



Technical assistance on assessing the effectiveness of the implementation of the definition of small and medium-sized enterprises for the purposes of Article 8(4) of the Energy Efficiency Directive

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Final report

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Abstract

This is the final report of a study to provide "Technical assistance on assessing the effectiveness of the implementation of the definition of small and medium-sized enterprises for the purposes of Article 8(4) of the Energy Efficiency Directive (EED)" for the Directorate-General for Energy (DG ENER).

The report evaluates the scope of Article 8(4) of the EED and assesses potential alternatives.

Companies that are not small or medium-sized enterprises (SMEs) as defined in EU Recommendation 2003/361/EC¹ are currently required to conduct an energy audit every four years. For both the companies concerned and the implementing authorities it is difficult to determine whether a company is a non-SME. Moreover, the scope is only indirectly linked to the general objectives to reduce energy consumption and GHG emissions.

This report assesses the impact of four potential alternative options for identifying the companies required to conduct a mandatory energy audit, including (i) a simplified definition, (ii) a definition based on energy consumption, (iii) a mix of the simplified and energy consumption-based definitions, and (iv) a nationally determined definition. For each of these options and various sub-options, the quantitative and qualitative impacts are assessed against the current definition of non-SMEs.

¹ See <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003H0361&from=EN>.

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Executive summary

This study evaluates the scope of Article 8(4) of the Energy Efficiency Directive (EED) and assesses potential alternatives.

Article 8(4) includes an obligation for companies that are not small or medium-sized enterprises (SMEs) to undergo a high-quality energy audit at least every four years.

The energy audit is a systematic procedure to collect sufficient information concerning the enterprise's current profile on energy consumption in order to identify possible cost-efficient, energy-saving options.

The definition of SME follows EU Recommendation 2003/361, which requires information on the socioeconomic indicators (number of employees, assets and turnover) of the entity concerned as well as the related entities.

This definition is difficult to use by both national energy authorities and companies.

Objectives

This study focuses on companies within the scope of the energy audit requirement. More specifically, the main objectives of the study can be formulated as follows:

- Determine the size of the population of non-SMEs within the scope of Article 8(4), with a particular emphasis on companies that become non-SMEs due to their ownership links with other entities.
- Identify the key obstacles that national authorities face in the full application of the EU's SME definition, the factors causing these difficulties and the extent to which this is due to specific national circumstances.
- Identify and assess the impacts of potential alternative definitions for the companies within the scope of Article 8(4).

Methodology

The analysis of impacts is based on a combination of quantitative and qualitative data collection and consultation tools. Models have been designed to estimate the number of companies, energy consumption, GHG emissions and energy audit savings. Yet, the models have been hampered by limited financial information, especially on smaller entities and the cost-effectiveness of energy audits for all companies.

In addition to the models, interviews, surveys and workshops have been conducted with about 75 stakeholders to collect information on current implementation, potential alternatives and special ownership cases.

Current implementation

At the end of 2016, there were an estimated 0.75 million active non-SMEs or about 2% of all approximately 42 million companies in the EU-28. Among them, only about 12% of the non-SMEs meet the size thresholds on a stand-alone basis. However, most of the companies qualify because of their special ownership relations. Linked domestic (51%) and multinational companies (21%) account for the largest shares, followed by partner domestic (8%) and multinational companies (2%). The remaining non-SMEs are publicly owned entities (6%).

In practice, national energy authorities are likely to identify significantly fewer entities. They experience four important obstacles in the implementation of the current definition.

First, identifying the non-SMEs is very complex. It requires information on the socioeconomic indicators of the entity concerned as well as the partner and linked companies. Moreover, they also need to consider information on the type of ownership for publicly owned entities and sectoral information for natural persons.

Second, the definition is only very indirectly tied to the energy savings and GHG emission reduction objectives of the EED. Indeed, the definition of non-SMEs mostly captures larger corporate groups, which are likely but not necessarily consuming more energy than smaller companies.

Third, the non-SME definition requires the consideration of ownership information, which is often not available to many of the authorities.

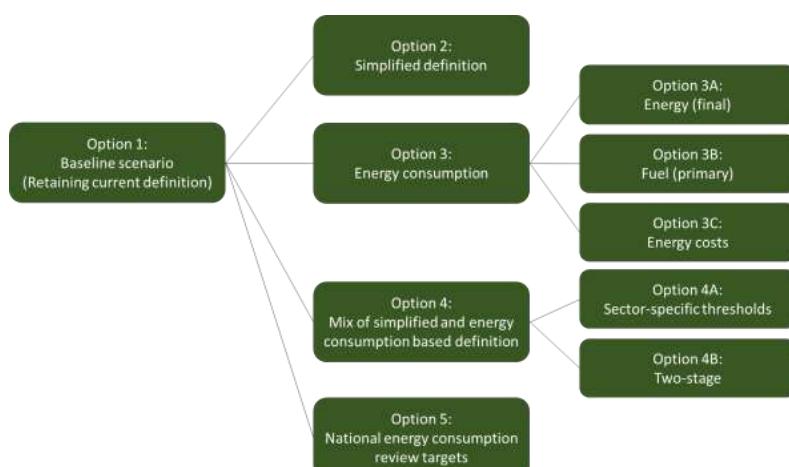
Fourth, almost all of the national energy authorities lack some or all of the information required to determine whether a company qualifies as a non-SME.

Alternative policy options

To identify suitable alternative definitions that could potentially replace the current definition (Option 1, baseline), in total seven potential alternative options and sub-options have been formulated in consultation with DG ENER (see Figure ES.1):

- Option 2, a simplified definition (socioeconomic thresholds applied at the entity level);
- Option 3, a definition based on energy consumption;
 - Option 3A, a final energy-consumption threshold (final energy consumption of more than 20 TJ at the entity level);
 - Option 3B, a fuel-consumption threshold (primary energy consumption of more than 25 TJ at the entity level);
 - Option 3C, an energy-costs threshold (energy costs of more than EUR 200 000 at the entity level);
- Option 4, a mix of the simplified and energy consumption-based definitions;
 - Option 4A, thresholds depending on the sector energy intensity (with socioeconomic thresholds defined for each sector);
 - Option 4B, a two-stage selection with current and energy thresholds (the current SME definition, with an exemption for companies with final energy consumption below 20 TJ); and
- Option 5, a selection at the national level given minimum energy coverage (a nationally determined definition covering at least 60% of domestic corporate energy consumption).

Figure ES.1 Overview of definition options



Source: CEPS (2020).

Assessment of impacts

The alternative definitions were assessed against the current definition of non-SMEs (Option 1, baseline – see Figure ES.2).

The present system for selecting enterprises (Option 1) covers the highest number of active companies among all the policy options. Through application of any of the alternative policy options the number of enterprises that should execute audits could decrease substantially, thus the administrative burden could (significantly) reduce.

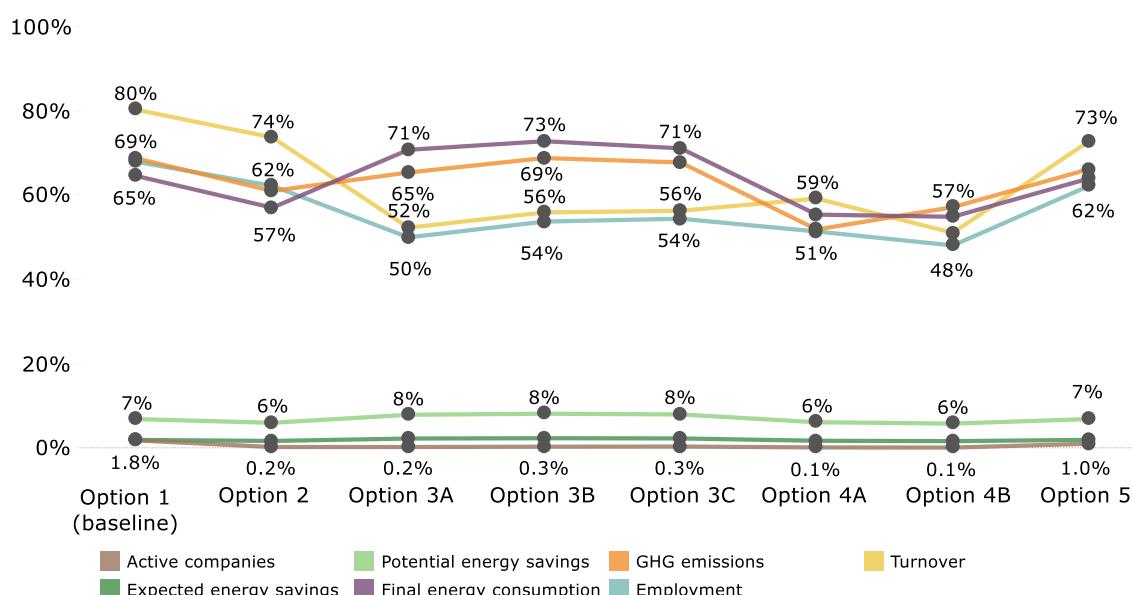
SMEs as part of a large company have to perform audits, while their savings are often too small to justify the costs of the audit. The simplified definition (Option 2) solves this problem by not treating SMEs as part of a large conglomerate. Still, large enterprises in socioeconomic terms, but which do not use much energy, would be forced to execute audits while the expected and potential savings would be relatively low. None of the alternatives with socioeconomic thresholds (Options 2, 4A and 4B) solve this problem, as the companies at stake would still be classified as non-SMEs.

The options with energy-related thresholds (Options 3A, 3B and 3C) solve the problem by using a threshold for actual energy consumption that excludes SMEs with too little energy consumption and includes SMEs with high energy consumption. The two-stage approach (Option 4B) only removes those already selected companies that have limited energy consumption. Correcting the current thresholds for energy intensity per sector (Option 4A) does not lead to better savings performance, which are estimated to be slightly less than the baseline scenario.

The options with energy-related thresholds (Options 3A, 3B and 3C) score best on potential and expected energy savings. Nevertheless, the differences with other options are not large, which is due to a set of large companies with ample savings that are always selected and provide the bulk of possible savings. The difference with the baseline is also limited, which supports the idea that many currently executed audits are marginal as to their contribution to total savings.

The coverage in terms of employment and turnover varies across the policy options, but this has no direct relation to the impact or other effects.

Figure ES.2 Comparison of the policy options



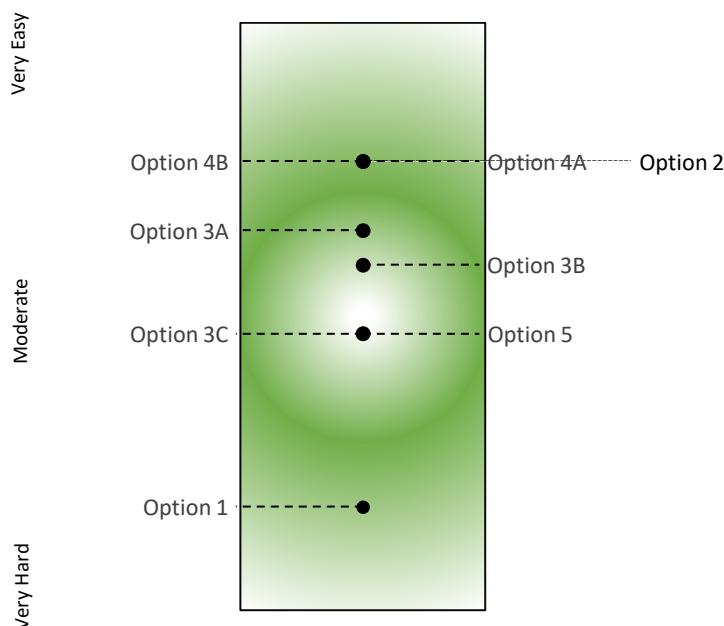
Source: CEPS.

For all of the alternative options, internal coherence is considered to be better than the baseline, with higher expected energy savings and in particular more cost-effective audits.

The main issue for external coherence is alignment with the SME definition for EU State Aid rules. All the options except the two-stage definition (Option 4B) are less aligned than the baseline, as they do not consider ownership relations.

Implementation in most Member States has not been fully in line with the EED. All the alternative options enable better implementation, as they shift to fewer and less complex thresholds, either socioeconomic or energy-related ones. Most importantly, these alternatives do not consider the ownership relations (see Figure ES.3). The national definition (Option 5) makes implementation unclear, as Member States can choose their own approach.

Figure ES.1 Feasibility of the policy options



Source: CEPS.

Additionally, it must be noted that selection at the national level (Option 4B) mostly has an ambiguous impact, depending on how Member States would use their room for setting up their audit systems. Therefore, no conclusions can be drawn with certainty on this option. That being stated, for a level playing field national definition is worse due to its room to specify a selection system.

Recommendations

Taking all the assessed impacts into account, all of the alternative policy options could be an improvement compared with the current definition.

The simplified definition (Option 2), based on just socioeconomic indicators, could limit the administrative burden and contribute to more cost-efficient audits.

An alternative threshold type should preferably be energy-related, for closer alignment with the energy savings objective of the EED. Data limitations would restrict most Member States in trading the current selection system based on socioeconomic

thresholds (Option 1) for one based on energy consumption (Options 3A, 3B and 3C). A distinction should nonetheless be made between energy data for smaller users (which indeed pose a problem) and data for larger users (which are selected by statistical offices for their surveys). With the threshold of 20 TJ for the final energy-consumption policy option (Option 3A) some of the enterprises with an energy consumption near or above this threshold would participate in the survey by statistical offices. Thus, energy data could be available to authorities. Legislation might be needed for this to occur and ensure the availability of energy data. However, there are proven examples of national policy instruments, such as long-term agreements on energy efficiency for companies, that have solved the problems of gathering and using (confidential) data. Although it may be an additional burden at the start, it would serve the much wider goal of obtaining energy data that are needed for other corporate energy and climate action policies.

The simplified, energy-consumption and sectoral definitions differentiate significantly from the current EU SME definition. If the revised definition has to follow the EU SME definition for State Aid rules more closely and be coherent with other legislation considering the SME definition, then the two-stage option (Option 4B), which excludes companies using limited energy, remains preferred as an alternative to avoid too many cost-ineffective energy audits.

Although determining the definition at the national level (Option 5) could reach the energy savings objectives, this option is not preferred as it would likely distort the level playing field.

Finally, it is advisable to allow the energy audits to be spread out more across the four-year audit cycle, to reduce the costs of energy audits and improve their quality.

1 Introduction

The EU-level policy target of the Energy Efficiency Directive (EED – December 2012)² and the revised EED (December 2018)³ is to reduce overall energy demand in the EU. The energy demand should, with respect to a business-as-usual projection made in 2007, in 2020 drop by 20% and in 2030 by 32.5%, with a clause for upward revision by 2023. This has to be realised by energy-efficiency improvements (applying production technologies and processes, providing the same level of output of performance,⁴ service,⁵ goods or energy⁶ with less energy), energy conservation (preventing wasteful use of energy by good housekeeping measures) and finally yet importantly, energy savings (achieving lower overall energy consumption) with positive contributions to welfare, health and the environment.

Article 8 of the EED addresses energy audits and energy-management systems (see Annex 1). It includes an obligation for companies that are not small or medium-sized enterprises (SMEs) to undergo a high-quality energy audit at least every four years, starting 5 December 2015 at the latest. An EU-wide application of the same definition for non-SME enterprises ensures consistency with State Aid rules. The size of the threshold for the enterprises within the scope of the audit obligation relates to the fact that in general, large enterprises consume more energy than SMEs. Hence, the former category of enterprises has greater energy-savings potential. Furthermore, as large enterprises tend to have an energy- or environmental-management system⁷ in place with energy audits as an integral part, the cost burden for larger enterprises tends to be relatively much less than for SMEs.^{8,}⁹

1.1 Energy audits

An energy audit is a systematic procedure, which for non-SMEs is to take place at least every four years. It aims to collect sufficient information concerning the enterprise's current profile on energy consumption in order to identify possible cost-efficient energy saving options¹⁰ in buildings, industrial and commercial operations or installations, and in private or public services, but also to quantify and report its results.

The most energy-efficient and cost-effective energy conservation opportunities (ECOs) and measures (ECMs) are to be identified. Energy savings in monetary terms can be related to total energy costs and total production costs of the enterprise concerned. Audits are to result in the improved energy-consumption performance of the enterprises concerned, including the due implementation, within a reasonable period after issuance of the audit report, of the identified opportunities and measures for improvement, in particular the most significant ones.

² Directive 2012/27/EU.

³ Directive 2018/2002/EU.

⁴ For example, thermal comfort in a building (Erbach, 2015).

⁵ For example, transport of people or information (Erbach, 2015).

⁶ For example, for the conversion of crudes to oil derivatives, such as gasoline and diesel oil.

⁷ Energy-management systems (EMS) are defined as sets of elements of plans establishing energy-efficiency objectives and strategies to achieve these objectives. These enterprises often apply the European and International Standard for energy management systems EN ISO 50001 or Environmental Management Standard EN ISO 14001. EN ISO 50001 emphasises the involvement of the executive leadership (The Coalition of for Energy Savings, undated).

⁸ The Coalition for Energy Savings (undated).

⁹ It should be noted that there is important interaction between the (revised) EED on the one hand and other EU legislation on the other, including the Energy Efficiency of Buildings Directive (2010/31/EU); the Ecodesign Directive (2009/125/EC); the Energy Labelling Directive (2010/30/EU); the Energy and Climate Governance Regulation, notably the gap-filler mechanism introduced in this regulation; Directive (EU) 2018/844 of 30 May 2018 amending Directive 2010/31/EU on the energy performance of buildings; and Directive 2012/27/EU on energy efficiency.

¹⁰ An oft-applied criterion for cost efficiency is a simple payback period less than five years (RVO, 2016). Yet criterion (c) of EED, Annex XI, stipulates LCCA instead "whenever possible".

It is good practice that audits not only meet the financial and economic criteria set out in Article 8 and Annex VI of the EED, but that they are investment-grade as well. Investment-grade audits provide additional guidance for future investments and maintenance, whenever this is appropriate and proportionate.

1.2 Definition of SMEs

The definition for the enterprises within the scope of Article 8(4) of the EED follows the European Commission's definition of SMEs included in Commission Recommendation 2003/361/EC.¹¹ Whether an enterprise is an SME or non-SME is in the first instance based on three criteria: staff headcount, annual turnover and annual balance sheet total. Recital 4 of Commission Recommendation 2003/361/EC states:

The criterion of staff numbers (the 'staff head count' 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 in order to grasp the real scale and performance of an enterprise and its position compared with its competitors.

The European Commission developed specific thresholds for each of the criteria to classify enterprises. The Directive indicates that non-SMEs have to undertake energy audits once every four years. Non-SMEs are those that employ 250 or more people (headcount) and have either annual turnover of more than EUR 50 million or total assets of more than EUR 43 million. However, these indicators on a considered enterprise in isolation might not be sufficient to define the size of enterprise, as calculations for each of the criteria differ depending on the company's status.

Indeed, the definition also takes the dependence of the enterprise on other enterprises into account. This requires that the status of the enterprise (i.e. autonomous, linked or partner enterprise) needs to be ascertained before the company category can be determined. The calculation then differs for each: autonomous enterprises only calculate their own data;¹² partner enterprises take into account only their proportion of data;¹³ and linked enterprises calculate all the data of their subsidiaries and branches.¹⁴ The enterprises can combine linked and partner enterprises. Moreover, an enterprise is not an SME if 25% or more of its shares are owned or controlled by public bodies. Hence, an enterprise follows a multistep process, having to define its status first in order to identify its size.

The application of the SME definition described above is difficult in practice and has unintended consequences (see Chapter 3). For example, linked companies that do not use large capital/labour inputs would be considered large enterprises due to all their subsidiaries/branches and thus would have to comply with various requirements for large enterprises. Furthermore, it might have implications for the compliance of enterprises under other legislation, where requirements are specified based on the size category.

1.3 Objective of the study

Against this background, the main objectives of the study can be formulated as follows:

- **Objective 1. Determine the size of the population of non-SMEs within the scope of Article 8(4),** with a particular focus on the companies with a link to partner enterprises.

¹¹ See <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32003H0361&from=EN>.

¹² No other enterprises control 25% or more of its shares or the enterprise does not control more than 25% of other enterprises.

¹³ Another enterprise controls between 25% and 50% of its shares or the enterprise controls between 25% and 50% of other enterprises.

¹⁴ Another enterprise controls more than 50% or more of its shares and the enterprise controls more than 50% of other enterprises.

- **Objective 2. Identify the key obstacles that national authorities face** in the full application of the EU SME definition, the factors causing these difficulties and the extent to which this is due to specific national circumstances.
- **Objective 3. Identify and assess the impacts of potential alternative definitions** for the companies within the scope of Article 8(4).

1.4 Reading guide

The remainder of this study first provides an overview of the methodologies used to assess the impacts of potential alternative definitions in Chapter 2. The methodologies include estimations, surveys, interviews, workshops and case studies. The end of this chapter notes the main limitations of the study and the extent to which they have been mitigated.

Chapter 3 identifies obstacles in the present implementation of the non-SME definition by Member States for energy audits, as well as the alternative definitions that are applied to determine whether companies are required to conduct energy audits.

Chapter 4 outlines the policy options for which the impacts are assessed. Potential alternative definitions for SME that are in accordance with EU Recommendation 2003/361/EC are identified, based on today's implementation of the EED. Potential alternative definitions in legislation other than the EED are also identified, before the policy options for assessment are defined.

Chapter 5 provides an assessment of the selected policy options. This includes estimating the companies within the scope, examining feasibility and providing a SWOT analysis for each of the options.

Finally, Chapter 6 draws the main conclusions regarding the most effective, efficient and coherent policy option, taking into account the subsidiarity principles.

2 Methodology

This section provides an overview of the methodology used in this report. This covers the methodology to identify the companies within the scope of the EED and the considered alternative policy options as well as their respective contribution to energy savings. Moreover, it also describes the surveys, interviews and case studies that have been conducted. Additionally, the chapter discusses the main limitations to the analysis.

2.1 Estimating energy-related indicators

This section outlines the methodology adopted to estimate energy-related indicators, including the (i) final energy consumption, (ii) primary energy consumption, (iii) energy costs, and (iv) GHG emissions. The energy-related indicators are estimated for each EU active company.

2.1.1 Final energy consumption

The estimation of the final energy consumption of each EU company is performed multiplying the aggregate energy-consumption statistics at the country and sector level by the company's share of employment in the specific country and sector in which it operates.

