)

The requirements in Annex VI of the EED mention that the energy audits need to be proportionate and sufficiently representative, without providing more detail on what this means in practice. To address this issue, several Member States have included in their national legislation a specific de minimis energy consumption that needs to be covered by the audits. This flexibility has helped ensure that the audit of large enterprises does not need to take into account for energy consumption that may be immaterial or difficult and costly to quantify/measure. It may also allow for the exclusion of certain operations where it is known that there is minimal opportunity to reduce energy consumption and costs (Ricardo/DNV GL/Fraunhofer, 2015). For all these reasons but depending on how it is designed, a de minimis approach can be considered as a useful mechanism to ensure cost-effectiveness of undertaken audits.

2.4.2 Member States' approaches

Most Member States accept that a certain part of the energy consumption can be excluded from the energy audit scope. However, several (Sweden, Estonia, Malta, Bulgaria, Hungary, etc.) do not specify what this percentage is, but indicate that it is up to the auditor to decide on a suitable percentage of the energy consumption to be audited. In Member States that do specify the de minimis, the percentage is seen to range between 50-90% with most having an 80% or 90% de minimis.

MS can also choose not to provide for any de minimis, setting a practice that requires all operations to be included in an audit. Whilst this option appears to maximise the potential to identify energy saving opportunities, it may be at the expense of creating a framework for cost-effective audits (Ricardo/DNV GL/Fraunhofer, 2015). In the Czech Republic, not even the smallest legal entity, process or building can be excluded from the audit scope (MPO, 2015).

Box 2.4. UK De Minimis guidelines (BEIS, 2017).

... can exclude up to 10% of your total energy consumption from any audit or alternative compliance measures. This 10% is your "de minimis energy consumption". This means you can exclude energy on:

- *a group basis – for example excluding the consumption of a one or more undertakings*
- *a site basis – for example excluding the consumption of a particular site or number of sites*
- *an asset/activity basis – for example excluding the consumption of an asset or activity, or a defined list of assets or activities*
- *a fuel basis – for example excluding consumption associated with the use of a particular fuel or fuels.*

You could also exclude energy using a combination of the above.

If you do not choose to identify your areas of significant energy consumption then you must audit your total energy consumption or cover it under another route to compliance.

Research by the authors of this report (during Q3 2017) provides an overview of the present status of de minimis provisions/ approaches in Member States to be set out, as shown in **Error! Reference source not found.** Where it should be noted that the underlying detail contains some variation between Member States in their approaches towards setting and specifying a de minimis, whereby for:

- Croatia¹⁰, Estonia, Hungary, Malta, Sweden and Luxemburg: the minimum percentage of energy consumption to be audited ('coverage') is not specified, but non-significant energy uses/energy uses without significant saving potential can be excluded based on findings of the auditor.

¹⁰ In Croatia, transport is only included if the company uses 50 or more registered vehicles or if the power of all registered vehicles owned by the company is greater than 3,000 kW (NEEAP Croatia, 2017).

- Finland: while the minimum coverage is not specified it is still ‘expected’ that companies audit 95% of their total energy consumption (a more detailed site audit need to cover at least 10% of consumption). France: the minimum coverage has been 65% of energy cost (not of energy consumption) in the first compliance cycle and 80% in the following cycles. France has in fact implemented a progressively more stringent de minimis. It should also be noted that the de minimis in France is presently based on energy cost and not on energy consumption.
- Ireland: minimum coverage is at least 70% of primary energy consumption (not of total energy consumption). The revision of the legislative requirements will bring it up to 85% from 2019.
- UK: the minimum coverage is at least 90% of total energy consumption, based on basis of group/ site/ activity/ fuel/ etc.
- Romania: the obligation is for 100% of the energy to be audited for energy intensive companies whose consumption is greater the 1,000 toe. Companies with lower consumption can elect to audit a lower level of total consumption (where while a minimum coverage is not specified it must be proportionate to the business and approved by ANRE). For non-SMEs, a minimum coverage of 50% has been suggested (but not yet approved) in draft legislation.
- Austria: the minimum coverage is not specified but all significant areas of energy consumption must be audited (and audits must be proportionate and representative). Any aspect (building/ processes/ transportation) exceeding 10% of total energy consumption must not be excluded and beyond this it is for the auditor to decide what is applicable (but in theory the minimum energy coverage is 100% per sector that consumes > 10%).

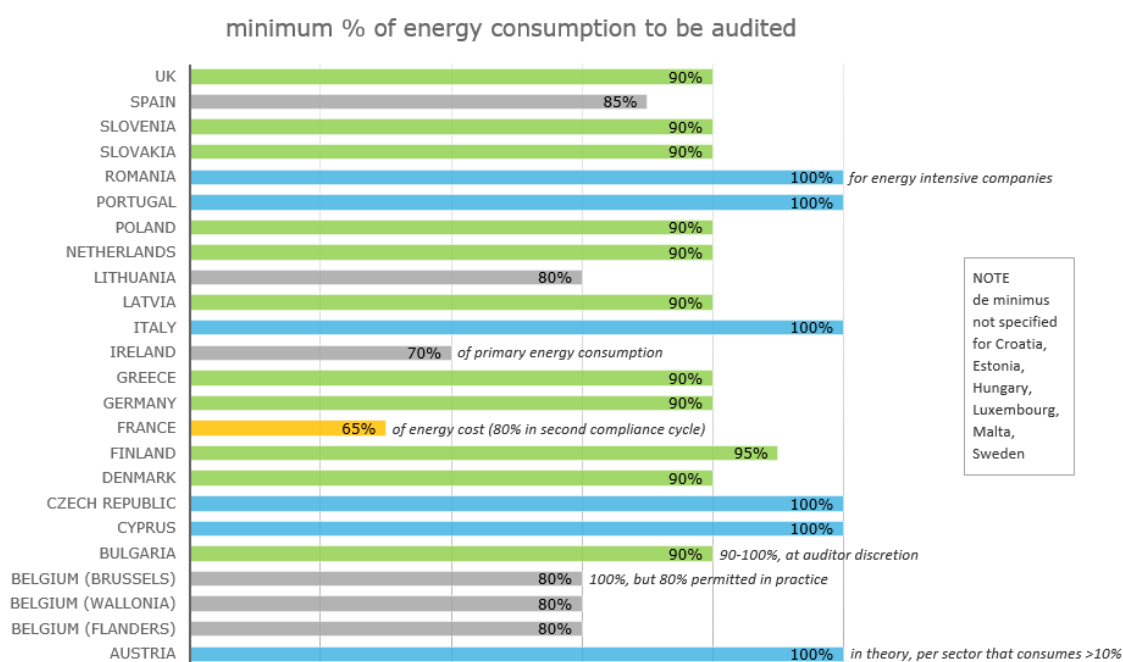


Figure 2.3. Overview of current de minimis provisions/ approaches in MS.

2.5 Definition of large enterprise

2.5.1 General (nature of issue)

To be considered as an SME, an organisation must first fall within the definition of an ‘enterprise’. An enterprise is “any entity engaged in an economic activity, irrespective of its legal form, including, in particular, self-employed persons and family businesses engaged in craft or other activities, and partnerships or associations regularly engaged in an economic activity” (European Commission, 2003). Any activity whereby goods or services are offered on a given market is an economic activity (European Commission, 2013).

The EU definition of an SME adopted by the European Commission - as it was published in the Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises (2003/361/EC), Annex, Title 1, Article 2 - states that: “*The category of micro, small and medium enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons AND which have an annual turnover not exceeding 50 million Euros AND/OR an annual balance sheet total not exceeding 43 million Euros*”.

The same EC Recommendation also states that: “The criterion of staff numbers (the ‘staff headcount criterion’) remains undoubtedly one of the most important, and must be observed as the main criterion; introducing a financial criterion is nonetheless a necessary adjunct to grasp the real scale and performance of an enterprise and its position compared to its competitors. However, it would not be desirable to use turnover as the sole financial criterion, because enterprises in the trade and distribution sector have by their nature higher turnover figures than those in the manufacturing sector. Thus, the turnover criterion should be combined with that of the balance sheet total, a criterion which reflects the overall wealth of a business, with the possibility of either of these two criteria being exceeded.” The number of employees is hence the main criterion to determine whether an enterprise is an SME. This headcount is accompanied by a financial criterion, either turnover or balance sheet total. An SME does not need to satisfy both financial criteria, whereas a large enterprise does (European Commission, 2013).

2.5.2 Member States’ approaches

Recent research by DNV GL and Ricardo (during Q3 2017) has shown that the specific definition of non-SMEs still contains some degree of variation between MS. This variation in interpretation of the definition, as set out below in Table 2.1 has resulted in some difficulty for industry organisations based within or across MS.

Table 2.1. Member States’ non-SME definition status

MS	Non-SME definition	Notes
Austria ¹¹	≥ 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	Only the figures for operations within Austria are relevant. Foreign subsidiaries and foreign parent companies are not counted in the calculation of number of employees, turnover and balance sheet total.
Belgium (Brussels)	≥ 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	The regulation specifically states that "enterprise" means any undertaking, regardless of its legal form.
Belgium (Flanders) ¹²	> 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	The above criteria apply to an establishment defined as such by its KBO number (i.e. company registration number).
Belgium (Wallonia)	≥ 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	Only entities engaged in economic activities and registered with Banque-carrefour des Entreprises are subject to the above energy efficiency regulation.
Bulgaria	≥ 250 employees OR > BGN 97.5 million (€50 million) annual turnover AND > BGN 84 million (€43 million) annual balance sheet	In addition to the requirement placed upon large enterprises using the above definition, the Bulgarian Energy Efficiency Act requires each industrial system that consumes more than 3,000 MWh of energy per annum to be subject to mandatory energy audits.
Croatia	At least two of the following criteria:	

	<p>≥ 250 employees</p> <p>> HRK 260 million (ca. €34 million) annual turnover,</p> <p>> HRK 130 million (ca. €17 million) annual balance sheet</p>	
Cyprus	<p>≥ 250 employees AND</p> <p>> €50 million annual turnover OR > €43 million annual balance sheet</p>	
Czech Republic	<p>≥ 250 employees OR</p> <p>> €50 million annual turnover AND > €43 million annual balance sheet</p>	Furthermore, companies not meeting the above criteria are mandated to carry out an energy audit if their total energy consumption exceeds 35,000 GJ/year (9,722 MWh)..
Denmark	<p>≥ 250 employees (globally) AND</p> <p>> €50 million annual turnover OR ≥ €43 million annual balance sheet</p>	Related enterprises in other countries (including outside the EU) need to be included when determining eligibility. Enterprises covered with a total energy consumption of less than 100,000 kWh/year are exempted from the obligation to carry out energy audits.
Estonia	<p>≥ 250 employees AND</p> <p>> €50 million annual turnover AND/OR > €43 million annual balance sheet</p>	
Finland	<p>≥ 250 employees OR</p> <p>> €50 million annual turnover AND > €43 million annual balance sheet</p>	The large company definition is applied to enterprises registered in Finland and Finnish subsidiaries of overseas enterprises. The regulations do not apply to any operations outside of Finland.
France ¹³	<p>≥ 250 employees OR</p> <p>> €50 million annual turnover AND > €43 million annual balance sheet</p>	Enterprises are defined as such by their SIREN number (French company registration number). Separately registered enterprises, even if related through a corporate group structure, need to consider the application of qualification criteria individually.
Germany ¹⁴	<p>≥ 250 employees OR</p> <p>> €50 million annual turnover AND > €43 million annual balance sheet</p>	Employees abroad should be included when determining eligibility (always as full-time equivalents); it is not stated whether the same applies to turnover and balance sheet figures.
Greece	<p>≥ 250 employees OR</p> <p>> €50 million annual turnover AND > €43 million balance sheet</p>	
Hungary	<p>≥ 250 employees OR</p> <p>> €50 million annual turnover AND > €43 million annual balance sheet</p>	The qualification criteria apply to companies registered in Hungary. While the companies within a group are individually obligated to carry out an audit, they can conduct it as a group. If a company meets the qualification criteria as a group, all companies registered in Hungary need to carry out an energy audit. Companies are only responsible for building energy audits where they take up at least 50% of the surface area and consume at least 50% of the energy of the building in question.
Ireland ¹⁵	<p>≥ 250 employees OR</p> <p>> €50 million annual</p>	Enterprises are identified as such by their registration number in Ireland. In other words, each registered company must be considered in isolation, regardless of its

	turnover AND > €43 million annual balance sheet	relationship to another company under a separate registration number. The audit requirement also applies to Public Service Organisations that meet the above thresholds.
Italy ¹⁶	≥ 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	Related enterprises in other countries DO NOT need to be included when determining eligibility. Public sector institutions are exempt from the obligation. Energy intensive manufacturing companies must also comply with the legislation regardless of whether they are considered a 'large enterprise' (these are those that are registered on the annual CCSE list). Energy intensive companies are those which consume at least 2.4 GWh and whose energy costs are over 3% of the turnover.
Latvia	≥ 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	
Lithuania	≥ 250 employees OR > €40 million annual turnover AND > €27 million annual balance sheet	For multi-national companies, only operations in Lithuania must comply with the requirements of the Lithuanian legislation.
Luxembourg	≥ 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	The above qualification criteria apply to a company's global operations. Note that companies with energy consumption less than 100 MWh can complete a "simplified" energy audit.
Malta ¹⁷	≥ 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	Large enterprises whose energy consumption is below 50,000 kWh (4.3 toe) per annum are excluded from the energy audit obligation.
Netherlands ¹⁸	> 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	The qualification criteria apply only to the Dutch branches of a given enterprise.
Poland ¹⁹	≥ 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	
Portugal	≥ 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	Multi-national companies must comply with Portuguese legislation for any sites located within Portuguese national territory.
Romania	≥ 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	Furthermore, if the company or site has an annual energy consumption greater than 1,000 toe, then it must complete a full audit annually and employ an approved energy manager. International companies must comply with the same obligations as companies solely based in Romania.
Slovakia	> 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	

Slovenia	meeting at least 2 of the following criteria: > 250 employees > €40 million annual turnover > €20 million annual balance sheet	Companies established in the Republic of Slovenia are subject to the regulation.
Spain ²⁰	≥ 250 employees OR > €50 million annual turnover AND > €43 million annual balance sheet	Related enterprises in other countries (including outside the EU) need to be included when determining eligibility.
Sweden ²¹	≥ 250 employees AND > €50 million annual turnover OR > €43 million annual balance sheet	Qualification criteria are applied to a corporate group's global operations. However, should the Swedish operations be sufficiently small (in terms of energy consumption) relative to the company's overall European operations, the company may ask the Swedish Energy Agency for exemption from the audit requirement. Companies are responsible for the energy consumption over which they have direct control.
UK ²²	> 250 <u>employees OR</u> > <u>€50 million</u> (<u>£38,937,777</u>) <u>annual</u> <u>turnover AND > €43 million</u> (<u>£33,486,489</u>) <u>annual</u> <u>balance sheet</u>	

2.6 Other (Leased assets)

2.6.1 General (nature of issue)

Article 8 and Member States' legislation must target the entities that have control over energy use if the overall objectives of Article 8 are to be achieved. In order to support the overall effectiveness of energy audit regulations, Member States' legislation should be able to provide the entities that have control over energy use with clear guidance on where the responsibility for assets lies and auditing thereof. Such clarity on responsibility for leased assets also avoids double counting of energy use. Furthermore, clarity is particularly important for instances where a building is multi-tenanted, as there may be different responsibilities for energy use between the operational areas of each tenant and the general building services provided for all tenants.

2.6.2 Member States' approaches

The regulation concerning rented buildings varies significantly across MS. However, a large group of Member States apply the following rule: when a large enterprise rents a building, it is responsible to audit the building too, but only those parts where it can directly influence the energy consumption.

For example, the building envelope itself does not need to be considered (e.g. Austria, Netherlands). Another practice concerning rented buildings is that when the tenant pays the energy bill of the building, it is also responsible to audit the building envelope. However, for example in Finland, the owner of the building mostly pays the energy bill, which makes the landlord responsible for the energy audit of the building envelope, if this landlord is considered a large enterprise (Energiavirasto, 2016). Another prevailing practice is to put the responsibility for the rented building with the landlord (e.g. Latvia).

Other regulations regarding rented buildings include:

- In Hungary, large enterprises are not responsible for the energy audit of the rented building if the company is using less than 50% of the building or if it is responsible for less than 50% of the building's energy consumption (MEKH, 2015). When this threshold is exceeded, the large enterprise becomes responsible for the building audit. When the owner of the building is also a large enterprise, the audit obligation of the building becomes a shared responsibility (NFM, 2015).
- In Lithuania, rented buildings are not included in the audit scope: a large rented office is therefore exempted from the audit obligation.
- In Bulgaria, a non-SME renting a building is not responsible to audit this building. The landlord is responsible to do an energy audit (and certification) of the building as soon as it is bigger than 250m², regardless whether that landlord is a non-SME or not (SEDA, 2017).
- In Belgium (Flanders), the audit responsibility lies with the operator of the facility (exploitant ingedeelde inrichting) and it is linked to the environmental permit. For example: when renting offices, the owner of the offices is responsible for the boiler for heating the building and therefore also responsible to carry out the energy audit. But if a company rents a warehouse for storage of chemicals, the company is responsible for the environmental permit and therefore also for the energy audit (VEA, 2015).