2.1.1.1 Step 1: obtaining data on energy consumption

Energy consumption data are retrieved from the Eurostat "Energy Balance"¹⁵ and the "Supply, transformation and consumption" tables.¹⁶ The Eurostat energy statistics are particularly suitable for this exercise, as the data are highly comparable across countries and largely complete, especially regarding the companies' preferred energy carriers (i.e. electricity, heat, gas and motor fuels). To ensure coherence across the alternative policy options, the statistics on final energy consumption take into consideration the EU companies' preferred energy carriers, namely electricity, gas, gasoline, diesel and fuel oil.¹⁷ The statistics are expressed in both terajoule and tons.

2.1.1.2 Step 2: matching Eurostat sectoral energy data with NACE sectors

To match the sectoral classification of the Eurostat energy-consumption statistics¹⁸ with the NACE classification available for the companies, the reconciliation tables provided in the Eurostat Energy Manual are used.¹⁹ In addition, three further adjustments are made.

First, as this study takes into consideration the final consumption of companies, statistics related to the consumption of households are excluded from the computation.

Second, the commercial and public sector energy consumption statistics are separated. The obligation to perform an energy audit is not applicable to entities of public administration.²⁰ Therefore, the final energy consumption of the public administration,

¹⁵ Eurostat, "Complete energy balance".

¹⁶ Eurostat, "Supply, transformation and consumption" table.

¹⁷ The energy carriers used to compute the final energy consumptions account for 80% of the total energy consumption. A number of energy carriers are excluded because of their small share of the overall final consumption. Furthermore, some energy carriers – such as blast furnace gas – are the result of industrial processes ('by-products'). For these fuels, it is not possible to determine the primary energy consumption or the price levels.

¹⁸ The sectoral classification in the Eurostat energy statistics is in line with Regulation (EC) No 1099/2008 on Energy Statistics, which differs from the NACE sectoral classification.

¹⁹ Eurostat (2019), "Energy balance guide", section on "Final energy consumption", pp. 31-34.

²⁰ The SME definition is applicable to entities engaged in economic activity, thus excluding entities of public administration (Art. 1 2003/361/EC).

estimated based on its share of employment,²¹ is deducted from the sectoral total. This results in a decrease of about 30% in the overall final energy consumption.

The third concerns the distribution of energy consumption for transportation across sectors. The Eurostat statistics for road transportation do not distinguish between fuels consumed by households and companies. The information is thus complemented by fuel consumption statistics broken down by type of vehicle from the United Nations Framework Convention on Climate Change (UNFCCC). To avoid a significant overestimation due to fuels consumed by households, it is assumed that the business sector is responsible for the consumption of all fuels used to power light and heavy trucks, while households are responsible for all the fuels used in cars and motorbikes (about 80% of gasoline and 15% of road diesel consumption). This adjustment influences primarily the transportation sector.

After the adjustments related to households, bodies of public administration and fuels consumed by households in road transportation, the estimated total energy consumption of companies in the EU-28 amounts to 26 million TJ, which is approximately 60% of the total energy consumption for energy use (including companies, households, public administration and the energy sector)

2.1.1.3 Step 3: determining the final energy consumption per company

The number of employees forms the best proxy for production activity among the available size indicators (employees, turnover and total assets). Hence, turnover figures are sensitive to intra-group transactions and input costs, which increase the level of turnover and entail an overestimation of the production activity for corporate groups. Similarly, total assets are not necessarily all used for production capacity, but for instance for stock and liquidity reserves.

For almost all active companies, the number of employees used to estimate the companies' final energy consumption is determined at the entity level (i.e. the most granular level available). In general, the unconsolidated figures are either provided or estimated at the legal entity level. For about 50 000 companies or 0.1% of the active companies, staff and financial figures were only available at the consolidated level. For the companies reporting on a consolidated basis, the reported number of employees considers the employees of the entity as well as other entities that have been consolidated.

Without adjustment for consolidation, the energy consumption of these companies is likely to be overestimated. This is due to two main reasons. One is that the number of employees is reported in both the consolidated accounts of the reporting entities as well as in the unconsolidated accounts of the controlled subsidiaries. The other reason is that the consolidated accounts of certain corporate groups include the figures of entities established outside the EU. Therefore, the unavailability of unconsolidated accounts is particularly relevant for large multinational companies, which often control entities domestically, in other Member States and outside the EU.

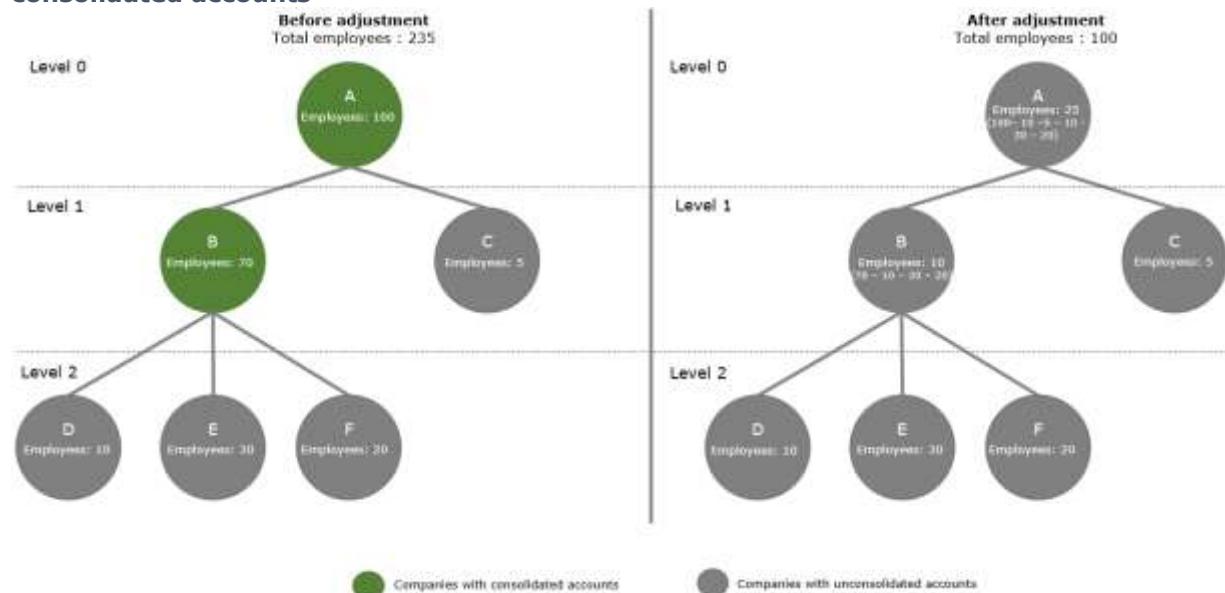
For the purpose of this study, the consolidated accounts of entities that could lead to a material change in the results were adjusted. More specifically, the about 250 entities reporting consolidated accounts and employing more than 5% of the total domestic employment of the sector in which they operate were identified. Each of these entities employ on average 40 000 employees on a consolidated basis and cumulatively control more than 500 000 subsidiaries worldwide.

For each of the entities, detailed ownership information was used to reconstruct the legal structure of the entities that were covered by the consolidated accounts of the reporting

²¹ Eurostat National accounts

entity as well as the relationship with one another. This is necessary as some of the entities with consolidated accounts cover other entities also reporting consolidated accounts. The number of employees on an unconsolidated basis of all the entities with consolidated accounts were derived by deducting the number of employees of subsidiaries on an unconsolidated basis, starting at the ownership level furthest away from the parent. Indeed, the consolidated figures of the subsidiary entity are converted first into unconsolidated figures, before the unconsolidated figures of the parent entity are calculated (see Figure 2.1).

Figure 2.1 Graphic example showing the adjustment applied to large entities reporting consolidated accounts



Source: CEPS (2020) elaboration.

2.1.1.4 Step 4: distributing the energy consumption across companies

The energy consumption at the country and sectoral levels is distributed across the active companies based on the share of the company among the total employees of all companies active in the NACE sector combined.

2.1.2 Primary energy consumption

The estimation of the primary energy consumption is based on the final energy consumption estimated in the previous section. The estimates of the quantity of primary energy consumption account for the transformation and distribution losses for electricity, natural gas and motor fuels across countries.

The energy used as input for the electricity generation are used to estimate the primary energy consumption for electricity. The statistics are collected at the country level from the "Supply, transformation and consumption" table from Eurostat. The primary consumption for electricity is adjusted for national imports and exports. The information on electricity trade across Member States is collected by using the import and export tables provided by Eurostat. The share of exported electricity over the total electricity produced is calculated for each EU Member State. The amount of primary energy consumed for exported electricity is determined and included in the total primary energy consumption of the partner country.

To determine the primary energy consumption for natural gas and motor fuels, the final energy consumption is multiplied by the transformation and distribution loss factor for

each fuel. The transformation and distribution loss factors are respectively 10% for natural gas and 5% for motor fuels and jet fuels.

2.1.3 Energy costs

The energy costs are based on the final energy consumption (see Section 2.1.1). The methodology to determine the energy costs considers the differences in energy prices across sectors, countries, energy carriers and amounts of energy consumed by individual companies.

For the companies operating in the mining and quarrying, manufacturing and construction sectors, the energy costs are determined based on the Eurostat SBS indicator for total purchased energy goods²² for 2016, the study's reference year. The data are collected through surveys and validated by Eurostat. Therefore, the 'total purchased energy good' indicator is an overestimated value. The data are aggregated at the country and sectoral levels. To limit data availability issues, information is retrieved for each NACE sector at the three-digit level. The total purchased energy goods statistics by country and sector are distributed for the companies operating in that specific country and sector based on their share of total energy consumption.

For the companies operating in the other sectors, the energy costs are estimated based on the energy consumption and price by carrier. For each economically active company, the estimated final energy consumption of electricity, natural gas, gasoline, gasoil and oil fuel is multiplied by the average price of the respective energy carrier in 2016. The average prices of electricity and natural gas are obtained from Eurostat. Since the prices of electricity and gas depend on the total energy consumed, the analysis applies different wholesale prices depending on the electricity consumption of the individual companies. Prices for gasoline, gasoil and fuel oil are retrieved from the weekly oil bulletin published by the European Commission. The average of all weekly statistics constitute the average annual price (see Annex 3 for an overview of the energy costs).

The prices for all the energy carriers exclude taxes and levies, and thus refer only to the energy component.

2.1.4 Greenhouse gas emissions

Estimates of the GHG emissions are derived from final energy consumption (see Section 2.1.1). The methodology to determine the GHG emissions accounts for differences across sectors and countries.

The air emission accounts are based on the national emission inventories established by two international conventions, namely the UNFCCC and the Convention on Long-range Transboundary Air Pollution (CLRTAP). These sources record the amounts of GHG emissions and other air pollutants by country and emitting activity. The statistics are reclassified by Eurostat to match the NACE classification for sectors.

Unlike publicly owned companies, the SME definition is not applicable to public bodies. Therefore, the emissions related to the sector 'Public administration & defence; compulsory social security' are excluded from the computation.

The country- and sectoral-adjusted emission totals are redistributed to each of the companies based on the final energy consumption.

²² The indicator published by Eurostat takes into consideration only purchased energy goods, and therefore does not take into consideration energy which is auto-produced or results from industrial processes.

2.2 Energy audit savings

The savings resulting from energy audits are estimated based on a model, which is informed by existing empirical evidence. More specifically, the model estimates for each of the companies in the database both the savings based on the recommendations in the energy audit (i.e. potential energy savings) as well as the expected savings resulting from the implementation of recommendations in the energy audit (i.e. expected energy savings). The estimations are adjusted for both sector characteristics and company size.

2.2.1 Step 1: determining energy savings per specific activity

There is limited public data available on company-specific energy consumption and realised energy savings due to energy audits. Most studies on this topic are conducted using fictitious examples for improvement measures or only covering some of the energy savings measures.²³ The evaluation of the German Ministry for Economy and Energy, aimed at providing funding for voluntary energy audits at smaller companies (PwC, 2018),²⁴ constitutes one of the few exceptions providing comprehensive information on the impact of the energy audits on energy consumption. For the evaluation, 272 smaller companies that conducted a voluntary subsidised energy audit between 2015 and 2017 were questioned about the realised energy savings. The realised savings are also compared with potential savings per recommendation, given by general estimations made by a group of auditors beforehand.

Another study covering the recommended electricity savings of larger companies in a limited number of sectors required to conduct an energy audit in Germany (Mai et al., 2017)²⁵ shows that the expected savings as a share of energy consumption are fairly different. When comparing the studies, among the companies conducting voluntary audits the savings were 13.9% while the companies that conducted mandatory audits saved around 3.4%. The main reason for this difference seems to be the lack of implementation of recommendations. While the likelihood of recommendations for activities by the auditor are broadly similar across the two studies, the rate of implementation is much lower for companies in the study undertaking obligatory audits. The reason for this seems to be that voluntary participation in an audit may already signal a motivation to improve and follow through on audit recommendations. The company size difference between the studies does not seem to be a reason for the difference in savings, as other literature suggests that audits are no less effective for larger companies than for smaller ones (Schleich & Fleiter, 2017).²⁶

The achieved and potential savings for specific activities are used for the model in the steps described below.

2.2.2 Step 2: determining energy savings per broader activity group

To obtain the potential savings, those stemming from each specific activity are weighed by the relative importance of the activity within a broader group of related activities. The savings actions can be classified into three broad groups of activities (process-related, non-process related, cogeneration/boiler uses). The auditor's estimations of the recommended savings form the base for the calculation of the potential savings. The

²³ Hirzel et al. (2016), "A Study on Energy Efficiency in Enterprises: Energy Audits and Energy Management Systems Library of Typical Energy Audit Recommendations, Costs and Savings", European Union.

²⁴ PwC (2018), Evaluierung der Förderprogramme „Energieberatung im Mittelstand“ und „Energieberatung für Nicht-wohngebäude von Kommunen und gemeinnützigen Organisationen“. Endbericht Frankfurt, September 2018.

²⁵ Mai, Michael, Edelgard Gruber, Natalja Ashley-Belbin, Anna Schulz, Anton Barckhausen, Gunnar Will und Jan-Erik Thie (2017), Analyse der Entwicklung des Marktes und Zielerreichungskontrolle für gesetzlich verpflichtende Energieaudits. Schlussbericht an das Bundesamt für Wirtschaft und Ausfuhrkontrolle (BAFA). Karlsruhe: Institut für Ressourceneffizienz und Energiestrategien (IREES).

²⁶ Schleich, Joachim, and Tobias Fleiter (2019), „Effectiveness of energy audits in small business organizations“, *Resource and Energy Economics* 56: 59-70.

Manufacturing Energy Consumption Survey (MECS)²⁷ is used to determine the relative importance of each of the activities within the broader group of activities (see Table 2.1).

Table 2.1 Adjusted expected and potential energy savings across activities (% of energy consumption)

Activity	Expected energy savings	Potential energy savings
Process related	0.6%	5.8%
Process Cooling/Heating	0.3%	5.1%
Process Technology	0.3%	6.4%
Compressed Air	0.5%	2.1%
Motors	1.0%	9.6%
IT	0.3%	1.9%
Non-Process related	1.4%	5.9%
Heating	3.4%	7.6%
AC, Ventilation	2.2%	7.2%
Lighting	2.9%	4.4%
Organisation, Behaviour	0.7%	2.0%
Energy Management/Controlling	0.5%	2.8%
Other Energy Services	0.1%	2.0%
Other	1.0%	1.8%
Cogeneration / Boiler Usage / Own Electricity Production	1.3%	10.2%
Cogeneration System	1.9%	15.0%
Photovoltaics	1.0%	9.0%
Heat Recovery	1.1%	8.3%

Sources: CEPS (2020) based on MECS (2018) and PwC (2018).

2.2.3 Step 3: determining the relative importance of the activity groups

The relative importance of the broader group of activities varies across sectors. The importance of each of the broader activity groups for most sectors is determined (see Table 2.2) based on the information contained in the MECS, but this study only covers manufacturing sectors.

²⁷ US Energy Information Administration (2018), "2014 Manufacturing Energy Consumption Survey Data", <http://www.eia.gov/consumption/manufacturing/data/2014/>.

Table 2.2 Breakdown of energy consumption by sector (% of energy consumption)

Sector	Process related	Non-Process related	CHP/Boiler usage	Total
Steel	85%	8%	7%	100%
Chemical and petrochemical	52%	7%	41%	100%
Non-metallic minerals	91%	7%	2%	100%
Non-ferrous metals ²⁸	73%	12%	14%	100%
Transportation equipment	51%	40%	9%	100%
Machinery	49%	42%	9%	100%
Food, beverage and tobacco	40%	16%	44%	100%
Paper, pulp and printing	47%	7%	46%	100%
Wood and wood products	71%	20%	9%	100%
Textile and leather	56%	19%	25%	100%
Other	58%	14%	28%	100%

Source: CEPS (2020) based on MECS (2018).

The main sector that is not covered in the MECS is the transport sector, responsible for about 41% of the corporate energy consumption. The expected savings for transportation are based on the savings provided in Mai et al. (2017). The drawback is that only expected savings as a single number are reported in this study. The savings dynamics in this sector are assumed to be broadly comparable with all other sectors.²⁹ Indeed, the average ratio between the potential and actual savings in combination with the actual savings is used to estimate the potential savings. The same approach is used to estimate the potential savings for most of the remaining sectors for which the expected savings information is not available (mining and quarrying, construction).

Another important missing sector is the commercial sector, responsible for about 13% of corporate energy consumption. This sector is estimated using Schwartz et al. (2017),³⁰ as the breakdowns and drivers for the commercial sector are different to the manufacturing sector.³¹

For the agricultural sector, which accounts for around 3% of total energy consumption, values from Fabiani (2014)³² on energy audits on Italian farms are used. That study lists savings of between 5% and 12%. These values are broadly in line with expected savings from other sectors.

The information covering expected savings for the remaining missing sectors (mining and quarrying, construction) are taken from the German study covering mandatory audits (Mai et al., 2017).

²⁸ This does not sum up to 100% in this illustration due to rounding.

²⁹ British Department for Business, Energy & Industrial Strategy (2020), "Research on Energy Audits and Reporting, including the Energy Savings and Opportunity Scheme (ESOS)", Phase 2 Final Report.

³⁰ Schwartz, Lisa, et al. (2017), "Electricity end uses, energy efficiency, and distributed energy resources baseline".

³¹ The specific breakdowns from this source for the commercial sector are other (34%), lighting (17%), refrigeration and ventilation (31%), cooling (15%), computers and IT (14%), heating (5%).

³² Fabiani, Stefano (2014), "Energy efficiency in agriculture – Energy audit impact on environmental and economic performance at farm level".

There is no available information on any savings related to audits for the fishing sector. As the sector only contributes very little to the overall energy consumption and the main energy consumption is expected to be fuel for fishery vessels, the savings are assumed to be similar to those of the transport sector.

2.2.4 Step 4: determining the energy savings per sector

The expected energy savings are determined using the previously calculated conversion factors, i.e. shares of total energy consumption. These factors are multiplied by the savings attributed to the respective broader activity group. The resulting savings per activity group for a sector are then summed up, resulting in the expected/potential savings for that sector (see Table 2.3).

The process is different for the commercial sector, given the different source used and distinct activities. In this case, a weighted mean of the expected savings from the activities is calculated. The weights are the percentages from that activities breakdown.

Table 2.3 Expected and potential energy savings across sectors (% of energy consumption)

Sector	Expected energy savings	Potential energy savings ³³	Source
Agriculture	5.0%	12.0%	Fabiani (2014)
Fishing	4.9%	15.2%	See text.
Mining and quarrying	4.3%	14.6%	Mai et al. (2017), calculations
Steel	2.0%	12.2%	MECS calculations
Chemical and petrochemical	3.1%	9.9%	MECS calculations
Non-metallic minerals	1.8%	12.4%	MECS calculations
Non-ferrous metals	2.7%	13.2%	MECS calculations
Transportation equipment	5.0%	22.3%	MECS calculations
Machinery	5.3%	23.0%	MECS calculations
Food, beverage and tobacco	4.1%	12.9%	MECS calculations
Paper, pulp and printing	3.3%	9.7%	MECS calculations
Wood and wood products	3.2%	15.8%	MECS calculations
Textile and leather	3.7%	15.0%	MECS calculations
Commercial	1.4%	7.3%	Schwartz et al. (2017), calculations
Construction	5.1%	15.4%	Mai et al. (2017), calculations
Transport	4.9%	15.2%	Mai et al. (2017), own calculations

Sources: CEPS (2020) based on MECS (2018) and PwC (2018).

2.2.5 Step 5: determining the energy savings per company

The final step entails the estimation of the expected and potential energy savings per company. For this, the energy consumption of the company is multiplied by the expected and potential energy savings percentages for the respective sector.

³³ Part of the potential savings are estimated based on the method laid out in step 3.

2.3 Case studies

Based on prior experiences, the use of the EU SME definition (EU Recommendation 2003/361) might require some companies that have characteristics or similarities with SMEs to conduct mandatory energy audits. For this study, the five most obvious cases have been singled out for an in-depth assessment.

The case studies add both a qualitative and quantitative assessment of the energy consumption by linked, partner, publicly owned enterprises that on a stand-alone basis would be considered SMEs based on the size indicators (i.e. number of employees, total assets and turnover). The case studies in particular contribute to the understanding to the effectiveness of energy audits for the various cases that due to their ownership structure turn into non-SMEs.

In the case studies the autonomous enterprises (non-affected) are compared with the enterprises that are non-SME due to their links, partnerships and public ownership (affected). Moreover, for the linked and partner enterprises a distinction will be made between countries active in a single country (domestic) and across borders (multinational).

The case studies are prepared based on a combination of desk research, data analysis and interviews.

2.4 Survey

To determine the current implementation, including the instruments that are used to identify companies within the scope as well as obstacles in the implementation of the SME Recommendation, a survey of national authorities was conducted between 6 August and 30 October 2019. In total, 29 authorities from 27 Member States completed the survey. This means that with the exception of Slovenia, all the authorities completed the survey.

2.5 Interviews

For the preparation of the case studies, assessment of the policy options, alternative SME definitions and energy-related policy options, in total about 50 interviews were conducted.

There were 19 interviews conducted for the case studies, which were performed between February and August 2020. Among the case studies were domestically and internally linked companies, companies with partner links and public entities.