3. Stakeholder feedback after the first Article 8 compliance cycle

During the first four-year cycle of the EED Article 8 implementation, all actors of the process, including governments, complying companies and auditors, gained valuable understanding of aspects which proved to be efficient or, on the contrary, hindered the work of the legislation. This chapter summarises and analyses information collected from the National Authorities (4.1) as well as companies and auditors (4.2) on their experience of the first EED compliance round.

3.1 National Authorities

3.1.1 Common topics related to the transposition process

Whilst the Directive sets out the principles and the general audit requirements which have to be transposed at the national level, Member States have some flexibility as to how to implement them. The feedback obtained from a number of Member States (Finland, Netherlands, Germany and Denmark) in relation to transposing and implementing the Article 8 was grouped into a number of common topics.

Overall, the collected feedback demonstrated that multiple factors have been considered by the National Authorities to define their transposition approaches and undertaken analyses were in many cases situational and depended on available information and pre-existing auditing regulations. The main topics mentioned by the National Authorities in their feedback are summarised below.

Use of audit data from previous audit experiences and case studies:

Finland and the Netherlands already had energy efficiency schemes in place prior to the implementation of the EED and as a result had access to energy audit data to inform the EED Article 8 transposition. However, the interviews have demonstrated that collected audit-level data was not used to calculate certain EED thresholds (e.g. de minimis exclusion level) but was primarily used for the overall sense checking of the transposition approach.

For example, Finland collected information on 6,500 voluntary audits which allowed to calculate the cost efficiency figures presented in Box 3.1. Data collected on cost effectiveness of the national audits - Finland.. This information was considered during the implementation of the EED, however it was not incorporated into specific methodological calculations (e.g. audit cost efficiency calculation formula).

Case studies and discussions with enterprises have been considered as part of the transposition process. This was found to be useful since many large enterprises, due to their size and organisational complexity, were in a position to highlight the inefficiencies of the auditing requirements via specific examples within their portfolio. This included, as an example, demonstration of inefficient audit requirement applying to small energy use or complexity with defining the legal obligation in specific cases. In order to resolve such issues, some organisations initiated a discussion with the governments thereby providing valuable information for National Authorities.

Box 3.1. Data collected on cost effectiveness of the national audits - Finland.

In Finland, sites with an annual energy bill under EUR 15,000 or floor area under 500 m² do not have to be audited as audits of facilities below these thresholds are not considered to be cost-effective.

According to the Finnish approach, an audit can be considered cost effective if within one year all identified behavioural (operational and maintenance) improvements can generate energy savings not lower than the audit cost. This approach is only based on accounting for behavioural energy management changes (i.e. more efficient operation of office equipment to avoid energy wastage) which do not require financial investment. The approach excludes recommendations requiring technical upgrades as it would also result in adding the cost of these improvements to the cost efficiency calculations thereby complicating the comparison.

It was pointed out that behavioural energy management changes in office premises tend to have

higher energy saving potential in Finland as compared to many other EU Member States since heating constitutes a larger proportion of energy consumption in Finland due to climatic conditions.

Based on the data collected from the pre-existing audit scheme, the following indicators were calculated:

- Average savings with payback period < 1 year: 4.6% of total energy consumption
- Average savings with payback period < 3 years: 7.7% of total energy consumption
- Average savings with payback period < 10 years: 13.5% of total energy consumption
- Minimum cost of audit: 2,000 EUR

These figures together with a selection of case studies were considered for implementation of EED Article 8 transposition, yet they were not directly used for calculation of the defined thresholds (EUR 15,000 or floor area 500 m²).

Alignment with existing audit schemes:

Member States with auditing requirements/recommendations already in place decided to align the transposition of EED Article 8 with existing schemes, to build on the developed experience and avoid confusion. In this way, the Netherlands kept the requirement to audit 90% of total energy consumption since this threshold was already implemented via the national voluntary auditing scheme (“Long-Term Agreements”). Germany, in turn, aligned the EED sampling approach with the existing regulation IAF MD 1:2007 for ISO 50001 certified energy management systems.

Experience of other Member States:

Experience of other Member States made a significant contribution to the implementation steps of the interviewed National Authorities. All Member States indicated that they have been following the progress made in other countries, including pre-existing auditing schemes, any impact assessment studies, public consultations and, ultimately, the final version of the implemented auditing requirements and national guidelines.

3.1.2 Analysis of audits data

Overall, 30 national and regional EU governments (Flanders, Brussels region and Wallonia are considered individually) were asked to provide their information on the first cycle of the EED Article 8 implementation.

Data was received from 25 Member States and regions (see Appendix 4). Two countries have not been able to provide data due to late compliance deadlines resulting in a lack of time to collect and analyse the necessary national data. A small number of Member States provided no response.

The quality and level of detail of the data provided varied significantly across Member States. The granularity of data available to Member States largely depended on the way the compliance reporting was set up in each country. Whilst some Member States require detailed online reporting on the findings of compliance audits, which is gathered into a database, others only ask for a simple notification of compliance or no notification at all. As a result, those countries which have collected company level information on undertaken audits were able to provide much more detailed responses to the project questions as well as to use collected data for the purposes of implementation analysis.

The figures below provide an overview of the level of detail of the received answers. Most Member States were able to provide sector level or total data on the number of complying enterprises, their energy consumption and identified energy saving potential. A limited amount of data was provided on sectoral level. Very little information was available on the implemented energy saving measures and achieved energy savings as well as the audit cost. It is recognised that the information on the achieved energy savings was not yet available since energy saving improvements are expected to be implemented at a later stage following audits undertaken in the first EED Article 8 compliance cycle.

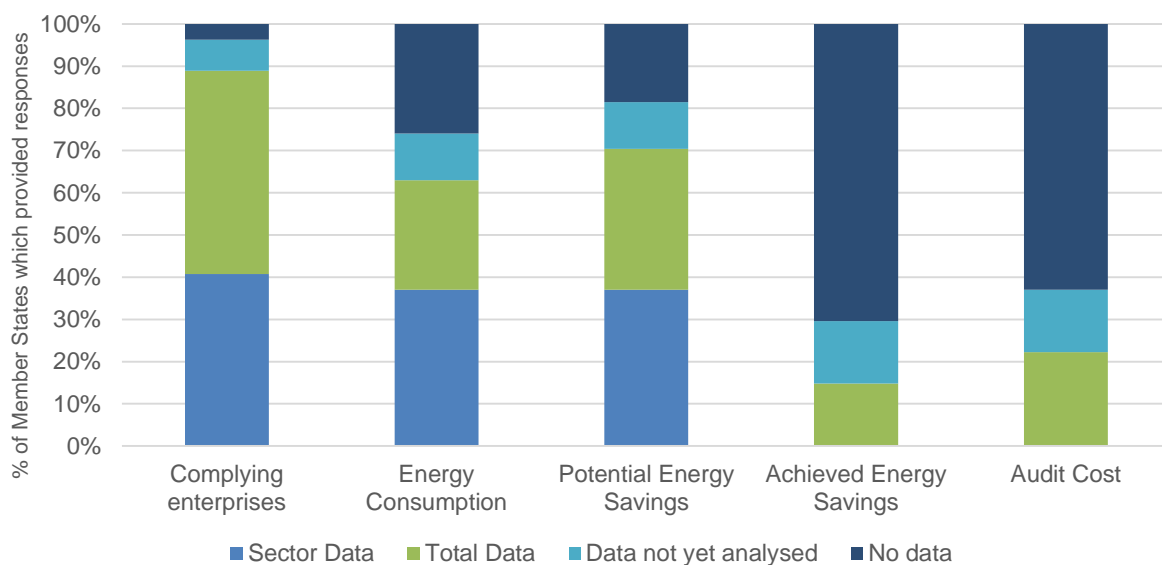


Figure 3.1. Summary of the data provided by National Authorities

The quality and type of the data provided by the National Authorities varied and complicated comparison across Member States. Some Member States provided aggregated data covering EED Article 8 compliance audits together with mandatory/voluntary audits implemented before the EED came into force, which made it more difficult to assess the effect of the EED Article 8 introduction. Other obstacles to analysing certain datasets were linked to (1) inclusion of companies complying through the implementation of certified Energy Management Systems which may not necessarily be a result of the legislation implementation; (2) differences in the legal level of reporting (e.g. legal group vs legal entity); (3) incomplete datasets.

Even though for the reasons described above it was not possible to complete a full quantitative analysis of the provided data, the following observations were made.

Observation 1: Varying energy saving potential across energy use types

Where sectoral data was available, findings for the three key energy use types (industry, buildings and transport) were compared. Based on the analysed data, although the highest absolute energy saving potential was identified in energy consumption related to industrial processes²³, the potential found in buildings also appeared to be significant.

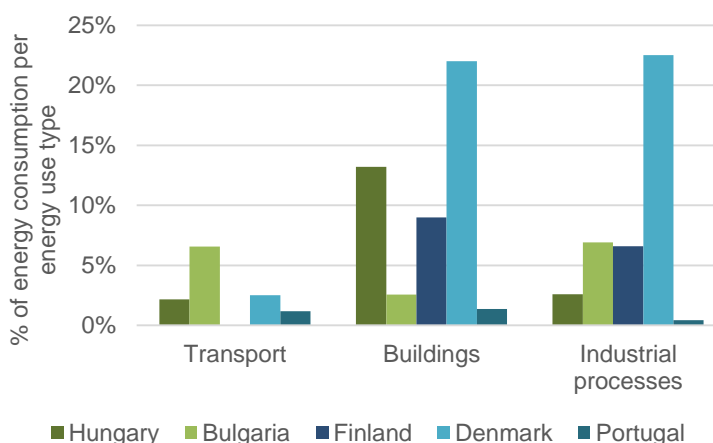


Figure 3.2 Energy saving potential per sector

²³ Industrial energy use includes heat application in manufacturing, boiler fuel, electricity used for operating industrial motors and machinery, heating and lighting of the manufacturing areas, and other types of energy use directly enabling the manufacturing process.

In addition, when considering relative energy saving data (i.e. the energy saving potential compared to the total energy consumption per energy use type), both buildings and industrial processes appear to have high relative energy saving potential. Transportation operations and companies in the transportation sector tend to have identified the lowest absolute and relative energy saving potential of the three considered sectors.

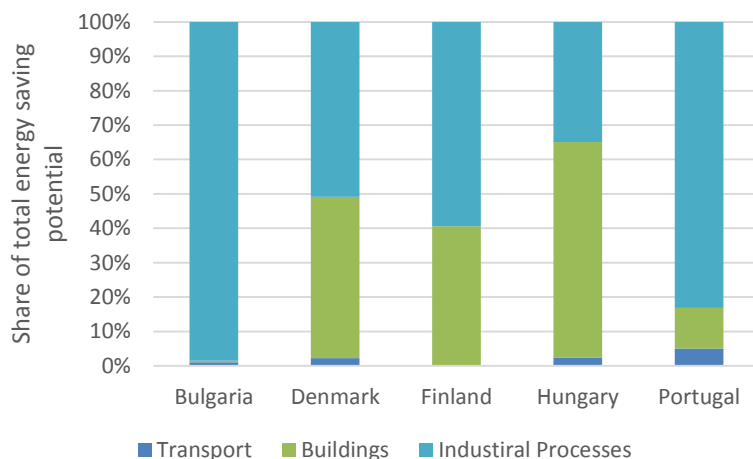


Figure 3.3. Relative energy saving potential per sector

Observation 2: Average energy saving potential around 7% of the total energy consumption

Overall, the identified energy saving potential across the provided audit data is around 7% of the total energy consumption with an outlier in Croatia of 25%. The latter is likely due to a limited size of the data provided.

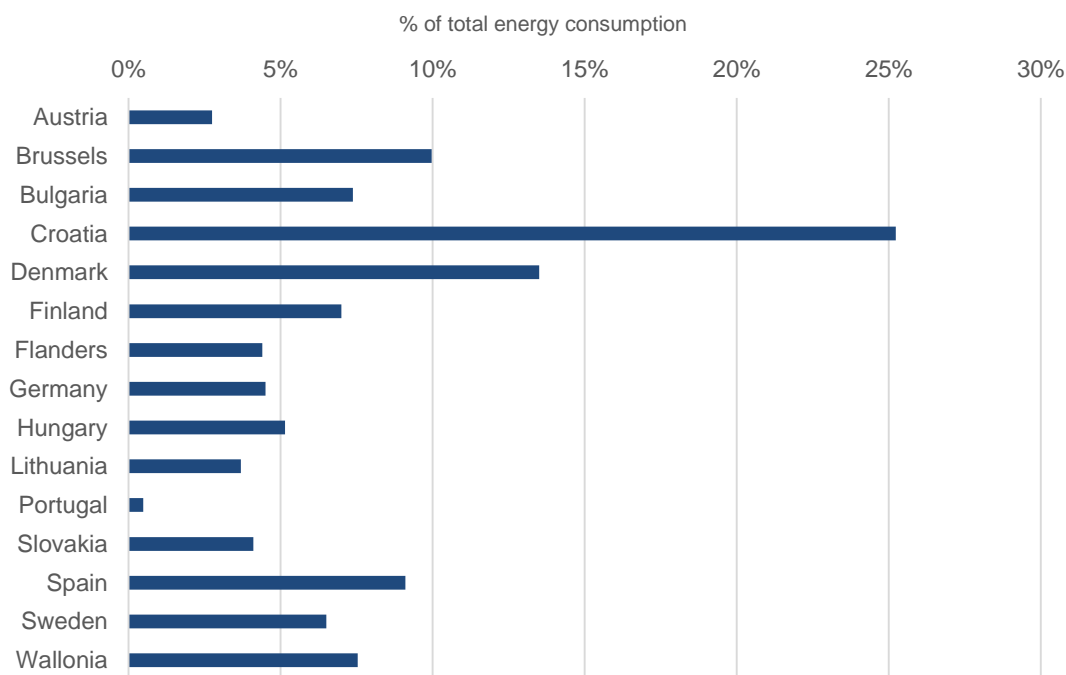


Figure 3.4 Total identified energy saving potential as share of total energy consumption

Observation 3: Implementation of identified energy saving opportunities higher in companies with EnMS

The cost-effectiveness of the audit obligation largely depends on whether the identified energy savings opportunities are implemented. A study undertaken by the German National Authority and provided as a response to the data request in the framework of this project, reveals that organisations with an Energy Management System (EnMS) implement the identified energy saving opportunities more systematically (see Table 3.1).

Table 3.1 Energy saving potential identified and realised (Germany)

Unit	Potential of all sites		Energy savings realised and fixed planned (all sites)	
	GWh/a	%	GWh/a	%
EnMS 1 site	220	2.4 %	261	2.8 %
EnMS > 1 site	1,874	5.2 %	1,478	4.1 %
Audit 1 site	50	7.4 %	17	2.6 %
Audit > 1 site	204	3.5 %	157	2.7 %
Sum of all categories	2,348	4.5 %	1,913	3.7 %

This could be explained by the tendency of identified energy saving opportunities to be better investigated in an EnMS and therefore more likely to happen from technical, economical and organisational perspectives. In addition, companies with an EnMS are likely to be committed, from top management down, to improving energy performance.

Observation 4: Companies with low energy consumption identify the highest energy saving potential and face the highest cost of compliance

Companies with low energy consumption tend to identify a higher share of energy saving opportunities relative to their consumption level. A possible reason is that these companies do not typically assign high priority to energy efficiency improvement opportunities or have less knowledge about them, in contrast to companies with higher consumption levels for which energy bills represent a higher share of costs.

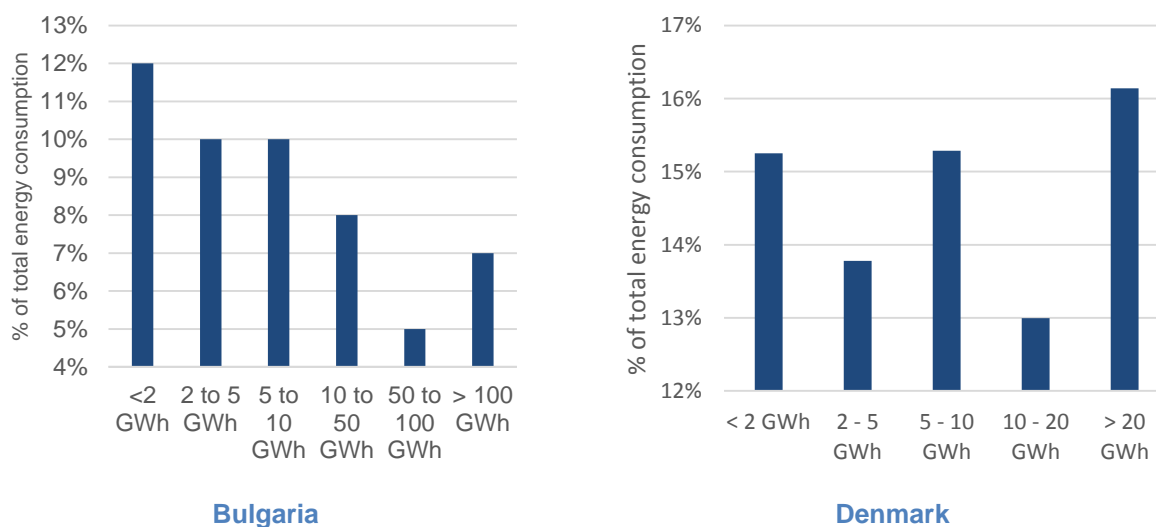


Figure 3.5. Identified energy savings potential by annual energy consumption level

However, the smallest enterprises also resulted to have largest relative audit costs when compared to the identified energy saving opportunities. As Figure 3.6Error! Reference source not found. demonstrates, in Denmark companies with energy consumption under 2 GWh annually, would need to implement almost all identified energy improvements to recover the cost of the audit within the first year.

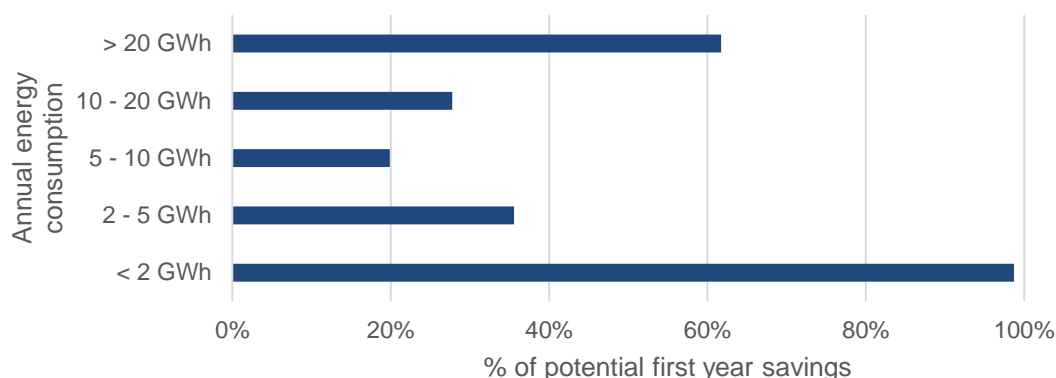


Figure 3.6. Cost of energy audit compared to potential 1st year savings (Denmark)

Observation 5: Energy saving potential may tend to decrease over time

Information from Bulgaria, which already was collecting data on mandatory energy audits conducted prior to the EED Article 8 obligation, revealed the possibility that the identified energy saving potential could be significantly higher in the first compliance period compared to the following ones. As can be seen from Figure 3.7, as the national auditing requirement progressed, the average identified energy saving potential showed a tendency to decrease. This can be linked to the fact that companies are becoming more aware of the energy saving opportunities and are following up on the audit recommendations as well as advancements in energy efficient technologies which are becoming available to the companies over time thereby increasing their average energy efficiency.

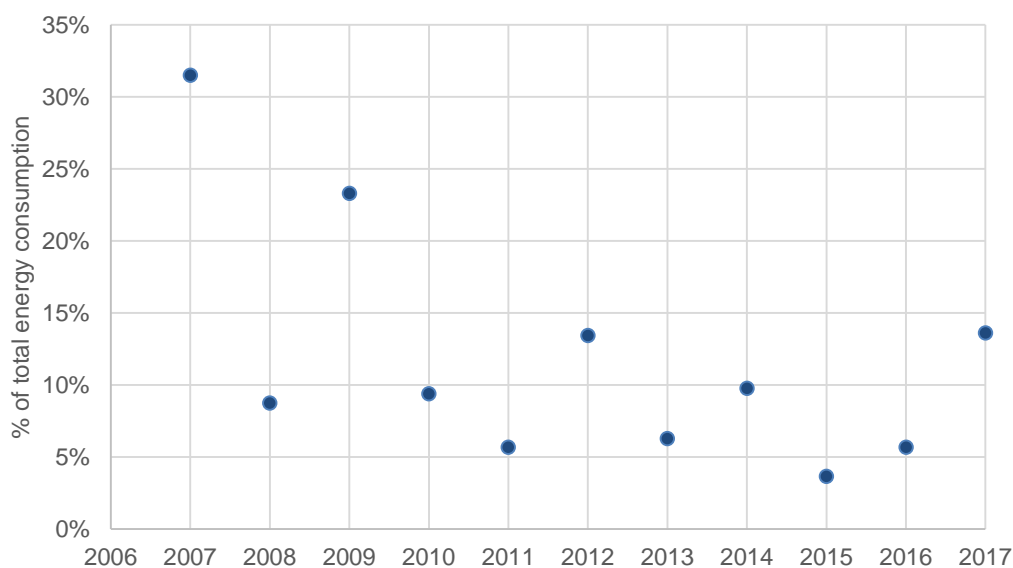


Figure 3.7. Average identified energy saving potential (% of total energy consumption) in 2006-2017 (Bulgaria)

However, it is recognised that this observation is based on a very limited amount of data. It will need to be reassessed once information for the second compliance cycle of EED Article 8 audits becomes available.

3.1.3 Other feedback

In addition to the observations presented earlier in this chapter, the following topics were repeatedly mentioned by interviewed National Authorities.

Identifying enterprises under the scope of EED Article 8. One of the main issues which National Authorities faced during the first round of implementation was understanding what companies need to comply with EED Article 8.

The typical issues were:

- Governments had no easy access to data on the global enterprise group connections which did not allow them to efficiently verify which companies need to comply with the auditing requirement.
- The national statistical sources use different classification (different thresholds) to define large, medium, and small enterprises which requires detailed analysis to cross check the national database with the EU SME definition (e.g. Netherlands).
- It is hard to separate economic and non-economic activities of certain organisations (e.g. universities) to define whether they fall under the scope of EED Article 8.

Granularity of compliance methodology. Most National Authorities did not establish strict rules as to the application of de minimis thresholds, clustering and sampling approaches. The main arguments made by the National Authorities supporting this position were:

- It is highly complicated to establish rules which would fit organisations of all types and sizes. Therefore, many countries preferred to rely on the experience of auditors and complying enterprises themselves in order to define the right approach.
- Those countries which decided to implement more defined rules in these areas tried to ensure sufficient flexibility for complying enterprises.

3.2 Companies and auditors

This section summarises the feedback collected from companies and auditors and presents it by topic. It includes the experience of Article 8 compliance in the first compliance round as well as suggestion for potential future enhancements based on this experience. Conclusions for each subcategory are outlined after the overview of the general interview findings.

3.2.1 Definition of large enterprises

The experience of companies complying with EED Article 8 differ significantly depending on their portfolio and countries of operation. In this way, those companies which operate in multiple Member States and coordinated EED compliance centrally faced certain difficulties because of the difference of Article 8 qualification criteria in various countries. The main point of uncertainty was qualification status in those countries where large multinational corporate groups had small operations. However, large companies with large operations in one or more countries did not have any difficulties with defining their status as they easily identified that they fall under the scope of the regulation.

Recommendation. Multiple participants suggested that a EU-wide set of rules (in English) supporting a consistent qualification status in all EU Member States would make requirements clearer.

A number of interviews demonstrated that large international enterprises with very small operations in certain Member States (e.g. one office) fell under the EED Article 8 regulations because of their global size. Audits of these small properties were not found to be highly beneficial or cost-effective, based on the qualitative feedback of the interviewed companies/auditors.

Recommendation. It was suggested that an additional energy consumption related criterion may be introduced either at the qualification stage or as an audit requirement exemption for very small sites in order to support the principle of cost-effectiveness of energy audits.

Key observations:

- The clarity on the qualification requirements differs significantly among Member States, with some countries being encouraged to provide more detailed guidance.

- An EU-wide qualification guidance in English covering all Member States would significantly facilitate compliance process for the multinational which decide to coordinate the process centrally.

3.2.2 De minimis

The majority of interviewed companies and auditors confirmed that a de minimis exclusion threshold is an important factor facilitating compliance and increasing cost-effectiveness. Most companies claimed that they decided to exclude those areas where they did not expect audits to be cost effective or where data was not available, these being mainly small offices and/or transportation activities. However, if no extra effort was required to ensure full portfolio coverage (e.g. via sampling or in case of small energy portfolios with few properties), a number of interviewees claimed to prefer the full portfolio coverage. This was mainly observed in companies with established energy management systems and those which had better access to energy related information.

Despite the general benefits of de minimis exclusions, it was mentioned that they may be counter-productive if applied without consideration of energy saving potential, i.e. excluding energy consumption areas which could generate significant savings. In addition to this, a few interviews demonstrated that for very large energy consumers (e.g. power generation stations, metallurgy) excluded energy consumption, whilst remaining low in relative terms, appeared to be significant in absolute values which means that considerable energy saving opportunities might not have been identified.

Recommendation. For businesses with low energy intensive operations (e.g. offices), it was repeatedly mentioned that an international group-wide de minimis threshold would support the cost-effectiveness of audits as in many cases recommendations would be applicable across the international portfolio. Yet it was recognised that the similarity of properties in question would need to be confirmed for this scenario.

A large number of companies and auditors agreed that 10% is a reasonable exclusion threshold in order to maintain audit representativeness at a required level. However, most companies supporting a 10% threshold are operating in Member States with an existing threshold of 10%.

The majority of interviewed companies and auditors agreed that a threshold for small sites is a reasonable measure ensuring cost-effectiveness of the auditing process. It was particularly relevant for large international corporate groups which required to audit small offices with very low energy consumption in those Member States where they qualified based on their global size. The general feedback was that these audits were not cost-effective with no significant energy savings identified.

Recommendation. It was mentioned that a guidance with best practice energy management actions can be provided to companies with very small energy consumption instead of complete on-site audits.

Some interviewed auditors, however, were sceptical about implementation of an exemption threshold claiming that each portfolio should be considered individually and an auditor should be able to decide whether exclusion of small facilities should be allowed.

Recommendation. In some cases different exemption thresholds for different sectors could be justifiable.

Key observations:

- Application of de minimis is highly beneficial for ensuing cost-effectiveness of audits.
- Selection of energy uses excluded under de minimis should be evaluated based on their energy saving potential.
- A de minimis threshold of 10% appears to be reasonable to a very high share of interviewed companies and auditors.
- Overall, a small site exclusion threshold is seen as a positive criterion to support audit cost-effectiveness.
- The threshold should be carefully defined and can differ depending on the sector.
- Alternative solutions can be considered to support energy management in small low energy intensive units (e.g. offices) such as best practice energy management manual.

3.2.3 Clustering and Sampling

Almost all interviewed companies and auditors confirmed the benefits of application of clustering and sampling, claiming that it facilitates compliance and ensures cost effectiveness of the auditing process through avoiding audits of highly similar energy uses where developed recommendations can be shared. Whilst most interviewed companies applied clustering and sampling, some did not use these approaches because of specific energy portfolio characteristics or a lack of awareness about how these approaches can be applied.

The majority of interviewed auditors stated that it would be virtually impossible to develop a clustering and sampling methodology which would fit all situations. Therefore, a qualified auditor should be responsible for defining appropriate clusters and representative samples.

However, it was also mentioned, that while it may be challenging to develop a detailed clustering and sampling methodology, certain guidelines as to the clustering rules and minimum sample size could be useful. An issue brought to light by a number of auditors was that some auditing companies, while trying to look more competitive to potential customers, may tend to favour larger clusters and smaller sampling sizes thereby offering lower service fees to their clients. In such cases, the quality of undertaken audits, and particularly the principle of representativeness, may be compromised.

Recommendation. In order to ensure the quality of the undertaken audit and address this issue, it was suggested that some minimum clustering and sampling requirements may be useful.

Concerning sample size, it has been claimed that although the methodology based on square root of the total number of sites rounded up to the highest integer is favoured because of its simplicity, a higher sampling size may be more representative in the industrial sector while a lower sample size would suffice in buildings. In some Member States with different climatic zones (e.g. Spain) sampling also needs to take the climate into consideration for clustered sites.

Considering which facilities should be selected for sampling, both interviewed companies and auditors agreed that there should be a certain degree of freedom since companies should be able to audit those facilities where they are likely to invest in energy efficiency improvements. As an example, if a company has a plan to shut down or sell a facility within a year, it would not be cost effective to audit it, and therefore the company should be able to select the audit sample in line with its strategy. This would improve the chances of energy saving measure implementation.

Recommendation. A group-based approach for companies reporting on all legal entities under the same parent company would be useful towards increasing cost-effectiveness in those cases where the audit obligation is coordinated centrally.

Recommendation. As for the clustering methodology, whilst very few countries provide a clear guidance on this matter, a number of suggestions were made by the interviewed auditors as to how this requirement can be elaborated, e.g. ensuring cluster homogeneity via using the share of similar energy use (e.g. 95%) as the main criterion.

Key observations:

- Clustering and sampling are beneficial for the auditing process and support cost effectiveness and proportionality of energy auditing process.
- Developing a one-size-fits-all methodology would be virtually impossible due to the variety of energy portfolios, yet certain minimum standards would be useful.
- Qualified energy auditors and responsible people within complying businesses should have the opportunity to justify the appropriate application of these approaches to each business.

3.2.4 Other interview feedback

3.2.4.1 General cost-effectiveness of audits

During the auditing process, numerous comments and suggestions addressing a wider question of audit cost-effectiveness were made. The most relevant of them are summarised below.

Implementation of identified energy saving measures. A few interviewees suggested that centrally organised multinational companies focus investment where they see the biggest strategic interest, while

neglecting cost-effective energy saving projects in other locations. To tackle this, it could be useful to make it mandatory to implement the most cost-effective energy saving measures. An example from Flanders was used to support this statement. In Flanders, companies that are part of the voluntary agreement, known as the Energie Beleids Overeenkomst (EBO), are required to implement all projects with an internal rate of return (IRR) of more than 14%.

Extra financial benefits of energy savings. It was pointed out that in countries where energy savings can bring financial benefits in addition to the avoided cost of energy (e.g. White Certificates in Italy), the implementation of the energy saving recommendations tends to be considerably higher than in other countries. A number of auditors also noted that interest towards energy saving measures very clearly correlates with the electricity prices in country.

Auditor qualification. A number of interviewed companies highlighted that the knowledge of auditors to identify energy improvement opportunities in process industries was found to be limited. Typically, auditors were raising energy improvement opportunities in the utilities area but not in the process itself. As a result, the mandatory audits may not appear to be cost-effective after a few compliance periods have elapsed. To address this, auditors specialising in the company's sector should be undertaking audits to be able to identify process related energy savings. A sector level auditor qualification could support this.

Life-cycle costing approach. Wider use of an LCC-based approach was noted as likely to be beneficial and its application in EED compliant audits should be encouraged.

3.2.4.2 Leased Assets

Defining the responsibility for auditing leased assets, particularly in cases with multi tenanted buildings, was found to be challenging for many complying enterprises. In some cases, the same building was audited multiple times by various tenants and a landlord, significantly reducing the cost-effectiveness of the audits.

The general finding in this area was that it is reasonable for a tenant to undertake audit of rented premises where it is possible to affect energy consumption. Where possible, the audit of an entire building (tenanted areas and building envelope) can be coordinated with a landlord and other tenants to increase cost effectiveness.

One example brought up in this respect is in Denmark, where building envelope audit is enforced by another regulatory measure (energy labelling for buildings) which exempts landlords from the EED Article 8 obligation. This approach ensures avoidance of double auditing for the EED Article 8 compliance, via clearly separating the areas or responsibility of tenants and landlords.

3.2.4.3 Other

- It was widely mentioned that many multinational companies struggle to understand the practical implementation rules of the EED Article 8 in different Member States, due to language barriers or to the difficulty in identifying the exact obligations in place. Even if some companies were helped externally in understanding the legislation, it is still a complex exercise that lowers the cost-effectiveness of the audits overall. One idea highlighted was that the European Commission could provide a tool where detailed information on how to comply in different Member States is provided in English.
- Companies are often not aware of the audit requirements (scope, sampling, de minimis, leased assets, etc.) and leave it up to the auditor to provide them with a cost-effective and representative audit. Multinationals that coordinate the obligation in a centralised way can be better informed through the help of an external consultant, while single-sites have less resources to check the legislation in detail.
- Late implementation of legislation and lack of auditors during the first EED Article 8 implementation round complicated compliance in a number of Member States, yet it is expected to have been resolved for the second compliance cycle.

3.2.5 Survey Results

As a complementary measure to the interviews conducted in the framework of this project, a survey form was sent out to the interviewed companies and auditors. As it was detailed in Chapter 2, this form was designed to collect basic information on the audit cost effectiveness and the extent of identified energy saving opportunities.

This exercise collected quantitative data only on a limited number of audits (57). Due to the limited number of collected samples and potential errors in provided figures, it is recognised that a quantitative analysis might not provide reliable results. Therefore, only the following observations were drawn from the survey results.

Energy saving potential. Identified energy saving potential for industrial processes and buildings supports conclusions obtained from the National Authorities' data. Processes demonstrated slightly higher energy saving opportunities than buildings. The average energy saving potential for the considered sample (6% of total energy consumption) also broadly aligns with the EU wide data reviewed in Section 4.1 (7% of total energy consumption).

Audit cost. The audit cost per unit of identified energy saving opportunities is almost four times higher in the energy used in buildings. This is due to the fact that whilst the cost of audit in the industrial processes is twice as high as in buildings, the identified energy saving opportunities tend to be about seven times higher making the audit considerably more cost-effective.