Furthermore, 29 interviews were conducted with national energy authorities and national business associations. The interviews were conducted between June and September 2020. There were in total 17 interviews conducted with energy authorities from 16 Member States. The 12 national business associations that were interviewed represent companies in 9 Member States.

Additionally, there were also interviews conducted with various European Commission officials about the SME definition applied in various legal contexts as well as the implications of the State Aid legislation.

2.6 Limitations

This section highlights the main limitations to the methodology used for the preparation of this study and the main mitigating measures.

The coverage of financial reporting in the business registers varies significantly across EU Member States (see Annex 2), because of limited coverage of some of the national registers as well as certain companies (e.g. self-employed) that are exempted from the publication of their figures or subject to simplified reporting (e.g. micro undertakings). The lack of complete business information makes the identification of the economically active

companies more difficult. The impact on the number of non-SMEs in the EU should be relatively limited, as larger companies tend to report better than SMEs.

There are differences in the consolidation bases. More specifically, there are some companies that report solely on a consolidated basis. For approximately 50 000 companies or 0.1% of the total number of companies, the number of employees and financial indicators are provided only at the consolidated level. The use of consolidated instead of unconsolidated figures to estimate final energy consumption may result in an overestimation. In fact, the companies with consolidated accounts report the number of employees and financial indicators of the reporting entity and those of all the consolidated entities. This means that the figures of subsidiaries are counted at least twice. The unconsolidated figures are derived by using detailed ownership information (see Section 2.1.1.3).

The number of energy carriers included in the analysis is restricted to the main energy carriers. More specifically, the energy-related indicators³⁴ in this study are based on the companies' preferred energy carriers, namely electricity, gas, gasoline, diesel, fuel oil and jet fuel. Cumulatively, these energy carriers account for more than 80% of the total final energy consumption. A number of energy carriers have been excluded due to their small share of the overall final consumption. Furthermore, some energy carriers – such as blast furnace gas – are the result of industrial processes (by-products). For these fuels, the available statistics do not allow determination of the primary energy consumption or price levels. Due to this, the share of companies under Options 3A, 3B and 3C are likely to be underestimated for the sectors using the excluded fuels (e.g. electricity and heat supply sector, mining sector).

The unavailability of detailed data related to the transformation and distribution losses for natural gas and petroleum products makes the estimation of the primary energy consumption for these fuels more difficult. This is addressed by using the WTT factors in the JEC report (see "Primary energy consumption" in Annex 3. Estimating energy-related indicators").

The costs for petroleum products used for the computation of the total energy costs are based on the retail prices of gasoline and diesel. This might entail an overestimation of the energy bill for companies in the transportation sector, as larger users are likely to obtain the fuels at a discount.

The expected and potential energy savings as a share of final energy consumption are assumed to be the same across countries and company size. Similarly, the final energy consumption per unit of employees is assumed to be constant across company size. It follows that the energy savings and the final energy consumption indicator do not capture the difference in energy efficiency that might exist between companies of different sizes or companies based in different Member States. There have not been country or size adjustments because there is no strong empirical evidence to support those adjustments.

The model for the expected and potential energy savings does not consider the decreasing marginal impact that routine energy audits might have because of a lack of reliable statistics.

Finally, there is uncertainty about the effective definition of non-SMEs applied by national authorities. Indeed, for many authorities there is a difference between the operational definition they apply and the ability to identify these companies using the available instruments. This concerns especially the ability to identify partnerships and foreign-ownership relations. As also companies might often not consider these aspects in determining whether they are a non-SME or not, there could potentially be large differences between the companies meeting the definition as applied by the national authorities and the companies actually conducting energy audits. This issue might especially effect the estimations for the baseline scenario.

³⁴ Namely, the final energy consumption, primary energy consumption and annual energy bill.

3 Obstacles in implementation

This chapter identifies the obstacles in the current implementation of the non-SME definition by Member States for energy audits as well as the alternative definitions that are currently applied to determine whether companies are required to conduct energy audits.

3.1 Obstacles for energy authorities in implementation

In the survey, only five authorities referred to the absence of obstacles in implementing the SME definition pursuant to Article 8(4) EED (Lithuania, the Netherlands, Poland, Romania and the UK). Others referred to a number of issues arising during the implementation of the SME definition, and initial results of this study have revealed important obstacles in the implementation of Article 8(4) EED. The problems mostly referred to are the complexity of the SME definition, for both the authorities and businesses, difficulties in identifying the ownership relations, the lack of an energy component in the definition and the lack of relevant instruments for identifying the companies obliged to undergo an energy audit. These results are consistent also with the findings of the European Commission's Study on Energy Efficiency in Enterprises (2016),³⁵ which demonstrate that in many Member States the implementation of the definition of SMEs faces several challenges, including the implicit definition of large companies, the lack of data for identifying large companies and missing details on national implementation.

The obstacles in the implementation are outlined following the critical elements of the definition (size criteria, ownership relations and legal forms) and actual tools for the identification of the companies within the scope. The analysis stems primarily from the completed surveys obtained from the relevant authorities in Member States, as well as secondary sources for additional information.

3.1.1 Size criteria

All Member States follow the SME definition provided by EU Recommendation 2003/361 (see Table 3.1). They apply the size criteria as specified in the EU Recommendation; thus, the number of employees is to exceed 250 in order for an enterprise to qualify as a non-SME. Also, most of the authorities follow the SME criteria on turnover (not exceeding EUR 50 million) and balance sheet total (not exceeding EUR 43 million).

However, several Member States have slightly adjusted the financial threshold values. In two Member States using a currency other than the euro, the size criteria deviate from the EU Recommendation. Croatia sets HRK 260 million (approximately EUR 35 million) as the turnover threshold and HRK 130 million (approximately EUR 17.5 million) as the total assets threshold; Slovenia also establishes a threshold for the balance sheet total not to exceed EUR 17.5 million.³⁶

³⁵ See "A Study on Energy Efficiency in Enterprises: Energy Audits and Energy Management Systems" (2016), Report on the fulfilment of obligations upon large enterprises, the encouragement of small- and medium-sized companies and on good-practice, European Commission Study. Here pp. 201-203.

³⁶ Lisa Nabitz and Simon Hirzel (2019), "Transposing the Requirements of the Energy Efficiency Directive on Mandatory Energy Audits for Large Companies: a Policy-Cycle-based Review of the National Implementation in the EU-28 Member States", *Energy Policy* 125, pp. 548-561. Here, p. 556.

Table 3.1 Definition of the obliged target group

Criteria	Identical SME definition criteria		Thresholds, different to the SME definition	
	N	%	N	%
Total number of employees (>250 employees)	29	100%	N/A	N/A
Turnover (EUR >50 million)	26	90%	3	10%
Total assets (EUR >43 million)	25	86%	4	14%
<i>Additional criteria</i>	10	34%		
<i>SME Recommendation</i>	19	66%		
<i>SME Recommendation + Additional criteria</i>	10	34%		

Note: These figures are based on survey responses from 29 national authorities in 27 Member States (EU-28).

Source: CEPS' elaboration.

Obstacle 1 – over-complex definition of SMEs/an implicit definition of large enterprises

Scholars notice that “one of the major challenges for Member States during the transposition was to define the target group... Some Member States decided to explicitly define large enterprises in their legal documents, other[s] followed the approach of the EED and only defined SMEs and outlining large companies as any others.”³⁷

While all authorities apply the EU definition of SMEs, the definition of the obliged target group might be challenging, and 8 authorities (28%) have pointed to the complexity of the SME definition. Nabitz and Hirzel (2019; p. 558) argue that “due to the implicit (and inverse) delimitation of large companies, the definition in law as well as the real identification of obliged companies is challenging for Member States... this further complexity is added by adding further (e.g. energy-related) criteria in some Member States”.

Lack of precision and clarity of the definition was highlighted several times (e.g. by the Czech Republic), as well as the definition’s complexity and a need for special resources and tools for defining the obliged group (Malta). In Italy, the transposition of Article 8(4) EED raised particular difficulties to identify the companies subject to obligations due to the fact that it was not possible to specify in the legislative decree of transposition these companies as “all those who are not SMEs”. Therefore, a definition of “large enterprise” was introduced, which, however, is not foreseen by EU Recommendation 2003/361. In practice, this has created a situation whereby the enterprises obliged to carry out an energy audit pursuant to Article 8(4) EED and the enterprises that are not SMEs are not completely complementary groups in Italy.

The definition has been reported as challenging to apply also by companies themselves (in Hungary and Ireland). While the size criteria are rather easy to applied, businesses have difficulty understanding the financial criteria for Article 8(4) EED energy audits, which by default has to include either of the financials (turnover and balance sheet) to qualify as a non-SME.³⁸ The fact that there are two financial criteria to meet can create confusion as to whether it is ‘and’ or ‘or’ (Ireland). Some authorities wondered whether it could be more feasible to keep only the size criterion for the purpose of the definition (Brussels).

³⁷ Ibid.

³⁸ For example, as explained in the User Guide to the SME Definition (2015), https://ec.europa.eu/regional_policy/sources/conferences/state-aid/sme/smedefinitionguide_en.pdf.

Obstacle 2 – lack of energy criteria in the SME definition

It was pointed out by 5 authorities (17%)³⁹ that the energy audit obligation is defined on the basis of a non-energy component. The lack of energy-related criteria leads to two main consequences: (i) SMEs with energy-intensive activities are not considered and (ii) small companies might be subject to the mandatory audit obligation only because they do not fall within the scope of the SME definition.⁴⁰

On the one hand, as the Coalition for Energy Savings notices,

the justification for setting a threshold for the size of the enterprises required to carry out energy audits lies in the fact that large enterprises consume more energy than SMEs, and thus have greater energy saving potentials. In addition, energy audits, including audits that are part of an energy or environmental management system, are less of a cost burden for large enterprises than they would be for SMEs, not to mention households and other small end users.⁴¹

On the other hand, energy consumption in SMEs varies across sectors.⁴² The Ricardo Energy and Environment Study (2018)⁴³ shows that

[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.⁴⁴

The study suggests 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.”

3.1.2 Ownership relations

Taking into account the possible dependence of an enterprise on other enterprises, it is crucial to define the status of the enterprise before the company category can be defined. All authorities consider the stand-alone (parent) entity. Among them, Brussels, Flanders, Bulgaria, Estonia, France and Ireland consider only stand-alone entities. For example, when a large European company has a branch in Bulgaria and the branch does not meet the criteria for a mandatory energy audit according the Energy Efficiency Act (Article 57, para. 2), the Sustainable Energy Development Agency (SEDA) does not require the branch to perform a mandatory energy audit either.

Stand-alone entities, subsidiaries and participations are considered by 5 authorities (Cyprus, Croatia, Italy, Latvia and Portugal).

Stand-alone entities, subsidiaries and majority shareholders are considered in Austria (number of levels – 99), Spain (unlimited), Finland (number of levels – 10), Hungary (unlimited) and Poland (unlimited).

Table 3.2 provides an overview of the findings:

- A large majority of authorities (76%) considers the subsidiaries.

³⁹ Notably, Flanders, Wallonia, Cyprus and Germany.

⁴⁰ Wolfgang Eichhammer and Clemens Rohde (2016), “Enhancing the impact of energy audits and energy management in the EU. A review of Article 8 of the Energy Efficiency Directive European Council for an Energy Efficient Economy (eceee)”, 2 February. Here, p. 6.

⁴¹ See “Energy Audits (Article 8)”, The Coalition for Energy Savings <http://eedguidebook.energycoalition.eu/energy-audits.html>.

⁴² See <https://www.sciencedirect.com/science/article/pii/S0959652615004485>.

⁴³ Ricardo Energy and Environment Study (2018), “Development of recommendations on the implementation of certain aspects of Article 8 and Annex VI of the Energy Efficiency Directive”, 5 October, https://ec.europa.eu/energy/sites/ener/files/final_report_-_development_of_guidelines_and_recommendations_on_the_impl.pdf.

⁴⁴ Ricardo E&E (2018), p. 27.

- More than half of the authorities consider participations (55%) and majority shareholders (59%).
- Only a minority of authorities consider minority shareholdings (43%).

Table 3.2 Ownership relations

Ownership relations	Yes		No		Do not know	
	N	%	N	%	N	%
Entity on a stand-alone basis	29	100%	0	0%	0	0%
Subsidiaries	22	76%	6	21%	1	3%
Participations	16	55%	12	41%	1	3%
Majority shareholders	17	59%	12	41%	0	0%
Minority shareholders	12	43%	16	57%	0	0%
All ownership relations	11	38%				

Note: These figures are based on survey responses from 29 national authorities in 27 Member States (EU-28).

Source: CEPS' elaboration.

According to the survey, 11 authorities (38%) consider all forms of ownership relations – stand-alone entities, subsidiaries, participations, and majority and minority shareholders.⁴⁵

It is important to note that the EED is considered fully implemented only if all forms of ownership relations are considered; thus, the fewer the ownership forms taken into account by the authorities for the purpose of Article 8(4) EED, the less complete the implementation of the EED is.

Obstacle 3 – inclusion of ownership relations

The inclusion of ownership relations was mentioned by 10 authorities (41%). This includes ownership relations outside Member States and the EU, when, for example, enterprises do not meet the criteria of a large company but belong to a multinational corporation (Spain). There could be cases where most of the companies in a corporate group do not belong to large enterprises; it is also difficult to identify companies belonging to a foreign large company group (Sweden). Some authorities do not have access to the relevant information relating to the non-SMEs registered in any other Member State, and therefore are not able to effectively monitor subsidiaries of the companies registered in other Member States (Finland).

At the same time, the EC Recommendation⁴⁶ in para. 25 states that

[a]s a result, small branches in one Member State may need to carry out an energy audit every four years because they do not fall within the definition of SME and therefore come within the category of large enterprises. This should not be considered an extra burden or disproportionate because on the one hand such enterprises may well be implementing energy-management systems (see Section D2) or may have arrangements whereby the branch could be helped with the audit,

⁴⁵ More specifically, in the Czech Republic, Denmark, Germany, Greece, Luxembourg, Malta, Netherlands, Romania, Slovakia, Wallonia and the UK; The number of levels of minority and majority shareholders considered ranges from 1 000 in Luxembourg and Romania to 1 in others.

⁴⁶ See the (Existing) Guidance note on Article 8: <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52013SC0447>.

for example by in house experts from the parent company; and on the other hand, because the energy audit in question is likely to have a more limited scope and cost.

Another obstacle mentioned by some authorities is the unavailability of consolidated figures for identifying linked and partner enterprises. A problem with identifying small branches of multinational companies was raised by several authorities.⁴⁷ For example, Germany noted that “especially the determination regarding who is considered a linked or partnered enterprise and how to identify the interdependencies of enterprises raises a lot of questions and causes a lot of uncertainty regarding the (potential) audit obligation”. The same can be true for enterprises which are more than 25% state owned (in some cases such non-SMEs occupy a small rented office with fewer than 10 employees).

3.1.3 Legal forms

All authorities consider public and private limited liability companies, and the vast majority of authorities (86%) also include sole traders/proprietorships (except for Finland and Italy).

Legal forms do not seem to be a particular issue for the definition.

Table 3.3 Legal forms for the purpose of the identification of non-SMEs

	Yes		No		Do not know	
	N	%	N	%	N	%
Public limited companies	29	100%	0	0%	0	0%
Private limited companies	29	100%	0	0%	0	0%
Sole traders/proprietorships	25	86%	2	7%	2	7%
Other legal forms	20	69%	4	14%	5	17%

Note: These figures are based on survey responses from 29 national authorities in 27 Member States (EU-28).

Source: CEPS' elaboration.

3.1.4 Identification

Only just over half of the authorities (52%) identified the companies within the scope.⁴⁸ Of these authorities, about half (28% of the total) consulted the companies within the scope. A large majority of the authorities (72%) recorded the companies that have conducted energy audits.⁴⁹

A significant minority of the authorities (11 or 38%) maintained a list of enterprises that are obliged to conduct energy audits and those that actually have.⁵⁰

In addition, 5 authorities (17%) that follow the EU definition (criteria plus ownership relations) have a list of companies within the scope.

Only 4 authorities (14%) that follow the EU definition have both a list of companies within the scope and a list with companies that have conducted an energy audit.

⁴⁷ Specifically, Cyprus, Denmark and Estonia.

⁴⁸ Among them are Bulgaria, Croatia, Cyprus, Estonia, Greece, Finland, Ireland, Italy, Latvia, Lithuania, the Netherlands, Romania, Sweden, Wallonia and the UK.

⁴⁹ These are Austria, Flanders, Wallonia, Brussels, Bulgaria, Croatia, Cyprus, Denmark, Greece, France, Hungary, Ireland, Italy, Lithuania, Malta, Portugal, Romania, Sweden, Slovakia, Spain and the UK.

⁵⁰ Specifically, Bulgaria, Cyprus, Croatia, Greece, Ireland, Italy, Lithuania, Romania, Sweden, Wallonia and the UK.

Table 3.4 Identification of the companies within the scope

	Yes		No		Don't know	
	N	%	N	%	N	%
List of enterprises that are obliged to carry out energy audits?	15	52%	13	45%	1	3%
If so, have the enterprises that are on this list been consulted?	8	28%	4	14%	2	7%
List of enterprises that carried out energy audits	21	72%	8	28%	0	0%

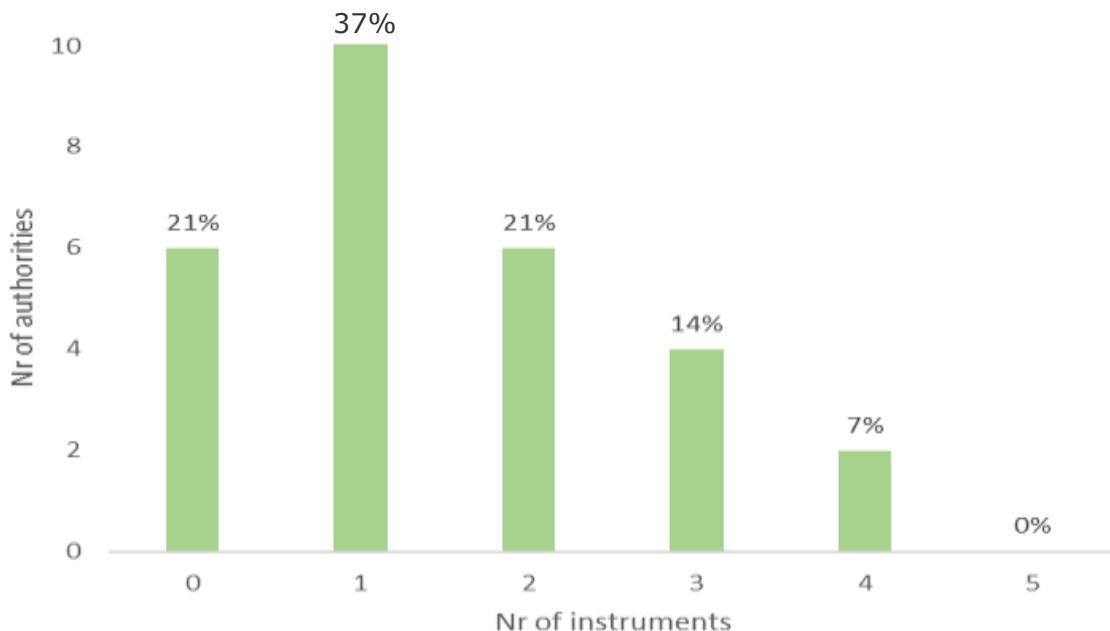
Note: These figures are based on survey responses from 29 national authorities in 27 Member States (EU-28).

Source: CEPS' elaboration.

Although only 15 authorities (52%) indicated they had a list of companies within the scope, 21 authorities (75%) indicated that they use instruments to identify companies.

The 21 authorities use 1 to 4 instruments (1.5 instruments on average) (see Figure 3.1).

Figure 3.1 Number of instruments used by authorities



Note: These figures are based on survey responses from 29 national authorities in 27 Member States (EU-28).

Source: CEPS' elaboration.

The 43 instruments cover public databases (tax, statistics, registers, etc.) (26), private databases (9), annual reports (2), the chamber of commerce (2), company declarations (2), an association of high-energy users (1) and a company survey (1).

Most of the instruments provide the number of employees (63%), total assets (45%), turnover and sectoral information (53%). The coverage of ownership information as well as energy consumption is limited (18–23%).

Most instruments only cover one Member State; none of the instruments cover all EU Member States.

Table 3.5 Instruments available for the authorities

	Yes, available and used	Yes, available but not used	Yes	No, not available	Do not know	Total
	N	N	N	N	N	N
Number of employees	25	3	28	10	2	40
Total assets	18	4	22	15	3	40
Turnover	21	5	26	11	3	40
Majority shareholders (>50% owned)	5	4	9	25	6	40
Minority shareholders (25-50% owned)	4	3	7	26	7	40
Subsidiaries (>50% owned)	9	3	12	23	5	40
Participations (25-50% owned)	7	3	10	25	5	40
Energy consumption	7	2	9	29	2	40
Sector	20	7	27	9	4	40
	%	%	%	%	%	%
Number of employees	63%	8%	70%	25%	5%	100%
Total assets	45%	10%	55%	38%	8%	100%
Turnover	53%	13%	65%	28%	8%	100%
Majority shareholders (>50% owned)	13%	10%	23%	63%	15%	100%
Minority shareholders (25-50% owned)	10%	8%	18%	65%	18%	100%
Subsidiaries (>50% owned)	23%	8%	30%	58%	13%	100%
Participations (25-50% owned)	18%	8%	25%	63%	13%	100%
Energy consumption	18%	5%	23%	73%	5%	100%
Sector	50%	18%	68%	23%	10%	100%

Note: These figures are based on survey responses from 29 national authorities in 27 Member States (EU-28).

Source: CEPS' elaboration.

Obstacle 4 – unavailability of instruments

Most authorities stressed that only data for the country is available and 5 of them (17%) highlighted the difficulties of obtaining information about the obliged companies.

Some Member States mentioned that no comprehensive databases are available (which include employees, turnover and assets) and often when there are available instruments. The lack of an available database makes it very complicated to control whether an enterprise is obliged to undergo an energy audit and to identify partner and linked enterprises (Wallonia). The difficulties also often refer to search parameters – many databases do not include SME parameters and allow only individual searches by a company's register number (Wallonia). Some authorities attempt to apply the whole set of the European criteria, including links with other enterprises, when the relevant information is available (Wallonia). Some authorities noted that commercial databases with fuller information are available and can be purchased (and used by authorities), but they often do not contain all the relevant data as they are provided on a voluntary basis (Austria).