4. Development of Guidelines for National Authorities

4.1 Overview

The guidelines provided in Appendix 1 were developed using information collected from the National Authorities, complying companies and auditors and in close consultation with DG Energy. They are intended to support National Authorities with further review and implementation of the EED Article 8 but may also inform companies and auditors on the background to National Authority requirements.

The guidelines are focused on how the three key principles of cost-effectiveness, proportionality and representativeness can be implemented through application of clustering, sampling and de minimis. They have been framed in support of the current legal requirements of the Article 8 and to avoid any possible inconsistencies with the legal requirements:

- Only a clarification of the definition of large enterprise in the context of Article 8 has been included
- Other topics (e.g. leased assets, size based site eligibility thresholds, etc.) represent significant interest for National Authorities have not been included.

However, information on these topics was collected and where applicable it was presented in previous Chapters.

The guidelines provide clarifications and recommendations for National Authorities on how to interpret Article 8 in the selected areas. They also provide implementation examples to demonstrate how suggested approaches can be applied.

4.2 Key principles and criteria addressed in the guidelines

Compliance with Article 8 should be grounded on key principles defined in the Article 8 and Annex VI of the EED:

- The principle of audit **cost effectiveness** sets the expectation that the value of the energy audits exceeds the costs of undertaking them.
- The principle of **representativeness** sets the expectation that audit results are applicable not just for the energy use examined in detail by the audit but more widely across the enterprise (across its sites and activities).
- The principle of **proportionality** sets the expectation that the regulatory obligation placed enterprises is reasonable in relation to the overall objective of the policy, which is to encourage energy saving.

To address these principles, various approaches to implementing de minimis exclusions, clustering and sampling have been considered. It is important to note, that whilst these areas are presented separately in the guidelines, they are closely interlinked as demonstrated in Figure 4.1.

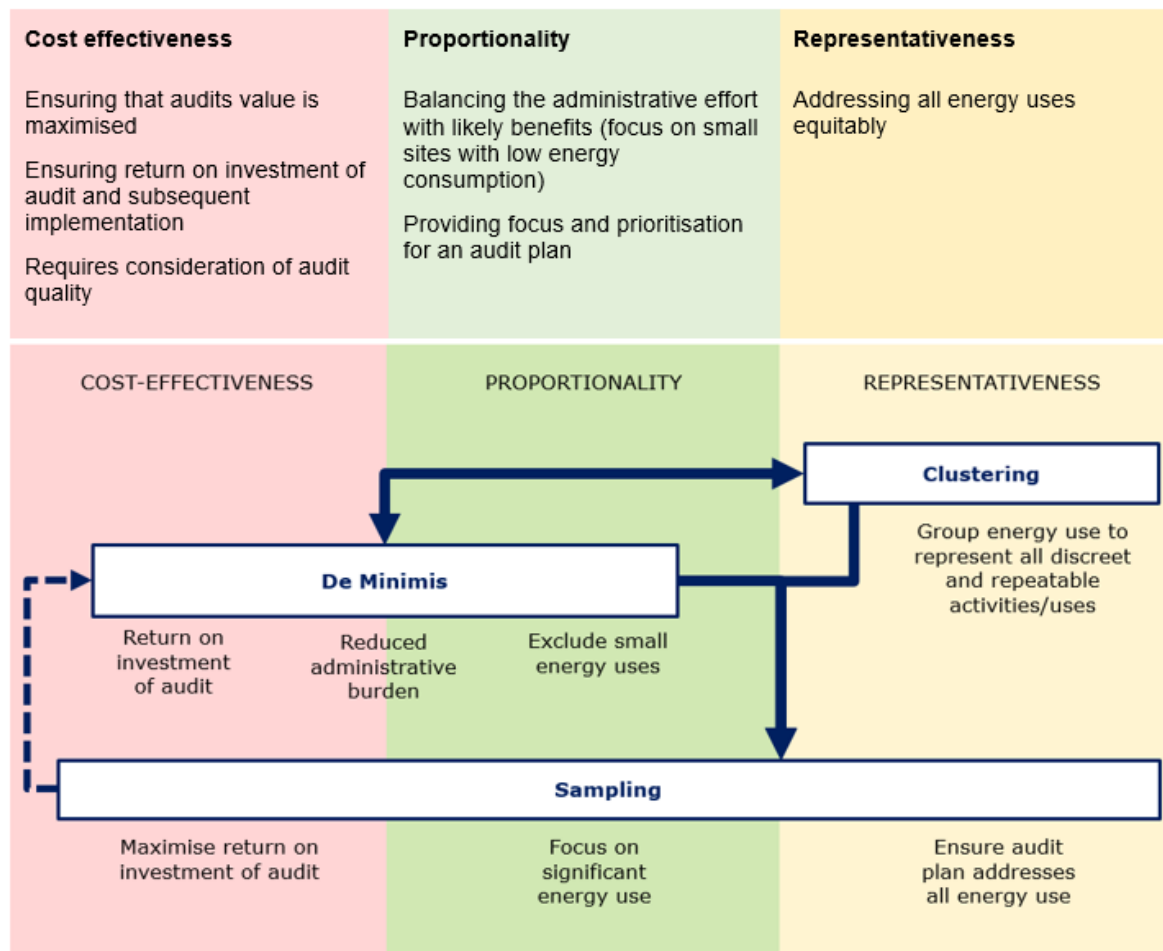


Figure 4.1 Framing principals for the study and their relation to concepts of de minimis, clustering and sampling

In developing the guidelines, the implementation of de minimis exclusions, clustering and sampling have been evaluated against five criteria.

- **Realisation of cost effective savings:** The potential for the approach to optimise the cost effectiveness of the savings that are achieved.
- **Ease of implementation:** The level of effort required for the Member States to put the approach in place and to monitor over time.
- **Equity of treatment:** The fairness of the approach to all participant enterprises.
- **Potential for audit bias:** The potential for the approach to result in a bias towards certain parts of the enterprise or its activities being included in, or excluded from, audits. This impacts on the representativeness of the energy audit.
- **Administrative burden:** The level of effort and resource required for the enterprise to apply the approach (this criterion was removed for the consultation document).

4.3 Best practices examples

Assessment of all the information gathered in this project lead to recommended implementation approaches which were included in the Guidelines in Annex I. In this section a selection of best practice approaches is presented for the main aspects included in the Guidelines as for monitoring of the audits requirements.

The best practice approaches are drawn from information collected from National Authorities, complying enterprises and auditors and should not be treated as an exhaustive list of efficient implementation practices. National circumstances should be considered by each Member State when evaluating applicability of these approaches.

Table 4.1 Best practices examples

Definition of large enterprises													
<ul style="list-style-type: none"> • Provision of tools and public lists of large enterprises required to comply with EED Article 8. This facilitates qualification assessment for national enterprises and reduces the chance of misinterpretation of the qualification rules which may lead to subsequent penalties or enforcement actions. (Examples: Greece, Hungary, Estonia). • Requirement for all enterprises to confirm their qualification status. Requirement for all enterprises to report that they undertook qualification assessment and confirm information they used for this purpose allows the national regulator to confirm the correctness of qualification assessment. This can be implemented via an online qualification form to facilitate this exercise. (Example: UK). 													
Clustering													
<ul style="list-style-type: none"> • Clustering based on sites' consumption. Even though clustering based on activity type is the most popular method which has obvious advantages, another clustering methods can also be applied. In this way, size based clusters can be determined with a defined number of sample audits required in each cluster. The number of required audits decreases with the facilities consumption in each cluster, starting with requirement to audit all facilities in the largest cluster and reducing the number as the average cluster consumption is going down. The clusters are different for industrial and non-industrial facilities. The underpinning logic of this approach is that facilities with higher energy consumption tend to identify higher energy savings in absolute terms, so more large facilities have to go through an audit as opposed to smaller sites. (Example: Italy. See section 3.4.2). 													
Sampling													
<ul style="list-style-type: none"> • Providing a flexible guidance on the minimum number of sample audits. To ensure equal quality of energy audits among the participants, a guidance on the minimum number of audits can be provided where the required number of audits depends on the overall number of company's facilities. Different approaches (fixed number of audits, share of total sites, square root, etc) can be applied to different clusters. These size-based cluster requirements should be elaborated considering national audit data. (Example: Finland) 													
<table border="1"> <thead> <tr> <th>Number of buildings or operational sites</th> <th>Number of site audits</th> </tr> </thead> <tbody> <tr> <td>At most 15</td> <td>1 site audit</td> </tr> <tr> <td>16–100</td> <td>10 % of targets</td> </tr> <tr> <td>101–400</td> <td>square root of target number</td> </tr> <tr> <td>Over 400</td> <td>5 % of targets</td> </tr> <tr> <td colspan="2">Sites that have energy consumption costs of under €15 000 or have floor areas under 500 m² do not have to be taken into consideration when determining the amount of audits required.</td> </tr> </tbody> </table>		Number of buildings or operational sites	Number of site audits	At most 15	1 site audit	16–100	10 % of targets	101–400	square root of target number	Over 400	5 % of targets	Sites that have energy consumption costs of under €15 000 or have floor areas under 500 m ² do not have to be taken into consideration when determining the amount of audits required.	
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Sites that have energy consumption costs of under €15 000 or have floor areas under 500 m ² do not have to be taken into consideration when determining the amount of audits required.													

<i>De minimis</i>
<ul style="list-style-type: none"> Progressively reducing de minimis exemption. With each cycle of EED compliance the data quality and energy management practices are expected to be improving within complying enterprises. This tendency allows for lower de minimis exclusion threshold to be expected in each consequent compliance exercise. To support this development from the regulatory perspective, a more a progressively reducing de minimis threshold can be implemented for each compliance cycle. Expected de minimis exemption thresholds should be announced beforehand to enable energy management planning for the complying companies. (Example: France).

4.4 Further implementation and monitoring recommendations

As it has been earlier discussed in this report, to ensure cost-effectiveness, representativeness and proportionality of the national EED audits, high quality granular data on the audit results is required. Being key to implementation not only for de minimis, clustering and sampling but also a wider analysis of the legislation, this data should be regularly collected.

Being implemented in four-year cycles, EED Article 8 offers Member States an opportunity to evaluate its effectiveness after each compliance round and, where necessary, introduce adjustments to enhance its implementation in the future. Whilst many Member States are already gathering the EED related data and are carrying out its extensive analysis, the below information summarises approaches and data categories which are recommended for considering when undertaking this exercise. These recommendations cover the general approach to audit data analysis and should be expanded/ revised as appropriate based on the national circumstances should it be necessary.

Key considerations

The key questions in the audit efficiency analysis usually cover two topics:

- Energy savings. How much energy savings (% of total energy consumption) did companies identify via EED Art 8 compliant energy audits?
- Cost-effectiveness. What is the relation of the energy audit cost to the identified energy savings?

Data categories

To analyse these questions, the following data categories are recommended for collection.

Table 4.2 Categories recommended for data collection

Focus area	Data category
Complying entities	<ul style="list-style-type: none"> Sector of complying entity Annual energy consumption (e.g. kWh, GJ, toe, etc.) Share of energy covered with ISO50001 EnMS (e.g. energy units or % of total energy)
Audit results	<ul style="list-style-type: none"> Share of audited energy consumption (out of total company's energy consumption) Identified energy savings (e.g. energy units or % of total consumption) Investment associated with identified savings Audit cost (including both external and internal costs)
Audit effect	<ul style="list-style-type: none"> Achieved energy savings (estimated) from implemented measures which were identified in the previous compliance cycle (e.g. energy units or % of total consumption)

Analysis Approach

It is recommended that this data is gathered on the company level. Where possible, the installation level data should be collected.

The results of the analysis will be most beneficial for decision making when studied per cluster, such as company size (e.g. companies with annual consumption < 1 GWh, from 1 to 3 GWh, from 3 to 5 GWh, etc.) or company sector (industry, buildings, transport, etc.). The boundaries and number of clusters should be defined based on the pool of available data on the national complying entities to ensure the appropriate analysis granularity.

Data collection

Whilst each Member State can choose how and in what format to collect audit related information, it is recommended to request this data together with a confirmation of compliance at the end of each auditing cycle. A dedicated web page where complying organisations or involved auditors can report audit related information would be one of the most effective ways to collect and aggregate the necessary data.

Appendix 1 Guidelines

Guidelines on the implementation of the principles of cost-effectiveness, representativeness and proportionality of energy audits in the context of Article 8 of the Energy Efficiency Directive

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 - B1. Legal and Policy Context
 - B2. Guidelines on the Application of the SME Definition to Identify Large Enterprises
- C. PRINCIPLES OF COST-EFFECTIVENESS, REPRESENTATIVENESS AND PROPORTIONALITY
- D. PRACTICAL METHODOLOGIES TO IMPLEMENT THE COST-EFFECTIVE REPRESENTATIVENESS AND PROPORTIONALITY PRINCIPLES.
 - D1. Common Aspects
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A. INTRODUCTION

The improvement of energy efficiency serves multiple economic, social and environmental purposes and has therefore been a focus of EU policy development for decades. One of the instruments implemented to support energy efficiency improvement in the EU is Directive 2012/27/EU of 25 October 2012 on energy efficiency (the Energy Efficiency Directive – hereafter also 'the EED' or 'the Directive') which entered into force on 4 December 2012. The EED aims to establish a common energy efficiency framework for EU Member States, address market barriers and promote efficient energy use on both the supply and demand sides. While the EED covers a wide array of energy efficiency related areas, its Article 8 specifically focusses on the promotion of energy audits and energy management systems in enterprises.

Energy audits are a crucial step for companies to understand their energy consumption patterns and identify energy saving opportunities. Through the evaluation of technical conditions and operational practices, energy audits aim to provide a series of tailored recommendations together with any additional information required for informed decision-making. Furthermore, energy audit results allow the quantification and ranking of energy saving opportunities and help overcome the information gap, which is often considered as a main obstacle to energy efficiency improvement.

Article 8 required Member States to oblige large enterprises²⁴ to undertake energy audits by 5 December 2015. Since Article 8 compliant audits have to be repeated not later than every four years, the National Administrations around the EU are currently preparing for the second compliance phase. The majority of the Member States, however, require all Article 8 compliance steps to be completed by 5 December 2019.

Throughout the first auditing phase, Member States have accumulated considerable experience of Article 8 compliance and monitoring. This guideline document supplements the existing guidance 'Guidance note on Directive 2012/27/EU on energy efficiency, amending Directives 2009/125/EC and 2010/30/EC, and repealing Directives 2004/8/EC and 2006/32/EC Article 8: Energy audits and energy management systems' from the Commission²⁵ to address specifically the principles of cost-effectiveness, proportionality and representativeness of energy audits set in Article. 8 and Annex IV. It includes also clarifications and recommendations on the application of the EU SME definition which establishes the enterprises subject to mandatory requirement set under Article 8(4). It aims to build upon the experience accumulated by Member States in the first compliance phase and contains a description of methodological approaches to implement the principles of cost-effectiveness, proportionality and representativeness with respect to compliance with Article 8.

²⁴ Throughout this document large enterprises and non-SMEs are terms that can be used interchangeably. There is no specific definition of a large enterprise, and is therefore determined as any enterprise that does not meet the requirements of being a SME as set out in 2003/361/EC. Therefore, by default large enterprise and non-SME are identical terms.

²⁵ Commission Staff Working Document Guidance note on Directive 2012/27/EU on energy efficiency, amending Directives 2009/125/EC and 2010/30/EC, and repealing Directives 2004/8/EC and 2006/32/EC Article 8: Energy audits and energy management systems (SWD(2013) 447 final) <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52013SC0447>

B. DEFINITION OF A LARGE ENTERPRISE IN THE CONTEXT OF ARTICLE 8.

B1. Legal and Policy Context

Article 8(1) of the Energy Efficiency Directive requires Member States to promote the availability of high quality energy audits for all end customers, with Annex VI outlining minimum criteria for the energy audits. There is a distinction in Article 8 between measures that are applicable to SMEs and non-SMEs.

Article 8(2) of the Directive states that:

'Member States shall develop programmes to encourage SMEs to undergo energy audits and the subsequent implementation of the recommendations from these audits.'

Whereas Article 8(4) of the Directive states that:

'Member States shall ensure that enterprises that are not SMEs are subject to an energy audit carried out in an independent and cost-effective manner by qualified and/or accredited experts or implemented and supervised by independent authorities under national legislation by 5 December 2015 and at least every four years from the date of the previous energy audit.'

An enterprise is an entity engaged in economic activity, irrespective of its legal form. Whether or not an individual enterprise qualifies as an SME is determined by applying criteria for employee numbers, financial turnover and/or balance sheet value. In applying these rules enterprises may need to take account of the data of other partner or linked enterprises, in accordance with the rules within Commission Decision 2003/361/EC, for which guidance has been produced by the Commission²⁶.