Several authorities referred to the complexity of identifying ownership relations – finding relevant data is complicated and is effectuated on a case-by-case basis (Wallonia). The available instruments may also have size thresholds that differ from the SME definition (e.g. no ownership considerations) or lack energy consumption data. Some authorities also underlined that ownership of enterprises might be dynamic and a switch from an SME to a large enterprise (e.g. through a merger of companies) can occur within the timeframe of four years (Austria).

Authorities in general experienced problems in obtaining all the relevant information; problems can also refer to consolidated accounts, erroneous data, errors in company reports and difficulties in establishing parental relationships (the UK).

3.2 Current differences in implementation

Implementation of Article 8(4) EED varies across Member States. In this section, the deviations from the Commission's SME Recommendation are identified and assessed.

A third of the EU Member States currently combine the Commission's Recommendation with additional criteria. Four Member States use energy-related criteria.⁵¹ Bulgaria set an obligation to perform an audit for all industrial systems with annual energy consumption over 3 000 MWh. In Italy, besides non-SMEs, enterprises in energy-intensive industries are obliged to carry out energy audits (with an energy consumption exceeding 2.4 GWh/year and ratio cost of energy used/turnover of more than 3%).⁵² In Portugal, companies with an energy consumption over 500 toe/year are required to carry out energy audits under the Management of Intensive Energy Consumption System (SGCIE) every eight years. Some Member States offer exemptions on the basis of energy consumption criteria: for example, in Denmark, companies with an annual energy consumption below 100 000 kWh/year are exempt, while in Malta, large companies with energy consumption below 50 000 kWh/year are exempt.⁵³

Some authorities consider annual energy costs or the space used by enterprises as criteria for an obligatory energy audit. Lithuania identifies companies that are also obliged to undergo energy audit as those with energy consumption in the owned property exceeding 20% of costs. These companies should also be registered in Lithuania and not be in the process of bankruptcy or reorganisation. Ireland applies additional criteria with an

⁵¹ More specifically, Bulgaria, Denmark, Italy and Malta.

⁵² Eurochambers (2015), "Energy Audits for Europe. Assessment of the transposition of Article 8 of the Energy Efficiency Directive (2012/27/EU) into Member State legislation", Transposition Study, 17 June. Here, p.35.

⁵³ Eurochambers (2015). Here, pp. 25, 37.

obligation to conduct energy audits for public bodies that meet either of the following criteria: (i) have individual buildings with a floor area >500m² or (ii) have an energy spend of more than EUR 35 000 per year. At the same time, schools that report data annually to the Sustainable Energy Authority of Ireland (SEAI) and take part in 'Energy in Education' training are exempt.

Some Member States establish various exemptions for obligatory energy audits. For example, in the UK, publicly funded bodies do not fall within the scope of the Energy Savings Opportunity Scheme Regulations, but where an enterprise is funded both by public and private sources, it can be required to participate.⁵⁴

⁵⁴See "A Study on Energy Efficiency in Enterprises" (2016). Here, p. 174.

4 Policy options

This section presents the potential policy options for the companies within the scope of mandatory energy audits.

4.1 Policy objectives

In line with the main goal of the EED, the introduction of obligatory audits through Article 8(4) should stimulate energy savings in companies. Therefore, the main issue at stake here can be formulated as follows: which policy option for the definition of SME generates – in a cost-effective way – the largest energy savings from obligatory audits? The ‘cost-effectiveness’ condition ensures that the costs of performing the energy audit are in balance with net cost savings resulting from the energy audit (i.e. cost savings from energy efficiency measures minus the investment costs to realise the savings).

4.2 Potential alternative options

This section discusses the main considerations in defining the potential alternative policy options.

4.2.1 Alternative SME definitions

In some EU legislation, the definition for SMEs deviates from the EU Recommendation. Based on a text analysis of the 640 regulations and directives, the SME definitions in EU legislation have been mapped and assessed (Table 4.1).

In fact, two thirds (61%) of EU legislation mention SMEs in one way or another. However, only about half of that or about a quarter (27%) of EU legislation has SME-related legal provisions, i.e. different treatment for SMEs or non-SMEs.

The large majority of the legislation with legal provisions for SMEs follows the EU Recommendation to determine whether a company is an SME (12%) or does not have an explicit definition (12%). The remaining 21 pieces of legislation with legal provisions for SMEs (2%) either follow a simplified (1.3%) or topic-specific definition (0.6%).

In general, less than half of the legislation with legal provisions for SMEs is relevant for State Aid. Looking at the alternative definitions, only one out of the eight simplified definitions has State Aid relevance, none out of the four topic-specific definitions, and four out of the nine pieces of legislation that use a combination of the existing SME definition and a topic-specific definition.

Table 4.1 SME definition in EU law

	Legal acts		State Aid relevance	
	N	%	N	%
Regulations and directives	640	100.0%	128	20.0%
Mentioning SMEs	389	60.8%	114	17.8%
Legal acts mentioning SMEs with legal provisions	171	26.7%	79	12.3%
Current definition	75	11.7%	37	5.8%
Simplified definition	8	1.3%	0	0.0%
Topic-specific definition	4	0.6%	0	0.0%
Mix of simplified and topic-specific definition	9	1.4%	4	0.6%
No explicit definition	75	11.7%	37	5.9%
Legal acts mentioning SMEs with no legal provisions	218	34.1%	35	5.5%

Source: CEPS' elaboration based on EU law.

The motivation for the alternative definitions varies across legislation (Table 4.2).

The **simplified definitions** use some but not all criteria of the traditional SME definition. The main motivation for the application of the simplified definition is to ensure that companies of the same size benefit from a level playing field in the EU (Recast Electricity Directive, Accounting Directive and Shareholder Rights Directive).⁵⁵ In several cases (Capital Requirements Regulation I & II and Bank Recovery and Resolution Directive) a simplified SME definition is used because it was directly transposed from Basel II international standards. In others (Unfair Trading Practices Directive and Directive on Restructuring and Insolvency) it was used to better accommodate the specific needs of SMEs.

The **topic-specific definitions** are entirely different from those based on the number of employees, balance sheet total and turnover. This is in practice only applicable to the financial sector, where market capitalisation is used to determine whether a company is an SME or not (Market Abuse Regulation, Regulation on Settlement and Central Securities Depositories). More specifically, it is used for listed companies on SME growth markets. This market was established by the Markets in Financial Instruments Directive II (MiFID) to improve the access of SMEs to capital markets and reduce their administrative burdens. According to the directive, an SME definition based on market capitalisation will ensure the smoother transition of SMEs from growth markets to main markets.

The **mix of a simplified and topic-specific definition** usually extends the current SME definition to other categories of enterprises (i.e. mid-caps⁵⁶). It is mostly used in legislation ensuring financial assistance to SMEs in certain industries, such as agriculture and defence. The regulations justify the mix of definitions by citing industry-specific circumstances like as lack of funding and lower competitiveness of SMEs and mid-caps (European Structural and Investment Funds Regulation, European Defence Industrial Development Programme, European Fund for Strategic Investments Regulation I & II).

When defining the list of companies eligible for venture capital fund investment, the proposal to amend the European Venture Capital Funds and European Social

⁵⁵ EC (2011), Impact assessment accompanying the Proposal on annual financial statements.

⁵⁶ A mid-cap here is a non-SME with a headcount of fewer than 500 employees.

Entrepreneurship Funds Regulation mentions companies listed on SME growth markets and other companies with fewer than 499 employees. The Commission believes that the extended definition will help fund managers to identify sufficient eligible investments and diversify their portfolio, while increasing capital supply to SMEs.⁵⁷

Other legislation employing a mix of simplified and topic-specific definitions are the Eco-Management and Audit Scheme, Notification Forms and Information Sheets Regulation, Horizon 2020 and the Prospectus Regulation. The Eco-Management and Audit Scheme defines SMEs in accordance with the current definition but also includes local authorities governing fewer than 10 000 inhabitants or other public authorities complying with a simplified SME definition. This is done to encourage greater participation in the scheme and promote continual improvement in the environmental performance. Similar motivation is behind the SME definition in Horizon 2020 – the legislation aims to spur innovation in Europe by increasing financial support to innovative SMEs and mid-caps.

The Notification Forms and Information Sheets Regulation mandates Member States to report in detail their State Aid to SMEs and smaller state-owned undertakings. Including smaller state-owned undertakings in the SME definition enables the potential impact of large aid budgets on trade and competition to be taken into account.

The broadest SME definition is specified in the Prospectus Regulation. It combines the current SME definition with that of MiFID II and further extends it to multi-trading facilities (MTFs) operating in SME growth markets, non-SME companies listed on SME growth markets with market capitalisation of less than EUR 500 million and other entities with a public offering of less than EUR 20 million and headcount of fewer than 500 employees. This is done to ensure the proportionality between the company size and the cost of producing a prospectus and to reduce the administrative burden for SMEs.

Overall, the results show that non-traditional SME definitions are most often used to provide support to SMEs and/or reduce their regulatory burden. In contrast to the EED, none of the above-mentioned legislation prescribes Member States to compile and maintain a national register of SMEs.

⁵⁷ EC (2017), Regulation amending Regulation (345/2013) on European venture capital funds and Regulation (EU) No 346/2013 on European social entrepreneurship funds.

Table 4.2 Alternative SME definitions used in EU law

Definition	Usage	Legal act	Competent Directorate General
<i>Simplified definition</i>			
Turnover ≤ EUR 50 million	Reduction of capital charges on SMEs exposures of credit institutions to ensure an adequate flow of credit to SMEs.	Capital Requirements Regulation (CRR – 575/2013/EU)	DG FISMA
Turnover ≤ EUR 50 million	Reduction of capital requirements on SMEs exposures of credit institutions to ensure an adequate flow of credit to SMEs.	Capital Requirements Regulation (CRR II – 2019/876/EU)	DG FISMA
Turnover ≤ EUR 50 million	Increase in priority ranking of deposits held by SMEs in order to ensure higher protection of SMEs in case of banks' bail-ins and other insolvency proceedings.	Bank Recovery and Resolution Directive (BRRD – 2014/59/EU)	DG FISMA
Turnover ≤ EUR 350 million	Prohibition of unfair trading practices negatively affecting SMEs to stop larger businesses exploiting small and medium-sized suppliers because of their weaker bargaining position.	Unfair Trading Practices Directive (UTPD – 2019/633/EU)	DG AGRI
Headcount ≤ 50 and either Turnover ≤ EUR 10 million or Balance Sheet ≤ EUR 10 million	Exemption of SMEs from fees related to switching electricity providers. Public interventions in the price setting for electricity supply to microenterprises by Member States to ensure affordable, transparent energy prices and costs.	Recast Electricity Directive (2019/944/EU)	DG ENER
Headcount ≤ 250 and either Turnover ≤ EUR 40 million or Balance Sheet ≤ EUR 20 million	Exemption of SMEs from preparing management reports and publishing their profit and loss accounts to limit administrative burdens and provide for simple and robust accounting rules.	Accounting Directive (2013/34/EU)	DG FISMA
Headcount ≤ 250 and either Turnover ≤ EUR 40 million or Balance Sheet ≤ EUR 20 million	Exemption of SMEs from an obligation to hold an official vote on the remuneration report. SMEs may, instead, only submit it for discussion in the annual general meeting to facilitate the implementation of the remuneration policy.	Shareholder Rights Directive (SRD II – 2017/828/EU)	DG JUST
As defined by national law	Exemption of SMEs from the obligation to treat affected parties in separate classes during debt restructuring proceedings. Comprehensive check-lists for debt-restructuring plans shall be developed and adapted to the needs and specificities of SMEs by Member States to increase effectiveness of debt restructuring.	Directive on Restructuring and Insolvency (2019/1023/EU)	DG JUST
<i>Topic-specific definition</i>			
Average market capitalisation ≤ EUR 200 million	Exemption of SMEs listed on SME growth market from drawing up an insider list to reduce administrative burdens on SME issuers.	Market Abuse Regulation (MAR – 596/2014/EU)	DG FISMA
Average market capitalisation ≤ EUR 200 million	Extension of time limit before the initiation of buy-in process/penalty mechanism up to 15 days for financial instruments traded on SME growth	Regulation on Settlement and Central Securities Depositories (CSDR – 909/2014/EU)	DG FISMA

Definition	Usage	Legal act	Competent Directorate General
	markets to allow for activity by market-makers in less liquid SME growth markets.		
Average market capitalisation ≤ EUR 200 million & entities with headcount ≤ 499	Inclusion of SMEs and other companies with less than 499 employees in the list of eligible undertakings in which qualifying venture capital funds can invest in order to further increase the supply of capital to businesses.	European Venture Capital Funds and European Social Entrepreneurship Funds Regulation (EuVECA & EuSEFb – 2017/1991/EU)	DG FISMA
Average market capitalisation ≤ EUR 200 million	Establishment of SME growth markets, where at least 50% of the issuers are SMEs to facilitate access of SMEs to capital and to facilitate the further development of specialist markets that aim to cater for the needs of SME issuers.	Markets in Financial Instruments Directive (MiFID II – 2014/65/EU)	DG FISMA
<i>Mix of current and topic-specific definitions</i>			
Current definition & entities with headcount ≤ 500	Financial contribution from Member States to SMEs and other enterprises with less than 500 employees in the agricultural sector and the fishery and aquaculture sector in order to enhance their competitiveness.	Common Provisions Regulation on five European Structural and Investment Funds (CPR – 1303/2013/EU)	DG REGIO
Current definition & entities with headcount ≤ 750 or turnover ≤ EUR 200 million	Financial support to SMEs and other eligible enterprises engaged in manufacturing of agricultural products for tangible or intangible investments in processing facilities and winery infrastructure, as well as marketing structures and tools. This is to provide a safety net to agricultural markets in the EU.	Common Organisation of the Markets Regulation (CMO – 1308/2013/EU)	DG AGRI
Current definition & entities with headcount ≤ 3 000	Financial support to SME-dedicated projects in defence industry in order to foster the competitiveness, efficiency and innovation capacity of the defence industry throughout the Union and promote cross-border participation of SMEs.	European Defence Industrial Development Programme (EDIDP – 2018/1092/EU)	DG GROW
Current definition & local authorities governing ≤ 10 000 inhabitants or other public authorities complying with simplified SME definition	Exemption or reduction of fees for small organisations to participate in Eco-Management and Audit Scheme (EMAS) in order to encourage greater participation in EMAS and promote continuous improvements in the environmental performance of organisations.	Eco-Management and Audit Scheme (EMAS III – 1221/2009/EC)	DG ENV
Current definition & entities with ≥ 25% controlled by public bodies	Obligation for Member States to detail State Aid to SMEs and smaller state-owned undertakings in difficulty in the notification form to avoid the undue negative effects on competition and trade between Member States.	Notification Forms and Information Sheets Regulation (2015/2282/EU)	DG COMP

Definition	Usage	Legal act	Competent Directorate General
Current definition & entities with headcount ≤ 3 000	Financial support to SMEs and other eligible enterprises from the European Fund for Strategic Investments to improve Union competitiveness and attract investment.	European Fund for Strategic Investments Regulation (EFSI – 2015/1017/EU)	DG ECFIN
Current definition & entities with headcount ≤ 3 000	Increased financial support to SMEs from the European Fund for Strategic Investments (EFSI) to improve Union competitiveness and attract investment. EFSI financing for SMEs and other eligible entities shall not be included in the computation of climate action project components.	European Fund for Strategic Investments Regulation (EFSI 2.0 – 2017/2396/EU)	DG ECFIN
Current definition & entities with headcount ≤ 3 000	Increased financial support to SMEs and other eligible entities through debt and equity facilities with a particular focus on research and innovation in order to strengthen the European scientific and technological base.	Horizon 2020 (1291/2013/EU)	DG RTD
Current definition & entities with capitalisation ≤ EUR 200 million; entities trading on SME Growth markets with capitalisation ≤ EUR 500 million; entities with ≤ EUR 20 million of securities on offer, not trading on MTF with headcount ≤ 500	Reduced content, standardised format and sequence requirements for SMEs and other eligible entities on the EU Growth prospectus to help these companies to access different forms of finance in the EU.	Prospectus Regulation (PR – 2017/1129/EU)	DG FISMA

Source: CEPS' elaboration based on EU law.

Based on public consultations and analysis of the impacts, it emerges that the effectiveness of the SME definition is not always clear-cut and varies depending on legislation.

For example, in the case of the alternative SME definition within CRR I,⁵⁸ industry representatives praised the overall effectiveness of legislation in improving SME lending and even suggested extending its scope to enterprises beyond SMEs. They also mentioned that using enterprise-specific criteria works in favour of SMEs. At the same time, many stakeholders found it is hard to reconcile their own definition with the official one, mostly due to lack of public data on SMEs' financials.⁵⁹ Credit institutions continue to use their own definitions of SMEs, which are not always aligned with that of the Commission. It disrupts the application of the CRR SME initiative and could harm the level playing field across EU Member States.

CRR II and BRRD employ the same definition for consistency purposes. Because CRR II was adopted very recently (2019), there are currently no formal analyses of the impact or ongoing public consultation. The information on the effectiveness of the SME definition within the BRRD is limited. Although Member States chose to extend the scope of SME provisions to other enterprises⁶⁰ during the transposition, the evidence remains inconclusive.

As compared with the previous version, the new Accounting Directive introduced substantially higher thresholds for turnover and balance sheet total to define an SME. Most of the Member States used this opportunity to update their legislation and increase the number of companies within the scope.⁶¹ For example, Denmark increased both criteria by 2 900% (from 2006 to 2019) and in France, the new Accounting Directive exempted 153 000 SMEs from the statutory audit requirement.⁶² This contributes to the reduction of the total administrative burden for SMEs, however strict size thresholds fail to account for cross-country differences in the EU. The European Federation of Accountants and Auditors for SMEs highlights that common thresholds will have different impacts on the scope of SMEs in different Member States.⁶³

The topic-specific definition of SMEs first appeared in MiFID II, primarily due to the establishment of a new category of equity markets – SME growth markets. These markets must have at least 50% of equity issuers with less than EUR 200 million of market capitalisation. The definition was further extended to account for debt-only issuers as well.⁶⁴ Generally, the move received mixed opinions from industry representatives. According to the European Banking Federation, the SME definition succeeds in accounting for different categories of SMEs and ensuring a level playing field.⁶⁵ Euronext, in turn, stressed that the market cap threshold is too low and does not fully account for medium-sized companies listed on Euronext.⁶⁶ Increasing the size

⁵⁸ EC (2016), [Commission Staff Working Document 2016/0360](#).

⁵⁹ EBA (2016), "[EBA report on SMEs and SME supporting factor](#)".

⁶⁰ White & Case (2016), "[Italy implements the Bank Recovery and Resolution Directive](#)".

⁶¹ Blomme, H. (2019), "[Evolution of SME audit in Europe from the perspective of legislation and auditing standards](#)".

⁶² European federation of Accountants and Auditors for SMEs (2019), "[Evidence on the value of audit for SMEs in Europe](#)".

⁶³ European federation of Accountants and Auditors for SMEs (2019), "[Implementing the new European Accounting Directive](#)".

⁶⁴ The SME definition was amended by the Commission Delegated Regulation 2019/1011 to include debt-only issuers with total nominal value of debt less than EUR 500 million.

⁶⁵ EBF (2019), "[EBF response to the FSB evaluation of the effects of Financial Regulatory Reforms on SME financing](#)".

⁶⁶ Euronext (2018), "[Euronext Position Paper on the promotion of the use of SME growth markets](#)".

threshold up to EUR 750 million would help to make markets more liquid and attract mid-caps.⁶⁷

MAR directly refers to the MiFID II (SME growth market issuers) when specifying the SME definition. Some stakeholders believe that this definition may be too narrow. For instance, European Issuers argue that the level of regulation introduced under MAR is far too burdensome for SMEs listed on multi-trading facilities. Although SMEs listed on SME growth markets are exempted from certain requirements (disclosure and insider lists), companies of the same size listed on non-regulated markets are not. Hence, European Issuers suggest extending the SME definition to SMEs trading on non-regulated markets.⁶⁸

EMAS III extended the SME definition to also include local authorities governing fewer than 10 000 inhabitants. This has proven to be very effective in some Member States. For instance, in Italy most of the SMEs and small local authorities expressed a desire to renew their EMAS registration. Although public enterprises face more difficulties to comply with regulation, they also show more enthusiasm and on average appear to be more satisfied with EMAS as compared with private SMEs.⁶⁹

Although information on implementation of the SME definition within the EFSI Regulation is limited, available sources indicate that the regulation has overall been effective.^{70, 71} Similar conclusions can be drawn from the interim evaluation of Horizon 2020. Despite still facing some challenges in spurring growth and innovation, the SMEs' funding target was surpassed in 2017: more than two thirds (70%) of all proposals submitted for Horizon 2020 funding came from SMEs.⁷²

The SME definition within the Prospectus Regulation drew more criticism. First, the Prospectus Regulation did not incorporate the update to the SME definition introduced in MiFID II and hence does not include non-equity issuers listed on SME growth markets. Second, some stakeholders (notably stock exchanges) argue that the threshold for mid-cap companies is too low and should be increased from EUR 500 million to EUR 1 billion. Euronext even suggested employing a 'predictive' market capitalisation threshold for SMEs that are not listed on SME growth markets yet. Third and lastly, the headcount criterion can be inconsistent across industries and therefore should not be reflected in the SME definition.⁷³

Information on implementation of the SME definitions in other legislation is limited. However, lack of criticism could be indicative of the relative effectiveness of the definitions employed. Moreover, several legal acts within the scope have been adopted recently (2017-2019) and the public consultations are still ongoing. Thus, interviews with respective competent DGs and European authorities will be scheduled to gain a better overview on how effective alternative SME definitions with respect to policy goals are. The tentative list of DGs to interview includes: DG FISMA, DG AGRI, DG ENER, DG JUST, DG REGIO, DG GROW, DG ECFIN, DG RTD, DG COMP.

⁶⁷ Federation of European Stock exchanges (2018), FESE Response to the European Commission's Regulatory Initiative to Promote SME Growth Markets.