The Directive does not provide a definition of large enterprises, as large enterprises are those which are non-SMEs. The definition of an SME is contained in Article 2(26) of the Directive which refers to Commission Decision 2003/361/EC:

'small and medium-sized enterprises' or 'SMEs' means enterprises as defined in Title I of the Annex to Commission Recommendation 2003/361/EC of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises (1); the category of micro, small and medium-sized enterprises is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million'

It follows from the above definition that:

- An enterprise can only be an SME when it meets both the staff headcount criterion and at least one of the financial criterion. When either the headcount or financial requirements of an SME are not met, the enterprise automatically becomes a large enterprise. Therefore, large enterprise and non-SME are terms that can be used interchangeably to mean the same.
- A large enterprise can therefore be defined as an enterprise employing at least 250 persons, or which has an annual turnover exceeding 50 million Euros and an annual balance sheet total exceeding 43 million Euros.
- Determining whether an enterprise is an SME is an exercise that must be undertaken for an individual enterprise. However, an enterprise needs to determine its SME/non-SME status taking into account its own data and potentially data from linked or partnered enterprises, in line with Commission guidance on the definition of SMEs. Article 3 of 2003/361/EC specifically defines autonomous, partner and linked enterprises for this purpose:

1. An 'autonomous enterprise' is any enterprise which is not classified as a partner enterprise within the meaning of paragraph 2 or as a linked enterprise within the meaning of paragraph 3.

²⁶ User guide to the SME Definition, European Commission, 24/02/2016
<http://ec.europa.eu/DocsRoom/documents/15582/attachments/1/translations>

2. 'Partner enterprises' are all enterprises which are not classified as linked enterprises within the meaning of paragraph 3 and between which there is the following relationship: an enterprise (upstream enterprise) holds, either solely or jointly with one or more linked enterprises within the meaning of paragraph 3, 25 % or more of the capital or voting rights of another enterprise (downstream enterprise).

3. 'Linked enterprises' are enterprises which have any of the following relationships with each other:

(a) an enterprise has a majority of the shareholders' or members' voting rights in another enterprise;

(b) an enterprise has the right to appoint or remove a majority of the members of the administrative, management or supervisory body of another enterprise;

(c) an enterprise has the right to exercise a dominant influence over another enterprise pursuant to a contract entered into with that enterprise or to a provision in its memorandum or articles of association;

(d) an enterprise, which is a shareholder in or member of another enterprise, controls alone, pursuant to an agreement with other shareholders in or members of that enterprise, a majority of shareholders' or members' voting rights in that enterprise.

There are exceptions to the above in certain cases, which are detailed in Commission Decision 2003/361/EC and the User guide to the SME Definition.

Article 6 of Commission Decision 2003/361/EC establishes how to determine the data of an enterprise when assessing its SME/non-SME status:

1. In the case of an autonomous enterprise, the data, including the number of staff, are determined exclusively on the basis of the accounts of that enterprise.

2. The data, including the headcount, of an enterprise having partner enterprises or linked enterprises are determined on the basis of the accounts and other data of the enterprise or, where they exist, the consolidated accounts of the enterprise, or the consolidated accounts in which the enterprise is included through consolidation.

To the data referred to in the first subparagraph are added the data of any partner enterprise of the enterprise in question situated immediately upstream or downstream from it. Aggregation is proportional to the percentage interest in the capital or voting rights (whichever is greater).

In the case of cross-holdings, the greater percentage applies. To the data referred to in the first and second subparagraph is added 100 % of the data of any enterprise, which is linked directly or indirectly to the enterprise in question, where the data were not already included through consolidation in the accounts.

3. For the application of paragraph 2, the data of the partner enterprises of the enterprise in question are derived from their accounts and their other data, consolidated if they exist. To these is added 100 % of the data of enterprises which are linked to these partner enterprises, unless their accounts data are already included through consolidation.

For the application of the same paragraph 2, the data of the enterprises which are linked to the enterprise in question are to be derived from their accounts and their other data, consolidated if they exist. To these is added, pro rata, the data of any possible partner enterprise of that linked enterprise, situated immediately upstream or downstream from it, unless it has already been included in the consolidated accounts with a percentage at least proportional to the percentage identified under the second subparagraph of paragraph 2.

4. Where in the consolidated accounts no staff data appear for a given enterprise, staff figures are calculated by aggregating proportionally the data from its partner enterprises and by adding the data from the enterprises to which the enterprise in question is linked.

Further information and examples of the application of these requirements is provided in Commission Decision 2003/361/EC and the User guide to the SME Definition and its subsequent updates.

It is important to note that, for the reasons described above, an enterprise may exceed the thresholds and be, classed as a non-SME because of its relationship with linked or partner enterprises in the same Member State, elsewhere in the EU or outside.

B2. Guidelines and recommended implementation approaches on the Application of the SME Definition to Identify Large Enterprises

Recommended implementation approaches

- Enough information and detailed explanations should be provided to companies to help them correctly identify whether they qualify for the EED Article 8 and reduce the likelihood of misinterpretation of the legislation.
- Provided information should provide clear links to any related legislation necessary to assess the qualification status.
- Treatment of autonomous, partner and linked enterprises should be clear.

To facilitate the identification of the enterprises which are subject to the mandatory requirement set under Article 8(4), it is recommended that the national rules implementing these provisions also include clear references and detailed explanations to make it easier for companies to assess if they are considered large enterprises or not and are therefore subject to regular mandatory audits and under which conditions.

Such clarification would also need to determine the eligibility of enterprises for the specific measures foreseen for SMEs under Article 8(2) which requires Member States to develop programmes to encourage SMEs to undergo energy audits and the subsequent implementation of the recommendations from these audits.

The following key elements should be included in the national guidelines to determining SME/non-SME status of an enterprise:

- An inclusion of the references to the rules set out in Article 3 of Commission Decision 2003/361/EC for autonomous, partner and linked enterprises to determine which related enterprises must be taken into account when assessing whether an enterprise is an SME or not. It is important to remember that the treatment of groups of enterprises is not relevant when determining the SME/non-SME status of an enterprises, which is assessed at a single legal entity level, albeit there are data aggregation rules (see below) that apply to determine if each entity is an SME or not.
- An inclusion of the references to the rules set out in Article 6 of Commission Decision 2003/361/EC to calculate whether or not an enterprise is an SME or not by taking account of the data from the related enterprises. For partner enterprises only a proportion of the employee, turnover or balance sheet numbers must be included, related to the larger of voting rights or share capital. For linked enterprises it is 100% that must be included.
- It is recommended that National Authorities direct enterprises to the detailed guidance 'User Guide to the SME Definition' that is available to help them determine whether they are a SME or not.

A non-exhaustive list of methods which could be applied by National Authorities to support companies in defining their status and in defining the scope for application of the requirements for large enterprises is the following:

- EU level tools and guidance, including the use of the EU SME self-assessment questionnaire²⁷ and the Model declaration on the information to the qualification of an enterprise as an SME that is available in the User guide to the SME Definition, published by the Commission.
- National self-assessment tools and declarations that have been developed. Note these should follow the same SME definition as used in Commission Decision 2003/361/EC when considering the status of an enterprise with respect to Article 8 of the EED.

A national register of large enterprises may be established, to consistently and efficiently determine and record company compliance requirements. It has been used by some Member States and it is recommended that National Authorities consider taking up and maintaining this approach.

A declaration from companies that claim not to qualify for audit under Article 8 may be used to ensure compliance and allow the national regulator to confirm the correctness of qualification assessment based on the provided information. This has been used by some Member States and it is recommended that National Authorities consider taking up and maintaining this approach.

²⁷ http://ec.europa.eu/growth/tools-databases/SME-Wizard/smeq.do;SME_SESSION_ID=4ColczryRBVJsZGHmtD90oYZ4lcrjCzszeOJ7NnCY7Azq3_e-erx!25758946?execution=e1s1

C PRINCIPLES OF COST-EFFECTIVENESS, REPRESENTATIVENESS AND PROPORTIONALITY

Compliance with Article 8 is grounded in the principles of high-quality and cost-effectiveness which are outlined in Article 8 (1) and (4) as well as Annex VI (see below). Annex VI also introduces the principles of representativeness²⁸ and proportionality²⁹.

The principle of audit **cost effectiveness** sets the expectation that the value of the energy audits exceeds the costs of undertaking them. The value of the audits is the information they provide that enables the enterprise to make energy efficiency improvements. The costs include those of the auditor (which could be internal effort or external contract costs) and the wider costs to the enterprise, for example related to the gathering of data. This leads to the consideration of approaches such as clustering and sampling which are aimed at reducing the costs of undertaking audits.

Experience gained from undertaking audits has identified the following key considerations with regard to cost effectiveness:

- An audit will be more valuable if it relates to energy use for which savings opportunities are greatest. It is therefore appropriate to assume, as a surrogate, that covering a larger proportion of energy by the audits will equate to a larger potential benefit.
- The audits can be more valuable if findings from one site or process are more widely applicable to other sites or processes. This highlights the value of clustering and sampling to focus effort on generating audit findings that can support wider energy savings activities within the enterprise.
- The costs of carrying out an audit are not proportional to the energy consumed, since there will be fixed costs associated with auditor visits to site, reporting etc. This means that audits covering small energy sources can be less cost effective and it's important to consider allowing these sources to be excluded from the audit requirements.

The principle of **representativeness** sets the expectation that audit results are applicable not just for the energy use examined in detail by the audit but more widely across the enterprise (across its sites and activities). It is however reasonable to assume that audits need not necessarily encompass equally all parts of an organisation if there is evidence that this is not cost effective.

The principle of **proportionality** sets the expectation that the regulatory obligation placed enterprises is reasonable in relation to the overall objective of the policy, which is to encourage energy saving. This means that the energy consumption subject to be audited should correspond to a significant part, but not necessarily all, of the energy consumed within the enterprise's activities or sites. This will also help to reliably identify the best opportunities for energy savings, whilst remaining representative.

It is recommended that National Authorities foresee within their national audit programmes transposing Article 8 specific measures to ensure cost-effectiveness while respecting the principles of high-quality audits which should also be representative and proportionate.

²⁸ Annex VI(d) states that energy audits must be sufficiently representative to permit the drawing of a reliable picture of overall energy performance and the reliable identification of the most significant opportunities of improvement. Therefore, national minimum criteria based on Annex VI must make clear that all energy related aspects listed in point (b) (buildings or groups of buildings, industrial operations or installations, including transportation) must be systematically screened.

²⁹ Annex VI(d) requires energy audits to be "proportionate". The principle of proportionality implies testing that a legislative or administrative measure or means is appropriate and necessary in order to reach or achieve a given goal or objective. The Court of Justice of the European Union applies the proportionality principle when it balances legislative measures against private interests, individual rights and fundamental freedoms.

ANNEX VI

Minimum criteria for energy audits including those carried out as part of energy management systems

The energy audits referred to in Article 8 shall be based on the following guidelines:

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

Energy audits shall allow detailed and validated calculations for the proposed measures so as to provide clear information on potential savings.

The data used in energy audits shall be storable for historical analysis and tracking performance.

D. PRACTICAL METHODOLOGIES TO IMPLEMENT THE COST-EFFECTIVE REPRESENTATIVENESS AND PROPORTIONALITY PRINCIPLES.

This section includes guidelines on some of the methodologies which are considered as appropriate to ensure cost-effectiveness, proportionality and representativeness with respect to compliance with Article. 8.

D1. Common Aspects

To support the undertaking, at a national level, of cost effective audits by enterprises, National Authorities could foresee different methodologies. Following a technical assessment of the possible options, two main approaches have been identified:

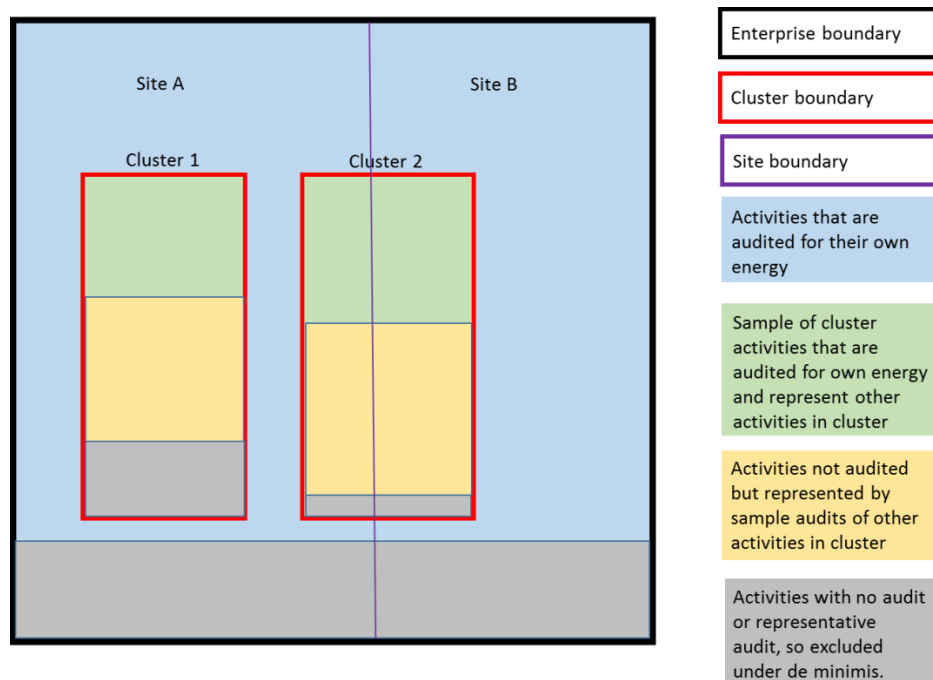
Clustering and sampling: Methodologies focused on grouping and sampling of energy consumption across similar activities taking place within or at different sites of the same enterprise. These methodologies can improve costs effectiveness by avoiding the need to audit some sites, for example small similar sites with low energy consumption.

De minimis: Methodologies for setting a threshold below which energy use can be excluded from the audit on the expectation that the value gained from including it would not be justified in comparison to the cost. The method allows effort to be focused on the areas where the energy savings are likely to be greatest.

The two approaches above are discussed separately in this document. However, interactions may arise between them and National Authorities should consider this in developing their methodology. Other flexible measures may also be appropriate to encourage energy savings through the use of cost effective energy audits.

National Authorities should consider providing guidelines on how energy consuming activities can be clustered and what use can be made of sampling approaches so that findings for activities examined in detail can be applied for other similar activities.

Figure 2: Illustrative treatment of enterprise energy under audit regime

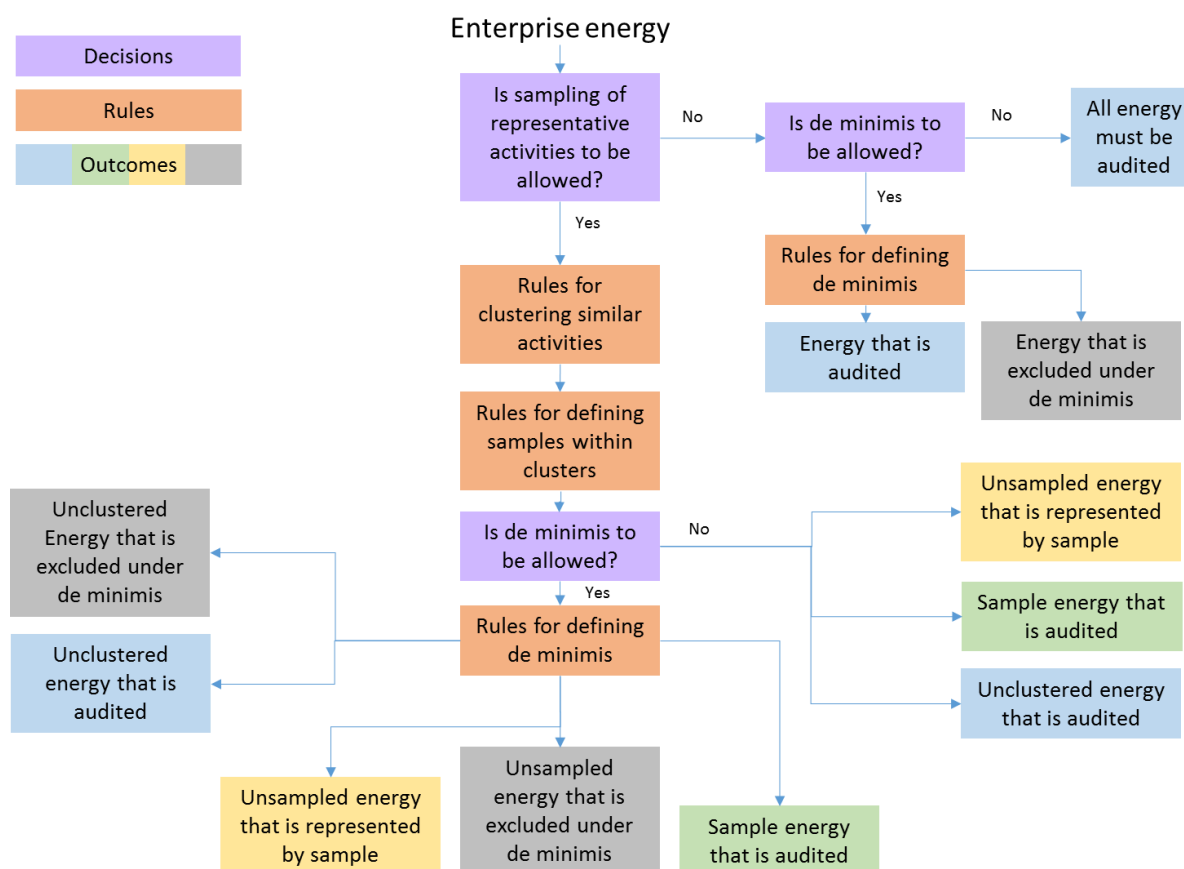


The above figure illustrates how the energy use of an enterprise could be treated under an audit regime. The enterprise boundary, in energy terms, is represented by the thick black line. The enterprise consists of two sites, the boundary of which is shown by the purple line. Within the enterprise, in this example, are two clusters, each comprising similar energy consuming activities. Within each cluster the energy could either be audited, could be represented by sample audits carried out on energy use for similar activities. A portion of the energy consumed could not be audited on a de minimis basis. In this

example Cluster 1 relates to energy consuming activities at Site A only, whereas Cluster 2 includes energy consuming activities at both Sites A and B. Outside of the clusters, the energy consuming activities use must either be subject to an audit or excluded on a de minimis basis.

It is recommended that National Authorities include principles in their national guidelines establishing how the elements of clustering, sampling and de minimis can be used and can work together. It is also recommended that National Authorities consider providing more detailed guidelines on the approach to clustering and sampling (see Sections D2.2 and D3.2). These guidelines should also include information and examples that will help enterprises and their auditors to apply clustering and sampling. Some examples are provided in Sections D2.3 and D3.3. However, if the diversity of enterprises within the Member State may make it difficult to establish an approach that is suitable for all, National Authorities may also identify that enterprises and their auditors are best placed to define clusters and determine whether activities are similar enough for the purposes of applying audit findings from one activity to another. Under these circumstances National Authorities guidelines should include requirements for enterprises to justify the clustering and sampling used.

Figure 3: Categories of energy consumption resulting from clustering, sampling and de minimis rules



There is a logic to the relationship between clustering, sampling and de minimis. First, a decision is made about whether use of representative sampling is to be allowed. If it is then the rules concerning how to cluster similar activities and how to define suitable samples within clusters must be defined. Even with such clustering and sampling it will be necessary to consider whether to apply a de minimis rule, for the exclusion of small sources either not covered by clustering or not represented by other activities within the cluster. If clustering and sampling are not used, then the only consideration is whether and how to apply a de minimis rule.

The figure above indicates the categories of energy consumption resulting from the application of clustering, sampling and de minimis rules.

D2. Clustering as a Pre-cursor to Sampling

D2.1 Legal & Policy Context

Large enterprises may undertake diverse activities either on multiple sites or on the same site. For example, an enterprise could undertake product manufacturing and subsequent distribution activities utilising a central manufacturing plant, and then several distribution warehouses with associated fleet vehicles and a small amount of office space. Clustering is an approach whereby activities within a large enterprise with similar energy use characteristics, based on parameters such as those outlined in Section D2.2, are placed into groups. Most enterprises may be able to apply some level of clustering, even if they have limited activities.

The Directive does not state whether clustering should or should not be undertaken, however clustering allows a cost effective and representative approach to identifying energy saving measures from each type of activity. It enables energy audits to be undertaken on specific operations that are representative across a large enterprise.

In practice enterprises will mainly draw on their own information, however, where there is a willingness there may be sharing of information between enterprises. This includes, for example, cases where enterprises can be grouped under a corporate identity or brand and groupings aligned through financial, management or operational controls. Where there is information sharing between groups of enterprises it must be remembered that all large enterprises are still required by Article 8(4) to be subject to an energy audit and must meet this obligation as an individual enterprise.

The guidelines in Section 2.2 provide advice on how to establish and apply a clustering approach and are grounded on the following key recommended implementation approaches:

Recommended implementation approaches
<ul style="list-style-type: none">• Undertaking clustering with a flexible approach across different enterprises should be supported.• Selected clusters should be justified.• Clusters should be reviewed and the rationale for previously identified clusters should be updated as necessary in future rounds of auditing.• Different sites should be audited in future rounds where the clusters are un-changed or similar to those previously audited or if the same sites are audited in future rounds where the clusters are un-changed this should be justified.

D2.2 Guidelines for National Authorities on establishing a clustering approach

In order to facilitate clustering and promote cost-effective audits, National Authorities are recommended to include in the national rules and guidelines transposing Article 8 specific rules to facilitate clustering of activities within enterprises. Such rules should include:

- 1. Requirements for enterprises to define the clusters associated with their activities.** National Authority guidelines should support enterprises to undertake clustering, with a flexible approach that can be used across different enterprises. National Authority guidelines should include information and examples on how to approach clustering. An approach to clustering such as the following could be used to ensure clusters are defined at a level that enables the results from sites audited within a cluster to be applied to other sites not audited within the same cluster:
 - Guideline (b) of Annex VI states an energy audit should be undertaken to provide a review of the energy consumption profile of buildings or groups of buildings, industrial operations or installations, including transportation. It is recommended that initial clustering is undertaken by buildings or groups of buildings, industrial operations or installations, including transportation. This also aligns with energy audit standards, for example EN 16247-1 (Energy Audits), which established three types of energy audit – buildings, processes (industrial operations or installations) and transport. This standard has been developed to support different Directives, including the Energy Efficiency Directive.

- Further clustering may then be applicable to identify activities that have similar energy consumption and use characteristics. Typical factors (not exhaustive) to consider when assessing the similarity of activities include the type of building in which the energy consumption occurs, the energy consuming processes undertaken and the nature of transport energy use. These are described below with illustrative examples.

Clustering of buildings

- Physical characteristics of the building including building size, construction type and age that may affect energy consumption. Newer buildings are more likely to have used more energy efficiency construction methods and materials, for example with respect to insulation and glazing. Some older building may have undergone renovation and have different characteristics to those that have not been renovated.
- Use characteristics of the building that affect its energy profile, for example whether it is mainly used for offices, manufacturing, industrial processes, distribution or retail.
- Systems within the building that affect its energy profile, such as lighting and heating/cooling technologies.

Depending on the enterprises circumstances it may necessary to take into consideration a mix of these characteristics. For example, a supermarket enterprise may have a series of retail stores, some of which are new build to the same specification, with the remainder in older pre-existing buildings, some with newer heating and cooling systems and others with older systems. The new build retail stores could be grouped as one cluster, but the other group of buildings would be better split into two further clusters due to the differences in their heating and cooling systems, since these factors affect their energy profile and energy efficiency improvement opportunities. This approach would ensure the results of audits were applicable to other sites within the cluster that are not audited.

Clustering of static processes

- The type of process needs to be considered; for example, industrial processes, manufacturing, assembly, packaging lines, component or final product manufacturing. Sub-divisions for different types of processes within these main groups are likely to be required as there needs to be sufficient similarities in the processes to ensure results can be applied across other processes included within the same cluster. For example, an enterprise may undertake several different industrial processes e.g. metal forming and then powder coating, which have different energy profiles and use different equipment.
- Within similar processes there may be factors that will affect the identification of energy efficiency improvements, which will need to be considered when defining clusters. This could include the equipment types and technologies used, the age and efficiency of the equipment and fuel types used.

For instance, a drinks manufacturer with three bottling plants, one installed recently using state of the art technology and two others using a previous generation of technology would need to have these as two separate clusters as the energy consumption and potential energy efficiency improvements would differ.

Clustering of transport activities

- When clustering transport activities factors to consider include different types of vehicles, fuels and the purpose of the transport. For example, staff travel, freight, deliveries and distance travelled could be useful factors to consider in identifying further clusters that would enable audit result to be applied to other parts of a cluster not audited.

For example, within a supermarket's vehicle fleet large lorries may be used for stock distribution over long distances from distribution centres to various stores as one cluster. A second cluster of smaller vans used for home deliveries over shorter distances could also be identified.

Further examples on the application of clustering that National Authorities could include in their guidelines is provided in Section D2.3.

Enterprises will be best placed to undertake the clustering exercise as they will have the most detailed knowledge of their activities. This should be done in accordance with National Authority guidelines and could include input and support from the qualified auditor appointed by the enterprise when developing the energy audit plan.

When identifying clusters, it will be important for enterprises to review available energy and activity data to identify similarities in sites and activities, alongside other information such as the physical infrastructure or process descriptions. It should not be permitted to consider as a cluster activities which do not have sufficient similarities to enable the findings of an audit to be applied to those activities within a cluster that have not been audited.

2. **Requirements for auditors to include the rationale and justification of the clusters selected within their compliance report.** When identifying clusters the particular circumstances and activities of the enterprise will have been taken into account. The details of this should be outlined, including any quantitative and qualitative evidence regarding their circumstances, to provide a clear rationale and justification for the clusters that are used. Auditors will need to discuss this with the enterprise if they were not included in the clustering decisions made by the enterprise.
3. **Requirements for an enterprise to review and update as necessary the rationale for clusters identified previously in future rounds of auditing.** This is required in case of any changes within the enterprise, for example new processes, buildings, sites.
4. **Requirements that different parts of the cluster e.g. different sites should be audited in future rounds where the clusters are un-changed or similar to those previously audited, or if the same sites are audited in future rounds where the clusters are un-changed this should be justified.** Auditing different sites help to identify different opportunities, highlight different approaches different sites may take and also act as a check to ensure other sites, and not just the audited site are acting on the results of previous audits. In some cases, auditing the same sites in future rounds may appropriate, for example to have a time series for the evaluation of measures implemented. Where this is the case it should be justified.
5. **A policy for combining clustering with sampling (See Section D3).**

D2.3 Example of Application

A Member State's guidelines could state that enterprises should cluster their operations/energy use into similar groups to support cost effective auditing and representativeness using the EN 16247 energy audit standards as a basis for initial clustering. Company A is a large retail enterprise with diverse operations covering stores and a distribution network, so in the first instance it groups its energy use into the following clusters for broad activity types:

- Buildings: Clusters for retail stores, head office and distribution centres.
- Processes: A cluster for distribution centres (some bespoke automated processes operate in the distribution centres).
- Transport: Clusters for delivery vans and company cars.

Company A then also identifies that the retail stores should fall into three separate clusters because they have different energy profiles, as follows:

- High street stores.
- Retail park stores.
- Shopping centre stores.

Company A therefore has a total of seven clusters of energy use to consider in its energy audits:

- Buildings: High street stores.
- Buildings: Retail park stores.
- Buildings: Shopping centre stores.
- Buildings: Head office.

- Buildings and Process: Distribution centres.
- Transport: Company cars.
- Transport: Delivery vans.

By considering these clusters, Company A is able to ensure that all energy use is covered by an audit plan that is representative of the whole business, and supports the development of a cost-effective sampling approach. It also means the audit focusses on each of the different clusters and its recommendations for saving energy will therefore be targeted to each cluster.

The guidelines to enterprises should support them in carrying out clustering at a suitable level of granularity. For example, the delivery van cluster above could be broken into further clusters if there were distinct categories of van with different energy use characteristics. The enterprise could identify that small petrol fuel vans are used for short deliveries and a programme to replace these with hybrid vehicles is underway, whereas larger diesel fuelled vans are used for longer deliveries. This would result in additional clusters of small and larger vans, as the fuel type and distances travelled will mean they have different energy consumption profiles and opportunities for improvements may differ, particular as action is already being taken with respect to the smaller vans with hybrid vehicle roll out.

D3. Sampling

D3.1 Legal & policy context

Within the context of Article 8 energy audits, sampling is the selection of a representative part of a population i.e. groups identified through clustering, such as industrial processes, building types, fuel use to determine energy saving opportunities that can be applied to the whole population. It's not mandatory to foresee a sampling approach, however this methodology is considered to be helpful in maximising the value of energy audits. Effective sampling increases the cost-effectiveness of the energy audit as a reduced number of audits can derive findings that are applicable to multiple sites/activities within the same cluster.

To ensure that the sampling methodology is compliant with the minimum requirements set in Annex V, the sampling of sites and activities must guarantee representativeness of the audit. To this end, sampling without clustering (Section D2) could lead to an audit plan that is not necessarily representative of the whole enterprise. It is important that clustering is applied before sampling so as not to undermine the quality of the audit results and ensure audit outcomes can be applied effectively to energy use that is not audited directly, but is covered indirectly by applying the results from those parts of the energy consumption within a cluster that is audited. Clustering is therefore a pre-cursor to applying sampling and it provides the groups within which sampling can be taken therefore ensuring the audit regime is representative.

If an enterprise's activities are such that they do not differ across sites e.g. a retail organisation with stores of a similar size, age, opening hours and energy use profile then a single cluster may be appropriate and further sub-division might not be necessary.

Recommended implementation approaches
<ul style="list-style-type: none">• Undertaking sampling, with a flexible approach across different enterprises, should be supported.• The sample methodology and sample of sites selected for auditing should be justified.• Different sites within a cluster should be sampled in future rounds of audits where activities and therefore clusters are un-changed or similar to those previously audited or if the same sites are sampled in future rounds where the clusters are un-changed this should be justified.

D3.2 Guidelines for National Authorities on establishing sampling approaches

In order to facilitate sampling and ensure compliance, national guidelines are recommended to establish:

- 1. A policy for sampling to support representativeness and cost-effective energy auditing.** Different sampling methodologies may be applicable depending on the enterprises circumstances. The use of sampling methodologies is compliant with Annex VI where it is justified by the strong similarities of the operations to be audited within the enterprise. A national authority could decide to allow flexibility and to leave to enterprises the choice of the most appropriate sampling approach. Alternatively, a national guideline could include specific and mandatory criteria that each enterprise should follow, to ensure greater consistency across audits.
- 2. A policy for clustering to complement the policy on sampling.** Please see Section D2 for guidelines on developing a clustering policy.
- 3. Requirements for enterprises (with the support of their auditor as necessary) to outline and justify the sample methodology and sample of sites selected for auditing.** Enterprises that carry out sampling will do so in a way that is suitable for their circumstances, so should provide a justification for the sampling approach used and the sample chosen. National Authority guidelines should establish requirements for auditors to include the rationale and justification of the sampling within their compliance report. Auditors will need to discuss this with the enterprise if they were not included in the sampling decisions made by the enterprise. Guidelines should clearly state that the sample size is a minimum, and encourage participant enterprises to consider the benefits of undertaking more audits and enhancing energy consumption measurement. A number of factors could form part of the justification, for example:
 - a. The use of sound statistical methodologies.
 - b. The use of results of previous energy audits.
 - c. A focus on larger sites, as this is where innovation and opportunities are most likely to arise.
 - d. The length of time since a site was last audited.
 - e. The strategy of the enterprise for managing its site portfolio, for example where improvements have already been made or are planned.
 - f. Plans for sites to be sold or undergo significant changes.
- 4. Requirements to sample different sites within a cluster in future rounds of audits where activities and therefore clusters are un-changed or similar to those previously audited. If the same sites are sampled in future rounds where the clusters are un-changed this should be justified.** Sampling different sites helps to identify different opportunities, highlight different approaches different sites may take and also act as a check to ensure other site, and not just the audited site are acting on the results of previous audits. In some cases, sampling the same sites in future rounds may be appropriate, for example to have a time series for the evaluation of measures implemented. Where this is the case it should be justified.

In relation to the above Point. 1, the National Authorities should provide guidelines that allow enterprises to determine the number of sites or energy consuming activities that should be considered in relation to the overall population. This should recognise that a smaller number can be representative if sites or activities are very similar (for instance restaurants built to the same design standard or vehicles within a distribution fleet) whereas if there are more significant differences (for example with office accommodation in older buildings) then a larger number would be needed. The following list includes describes approaches that could be used in the sampling guidelines (not exhaustive):

An approach could be used in which the sample size is directly defined by the number in the total cluster population, for instance the number of sites across a property portfolio. The requirement would be for an increasing the number of sites to be audited as the total number of sites within a cluster increases, but this would represent a reducing proportion of the cluster population, e.g. for 1-5 total sites, minimum 1 audit, 6-20 sites, minimum 2 audits, 21-50 sites, minimum 4 audits etc. For non-site based clusters, for example transport, the ranges could focus on number of vehicles. In order for this

approach to work effectively and ensure sampling is representative, it is necessary to use it in conjunction with clustering. The minimum sampling numbers could be expressed in one of two ways:

- A formula in which the number in the sample is calculated from the number in the cluster, for example a square root rule.³⁰
- The representation of the relationship between the number in a sample and cluster size as a look-up table.

As an alternative, flexible sample numbers could be allowed. This would be based on the enterprise's own assessment of what is representative within a cluster: The MS could set an expected percentage or number of sites/activities to be audited, but empower enterprises to use their discretion to justify a smaller sample.

D3.3 Example of Application

A national guideline could state that where an enterprise has multiple sites, it can audit a sample of each of those that are similar, for example in terms of energy use, the activities undertaken (See Section D1 regarding the types of parameters that can be considered when identifying similar activities). The guideline should state that the sample must be representative of total energy use and use a scaled sample size method.

As Company A has already identified a number of clusters of similar energy uses/sites, it develops an audit plan that addresses each cluster appropriately. It also seeks to ensure that the audit process is cost effective by identifying where audit findings from one site can be extrapolated to other sites.

Company A has 40 high street stores, 20 retail park stores and 4 stores located in shopping centres. Therefore, four high street stores (10%), two retail park stores and one shopping centre store must be audited - a total of 7 store site audits.