⁶⁸ European Issuers (2019), "European Issuers position on the review of the market Abuse Regulation".

⁶⁹ Merli et al. (2016), "Promoting sustainability through EMS application: A survey examining the critical factors about EMAS registration in Italian organisations".

⁷⁰ European Court of Auditors (2019), "European Fund for Strategic Investments: Action needed to make EFSI a full success".

⁷¹ EC (2019), Horizon 2020 Work programme 2018-2020.

⁷² EC (2017), In-depth interim evaluation of Horizon 2020.

⁷³ Euronext (2018), "Euronext Position Paper on 'the promotion of the use of SME growth markets'".

4.2.2 Energy-related policy options

Before proposing alternative policy options there is a need to further analyse the relation between energy-related indicators/thresholds and obtaining energy savings through cost-effective energy audits.

4.2.2.1 Differences in potential savings between Member States

Benchmarking shows that realised savings in companies, as a fraction of energy consumption, differ across countries.⁷⁴ This can be due to high energy prices or other policies than obligatory audits (e.g. financial support). When these have reduced the savings potential, the audit will lead to relatively less energy savings. A common threshold for energy consumption at the EU level could be based on averages for all Member States. But if all companies above this threshold are forced to perform an audit, the audit will possibly not be cost-effective for companies in countries with an 'exhausted' savings potential.

4.2.2.2 Differences in potential savings across sectors

Realised energy savings in companies, as a fraction of energy consumption, can differ per sector as for instance shown in the yearly evaluation results for the Netherlands.⁷⁵ If this is due to differences in savings potential, an audit will lead to different savings across sectors for the same level of energy consumption. This means that the threshold needs to be above the average energy consumption at which the energy audit would deliver net savings to generate financial benefits for all companies with a requirement to conduct energy audits (benefits due to energy savings are larger than the costs of energy audits and investments to realise energy savings).

4.2.2.3 Role of audits in realising actual savings

In order to understand the role of audits in the entire process from introducing a policy to realised savings, the logic behind obligatory energy audits for companies enterprises is analysed (see Figure 4.1).

Figure 4.1 Process logic of obligatory energy audits



⁷⁴ Benchmarking countries on industrial energy efficiency.

⁷⁵ MJA evaluations, the Netherlands.

In practice, there are several reasons why some of the energy audits are less cost-effective, including:

- Knowledge on **energy saving options is sometimes already available**, especially in cases where there is a strong incentive to save energy costs. Therefore, **energy-intensive companies**, with relatively high energy costs, in general know quite well how to save energy. An obligatory audit might not deliver much extra knowledge.
- For some saving options, knowledge of their availability is **not always necessary**, e.g. supply-driven options such as efficient electric motors, gas boilers and cooling equipment (**efficiency forced by standards**). For new or replacement situations these efficient devices will be implemented 'automatically' and audits do not play a role, although, they might accelerate the replacement process.
- Companies can have **alternative sources of information** on (standardised) saving options, e.g. efficient devices prescribed as part of environmental licence procedures (see recognised saving measures per branch in the Netherlands⁷⁶).
- The potential savings are likely to be **reduced with each consecutive audit**, of which the recommendations have been implemented, as it becomes increasingly difficult to find additional savings.⁷⁷
- For **very complex energy-using processes**, it will be costly to come up with viable saving options through an energy audit because the auditor has to acquire in-depth knowledge, not only on energy savings but also on technical and economic aspects.
- The **implementation of saving options in the audit is not guaranteed**, even if it concerns a profitable investment. In the case of large-scale processes, implementation has to fit into the long-term renovation cycle. For medium energy users in rented offices the split incentive might block implementation. For small energy users the incentive to implement saving options might not be strong enough due to the small absolute cost savings in relation to the required management time.
- Finally, and most importantly, the **cost-savings do not always pay for the costs of the audit**. This is especially true for companies with limited energy consumption, and thus small potential savings, where the costs of the obligatory audit are not much lower than that for larger-scale consumption.

4.2.2.4 *Operationalisation of the energy-based definition*

The current SME definition (EU Recommendation 2003/361) requires information on the number of employees, turnover and assets of the entity concerned as well as shareholders and shareholdings, which for many companies is only partially or not available.

If the threshold for the energy audit was based on energy consumption, then the operational challenges might be the same. Indeed, the availability of energy consumption data is a prerequisite to determining whether a company is obliged to conduct an energy audit.

4.2.2.5 *Measure of energy consumption*

The focus of the EED is on the final energy consumption of enterprises. Nevertheless, the EED allows Member States to define their energy savings in either final terms or primary terms.

⁷⁶ Kenniscentrum InfoMil Erkende maatregelen voor energiebesparing recognised energy savings measures for 19 branches, set up as part of the MJA-3 and MEE agreements with industry and applied as part of licensing procedures.

⁷⁷ ECORYS (2013), "Evaluatie Meerjarenafspraak Energie Efficiëntie 2008-2020". See Chapter 3 on effectiveness of MJA-3, p.43 "savings potential dependent on earlier realised results".

- **Energy savings in final terms** is the energy consumption per type of energy carrier (gas, oil, electricity or grid supplied heat) that is summed up on the basis of their heat content to total energy consumption, which is expressed in TOE or Joule. Savings in final terms can be calculated from total final energy consumption without knowing the split into energy carriers. But savings connected to a change in energy carrier (e.g. an electric heat pump instead of a gas boiler) cannot be dealt with in a proper way.
- **Energy savings in primary terms** considers, besides the energy savings in final terms, also the losses incurred in delivery to the enterprise gate. In practice, it concerns electricity (consumption multiplied by a primary factor in the range of 2.0–2.5) and grid-supplied heat (primary factor 1.2 for fuel as source or 0.5 for waste heat). Summing up over all energy carriers provides total energy consumption in primary terms. Calculating savings in primary terms should be done per energy carrier and then summed up. In this way the savings due to a change in energy carrier can be calculated properly. Still, this requires energy consumption data for all energy carriers.

For the same final energy consumption, enterprises with relatively high electricity consumption will have larger consumption in primary terms and have to execute the audit more often. Moreover, the incorporation of electricity in energy consumption and the choice of energy consumption in primary terms asks for a primary factor to convert final electricity consumption into primary consumption. As Member States can use their own primary factor (ranging from 1.0 to 2.8), total energy consumption can differ between countries for the same final energy consumption. The same problems hold for grid-supplied heat, although this energy carrier generally accounts for a smaller part of energy consumption than electricity.

Defining a threshold for the energy consumption of enterprises in final or primary terms can influence which enterprises should perform an obligatory audit. For the same final energy consumption, enterprises with relatively much electricity consumption will have higher consumption in primary terms and it is more likely they will be required to conduct an energy audit.

4.2.2.6 Ownership relations and energy consumption

Looking at the energy consumption threshold and the ownership relations, energy consumption is technically **registered per physical site**, but **financially settled per enterprise**. The last one is accounted for in statistical data.

- For **stand-alone enterprises with one site**, the registration and financial settlement coincide.
 - For enterprises with one site, the execution of audits is done at the site.
- For **stand-alone enterprises with more sites in one Member State**, the energy consumption can be derived from the financial settlement/statistics.
 - For enterprises with many sites in one Member State (e.g. supermarkets) audits will generally be done at the corporate level because here technical and financial expertise is available.
- For **stand-alone enterprises with sites in more than one Member State**, energy consumption data must be gathered for each country where sites are present. These data are contained in the Eurostat database, but at an aggregated level.
 - For enterprises with sites in more Member States, there could be a mix of national activity (due to specific national energy policy) and activity at the supra-national level (due to overall EU policy).
- For **stand-alone enterprises with sites also outside the EU**, energy consumption data must be gathered at the enterprise itself.

- For enterprises with sites within and outside the EU, there could be a mix of national activities (due to specific national energy policy) and activity at the worldwide level (due to corporate strategy on energy and the environment).
- For cases **other than stand-alone** enterprises, the same data gathering situations are valid. Energy consumption data need to be gathered for each of the enterprises involved.

Ideally, the energy consumption threshold is applied at the level for which the (statistical) data are available and decisions on the saving measures from the audit are taken.

4.2.2.7 Factors for cost-effective energy audits

The value of the threshold for energy consumption is essential to define which enterprises are obliged to execute an energy audit – that is, if they are not exempted from the obligation because they have an energy-management system in place.

Setting a threshold should comply with the objectives of the EED and contribute to solving the problems with the current approach. Moreover, the threshold should be defined in such a way that it maximises energy savings in a cost-effective way. A low threshold level will capture all eligible enterprises and provide more potential energy savings. But it can lead to low actual energy savings and an unnecessary burden due to unfairly selected enterprises.

In order to find the appropriate energy thresholds, the cost-effectiveness of saving measures for SMEs, non-SMEs and in between cases has been determined. These examples concern site-specific data; in the case of multi-site enterprises some factors (such as scale of energy consumption, energy prices and cost of audits) will be different.

The following inputs/factors are considered:

- gas and electricity consumption (leading to primary/final energy consumption). **Energy consumption** differs per type of use (sector, application) and the size of application (large or small building);
- the **savings rate** is a fraction of energy consumption defining the saving potential, which depends on the sector and country (Fraunhofer- ISI⁷⁸) and the period between executing audits (a chosen rate of 15% leads to 6% of the implemented savings over four years when accounting for 80% coverage of the audit and 50% actual implementation of suggested measures, or 1.5%/year in line with EED targets);
- **fraction of savings potential covered by energy audit**. The fraction of savings covered by the audit is prescribed in general terms by the EED and sometimes specified further by Member States;⁷⁹
- fraction of **saving measures from the energy audit** that is implemented. The fraction of implemented saving measures from the audit varies substantially.⁸⁰ It is very dependent on supporting policies of Member States, such as subsidies for implemented saving measures. This support can vary per sector and application;

⁷⁸ See the “Report on the fulfilment of obligations upon large enterprises, the encouragement of SMEs and on good-practice”, Ricardo and Fraunhofer ISI, April 2016 (A Study on Energy Efficiency in Enterprises: Energy Audits and Energy Management Systems for the EC).

⁷⁹ Ibid.

⁸⁰ Library of typical energy audit recommendations, costs and savings, DNV-GL, April 2016 (Study on Energy Efficiency in Enterprises: Energy Audits and Energy Management Systems for the EC).

- **energy prices** (gas and electricity) leading to the gross cost savings. Energy prices are generally lower for larger energy users (independent of the sector), but differ per country for the same level of energy consumption;⁸¹
- **investments per unit of savings**. The investments are defined, per unit of savings, in such a way that the pay-back time is at an interesting level for companies. However, the minimum pay-back period is dependent on national policy (e.g. a pay-back time up to five years in licences);
- **annuity factor** (to convert investments to yearly capital costs to gross cost savings). The annuity factor is set at a fixed level but interest rates can be dependent on the economic profile of the sector, risks for the application and the financing structure per country; and
- **costs to execute the energy audits**. The cost of executing an energy audit varies significantly.⁸² The costs depend on the scale of energy consumption or energy-related quantities, such as floor space in a building. They are also dependent on state-of-the-art situations (buildings) or complex situations (industrial processes).

Table 4.3 Scheme for calculating the cost-effectiveness of audits

Factor	Measure	SMEs (99% of total)			At Margin		Non-SMEs (1% of total)		Source
		Low	Low	High	High	Low	Low	High	
		Bakery (shop)	Large office	Metal-constr.	Equipment	Non-ferrous	Brick-factory	Chemical plant	
Energy consumption									
Gas(fuel) consumption	1000 M ³	50	100	1000	500	5000	30000	1000000	Own estimate for examples
Electr. consumption	1000 kWh	20	100	500	1000	10000	5000	100000	Own estimate for examples
Final energy consumption	TJ	1.7	3.5	33	19	194	968	32010	Calculated
Fraction electricity		4.4%	10.2%	5.4%	18.5%	18.5%	1.9%	1.1%	Calculated
Energy costs									
Natural gas price	EUR/GJ	12.0	10.0	7.3	7.0	7.0	6.6	6.3	Eurostat
Electricity price	EUR/kWh	0.13	0.11	0.09	0.08	0.08	0.07	0.06	Eurostat
Total energy bill	1000 EUR	22	43	276	191	1908	6617	205395	Calculated
Turnover/prod. Volume		200	500	10000	10000	50000	300000	1000000	Own estimate for examples
Relative energy costs		11%	9%	3%	2%	4%	2%	2%	Calculated
Energy savings									
Savings rate	%	20%	25%	15%	15%	15%	10%	20%	e.g. Fraunhofer
Savings potential	TJ	0.33	0.88	5.0	2.9	29.1	96.8	6402	Calculated
Fraction covered by audit		0.8	0.8	0.8	0.8	0.8	0.8	0.8	Ricardo & Fraunhofer, 2016
Follow-up fraction (0.1-0.8)		0.5	0.5	0.5	0.5	0.5	0.5	0.5	Estimate from DNV-GL data
Realised savings	TJ	0.13	0.35	2.0	1.2	11.7	38.7	2561	Calculated
Cost savings									
Electricity price	EUR/GJ	36.1	30.6	25.0	22.2	22.2	19.4	16.7	Calculated
Average energy price	EUR/GJ	13.0	12.1	8.3	9.8	9.8	6.8	6.4	Calculated

⁸¹ Eurostat, "Electricity prices for non-household users" & "Gas prices for non-household users", per consumption range, up to 2019.

⁸² Ibid.

Factor	Measure	SMEs (99% of total)			At Margin		Non-SMEs (1% of total)		Source
		Low Bakery (shop)	Low Large office	High Metal- constr.	High Equip- ment	Low Non- ferrous	Low Brick- factory	High Chemical plant	
Gross cost savings/year	EUR	1727	4265	16563	11447	114465	264668	16431600	Calculated
Investment costs									
Investment/GJ saved	EUR/GJ	25	24	17	20	20	14	13	Calculated from pay-back period
Pay-back period investments	Years	1.9	2.0	2.1	2.0	2.0	2.0	2.0	Usual value for enterprises
Total investments	EUR	3309	8460	34119	23310	233100	541800	33290400	Calculated
Annuity factor		0.12	0.12	0.12	0.12	0.12	0.12	0.12	Usual value
Annual investment costs	EUR	397	1015	4094	2797	27972	65016	3994848	Calculated
Net cost savings/year	EUR	1330	3250	12468	8649	86493	199652	12436752	Calculated
Cost-effectiveness audit									
Cost of audit	EUR	3000	10000	10000	10000	50000	50000	100000	DNV-GL, 2016
Audit costs per TJ consumption	EUR	1813	2837	299	515	257	52	3	Calculated
Audit costs per TJ saved	EUR	22665	28369	4983	8580	4290	1292	39	Calculated
Pay-back period	Years	2.3	3.1	0.8	1.16	0.58	0.25	0.01	Calculated

Based on the per (site) cases it is clear that audits are cost-effective for typical non-SME enterprises (with a pay-back period for an energy audit of less than one year). This is due to the scale effects with respect to energy consumption, providing large absolute (cost) savings, and the scale effects regarding the cost of audits, which are lower per unit of savings. Meanwhile, for a typical SME the opposite conclusion can be drawn: energy audits are cost-ineffective due to low absolute (cost) savings and relatively high audit costs per unit of savings.

In the case of multiple-site enterprises concerning SME-type sites, the energy consumption will be higher, energy prices lower and audit costs relatively (per unit of savings) lower. Therefore, the cost-effectiveness will be more favourable than shown for the SME examples, and probably resemble that for in-between companies or even non-SME examples. Notably, currently part of these multi-site enterprises is categorised as non-SME because employment, turnover and assets are also higher than for individual sites. The same analysis holds for companies with subsidiaries.

Thus, it can be concluded that typical SMEs or non-SMEs will be categorised rightly for a large range of energy consumption thresholds. For the in-between cases, the cost-effectiveness of audits is (very) dependent on the factors that can differ across countries, sectors and application as discussed above.

The in-between cases represent the area where the threshold is most important to meet the objectives. At the same time, the many differences in company characteristics complicate the definition of the threshold to ensure cost-effectiveness of the energy audits. Policy makers can define a maximum pay-back period for the cost-effectiveness of audits, which enables the definition of a threshold. Indeed, the longer the acceptable pay-back period is for the energy audits, the larger are the potential energy savings and the higher the risk that an energy audit becomes cost-ineffective.

4.2.2.8 Relation between energy costs and cost-effective audits

For the definition of the energy thresholds based on energy costs, the same objectives hold as for the thresholds for energy consumption. In Annex 6 the cost-effectiveness

for audits is shown for SME, non-SME and in-between cases. The cost-effectiveness depends on a set of inputs/factors which have been discussed in the previous section. The absolute and relative energy costs are derived from these factors. The following analysis concerns the relation between the derived quantities and the cost-effectiveness of the audit.

The **total energy costs** range from EUR 20 000 to EUR 200 million. For a typical SME with total energy costs up to EUR 50 000, no cost-effective audits are found. For typical non-SMEs with total energy costs above EUR 10 million, audits are found to be very cost-effective (with a pay-back period much shorter than a year). For the in-between cases there is a large range of total energy costs where the cost-effectiveness of audits can be acceptable or not (a pay-back time of one year or less).

The total energy costs are dependent on gas and electricity consumption and on gas and electricity prices. These inputs are also among the factors that define the cost-effectiveness of the audits. Therefore, the total energy costs are in principle better suited to being coupled with cost-effective audits than energy consumption alone.

The **relative energy costs** range from 2% to 21% of turnover. Specific SMEs show relative costs to be in the order of 10%, while specific non-SMEs show very low (2%) or very high (above 20%) rates. The relative energy costs are highly dependent on economic performance, represented in the turnover of enterprises. An activity with substantial energy consumption but few other production inputs will by nature have high relative energy costs. For the same energy consumption, but a different production process with more other inputs, the amount can be substantially lower. Hence, the relation between relative energy costs and the cost-effectiveness of audits will be less clear than for total energy costs.

It can be concluded that the (relative) energy cost threshold has one factor less to take account of, namely energy prices, compared with the energy consumption threshold.

4.2.3 The State Aid aspect

The SME definition is important for two aspects in the context of the EED. There is the current scope of the energy audit requirement and there is the encouragement for Member States to develop programmes for SMEs to undergo energy audits and implement the recommendations in these audits under Article 8(2) EED.

Member States may set up support programmes for SMEs on "transparent and non-discriminatory criteria and without prejudice to Union State aid law". This may comprise covering the costs of energy audits, for which it is important that the support is not considered State Aid. Financial assistance under these provisions can only be granted to SMEs "on the basis of transparent and non-discriminatory criteria without prejudice to the EU State Aid rules".⁸³

Under the De minimis Regulation, Member States can avoid notification or any administrative procedures when granting aid to SMEs, subject to a maximum threshold of EUR 200 000 per company. Additionally, the General Block Exemption Regulation (GBER) exempts certain types of State Aid from the notification requirement to accelerate State Aid decision-making. Also the aid exempted under the GBER⁸⁴ needs to be reported to the Commission through a separate *ex post* procedure.⁸⁵ More

⁸³ European Commission (2012), Directive 2012/27.

⁸⁴ European Commission (2014), Regulation No 651/2014.

⁸⁵ Only short summary information is required. The summary form is available in the Annex II of the GBER.

specifically, Member States must indicate the SME status of the aid recipient, while no justification or elaboration is needed.

The maximum aid that is exempted is capped. The maximum threshold for aid granted depends on the type of aid granted and its beneficiary. The aid for environmental studies⁸⁶ must be below EUR 7.5 million per undertaking per investment project for SMEs and EUR 15 million for non-SMEs to qualify for the exemption. The maximum aid can cover a maximum of 50% of the total costs, which may be increased to 60% for medium-sized enterprises and 70% for small enterprises.

According to the Treaty on the Functioning of the European Union (TFEU), State Aid measures must be compatible with the internal market. State Aid in the field of environmental protection and energy is only compatible with the internal market if it has an incentive effect. Because energy audits are only mandatory for non-SMEs, the Commission argues that subsidies would incentivise more SMEs to conduct an energy audit.⁸⁷ Indeed, this would change if some of the SMEs were required to conduct an energy audit. In that case, for those companies the State Aid would lose its incentive effect.

However, the use of an alternative SME definition does not appear to be conflicting with the State Aid rules, largely due to the recently implemented simplification measures. At the EU level, 4 out of 21 pieces of legislation that employ alternative SME definitions (see Section 4.2.1) have State Aid provisions (EMAS III, European Structural and Investment Funds Regulation, Common Organisation of the Markets Regulation and Horizon 2020). They define SMEs through a mix of current and topic-specific definitions. Three of them fully qualify for the notification exemption under the GBER or Commission guidelines. Furthermore, there is the possibility to apply two different definitions for companies for which Member States are called upon to set up support mechanisms and requirements to conduct an energy audit. The support scheme would in any case cover SMEs, excluding those that are required to conduct an energy audit.

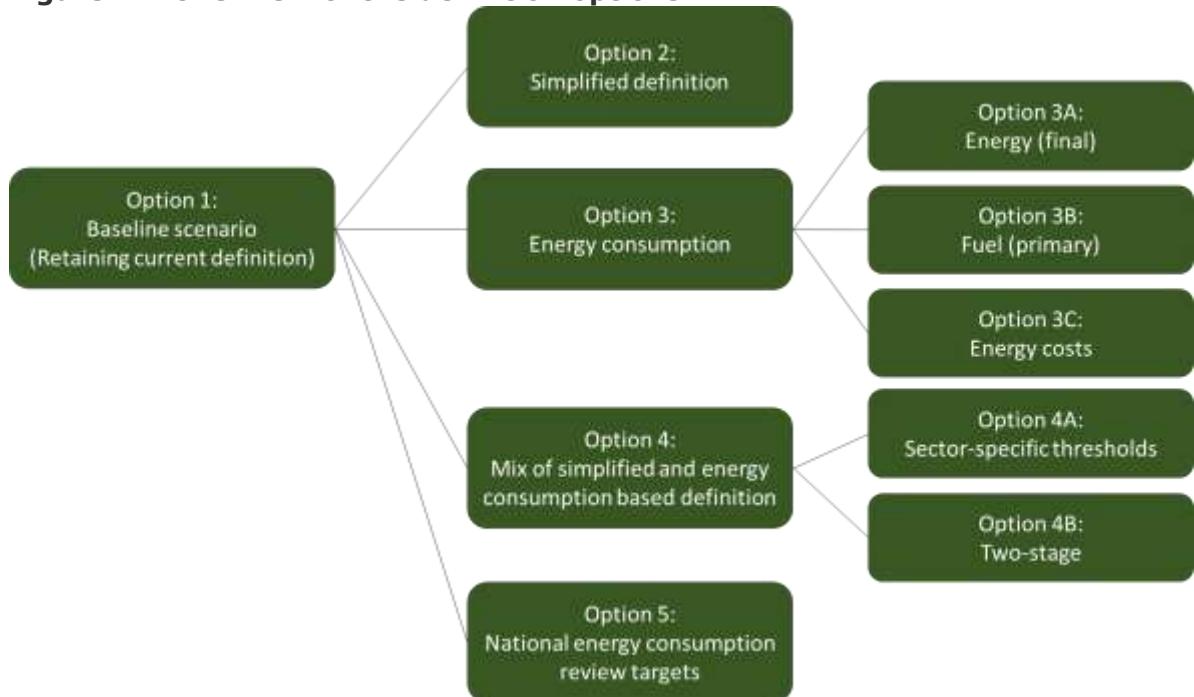
4.3 Selected policy options

The proposed policy options consider the current definition, which requires non-SMEs to conduct energy audits, and four alternative policy options: (i) a simplified economic definition; (ii) definitions based on energy consumption; (iii) a mix of simplified and energy consumption-based definitions; and (iv) national energy-consumption review targets. For the energy consumption and mixed definitions, various sub-options are evaluated (see Figure 4.2).