Company A considers how different approaches to selecting the sample size based on other methods would impact the sample:

- Auditing a number of sites equivalent to the square root of the total would mean visiting 8 stores.
- Auditing a minimum of 10% of sites would require 7 store site visits.
- Auditing a representative sample may involve visiting only two high street stores, one retail park and one shopping centre store - four store visits in total - as the findings of the audits can be extrapolated to cover all stores. However, it would require significant work by the enterprise to prove that this small sample was representative of all sites and, whilst this option would provide the lowest cost of audit, it could compromise the potential energy efficiency benefits that could be achieved in all stores.

As there is only one office no sampling is undertaken, and the office site is identified for a site visit as part of the audit plan.

Of the three distribution centres, one is significantly larger than the other two and accounts for 50% of the energy use in the distribution centres. This is due to it also being the main warehouse and fulfilment centre for on-line orders, and as such it has an automated 'pick and pack' system, previously identified as a unique process energy use through the clustering exercise. All other systems and features of the distribution centres are similar. As a result, the largest distribution centre is included in the audit plan, as any findings arising can be extrapolated across all centres without additional audit cost.

Company A includes two transport energy audits within its overall audit plan, one for company cars and one for delivery vans, as these have been considered separate clusters due to the way the vehicles are used.

Overall, nine building audits (7 stores, one office and one distribution centre) are included in the audit plan along with two transport audits. This clearly addresses all energy uses of the business, without incurring disproportionate cost of audit and maximising the benefits.

³⁰ Note that statistical approaches to sampling require knowledge or assumptions about the population characteristics (such as variations being either random or following a known pattern), which are not likely to be easily understood for an energy portfolio, therefore a rule of thumb approach may be the most pragmatic.

If Company A had not clustered its operations before selecting the sample, it may not have been able to demonstrate that the sites chosen were representative of all energy use (for example it may have audited retail stores only and not included any distribution centres).

D4. DE MINIMIS

D4.1 Legal & Policy Context

The assessment of the cost-effectiveness principle of energy audits might show that undertaking audits across all energy uses is not cost effective. For instance, there may be diminishing value/benefit from auditing small amounts of energy use. This leads to the admissibility of using a de-minimis rule to exclude marginal energy uses from audits. The overall aim of the de minimis rule must be to support the overall cost-effectiveness and proportionality objectives of Article 8.

Preliminary examination of the data collected across Europe reveals significant variations in the costs of performing audits across countries. While the assessed potential seems to be more consistent across countries, the audit cost ranges are significant. This evidence points to the need to establish de minimis thresholds at national level, and not at EU-level, and that it is not admissible to have a de minimis rule unless it is justified by a national cost effectiveness assessment. Such an assessment is a pre-condition for a de minimis rule and must establish the basis for allowing the exclusion of some energy use in terms of comparison of the audit costs with the likely value/benefits.

The principle of cost effectiveness that underpins the use of a de minimis rule could be challenged if enterprises simply treat it as the basis for excluding a part of their energy use without giving any consideration to whether, for their circumstances, it would be better to include it, or exclude a different part.

Recommended implementation approach
<ul style="list-style-type: none">• De minimis exclusion should be supported by and based on the assessment of the national audit data.• The appropriateness of using the de minimis rule must be justified.• Different energy consumption areas should be excluded in consecutive audits or it should be justified why previous de minimis exclusion is still relevant.

D4.2 Guidelines for National Authorities on establishing a de minimis rule

National Authorities are recommended to establish:

- 1. A policy for assessing de minimis requirements at national level.** This policy should be based on a national cost effectiveness assessment. The outcome of the assessment should provide justification of the de minimis rule being adopted. It is recommended the assessment is undertaken following each round energy audits required under Article 8. The policy could be refined in consultation with industry. The policy should be re-evaluated throughout the implementation of Article 8 by assessing the cost and benefits of the audits performed. Data on audits performed should provide a very good source of quantified costs and benefits related to the audit obligation. The assessment approach can also examine practical case studies to determine a suitable de minimis level. Such practice is already occurring in several Member States. Other sources of data available at a national level might also be relevant.
- 2. A justified de minimis rule.** This should set out the basis for the classification of energy covered by the de minimis, the metric to be used and the value to be applied, i.e. the de minimis threshold.

Depending on the national circumstances a de minimis rule may be based on different metrics and at different levels of energy use. For instance, a single threshold that is equally applicable to all enterprises could be used. Such a standardised approach across enterprises can provide a clear basis upon which small areas of energy consumption can be excluded. A number of Member States have set a de minimis as a percentage of total energy consumption (of an individual enterprise) that can be excluded from the audit obligation. This approach reflects the practical capacity constraints

within enterprises and the natural focus that they will place on prioritising the largest opportunities – it assumes that enterprises will have the capacity to focus efforts on the same percentage of their energy use, regardless of their size.

An increasingly stringent de minimis threshold could be justified over successive audit cycles. As enterprises improve their monitoring and management of energy, the cost effectiveness of auditing a greater proportion of total energy use may improve. Re-assessment of the de minimis policy should consider this. For example, if a threshold of 10% has been set in the first audit cycle, it may be appropriate to revise this to 5% for a future round to encourage enterprises to continue improving their data records and audit coverage. Alternatively, where significant energy savings have been implemented following audits the further audit cycles may be less cost effective suggesting the need for a less stringent de minimis. Re-assessment of the de minimis rule needs to consider such effects.

3. **Requirements for enterprises to justify that the use of the de minimis rule is appropriate.** Enterprises (with the support of their auditors if necessary) should be required to justify that their use of the de minimis rule is appropriate, i.e. auditing of the energy excluded would not be likely to identify significant cost-effective savings. This should not require a level of detail that would undermine the value in having a simple clear threshold applicable to all enterprises.
4. A further check to ensure continued cost effectiveness is that for successive audits the enterprise could be required to consider the energy previously excluded under a de minimis rule, to either justify its continued exclusion (i.e. there is no new strong evidence there would be cost effective savings) or seek to vary which energy is excluded, so that a greater proportion of energy is subject to an audit over time. This requirement should assist in re-assessment of the de minimis policy through successive audit cycles.

D4.3 Example of application

Enterprise A is a retail organisation with 64 retail stores, a head office, and three distribution centres plus a fleet of 20 delivery vans and 30 company cars. It has a total energy consumption of 50,000 MWh broken down as follows:

Company A		Site/Activity Type							
		Retail Stores		Head office		Distribution Centres		Total	
		Energy Use (MWh)	% of total energy	Energy Use (MWh)	% of total energy	Energy Use (MWh)	% of total energy	Energy Use (MWh)	% of total energy
Energy Type	Electricity	20,000	40.0%	500	1.0%	4,500	9.0%	25,000	50.0%
	Gas	6,000	12.0%	50	0.1%	1,500	3.0%	7,550	15.1%
	LPG	-	0.0%	-	0.0%	250	0.5%	250	0.5%
	Diesel	-	0.0%	2,000	4.0%	13,000	26.0%	15,000	30.0%
	Petrol	-	0.0%	2,200	4.4%	-	0.0%	2,200	4.4%
	Total	26,000	52.0%	4,750	9.5%	19,250	38.5%	50,000	100%

A national guideline could state that up to 10% of total energy consumption can be excluded as de minimis. Enterprise A can therefore achieve compliance by undertaking an audit of all energy use within retail stores and distribution centres (including the vans based at those distribution centres). The de minimis exclusion is applied to all energy associated with the head office operations (9.5% of total energy, including company cars). The LPG use could also be excluded whilst staying within the 10% limit overall.

Appendix 2 Methodology: acquiring implementation experience for the guidelines development

Key guiding principles and framing concepts

Member State interpretation of the principles and criteria that underpin Article 8, encompassing audit cost-effectiveness, proportionality and representativeness, has varied because different Member States have need to consider different structures and volumes of companies in scope. It has therefore been necessary to develop an evidence base with bottom-up detail from across the EU by a number of means (described below). Member States' experience in relation to the principles and associated concepts such as clustering, sampling and de minimis has helped to draw out what can be considered to be some of the more 'problematic' and indeed, most 'effective' examples of both interpretation and implementation. The detail gathered and its analysis (set out and described in the previous chapters) has then helped form the development of the guidelines for National Authorities.

This study also builds on previous work undertaken in 2014 (commissioned by DG Energy) which assessed the policy measures and methodologies put in place by those Member States which had transposed the requirements of Article 8 into national law by 5 June 2014. It provides an update on implementation practices and experience within different Member States up to early 2018.

Information/data collection and engagement process

The information/data collection and engagement process with National Authorities, auditors and companies in scope, has been aimed at understanding actual audit experience in relation to interpretation and implementation of Article 8 (and Annex VI) of the Energy Efficiency Directive.

An approach based on four distinct tasks has been used to gather an appropriate breadth and depth of experience, information and data for review and analysis to provide an evidence base for the development of the guidelines. Information/data gathering from the National Authorities has been directed through DG Energy to ensure that all requests for information have been appropriate and aligned to existing interactions, particularly the NA Committee.

The four information/data collection and engagement tasks are set out below in **Error! Reference source not found.**, along with their associated activities and sequencing.

Table A1.1 Overview of information/data gathering tasks, activities and engagement process.

Information and data collection task		Activity
1	Review of literature and other information and data sources	<ol style="list-style-type: none"> 1. Identification of in-scope literature and other information/data sources. 2. Review of identified literature and other sources in relation to study concepts³¹. 3. Synthesis and elaboration of findings.

³¹ Study concepts: audit cost-effectiveness, definition of large enterprises, clustering, sampling, de minimis and thresholds for small sites.

2	Assessment of current Member States' status	<ol style="list-style-type: none"> 1. Identification of in-scope material (including from stage 1, above). 2. Assessment of Member States' status against selected study concepts, e.g. sampling, de minimis and definition of large enterprises. 3. Synthesis and elaboration of findings.
3	Engagement with National Authorities on company-level data; and, on other/further information	<ol style="list-style-type: none"> 1. Definition of company-level audit-based data required and development of set of questions for direct request. 2. Identification and engagement with National Authorities to obtain company-level feedback on above data request. 3. Further identification and engagement (including through interview) with sub-set of National Authorities in support of analysis of study concepts (i.e. clustering, sampling, de minimis). 4. Synthesis and elaboration of findings.
4	Interview and survey of targeted focal organisations (auditors and multi-national/ multi-site/ single-site companies)	<ol style="list-style-type: none"> 1. Definition of research questions and development of interview/ survey process and script. 2. Identification of appropriate organisational focus and distribution (e.g. company type, sectors, auditors, Member State distribution, etc.) 3. Pilot interview of small sub-set of organisations and refinement of interview process and script. 4. Interview and follow up survey of targeted organisations. 5. Synthesis and elaboration of findings.

Review of literature and other information/data sources and assessment of Member States' status

The review of literature and other information and data sources has used both public information/data and analysis and the appreciation of Article 8 interpretation and implementation in Member States which has been gained by the consultant to date. This appreciation has been acquired through previous direct communications and interactions with stakeholders, such as the National Authorities, companies and auditors across the EU).

The review has included previous studies on the implementation of Article 8 as well as analyses that have assessed the conformity of the Energy Efficiency Directive's transposition (e.g. carried out during 2015-2016). Other sources that have been considered include:

- MS National Energy Efficiency Action Plans (NEEAP);
- Concerted Action reports and information;
- notified national legislation and other measures of legal transposition;
- Implementation analysis, guidance as notified by the Member States as part of their implementation of Article 8.

The review broadly covers the key concepts being considered in this study: the cost-benefit of audits, definition of large enterprises, clustering, sampling, de minimis, threshold for small sites and other topics such as leased assets. The present status across EU Member States with respect to their interpretation, provision and implementation of the sampling and de minimis concepts (and the definition of large enterprises) has also been assessed in detail.

The findings of the review and Member States' status assessment are presented in Chapter 2.

Engagement with National Authorities

The engagement with the National Authorities³² was undertaken in three stages, as described below.

1. Initial gathering of Member States' company-level data

An initial request for company-level audit-based data acquired within Member States under Article 8 was made to the National Authorities during June 2017 (the subsequent engagement and feedback process then effectively ran throughout the project).

The request to the National Authorities (via email directly through DG Energy) asked for company-level data held within Member States in relation to audited energy consumption, identified savings potential, savings achieved and audit cost. The questions that formed the request were defined and developed by the consultant in collaboration with DG Energy.

The focus and detail of the questions is shown below in **Error! Reference source not found.** Clarifications on the responses received from the National Authorities were raised directly by the consultant with them as agreed with DG Energy. However the quality and level of detail of the data received varied significantly across MS.

Company detail	Number of companies which have performed energy audits, their sites composition and their disaggregation per sectors?
Energy consumption	Energy consumption in given year and the disaggregation per company site and per sector (process, buildings, transport, others)?
Audited energy consumption	Share of the audited energy consumption in the total company's consumption?
Energy saving potential	Estimated energy saving potential resulting from the audits, in total and per each company site, i.e. site 1, 2, 3, ... and per sector (process, buildings, transport, other)?
Energy saving achieved	Estimated energy saving achieved through savings measures implemented, in total and per each company site, i.e. site 1, 2, 3, ... ?
Audit costs	Audit costs in EUR and/or effort days, in total and per each company site, i.e. site 1, 2, 3, ... ?

Figure A1.2 Focus and detail of request made to National Authorities to obtain MS-level detail on company-level data.

2. National Authority Committee meeting, Brussels

³² NOTE information and data gathered from the National Authorities was directed through DG Energy to ensure that all requests for information were appropriate and aligned to existing interactions, particularly the NA Committee.

A summary and interpretation of the responses received via the above process from the National Authorities was presented by the consultant at a National Authority Committee meeting in October 2017. An initial consultation document on the proposed Guidelines was also presented by the consultant at this meeting. Feedback was provided during the meeting to the consultant.

3. Follow up process

A second round of information was requested from the National Authorities during November 2017. Further detail was requested (through DG Energy) on national data concerning energy audits, in case new data had become available or not previously been provided. A number of the National Authorities provided extracts of data they had collected during the first compliance period and this was fed into the overall analysis process alongside input received from the initial request to the National Authorities.

Interviews with a small number of National Authorities were also undertaken early in 2018 to gather more detail on some of the key study concepts (e.g. clustering, sampling, de minimis).

Interview/ Survey of companies and auditors

The literature and Member States' status review along with the information acquired through the engagement with the National Authorities provided considerable detail and evidence on the interpretation and implementation experience of Member States to date in relation to Article 8 (and Annex VI). However, there was still the need for a more targeted interview process of in scope companies and auditors across Member States to enhance contextual understanding, to uncover and validate further relevant 'bottom-up' information and data and to identify best practice material.

An interview process was undertaken to acquire on-the-ground experience in Member States in relation to the principles of cost-effectiveness, proportionality and representativeness and the associated concepts such as e.g. clustering, sampling and de minimis. The interview process mostly focussed on targeting multi-national and multi-site companies operating across the EU and on a broad range of auditors currently operating in Member States.

Development of approach

A series of broad question sets based on the areas for investigation were defined and developed based on the experience and understanding of the consultant of Article 8 and its interpretation and implementation. The questions were designed to focus on the study concepts in turn: audit cost-effectiveness, definition of large enterprises, clustering, sampling, de minimis and thresholds for small sites. The question sets were provided to DG Energy in the first instance and then adjusted to reflect feedback.

The questions formed the basis for an interview script. Not all of the questions were posed to the interviewees due to the specific circumstances of each interview, interviewee knowledge, ability to answer. The interview script and questions are provided in **Error! Reference source not found.**

Engagement process

A representative sample of companies (and auditors) with experience of Article 8 implementation was developed to provide (in as much as it was possible) an appropriate organisational distribution across MS, industry sectors, company sizes and between multi-site companies and multinationals.

A Letter of Support was provided to the consultant by DG Energy during August 2017 to facilitate the interview engagement process with companies and auditors (and the wider engagement process with the National Authorities).

A small sample of around 5 pilot interviews was initially undertaken with a small sub-set of organisations late in 2017 to gain a better understanding of the breadth and depth of information that interviewees would be able/willing to provide and to test the process and approach. The interview process and question sets were then refined to reflect the feedback from this pilot. The interviews were conducted via telephone and primarily in English.

The engagement with and interviewing of the targeted organisations then ran from late 2017 to early 2018. Commencement of the interview process was scheduled so that the finalisation of the question

sets and underlying information and data requested could benefit from the outcome of the October 2017 National Authority Committee meeting.

A screenshot of one of the response capture tabs from the interview management system is shown below (for the multi-national company target group—the other response capture tabs included, multi-site companies and auditors).

1 2	A	B	C	O	P	Q	R	
1	MULTI-NATIONAL COMPANT INTERVIEW CAPTURE TEMPI			12	13	14	15	
2	INFO							
3	Company	[name = Company]						
4	Ref from interview planner	[DNV 1, DNV 2, etc; RIC 1, RIC 2]		DNV 34	DNV 42	DNV 40	DNV 41	
5	Interviewee	[name]						
6	Interviewer	[name]		KR	MJ	MJ	MJ	
7	Date	[insert]		20-Dec	Feb-18	Feb-18	Feb-18	
8	Interviewee confidentiality	[1. Yes, contribution may be					2	2
9	COMPANY CONTEXT							
16	RESEARCH QUESTION		SYNTHESIS					
17	1. Cost-Benefit							
18	1.1 Have you or your company undertaken an audit process	The audit process is generally seen a burden. It was highlighted during the		120 plants in one location with internal audits under ISO 50001,	Six audits have been carried out. All at boiler stations at different	Introduction of ISO 50001? 10 energy audits in order to	Yes, the enterprises' energy audits were performed to fulfil Polish	
19	1.7 Is there a requirement to implement any of the	Quite a few companies appear to have identified measures that have		Via ISO 50001	There are no requirements to imple	Yes. Reduce electricity consumption and reduce specific	There is no specific requirement for measures implementation.	
20	1.13 What internal threshold for energy saving project			no thresholds, decision of leader of individual cost center to go	There are no thresholds. It is up to the site manager or business area	Specific consumption monitoring (m3 / Eur, m3 / kWh). Energy input	Energy efficiency certificates (white certificates) or generally <	
21	1.14 What type of support (e.g. help desk/ tools/			Legal team in every location, check legislation. In germany	Do not know about support. Our own knowledge is regarded as	Consultation with accredited auditors for energy optimization	For some of subsidiaries external consultants support while audit	
22	2. De Minimis							
23	2.2 Is a de minimis concept in place in your MS? If so	There seems to be quite a bit of variation in the understanding and		yes 90% is all SEC (production sites) and 10% buildings where			It is required by Polish law to cover with audit at least 90% of	
24	2.4 Was the de minimis applied in your audits? If so how?			tried to always include everything; BAFA is now checking the energy	Yes. Since the boiler stations consume so much energy	Not used. Use another method of energy auditing and optimization		
25	2.5 What are the pros of a de minimis? What are the			might have some disadvantages: when started ISO 50001, problems	As I see it, we don't need to spend a lot of time traveling (Sweden is a		Pros - simplifying the audit and audit cost reduction. Cons - to	
26	2.6 Has the application of de minimis facilitated				No	No	Yes. No.	
27	2.8 Do clear guidelines exist on the use of de minimis in				To some extent, but you always have to interpret regulations to	No	above 90% threshold.	
28	2.11 Could you provide any examples of the application				We have focused on the largest sites, covering 90% of the total	Setting the specific energy consumption per m3 / kWh		
29	2.12 Based on your portfolio and compliance experience, do							
30	3. Clustering							
37	4. Sampling							
45	5. Threshold for very small sites							
50	6. Leased Assets							
54	General							
75	COMMENTS							
76								
77								
78								
79								
80								

Figure A1.4 Interview response capture tab (for multi-national company target group) in the interview management system.

While it was initially conceived that the interview process would be supplemented by a web based survey offering companies the opportunity to provide specific data, a key lesson from the pilot interviews was that this approach would not be successful in practice. It would have needed considerable publicity to attach the submissions and it would have required companies to spend time and effort to source their own data and get it to fit with the survey requirements. In place of the survey the consultant developed a simple data submission template in Excel format which was provided to illustrate the data that would be most useful to the project (the template was mostly provided to the interviewees after a short explanation and towards the end of the interviews to try and ensure a good understanding of its requirement and scope). TA screenshot of the data survey template as sent to, populated with some of the input received back from companies and National Authorities is shown below in Figure A1.5, along with an indication of some the countries and sectors that it was ultimately populated with.

Final Status

The final interview process included engagement with and responses from the following:

- 32 multinational companies (including from manufacturing, retail trade and service sectors)
- 18 auditors (covering the Netherlands, Belgium, Portugal, Germany, Denmark, Italy, Czech Republic, Finland, France, UK)
- 2 Trade Associations (EU-level, Denmark)

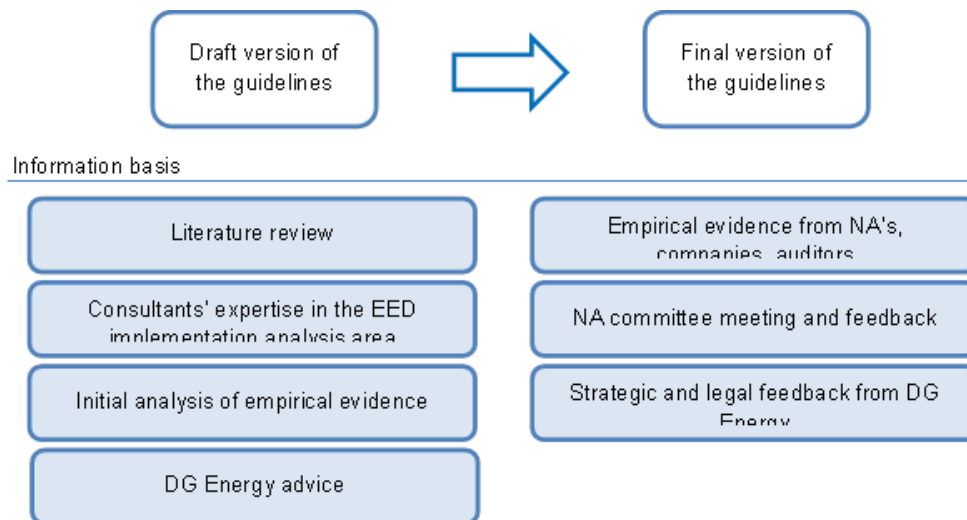
- 4 National Authorities (including Germany, Italy, Finland, Netherlands).

It should be noted that a considerable number of invitations were sent out by the consultant to specifically targeted persons within the identified companies and auditors. The response rate varied widely and included many who were unable/unwilling to participate and a number of instances where companies pointed the consultant to the auditors (for the specific detail) and where the auditors pointed back to the companies (for the data, which was seen as the property of the companies).

Approach to the development of the guidelines

Development of the guidelines followed the approach summarised in Figure A1.6.

Figure A1.6 Guidelines development process



The initial version of the guidelines was developed with advice and input from DG Energy to provide a consultation document for presentation to the National Authorities Committee meeting in October 2017. It considered:

- The findings of the literature review in previous studies on the implementation of the EED Article 8, National Energy Efficiency Action Plans (NEEAP), national legislation documents and other information sources.
- Quantitative data on the results on the first compliance cycle received from Member States between May and September 2017. Differences in the scope of data provided somewhat limited the extent of the analysis, but a number of preliminary findings were drawn. These findings were presented to the Member States during the National Authorities Committee meeting.

The final version of the guidelines was developed after presentation of the initial version of the guidelines to National Authorities and considered:

- NA feedback
- The findings of interviews with some National Authorities (selected and agreed with DG Energy)
- Data from the survey of companies and auditors
- Strategic and legal feedback from DG Energy

The final version of the guidelines is provided in Appendix 1.

Appendix 3 Interview process and full set of interview questions for companies and auditors

A. Interview process/ guidance

The process/guidance used during the interviewing of companies and auditors is set out below.

1	[prior to interview, populate new column for interviewee in appropriate tab of template]
2	<p><u>Opening</u></p> <p>As set out in my initial email message, we are undertaking a series of interviews as part of a contract with the European Commission to prepare a set of common guidelines and recommendations to improve the consistency of the implementation of certain audit aspects of the Energy Efficiency Directive (namely in relation to of Article 8 and Annex VI).</p> <p>The guidelines that are developed through this work will be supported by a strong evidence base, addressing the cost-effectiveness of audits, the proportionality of audit requirements and the representativeness of the audit findings.</p> <p>The work will undertake interviews such as this one and a follow up survey process, where applicable, with stakeholders across the EU, including Member State National Authorities, multi-national, multi-site and single-site companies and trade associations and auditors.</p>
3	<p><u>Confidentiality</u></p> <p>Please could you indicate one of the following:</p> <ol style="list-style-type: none"> 1. Yes, my contribution may be published in the reporting for this project under my [own/ organisation] name. 2. Yes, my contribution may be published but it should be kept anonymous. 3. No, my contribution is not to be published, but it may be used internally within the European Commission as part of the analysis for this project. <p>[NOTE Ask whether they would like to indicate when and if there are any specific response(s) where they would not like to be attributed or that they would not like to be published]</p>
4	<p><u>Questioning</u></p> <p>The questions in this interview are set out under 7 themes, which run in sequence. The themes are: Cost-Benefit, Clustering, Sampling, De Minimis, Threshold for very small sites, and Other (Leased Assets).</p> <p>Run through the RQs in the appropriate tab for interviewee and record responses in appropriate column as populated prior to opening of interview.</p>
5	<p><u>Closing</u></p> <p>Thank you very much for taking part in this interview.</p> <p>The information you have provided will be used to inform the preparation of a more appropriate and consistent (as well as user friendly) set of common guidelines and recommendations in relation to the implementation of certain audit aspects of the Energy Efficiency Directive.</p> <p>If you have any further thoughts that you might think are relevant to this evaluation, please</p>

do not hesitate to contact me. Thank you again for your time.

B. Interview questions – complete set for companies and auditors

The final complete set of questions used in the interviewing of companies and auditors is set out below. NOTE a wider set of questions was initially developed and these were refined down for the final approach. It should also be noted that while the final set of questions below were intended for use during the interview process, not all of them were ultimately posed to the interviewees due to the specific circumstances of each interviewee, their knowledge and ability to answer

Cost-Benefit
Have you or your organisation undertaken an audit process under Art. 8 of the EED? If so, how many audits/ where and when did they take place/ what was the outcome?
Is there a requirement to implement any of the measures identified in the audits? If so, under what economic criteria? Have you followed up on any additional recommendations?
What internal threshold for energy saving project implementation are you applying? What is the greatest challenge for project implementation?
What type of support (e.g. help desk/ tools/ consultancy support) is provided to companies in your Member State in relation to understanding the cost-benefit aspect of the Art. 8 audit process? How adequate do you feel this support is? Do you have any suggestions as to how this can be improved?
Clustering
Can clustering be applied by companies in your country? If yes, how? Have you applied it? How? Based on what information have you divided your energy portfolio into clusters?
Do clear guidelines exist on the use of clustering in your MS?
Could you provide any specific examples of the application of the clustering concept in your Member State or for your company? Please include detail on the manner and the degree to which activities have been grouped, audited and then scaled up, etc.
Where clustering has been adopted, to what extent is energy consumption similar across clustered activities? Were energy savings identified relevant across the cluster? How did you share the results of audits with other facilities within clusters?
How does clustering impact on the representativeness of the audits?
What characteristics would be most appropriate on which to cluster activities?
Sampling
Can sampling be applied by companies in your country? If yes, how? Have you applied it? How? How have you selected facilities for sampling?
Do clear guidelines exist on the use of sampling in your MS?
Could you provide any examples of the application of the sampling concept in your Member State or for your company? Please include detail on the manner and the degree to which sites or assets have been sampled as part of the audit process to ensure that representativeness has been maintained,

etc.)
What are the benefits of the sampling approach adopted in your MS? Are there any drawbacks?
How does sampling impact on the cost-effectiveness of the audit process? Has sampling reduced the costs of compliance?
Were any energy saving recommendations identified at sample facilities applicable across cluster/group? Do you think that the audit of sampled energy consumption areas identified all major energy saving opportunities across the group/cluster?
What approach to sampling do you think would work best (e.g. in terms of size, strategy, etc.)?
De Minimis
Is a de minimis concept in place in your MS? If so, please describe.
Was the de minimis applied in your audits? If so how? What was the proportion of energy omitted from the audits? Why was this energy omitted?
What are the pros of a de minimis? What are the cons?
Has the application of de minimis facilitated compliance for you? Do you think significant energy savings could be identified in the excluded energy consumption areas?
To what extent does a de minimis impact on the representativeness of audits? Is there potential for savings to be identified in energy not covered?
Do clear guidelines exist on the use of de minimis in your MS?
Could you provide any examples of the application of de minimis in your Member State or for your company? (including detail on what minimum % of total energy consumption has needed to be covered by the audit process, etc.)
Based on your portfolio and compliance experience, do you think it would make sense to re-evaluate de minimis threshold?
Threshold for very small sites
Has a threshold exemption for very small sites been applied in your MS?
What are the pros/ cons of your Member State approach to a threshold?
What is the impact of a threshold on cost-effectiveness of compliance with audits? To what extent has the threshold reduced your costs of compliance? To what extent are/could sites with very low consumption and hence very low potential for savings being required to undertake audits?
Could viable energy savings have been identified in the energy consumption omitted from the audits? Could audit process have driven a better understanding/ information gathering around the energy not covered by the audits if a threshold was not in place?
What would a suitable threshold be for energy consumption? Should this operate at a company-wide or site basis?
Other (Leased Assets)

If you rent, how does responsibility for audits fall between tenant and landlord in your MS? What are the advantages of this approach? Do these arrangements create any issues?

Do these arrangements affect the representativeness of the audits? Do these affect the effectiveness of the audits? Do these arrangements reduce the proportion of energy covered by audits? Is achievement of energy savings identified limited by arrangements around ownership of building payment of energy bills? Have you or your tenant/landlord implemented any of the recommendations identified in the audits? How was the responsibility split?

Are sufficient guidelines in place in your Member State for dealing with this potential issue? How might the guidance be strengthened?

General

To what extent would you say the arrangements for implementing Article 8 are consistent with the over-arching principles of cost-effective/ proportionality/ representativeness?

What element/activity of the audit process and its requirements do you consider to have been designed and then implemented well in your MS? Where identified, why do you consider it to be a positive? How does this impact on the cost-effectiveness, proportionality and representativeness of the audit process in you MS?

When implementing Art. 8, what have been the key challenges / issues?

Do you find any of the audits you carried out not cost effective?

Appendix 4 Data from National Authorities

Country/region	Status	Companies	Sites	Aver sites per company	Total Consumption of all compliant companies (GWh)	Aver site consumption (GWh)	Average identified energy saving (%)	Identified Energy Savings (GWh)	Average Savings (EUR)	Investment (mln EUR)	Payback period	Cost of audits per company (EUR)	Comment
Austria	Data provided	1893			200.554		2.75%	5.52				From <2k to > 15k	1893 companies registered as large enterprises, 1454 reported audits (due to joint EED compliance) Disaggregation: 82 % in processes, 8 % in buildings and 10 % in transportation.
Brussels (BE)	Data provided	303			1164	4.11	10%	116	36,963			8308	303 audits submitted since 2012, only 2 have been submitted as a result of the new legislation
Bulgaria	Data provided	69	140	4.2	11190	71.00	6.7%						Data included in this summary only covers audits in 2015-2017, without clear confirmation that these audits were undertaken as a result of the EED implementation
Croatia	Data provided				207	52	25.0%						ISO certified companies not included.
Cyprus	No response provided												
Czech Republic	Data provided	2808											Audit information submitted to the national database but not yet analysed and submissions were made in pdf format.
Denmark	Data provided	575			14124		13.7%			336	5.2	23650	Analysis performed based on the data provided on 214 companies out of 575 required to comply so far. Data extrapolated. No individual site data provided
Estonia	Data provided	65										12000	The audit cost includes energy and resource efficiency
Finland	Data provided	800	1754.84	2.2	12903	7	7.0%			176			There are 800 obliged enterprises, however data available only on a

													statistically representative sample (372 entities, 816 audits). Data extrapolated to cover 800 obliged companies.
Flanders (BE)	Data provided	458				17							Median consumption - 9.4 GWh
France	Data provided	4721	55258	11.7									
Germany	Data provided	50,000					4.5%					23605	50000 non-SMEs, data already analysed, not all categories of required information available. Data per company to be requested
Greece	No data available yet												Legal framework introduced only at the beginning of 2017 and therefore will not be available until mid-2018.
Hungary	Data provided	1095			24026		5.2%						Data provided for 163 companies out of 1095, extrapolated to cover all compliant entities
Ireland	Data provided	309											The number of companies does not include ISO certified companies. The government does not collect specific data.
Italy	Data provided	8130	15154	1.9									No information on total energy consumption provided, which complicates the analysis
Latvia	No response provided												
Lithuania	Data provided	347			4630	171	3.7%						Data only on 52 companies is available, extrapolated.
Luxembourg	No data available yet												Compliance deadline was in Dec 2016, and companies were not obliged to notify the government. The government is now looking to start implementing compliance control.
Malta	Data provided	64			999								In addition, 4 companies compliant via EnMS. Other companies exempt.
Netherlands	Data provided	1168					9.8%					2500	Average energy savings of 9.8% defined via exclusion of all reported energy saving potentials over 100%. Audit price provided as 2,000-3,000 EUR. Averaged as 2,500 EUR,
Poland	Data	3600						83.31					including 90 of those to which Article

	provided												8(5) is applicable (state for 30 October 2017).
Portugal	Data provided	1320	6425	4.9	121659	18.9	0.49%	594.3					
Romania	Data provided												
Slovakia	Data provided	606			18703		4.1%				8.47		Sample data of 606 audits provided
Slovenia	No response provided												
Spain	Data provided	3700			259036		9.1%						Is the % of the audited energy (80%)
Sweden	Data provided	3662			182638		6.5%						Only 40% of companies have completed their audits at the time of data provision, therefore audit results provided by the first 40% of audited companies where extrapolated to derive total values
UK	Data provided	6801											Previous analysis assumes that audits will deliver annual average savings of between 0.4% and 1.1% of total energy, in addition to existing policies. For enterprises that own buildings or industrial processes, this is equivalent to the implementation of 5% of the potential energy savings identified through assessments.
Wallonia (BE)	Data provided	265		1.15	25080	184	7.5%	1891				23650	Data is based on 136 available audit reports. 91% of data audited.

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