⁸⁶ Including energy audits under Article 8 EED.

⁸⁷ European Commission (2014), *Communication on the Guidelines on State aid for environmental protection and energy 2014-2020*.

Figure 4.2 Overview of the definition options



Source: CEPS (2020).

4.3.1 Option 1: baseline scenario – retaining the current definition

The current definition of non-SMEs, based on EU Recommendation 2003/361, will continue to be the official definition to determine whether companies are obliged to conduct energy audits or not.

4.3.2 Option 2: simplified definition

The current thresholds for the number of employees, turnover and total assets are applied at the entity level. This would mean that there is no longer information on the ownership relations required to determine whether a company is required to conduct an energy audit. This policy option would respond to the problems that national authorities have in applying the EU Recommendation in practice (Option 1).

4.3.3 Option 3: definition based on energy consumption

This option assumes a classification based on the energy consumed. A threshold for energy consumption per year would be defined, which is used to determine the companies that are required to conduct an energy audit. This alternative is potentially more effective as it is based on actual energy consumption and indirectly the energy savings potential. But this option might also be difficult to implement, as energy consumption data might only be available for specific types of energy consumption (e.g. electricity and fuel) and not all carriers.

4.3.3.1 Option 3A: final energy consumption threshold

Defining the threshold for SMEs/non-SMEs in terms of energy consumption instead of socioeconomic indicators enables audit-related energy savings to be optimised and assures cost-effective audits.

The threshold can be calculated according to the approaches outlined below.

First is to stick as much as possible to the current categorisation (energy thresholds that aim to match the current SME/non-SME classification). Under this approach, the energy

threshold is based on the average energy consumption of enterprises for which an economic indicator is at, or near, the currently valid thresholds (e.g. 250 for employment). In this way the numbers for SMEs and respectively non-SMEs will be about the same as found earlier. Therefore, administrative costs will be about the same for enterprises. Still, this threshold may not be optimal for getting the most, and cost-effective, savings from obligatory audits. Therefore, this approach is not assessed further.

Second is to follow the thresholds that have been defined by various Member States. Table 4.4 shows some additional energy thresholds currently used in the EU. If the special cases for other licensing are disregarded, then the thresholds range from 9 to 42 TJ. It is not justified to define an EU threshold given the large range and the limited number of countries considered.

Table 4.4 Energy thresholds used by countries for audit obligations

Country	Application	Carrier	Unit	Amount	Factor	Energy (TJ)
Netherlands	License companies	Electricity	KWh	50 000	$3.6/10^6$	0.18
Netherlands	License companies	Gas	M3	25 000	$31.65/10^6$	0.79
Bulgaria	Companies	Energy	MWh	3 000	$3.6/10^3$	10.80
Italy	E-intensive industry	Energy	GWh	2.4	3.6	8.64
Portugal	Companies	Energy	toe	500	$41.9/10^3$	20.95
Czech Republic	Enterprises	Energy	GJ	3 500	$1/10^3$	35.00
Romania	Company or site	Energy	toe	1 000	$41.9/10^3$	41.90

Third is to define a threshold based on the cost-effectiveness of the audits. This approach will be assessed as it is likely to deliver the most cost-effective results, as discussed above.

Many factors that define the cost-effectiveness of audits differ per application, sector or country or are uncertain by nature, such as energy prices. Nonetheless, for some factors minimum values can be agreed, restricting the range for cost-effectiveness. The following factors can be regarded as normative:

- savings rates of at least 15% of energy consumption;
- audits covering at least 80% of energy consumption;
- implementation of at least 50% of the recommended (cost-effective) saving measures;
- a pay-back period of about two years for investments in energy savings;
- financing conditions that enable the conversion of investments to yearly capital costs using the annuity-factor of 0.12; and
- availability of expertise at various levels of complexity to deliver audits at the costs specified in Table 4.4.

Most of the assumed values are conservatively chosen and/or can be influenced by national energy policy that is in line with the goals of the EED. Thus, the in-between cases can be still be considered cost-effective when determining a threshold.

The considerations above lead to choosing an **energy consumption threshold in the range of 20 TJ**. This coincides with the average value of the thresholds already applied by several Member States.

This approach will limit the number of more energy-intensive enterprises that unfairly do not execute audits because they have limited employment, turnover or assets. It will also limit the number of energy-extensive enterprises that were unfairly obliged to execute an audit due to their economic scale. Given the better categorisation of enterprises, the approach will probably result in more savings than the current approach. For the same reason it will also result in better overall cost-effectiveness.

For individual cases, the factors influencing cost-effectiveness can be less favourable. The same holds for some differences between sectors and countries. But the assumptions are so moderate that energy audits not paying back in four years will be an exception. Due to moderate assumptions, the threshold might be set too high and not deliver maximum savings. Yet this has to be seen in the light of national savings policies, which influence the savings due to energy audits.

Finally, the approach is vulnerable to the use of energy consumption in final or primary terms (see Section 2.5). No normative choice for one method seems possible given the current EED legislation. The defined threshold will lead to a different categorisations of enterprises depending on their definition of energy consumption.

4.3.3.2 Option 3B: fuel consumption threshold

A fuel consumption threshold will solve the problem of a different categorisation of two comparable enterprises due to defining energy consumption in either final terms or primary terms. There is only fuel consumption in final terms and not in primary terms.

The choice of excluding electricity and grid-delivered heat can be based on current developments in overall energy and climate policy at the EU level. The electricity sector is at the forefront in terms of realising the reduction of GHG emissions. This is a main reason for electrification of the energy system, e.g. electric heat pumps for space heating, electric cars for transport and even electric processes in industry.

Given this trend, the savings on electricity contribute less to reduction of CO₂-emissions than savings on (fossil) fuels⁸⁸. The same holds for grid-supplied heat, where the focus is on sustainable inputs, with hardly any CO₂ emissions. Thus, a fuel-based threshold can be regarded as an obvious future choice when categorising enterprises for audit obligations.

The threshold for fuel consumption is also based on the cost-effectiveness of the audits. The cases in Table 4.3 have been assessed without considering electricity consumption. This results in somewhat higher pay-back periods for the audits due to relatively lower prices for fuel and hence relatively lower cost savings.

In order to have the same values for cost-effectiveness, the level of energy consumption should be higher. This results in a **fuel consumption threshold in the range of 25 TJ**. This coincides still with the average value of the thresholds already applied by a number of Member States.

The same observations as for an energy consumption threshold are valid, such as cost-effectiveness in individual cases and yearly changes in cost-effectiveness.

4.3.3.3 Option 3C: energy costs threshold

A policy option that would account for volatility in energy prices and thus potential savings would be based on energy costs.

Energy costs cover both the amount of energy consumed and the price of energy. Energy prices (including taxes) influence the cost-effectiveness of the audit in two ways. First, prices for low levels of energy consumption are normally higher than those for high levels of energy consumption per unit. Consequently, the cost savings for small amounts of energy consumption will also be higher, which makes the audit cost-effective sooner. Second, higher prices might increase the possibility that the saving measures

⁸⁸ This reasoning is based on calculation of emission reductions of electricity savings with the (decreasing) average CO₂-emission factor for electricity production. This does not take into account the limitations as to renewable electricity production, which still require an efficient use of electricity.

advised in the audit will be implemented. Again this will make the audit for smaller enterprises more cost-effective.

Indeed, thresholds based on energy costs may help to avoid SMEs being unfairly exempted from executing cost-effective audits. For enterprises with substantial energy consumption the cost-effectiveness of the audit is less favourable due to relatively lower energy prices. But this is compensated by the scale (i.e. a large amount of energy consumption).

The threshold for energy costs is based on the same normative assumptions on the factors as is the case for the energy consumption threshold (see Table 4.3). The threshold is derived from the energy cost values for the in-between cases with a pay-back time of about one year for the audit costs. Given the conservatively chosen factors, the case with the lowest energy costs is chosen. This results in an **energy cost threshold of about EUR 200 000**.

Energy prices differ per sector and between countries, which can lead to different categorisations for enterprises with the same energy consumption and savings potential. However, due to the mechanisms above, a categorisation approach based on energy costs may be less vulnerable to different energy prices. In this way a common European energy-cost threshold will cause fewer problems stemming from the wrong categorisation of enterprises in some sectors of some countries, leading to the execution of audits that are not cost-effective.

Energy prices change due to international oil prices or market developments in the European electricity system. These changes can be rather large from year to year, and cause changes in total energy costs. Thus, the number of companies meeting the energy costs threshold would vary from year to year, unless the selection is retained for some years (e.g. two consecutive years with energy costs above the threshold).

For energy costs, the issue of final versus primary (energy consumption) is not valid. Energy costs are calculated using final consumption figures and prices per energy carrier. However, electricity prices per energy unit (GWh of MJ) are much higher than heating fuel prices. Therefore, electricity consumption contributes relatively much to total energy costs.

Due to differences in prices for electricity and (heating) fuel, the energy costs for a given level of energy consumption will be dependent on the fraction of electricity. The application of an energy cost threshold could not be optimal in cases where the fraction of electricity varies between enterprises in a sector, between sectors or between countries. It could lead to forcing enterprises with a large amount of electricity consumption to execute audits that are not cost-effective. Thus, the issue of final versus primary is in an indirect way present for the option of an energy costs threshold.

4.3.4 Option 4: mix of simplified and energy consumption-based definitions

This option combines the indicator from the other options. There are two mixed alternative options proposed. One option is based on the sector in which the company is active and one allows non-SMEs that use limited energy to request a waiver from the audit.

4.3.4.1 Option 4A: thresholds depending on sector energy intensity

This option foresees adjusting the threshold, depending on the energy intensity of the sector concerned.

The potential energy savings largely depend on the energy consumption, which is different across sectors. Yet, there is very limited public information available about the

energy consumption of individual companies. This would form an obstacle for authorities to identify the companies that are obliged to conduct an energy audit.

This option therefore considers applying socioeconomic indicators like those of the current non-SME definition, which are more widely available, but adjusting the thresholds for the energy intensity of the sector concerned (see Table 4.5). Indeed, when a sector is twice as energy-intensive per employee and euro of turnover as the EU average, the thresholds are halved and rounded to the nearest 50 employees and EUR 5 000 000 in turnover/balance sheet total for convenience in the application. The information on the main sector in which a company is active is available for nearly all companies.

This option would make SMEs that are likely to have high energy savings potential also obliged to conduct energy audits, while non-SMEs with limited energy savings potential would likely be exempted from the obligation to conduct energy audits. However, it raises concerns about compatibility with State Aid policies that allow for a different treatment of SMEs.

Table 4.5 Thresholds across sectors based on energy intensity (preliminary)

Sector	Energy intensity	Adjusted thresholds		
	Employment	Staff headcount	Turnover (EUR)	Balance sheet total (EUR)
Construction	0.70	350	60 000 000	70 000 000
Chemical and petrochemical	6.68	25	5 000 000	5 000 000
Food, beverages and tobacco	2.55	100	15 000 000	20 000 000
Iron and steel	13.34	25	5 000 000	5 000 000
Machinery	0.80	300	55 000 000	60 000 000
Mining and quarrying	4.47	50	10 000 000	10 000 000
Non-ferrous metals	14.19	25	5 000 000	5 000 000
Non-metallic minerals	7.11	25	5 000 000	5 000 000
Other industrial activities	0.65	375	65 000 000	75 000 000
Paper, pulp and printing	5.28	50	10 000 000	10 000 000
Transport equipment	0.74	325	60 000 000	65 000 000
Textile and leather	0.82	300	55 000 000	60 000 000
Wood and wood products	1.90	125	25 000 000	25 000 000
Agriculture and forestry	2.73	100	15 000 000	20 000 000
Commercial services	0.35	725	125 000 000	145 000 000
Fishing	6.80	25	5 000 000	5 000 000
Transport, domestic aviation	6.08	50	5 000 000	10 000 000
Transport, domestic navigation	8.40	25	5 000 000	5 000 000
Transport, pipeline transport	36.98	25	5 000 000	5 000 000
Transport sector – rail	7.44	25	5 000 000	5 000 000
Transport sector – road	9.69	25	5 000 000	5 000 000
Other transportation activities	0.65	375	65 000 000	75 000 000
Energy sector	7.30	25	5 000 000	5 000 000
Other activities	0.65	375	65 000 000	75 000 000
Total	1	250	50 000 000	43 000 000

Source: CEPS (2020).

4.3.4.2 Option 4B: two-stage selection with the current and energy-related thresholds

Another way of defining a mix is a **two-stage selection of companies** that should execute an audit. In the first step, companies are selected on the basis of the currently used economic indicators. In the second step, the selection is restricted to companies that meet the final energy consumption-related threshold (i.e. 20 TJ per year). The selected companies in the first step have to provide individual energy-related data to prove that they do not meet the second threshold. This approach solves the problem

that economic thresholds could force enterprises with low energy or fuel consumption or low energy costs to execute audits that are not cost-effective.

The other problem of overlooking companies with a level of energy consumption that justifies an obligatory audit is still present. This problem could be solved by lowering the value of the economic threshold in order to capture in the first step all potential enterprises with enough energy consumption, fuel consumption or energy costs.

A two-step approach with lowered values for economic indicators could increase the number of enterprises that are subject to the regulation on obligatory audits. But at the same time the administrative burden would be reduced because fewer enterprises would be unfairly selected to execute an audit.

4.3.5 Option 5: selection at national level given minimum energy coverage

This option allows EU Member States to decide on the companies that should be conducting a mandatory energy audit. The only criteria is that these companies collectively are at least responsible for a share of corporate energy consumption that is defined at the EU level. For the assessed option, the energy consumption target is set at 60% of total corporate energy consumption. This is similar to the average EU corporate energy consumption.

The preferred choice of each Member State is determined based on the information provided by national authorities in the survey and the interviews conducted for this study.⁸⁹ During the interviews, some of the national authorities gave an indication about the likely manner in which the option would be implemented. For the other Member States, it is assumed that they would define the option in line with their current implementation of the non-SME definition. If the assumed option did not meet the 60% threshold, then the remaining companies with the highest energy consumption would be added until the threshold level were met.

Overall, seven Member States are assumed to apply the EU SME definition (CZ, NL, RO, SE, SI, SK, UK; see Table 4.6). Five Member States are assumed to apply the SME size criteria to domestic and multinational linked companies (HR, HU, IT, LV, PL), while three Member States would be likely to apply the SME size criteria only to domestic linked companies (AT, DK, ES). In turn, eleven Member States would apply the SME size criteria at the entity level (BE, CY, EE, EL, FI, FR, IE, LT, LU, MT, PT). Additionally, Bulgaria would be likely to adopt a final energy consumption criterion. Finally, Germany would require the execution of mandatory energy audits for companies exceeding the SME size criteria, and considering domestic and multinational linked and partner companies along with a final energy-consumption criterion.

In 9 countries (AT, CY, DK, EL, LU, MT, NL, SE, UK), the assumed Member States' option would be sufficient to reach the 60% energy consumption target considered for this study. In the remaining 19 Member States, the scope of the companies subject to mandatory energy audits would be adjusted in order to reach the assumed energy consumption target.

⁸⁹ When national authorities did not provide a preferred choice for the identification of companies subject to mandatory energy audits, it was assumed that the country would carry on with the current identification strategy.

Table 4.6 Member States' preferred choice for the identification of companies subject to energy audits

Country	SME definition	Final energy consumption criteria	Ownership information					Adjustment to reach the final energy consumption target
			Entity-level	Domestic companies	Multinational companies	Linked companies	Partner companies	
AT	✓		✓	✓				No
BE	✓		✓					Yes
BG		✓						Yes
CY	✓		✓					No
CZ	✓		✓	✓	✓	✓	✓	Yes
DE	✓	✓	✓	✓	✓	✓	✓	Yes
DK	✓		✓	✓				No
EE	✓		✓					Yes
EL	✓		✓					No
ES	✓		✓	✓				Yes
FI	✓		✓					Yes
FR	✓		✓					Yes
HR	✓		✓	✓	✓	✓		Yes
HU	✓		✓	✓	✓	✓		Yes
IE	✓		✓					Yes
IT	✓		✓	✓	✓	✓		Yes
LT	✓		✓					Yes
LU	✓		✓					No
LV	✓		✓	✓	✓	✓		Yes
MT	✓		✓					No
NL	✓		✓	✓	✓	✓	✓	No
PL	✓		✓	✓	✓	✓		Yes
PT	✓		✓					Yes
RO	✓		✓	✓	✓	✓	✓	Yes
SE	✓		✓	✓	✓	✓	✓	No
SI	✓		✓	✓	✓	✓	✓	Yes
SK	✓		✓	✓	✓	✓	✓	Yes
UK	✓		✓	✓	✓	✓	✓	No

Source: CEPS (2020) elaboration.

5 Impacts of policy options

This section analyses the impacts of the different policy options. More specifically, for each policy option and sub-policy option it describes the companies within the scope, assesses feasibility and provides a SWOT analysis.

5.1 Option 1: retaining the current definition (baseline)

The first option considers retaining the current definition of non-SMEs based on EU Recommendation 2003/361 to determine which companies are obliged to conduct energy audits.

The total number of active companies in the EU-28 amounted to approximately 42 million in 2016. Overall, 98% of them are SMEs while the remaining 2% are non-SMEs (see Table 5.1). Cumulatively, Germany, the UK, France, the Netherlands, Spain and Italy host almost 70% of all non-SMEs in the EU. By contrast, Slovenia, Latvia, Lithuania, Estonia, Croatia and Malta are among the countries with the smallest number of non-SMEs, as they cumulatively host only just over 2% of them.

The share of non-SMEs across the EU-28 ranges between 0.6% and 8.8% of the total number of active companies. In 16 EU Member States, the share of non-SMEs ranges between 1% and 2.5%. Significantly, higher shares of non-SMEs are registered in Luxembourg (8.8%), Malta (7.4%), Ireland (6.6%), Germany (6.2%), Austria (3.2%) and the UK (2.6%). Meanwhile, Slovakia (0.9%), Slovenia (0.8%), Romania (0.7%), the Czech Republic (0.6%), Greece (0.6%) and Hungary (0.6%) show somewhat lower shares of non-SMEs.

Table 5.1 SME and non-SMEs in the EU-28

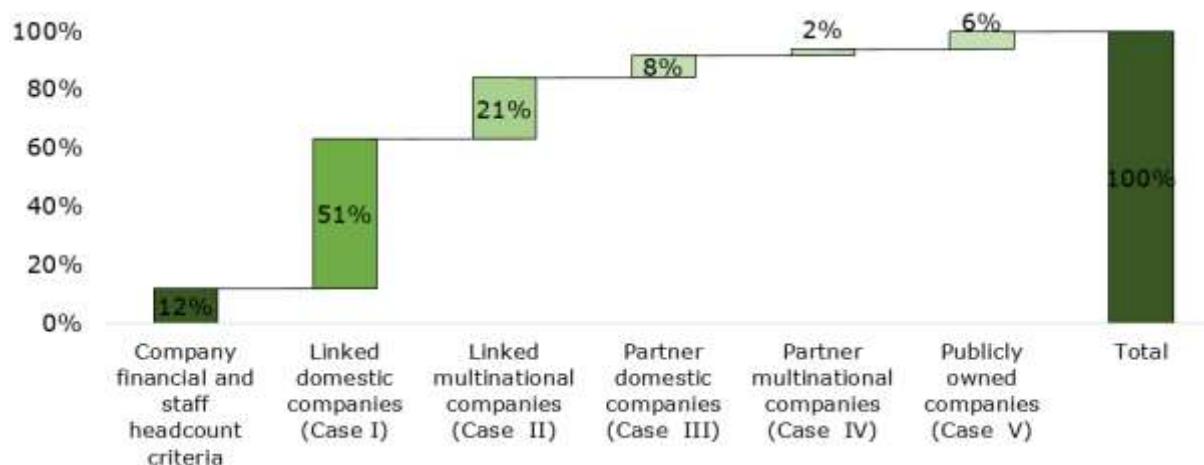
Country	SMEs		Non-SMEs		Total active companies	
	N	%	N	%	N	%
AT	573 553	96.8	18 799	3.2	592 352	100.0
BE	1 438 585	98.6	20 315	1.4	1 458 900	100.0
BG	1 418 078	98.8	17 508	1.2	1 435 586	100.0
CY	267 366	98.3	4 620	1.7	271 986	100.0
CZ	1 872 320	99.4	11 700	0.6	1 884 020	100.0
DE	2 140 587	93.8	140 345	6.2	2 280 932	100.0
DK	750 102	98.2	13 632	1.8	763 734	100.0
EE	240 116	98.9	2 765	1.1	242 881	100.0
EL	784 191	99.4	4 597	0.6	788 788	100.0
ES	2 313 744	97.9	48 704	2.1	2 362 448	100.0
FI	1 232 820	98.8	15 098	1.2	1 247 918	100.0
FR	8 621 095	98.9	91 537	1.1	8 712 632	100.0
HR	269 214	98.9	3 096	1.1	272 310	100.0
HU	747 658	99.4	4 242	0.6	751 900	100.0
IE	198 811	93.4	13 941	6.6	212 752	100.0
IT	3 842 056	98.8	47 434	1.2	3 889 490	100.0
LT	150 202	98.3	2 538	1.7	152 740	100.0

Country	SMEs		Non-SMEs		Total active companies	
	N	%	N	%	N	%
LU	144 914	91.2	13 937	8.8	158 851	100.0
LV	245 495	99.0	2 474	1.0	247 969	100.0
MT	42 381	92.6	3 377	7.4	45 758	100.0
NL	2 846 447	98.2	50 898	1.8	2 897 345	100.0
PL	1 752 552	98.6	24 418	1.4	1 776 970	100.0
PT	541 196	97.7	12 780	2.3	553 976	100.0
RO	1 286 542	99.3	9 313	0.7	1 295 855	100.0
SE	1 482 549	97.9	32 044	2.1	1 514 593	100.0
SI	262 484	99.2	2 134	0.8	264 618	100.0
SK	596 074	99.1	5 478	0.9	601 552	100.0
UK	5 206 879	97.4	137 626	2.6	5 344 505	100.0
Total	41 268 011	98.2	755 350	1.8	42 023 361	100.0

Source: CEPS' elaboration based on Orbis Europe data.

Approximately 12% of the total number of non-SMEs are classified as such based on the financial and staff headcount indicators of the entity in question (see Figure 5.1). The majority of the non-SMEs fall into this category because of links with other domestic companies, while a fifth fits in due to links with other multinational companies. About 8% of the non-SMEs fall into this category because of partnerships with other domestic companies. In comparison, 2% of the companies are classified as non-SMEs due to partnerships with multinational companies. Finally, 6% of the non-SMEs are classified as such because they are publicly owned entities. Thus, approximately 87% of the non-SMEs would probably not exceed the SME thresholds if they were considered stand-alone companies.

Figure 5.1 Classification of non-SMEs

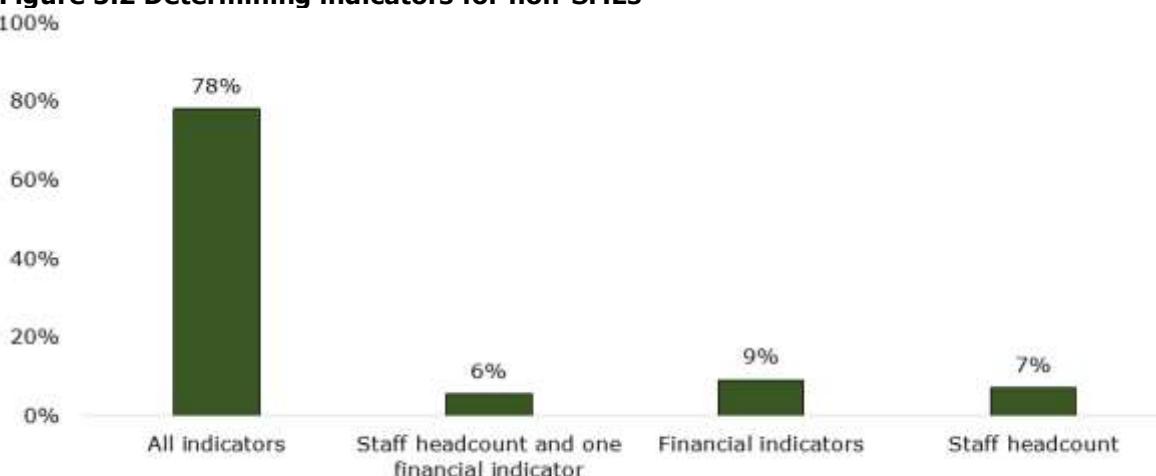


Source: CEPS' elaboration based on Orbis Europe data.

The large majority of the non-SMEs in the EU-28 – excluding publicly owned companies – are classified as such because their consolidated figures exceed the thresholds set in the SME Recommendation for all three size indicators (see Figure 5.2). For 15% of the

non-SMEs the determining criteria for the size classification are either both financial indicators or one financial indicator and the staff headcount. Finally, 7% of non-SMEs in the EU-28 fall into this category because they exceed only the staff headcount indicator.

Figure 5.2 Determining indicators for non-SMEs



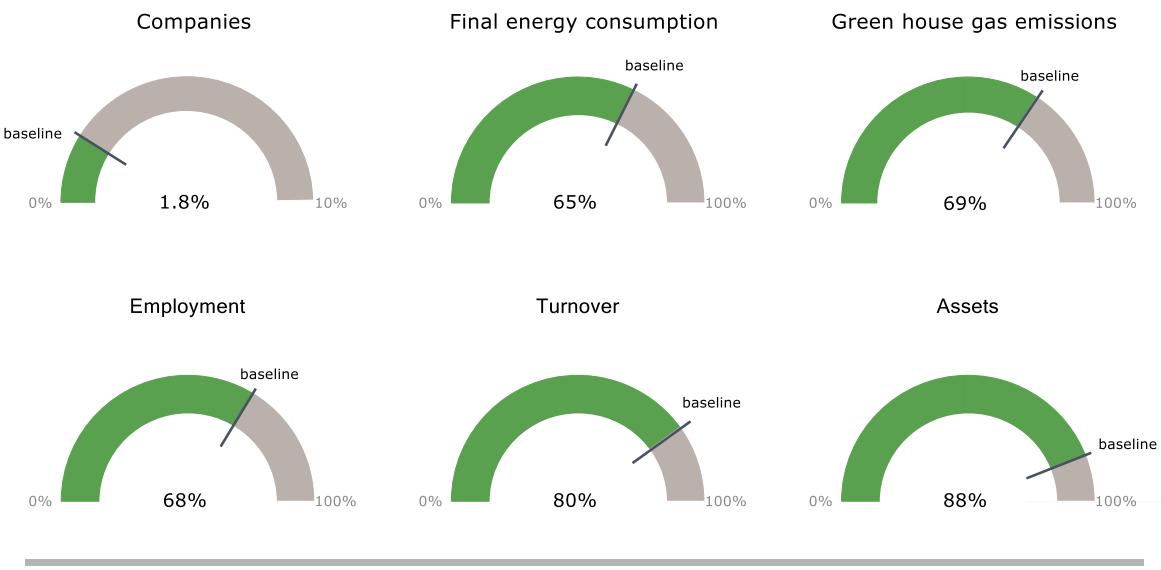
Source: CEPS' elaboration based on Orbis Europe data.

The companies required to conduct a mandatory energy audit amounts to approximately 755 000 or 1.8% of the total number of active companies in the EU-28 (see Figure 5.3). Due to their size, non-SMEs play a significant role in the economy. They are responsible for about 65% of the total energy consumption of corporates and for 69% of the GHG emissions. Furthermore, non-SMEs account for more than two thirds of the corporate employment (68%) and for an even higher share of turnover (80%) and assets (88%).

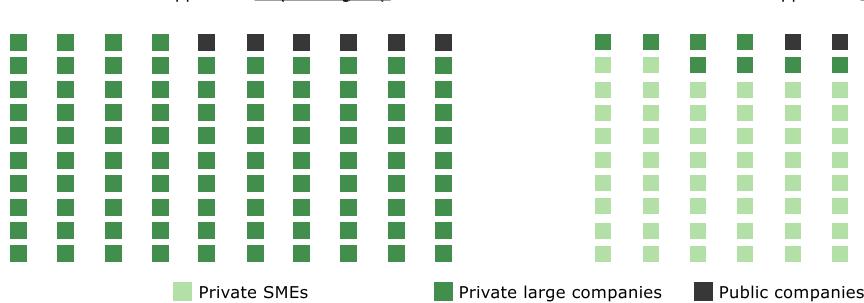
The vast majority of the companies subject to mandatory audits under the current definition are private large companies (94%), while the remaining ones are publicly owned enterprises (6%). Under the current definition, no private SMEs are subject to conducting energy audits. Notably, when applying the size criteria contained in EU Recommendation 2003/361 to each legal entity, rather than to the corporate group, the share of private large companies drops to 12%. In turn, the share of private SMEs increases to 82%. This is due to the fact that under the current definition, there is a large number of relatively smaller companies that are subject to conducting energy audits because they are part of a larger corporate group.

Considering the population of non-SMEs according to the current SME definition, mandatory energy audits are expected to result in energy savings equal to 2% of the total final energy consumption of corporates, and 3% if considering only the energy consumption of the companies subject to conducting mandatory energy audits. The potential energy savings are equal to 7% for the energy consumption of all companies and 12% for the energy consumption of the companies obliged to conduct energy audits.

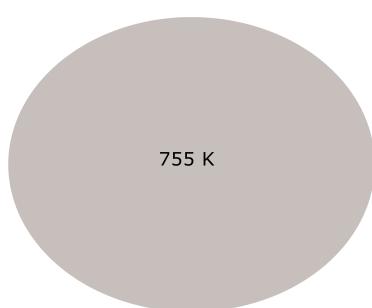
Figure 5.3 Overview of the key indicators for Option 1 (baseline)



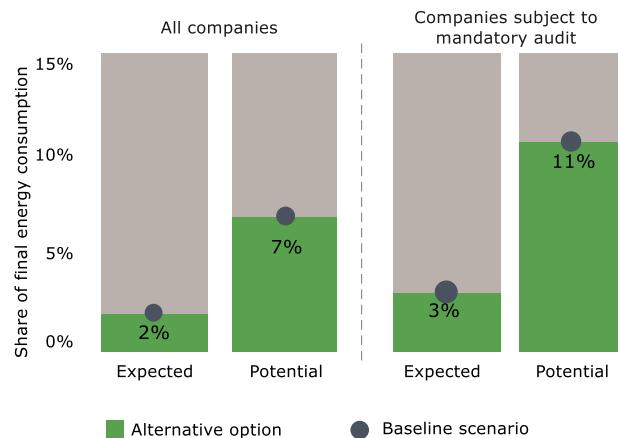
Company types according to EU SME definition



Overlap with baseline scenario
(nr. of companies)



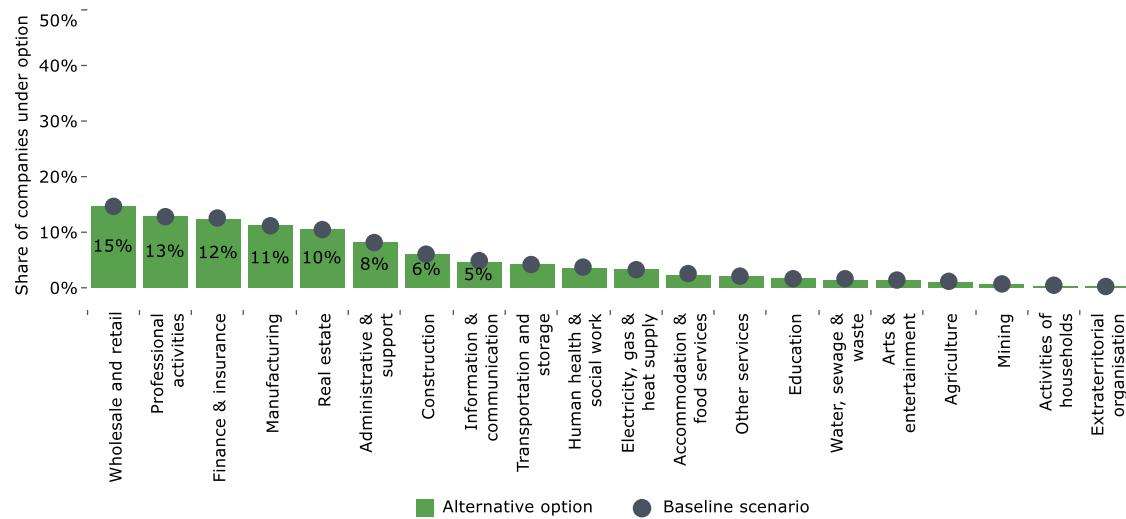
Energy savings due to mandatory audits



Source: CEPS (2020) elaboration.

Under Option 1, a large majority of the companies within the scope are registered in five main sectors, namely wholesale and retail (15%), professional activity (13%), financial and insurance (12%), manufacturing (11%) and real estate (10%) (see Figure 5.4). Cumulatively, non-SMEs operating in these sectors amount to approximately 460 000 or 61% of the total number of non-SMEs. Each of the remaining sectors accounts for less than 10% of the total.

Figure 5.4 Sectoral distribution of companies within the scope of Option 1

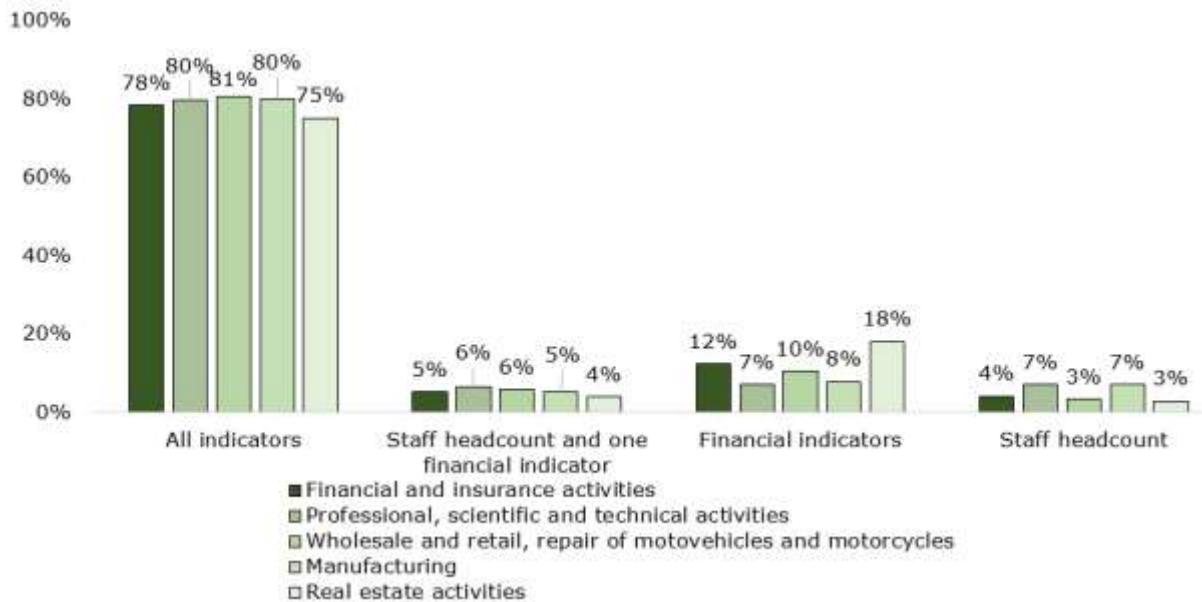


Source: CEPS' elaboration.

Moving to the determining indicators in the sectors with the largest number of non-SMEs, more than two thirds of the non-SMEs operating in the top five sectors exceed the thresholds of all the size indicators (see Figure 5.5).

Approximately a tenth of the non-SMEs operating in the financial and insurance sector or carrying out wholesale and retail activities exceed only the thresholds set for the financial indicators. These financial indicators are even more important in the real estate sector, as they are the determining factors for roughly a fifth of the non-SMEs operating in this sector. At the same time, staff headcount is the determining indicator for almost a tenth of the non-SMEs operating respectively in professional, scientific and technical activities, and manufacturing.

Figure 5.5 Determining indicators for non-SMEs in the five largest sectors, excluding publicly owned companies

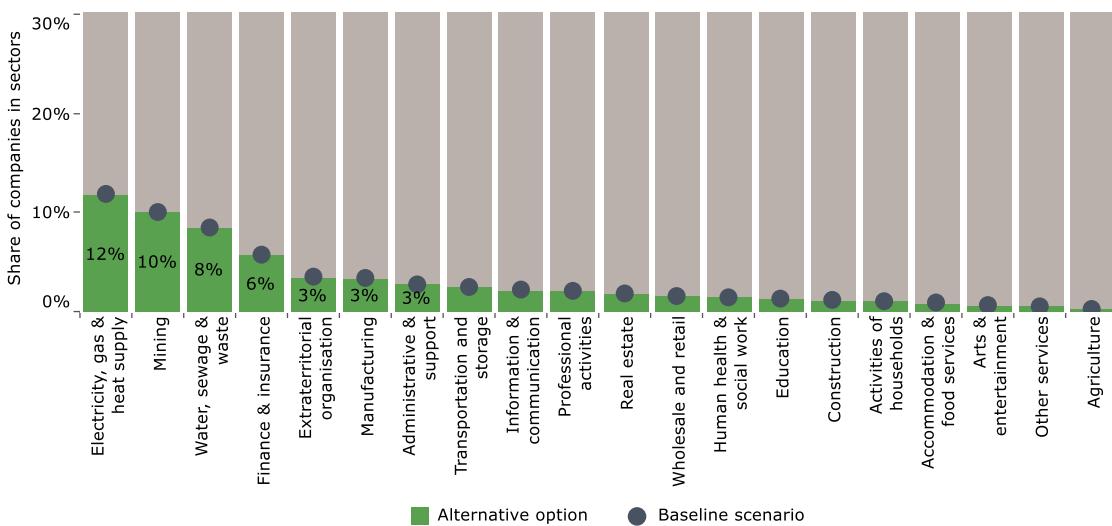


Note: The financial sector ranks first in terms of the number of non-SMEs, while it ranks third per share of non-SMEs.

Source: CEPS' elaboration based on Orbis Europe data.

For the majority of the sectors, the share of companies subject to mandatory energy audits under Option 1 is less than 5%. Higher shares are registered in capital-intensive sectors such as electricity, gas, steam and air conditioning supply (12%), mining and quarrying (10%), water supply, sewage, waste management (8%) and financial and insurance activities (6%). The smallest shares of non-SMEs are registered in agriculture, forestry and fishing, other service activities, arts, entertainment and recreation, accommodation and food service activities, as the share of companies covered in each of these sectors is below 1%.

Figure 5.6 Companies within the scope of Option 1, by sector



Source: CEPS' elaboration.

5.2 Option 2: simplified definition

The second option assumes that companies that meet the criteria as defined in EU Recommendation 2003/361 at the entity level would have to conduct an energy audit.

5.2.1 Companies within the scope

The coverage of Option 2 is by definition less than the baseline as the companies within the scope of Option 2 are a subset of the companies within the scope of the baseline.

Option 2 covers approximately 94 000 companies, or some 0.2% of the total active companies in the EU-28. Therefore, this option includes about 88% fewer companies than the baseline scenario.

Option 2 is closer to the baseline when the other indicators are considered. Companies subject to mandatory energy audits within the scope of Option 2 represent 57% of the corporate final energy consumption and 61% of the corporate GHG emissions. In comparison, the baseline option covers about 65% of final energy consumption and 69% of GHG emissions.

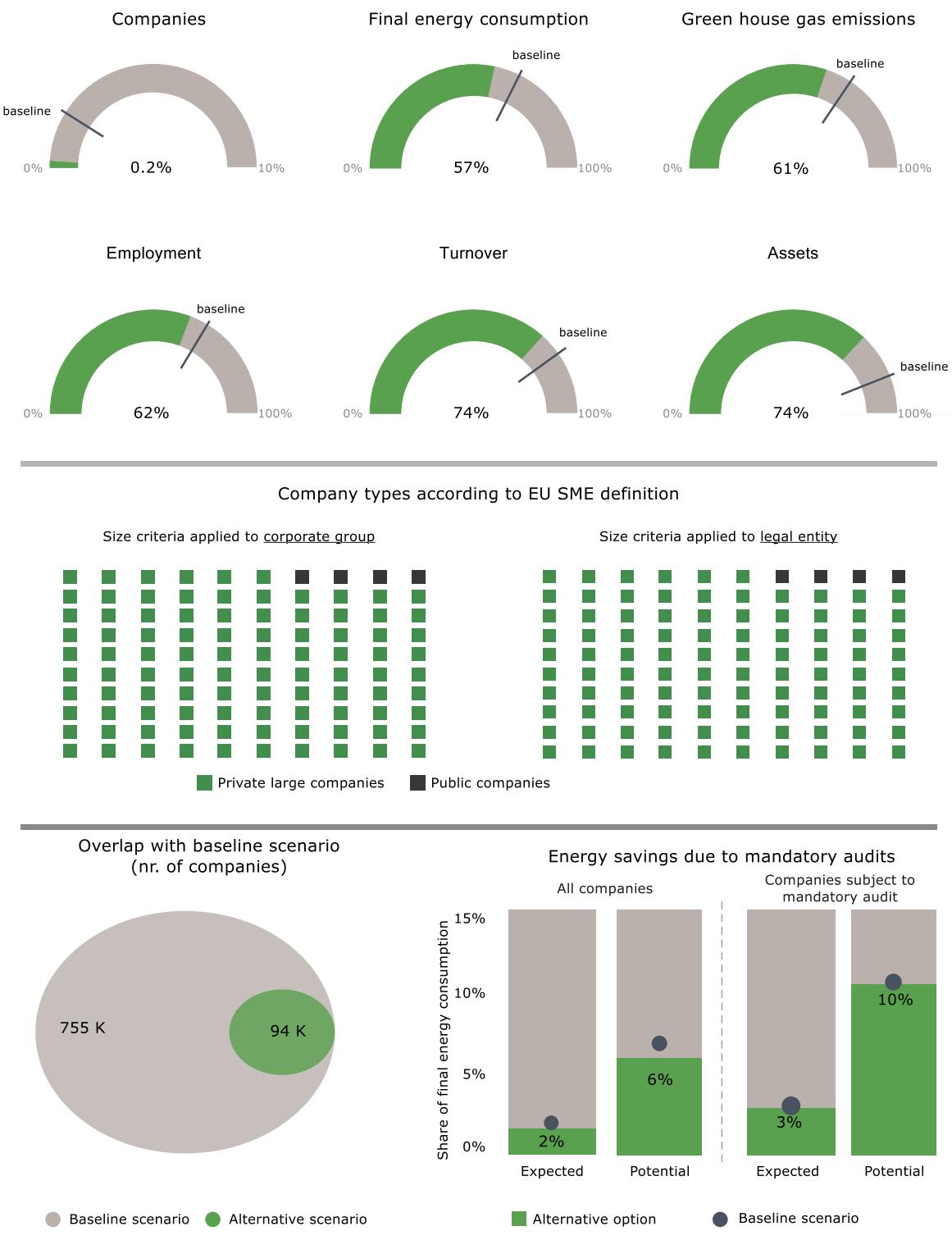
Regarding socioeconomic indicators, under this option companies account for about 62% of corporate employment, compared with 68% under the baseline. Similarly, under Option 2 companies account for approximately 74% of both total corporate turnover and assets (80% and 88% under the baseline respectively).

As this option applies the size criteria specified in EU Recommendation 2003/361 to each individual entity not considering the ownership relations, the corporate groups and entities under Option 2 are all large enterprises. The vast majority of the entities are private ones (about 96%), while there is a small minority of publicly owned companies (about 4%).

Option 2 overlaps fully with the baseline scenario. In particular, this option covers approximately 12% of the companies covered in the baseline option.

The energy savings in terms of final energy consumption generated under Option 2 are estimated to be almost identical to the savings generated in the baseline scenario. Expected savings across all companies are around 2% of final energy consumption and 3% when considering the total energy consumption of the companies obliged to conduct mandatory audits. The potential savings are 6% of all corporate energy consumption (7% under the baseline) and about 10% of the energy consumption of the companies obliged to conduct mandatory audits (about the same as the baseline).

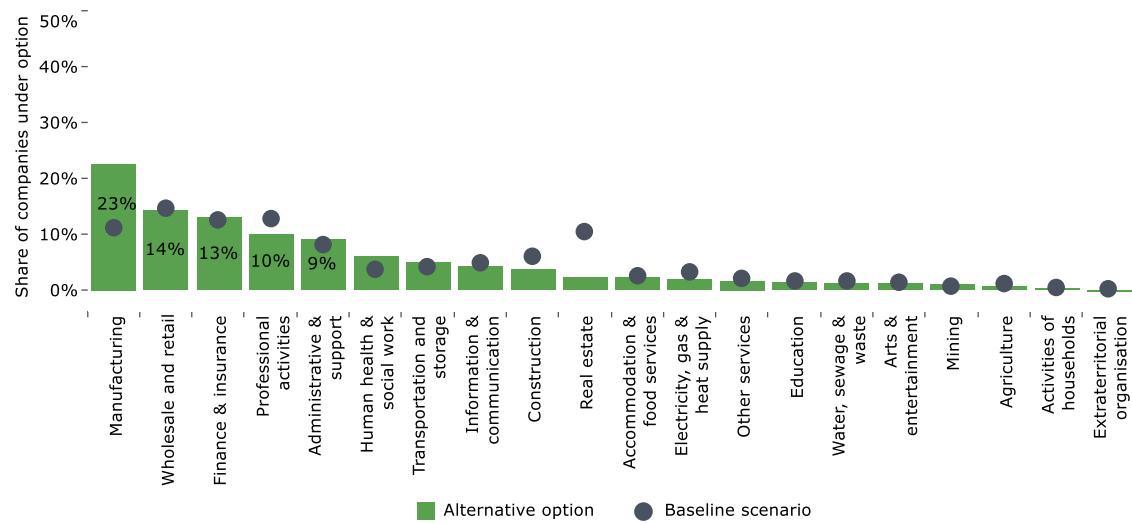
Figure 5.7 Overview of the key indicators Option 2



Source: CEPS' elaboration.

The sectoral distribution of the companies covered under Option 2 is very comparable with the baseline. Two changes in sectoral coverage are nevertheless significant. About 23% of the covered companies belong to the manufacturing sector, compared to 11% under the baseline. At the same time, only 2% of the covered companies are part of the real estate sector, which under the baseline represents about 10% of the companies in scope.

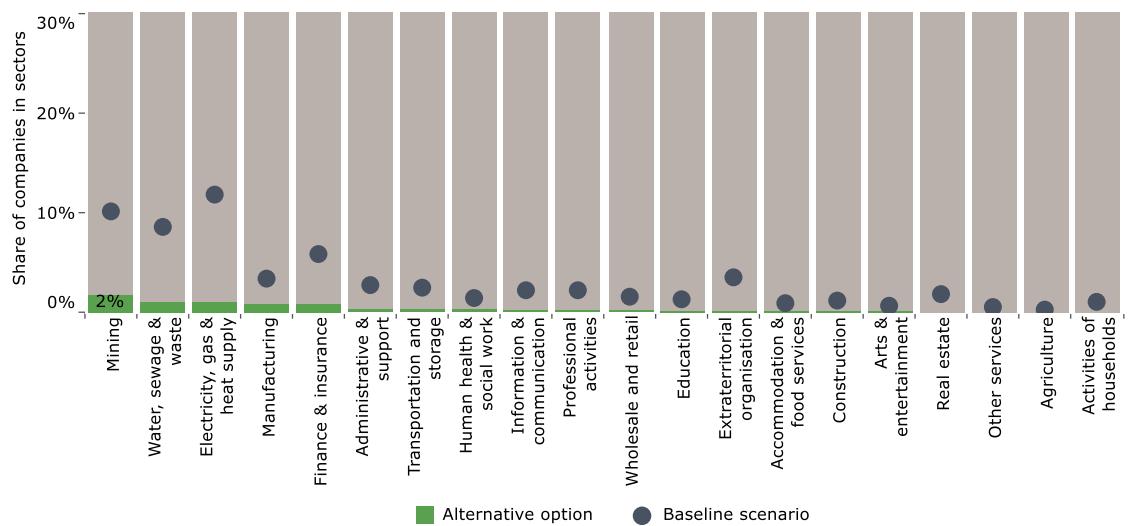
Figure 5.8 Sectoral distribution of companies within the scope of Option 2



Source: CEPS' elaboration.

The share of companies covered in each of the sectors is significantly less than under the baseline. The largest reduction in the share of companies subject to mandatory energy audits are registered in the mining sector (from 10% under the baseline to 2% of the total number of companies in the sector under Option 2), in the water, sewage and waste sector (from 8% to 1%) as well as in the electricity, gas and heat supply sector (from 12% to 2%). There are smaller differences for the remaining sectors. Overall, the percentage of companies covered per sector is quite low, with only mining exceeding 2%.

Figure 5.9 Companies within the scope of Option 2, by sector



Source: CEPS' elaboration.

5.2.2 Feasibility of the option

Option 2 just requires information on the size criteria (number of employees, total assets and turnover) to identify the entities is within the scope. Currently, most of the national energy authorities already have access to this required data via public or private registers. Moreover, among the energy authorities that do not have access to the required information at present, most could potentially get access to a database that provides it. For about half of such national energy authorities interviewed, this would be for a fee. The remaining about 12% (turnover) to 24% (number of employees and total assets) indicated that they cannot get access to the required information or that they do not know. This is in line with previous research that finds that there are about four EU Member States (14%) in which there is limited or basically no recent (public) information on the size criteria for domestic entities (De Groen et al., 2019).⁹⁰

The entities within the scope of Option 2 are much easier to identify than under the baseline, based on the currently available databases (see Table 5.2). The main difference is that Option 2 only considers the size criteria of the domestic entity and not the linked entities (50–100% ownership) and/or partner entities (25–50%). About half of the national energy authorities indicated that they have access to domestic ownership information, while less than a third indicated that they have foreign ownership information.

Table 5.2 Indicators required to determine whether companies are within the scope of Option 2

Indicator	Availability	Option 1 (Baseline)	Option 2
Number of employees	High (82%)	X	X
Total assets	High (76%)	X	X
Turnover	High (88%)	X	X
Sectoral Information	High (76%)	X	
Ownership information	Moderate (65%)	X	
Domestic majority owners (50-100%)	Moderate (53%)	X	
Domestic minority owners (25-50%)	Moderate (47%)	X	
Foreign/EU majority owners (50-100%)	Low (24%)	X	
Foreign/EU minority owners (25-50%)	Low (18%)	X	
Domestic majority owned subsidiaries (50-100%)	Moderate (56%)	X	
Domestic minority owned subsidiaries (25-50%)	Moderate (50%)	X	
Foreign/EU majority owned subsidiaries (50-100%)	Low (29%)	X	
Foreign/EU minority owned subsidiaries (25-50%)	Low (29%)	X	
Final energy consumption	Moderate (65%)		
Energy costs	Moderate (47%)		
Fuel consumption	Moderate (59%)		
Overall		Hard (18%)	Easy (76%)

Note: The availability in the table indicates the relative (potential) availability of the respective indicator among the national energy authorities interviewed for this study (%). The overall assessment at the bottom of the table provides an indication about the feasibility of the option based on the required indicator that is least available, which is presented in **bold**.

⁹⁰ De Groen, W.P., Alcidi, C., Musmeci, R., Baiocco, S., Busse, M., Lenaerts, K. (2019), "Study on the accounting regime of limited liability micro companies".

Source: CEPS

The exclusion of ownership information also reduces the challenges related to the quality of the ownership information. The data on ownership in most available databases only considers the current ownership relations based on a combination of official and unofficial sources. Indeed, the databases do not allow or make very difficult the determination of the ownership structure at a given point in time with certainty. Not having to use the ownership information makes enforcement easier for the national energy authorities.

Similarly, the exclusion of ownership information also eases the application of the size thresholds as they only need to be applied to the domestic entity to determine whether entities are within the scope of Option 2. Under the baseline the size criteria of the domestic entity need to be combined with information on the linked and partner entities on a pro rata or consolidated basis, which makes the calculation of the relevant size indicators more difficult for companies with linked and/or partner entities.

Overall, it is much easier to determine the companies within the scope of Option 2 than under the baseline.

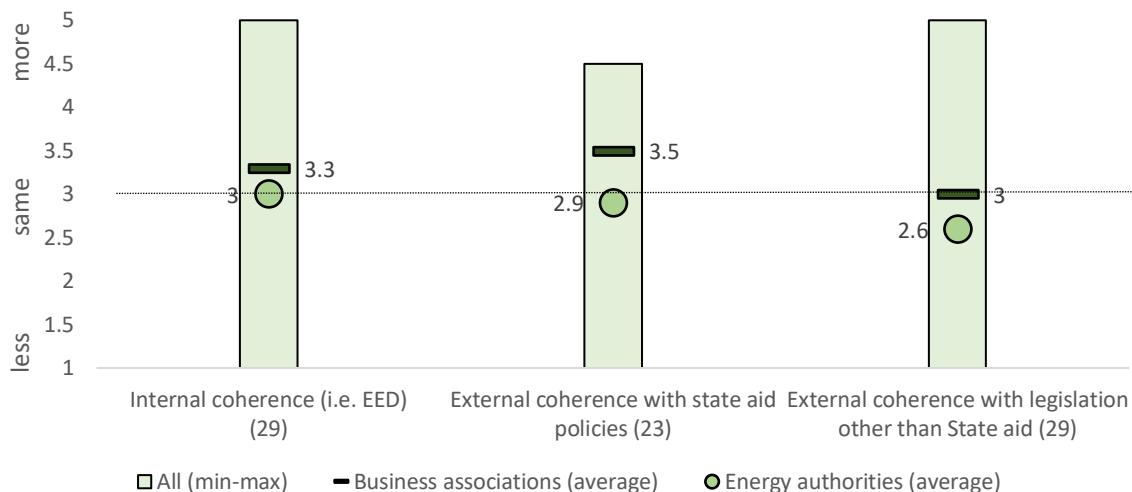
5.2.3 Internal and external coherence

The internal and external coherence of Option 2 is broadly similar to the baseline scenario.

The impact of Option 2 on the internal coherence is ambiguous in comparison with the baseline scenario. The general objectives of the EED are to enhance energy savings and contribute to the reduction of GHG emissions, while the specific objective is to realise the energy savings cost-effectively. Option 2 covers a selection of the companies currently within the scope of the EED. By definition, fewer companies are covered under the energy audits, resulting in less energy savings and GHG emission reductions. However, Option 2 would allow the exclusion of smaller subsidiaries of large companies for which the energy audit is less cost-effective. The energy authorities interviewed on average saw the internal coherence as being similar to the baseline. The business associations attached relatively more value to the cost-effectiveness of the energy audits, which was expressed by the fact that they considered Option 2 more coherent.

The external coherence with State Aid and other policies might be reduced because different SME definitions would be used for State Aid and for the energy audits. At a company level, for the purposes of an energy audit and taking into account ownership relations for State Aid, with this definition it would be easier for authorities to grant subsidies (no companies in a 'grey area'). For example, SMEs connected with larger groups have fewer possibilities to benefit from State Aid, and their exclusion from the scope might be beneficial to them.

Figure 5.10 Coherence with the EED goals of Option 2 compared with the baseline



Note: The figure above reflects the views of business associations and national energy authorities as expressed in the interviews. The rates indicate the coherence with the EED compared with the baseline, ranging from 1 – much less coherent to 5 – much more coherent.

Source: CEPS.

5.2.4 Effectiveness/efficiency for national authorities

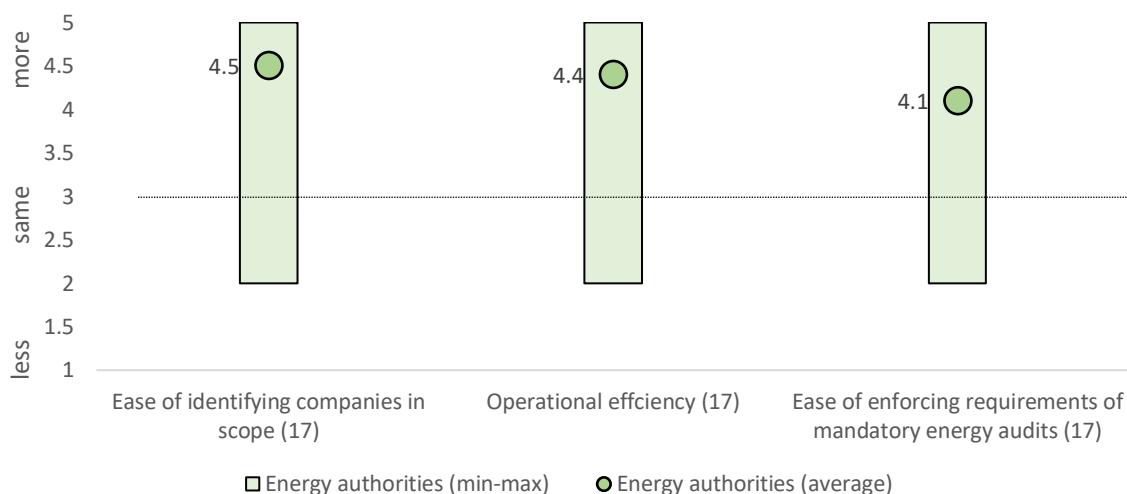
Most of the national energy authorities confirmed that simplification of the definition would ease the identification of companies within the scope and enforcement, and enable more efficient operation.

Option 2 only requires a subset of the indicators of the baseline scenario to identify the companies within the scope. More than 90% of the energy authorities interviewed confirmed this and indicated that under Option 2 it would be more or even much more straightforward to identify companies within the scope.

Similarly, most of the energy authorities interviewed agreed that this option would lead to better operational efficiency, among others because fewer entities would be concerned. This option would significantly simplify identifying non-SMEs, allowing authorities to use existing instruments. This is in line with the feasibility assessment of Option 2 (see Section Figure 5.11).

In keeping with the identification and operational efficiency, most national energy authorities deemed it easier to enforce the mandatory audits under Option 2. Indeed, the energy authority in principle only needs to consider the size indicators at the entity level. Yet, enforcement may face a new hurdle under this option for those companies for which it is not straightforward to determine the size indicators for the entity. This is primarily a concern for companies for which only consolidated accounts are available. For these companies, it would be difficult to allocate the employees and to a lesser extent their turnover and assets across the parent undertaking and the subsidiaries to determine which entities meet the size criteria.

Figure 5.11 Effectiveness/efficiency for national authorities of Option 2 compared with the baseline



Note: The figure above reflects the views of national energy authorities as expressed in the interviews. The rates indicate the effectiveness/efficiency for national authorities compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

5.2.5 Effectiveness/efficiency for companies

Most business associations expressed a preference for the simplification of the current definition, and thus considered this option more cost-effective.

Like the national energy authorities, the business associations saw it as easier or far easier for companies to determine whether they need to conduct an energy audit. They deemed the definition that just entails the size indicators to be clearer than the baseline scenario, which also includes the ownership structure. The companies have the size indicators at the entity level readily available, while many have to calculate the size indicators for the baseline scenario.

Many business associations viewed Option 2 as contributing more or much more to the level playing field. This option will exclude some small entities that are now obliged to do energy audits, often without significant energy-saving opportunities, while other enterprises of the same size and the same sector are not obliged. Additionally, this option could help remove existing asymmetries in the implementation of the directive across Member States, which contributes to the cross-border level playing field.

Most of the business associations interviewed expected the average costs of conducting an energy audit to increase. The companies subject to the energy audits are likely to be larger, which is likely to be reflected in the higher average cost. But the average costs as a share of turnover are expected to decrease. Moreover, the companies might also benefit from more competition among auditors, as fewer companies would require an energy audit under this option.

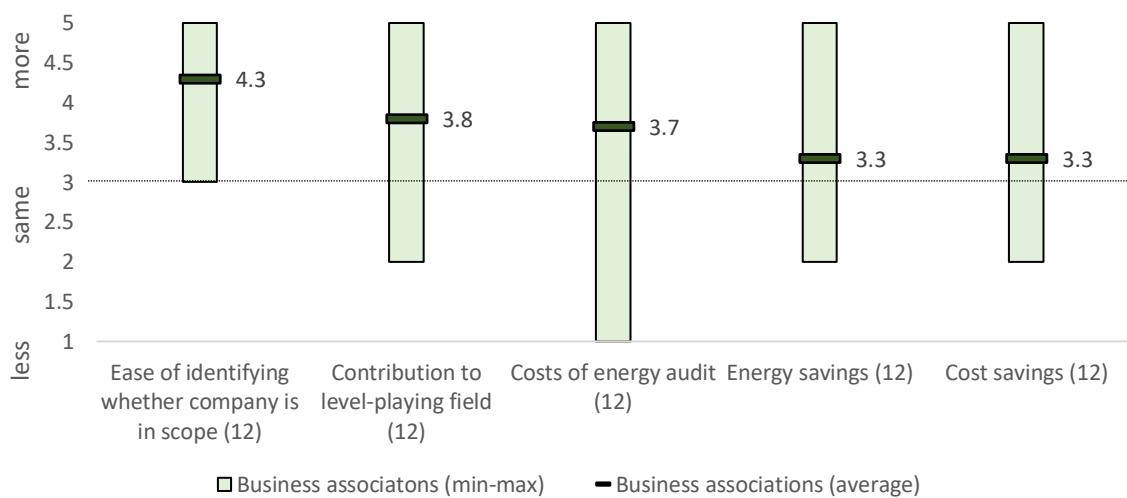
Since far fewer companies would be required to conduct an energy audit under this option, in theory this should also lead to a drop in the energy savings. Although the expected and potential energy savings are also likely to be less in practice, the difference with the baseline in practice is expected to be fairly limited. This was also indicated by many of the business associations, which considered that the application of a simplified definition would exclude primarily smaller companies, for which the expected energy

savings are limited. Furthermore, some of the business associations also indicated that simplification of the definition might improve enforcement at the national level, ensuring that larger companies conduct an energy audit.

The simulation results show that the savings in terms of final energy consumption are similar to the savings estimated in the baseline scenario, although far fewer companies are covered. This is broadly in line with the expectations of the business associations. Around 40% of the respondents pointed out that the cost savings are likely to remain the same in comparison with the baseline, around 20% indicated they would expect less cost savings, while the remaining 40% would expect Option 2 to contribute to more or much more cost savings.

The relatively large share of business associations expecting higher energy savings and cost savings also reflects the preference for this option.

Figure 5.12 Effectiveness/efficiency for companies of Option 2 compared with the baseline



Note: The figure above reflects the views of business associations as expressed in the interviews. The rates indicate the effectiveness/efficiency for business associations compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

5.2.6 SWOT analysis

Based on assessment of the various relevant elements of the option in previous sections, the table below summarises the key strengths, weaknesses, opportunities and threats of Option 2 in comparison with the baseline scenario.

Table 5.3 Summary SWOT analysis for Option 2

		Strengths	Weaknesses
Internal			
		<ul style="list-style-type: none"> • Scope is the same across Member States (i.e. internal coherence) • Fewer energy audits are required • Fewer indicators and an easier calculation are necessary to determine the companies within the scope • Definition requires indicators that are already used 	<ul style="list-style-type: none"> • Legal structure of a company will affect whether a company is within the scope (i.e. level playing field) • A relatively smaller share of the corporate final energy consumption and GHG emissions are covered • A relatively smaller share of the corporate employment, turnover and assets are covered • Like the baseline, the definition does not consider indicators linked to the energy savings objective of the legislation
External	Opportunities		Threats
	<ul style="list-style-type: none"> • Indicators required to determine companies within the scope are more widely available • It is easier for national energy authorities and companies to determine the companies within the scope (operational efficiency) • National energy authorities are more likely to apply the selection criteria consistently (i.e. level playing field) • Energy audits will cover more of the larger companies for which the energy audits are more cost-effective • It is easier to enforce the audit requirement for national authorities 		<ul style="list-style-type: none"> • Expected and potential energy savings are likely to be slightly less • With less energy savings the GHG emission reductions might also be less • Decreases external coherence by providing a different definition compared with State Aid

5.3 Option 3A: final energy-consumption definition

Option 3A assumes a selection based on the energy consumed at the entity level. More specifically, the option only considers companies that have a **final energy consumption above 20 TJ**.

5.3.1 Companies within the scope

Under this option about 95 000 entities or 0.2% of EU-28 active companies are covered, which means that Option 3A covers 87% fewer companies than under the baseline.

Nevertheless, the share of corporate energy consumption under the option is estimated to be higher than the baseline. The companies under Option 3A are responsible for approximately 71% of final corporate energy consumption (65% under the baseline option). The total corporate GHG emissions of companies under this option are slightly lower than in the baseline option. The GHG emissions are estimated at 65% of total corporate GHG emissions compared with 69% under the baseline.

Turning to the socioeconomic indicators, the companies under Option 3A account for a smaller share of the number of employees, total assets and turnover than the baseline scenario. The share of total corporate employees under Option 3A is estimated at 50% (68% under the baseline). The difference in terms of turnover and assets is even more pronounced. The share of total corporate turnover and assets under Option 3A are estimated at approximately 52% and 51% respectively, compared with about 80% and 88% under the baseline.

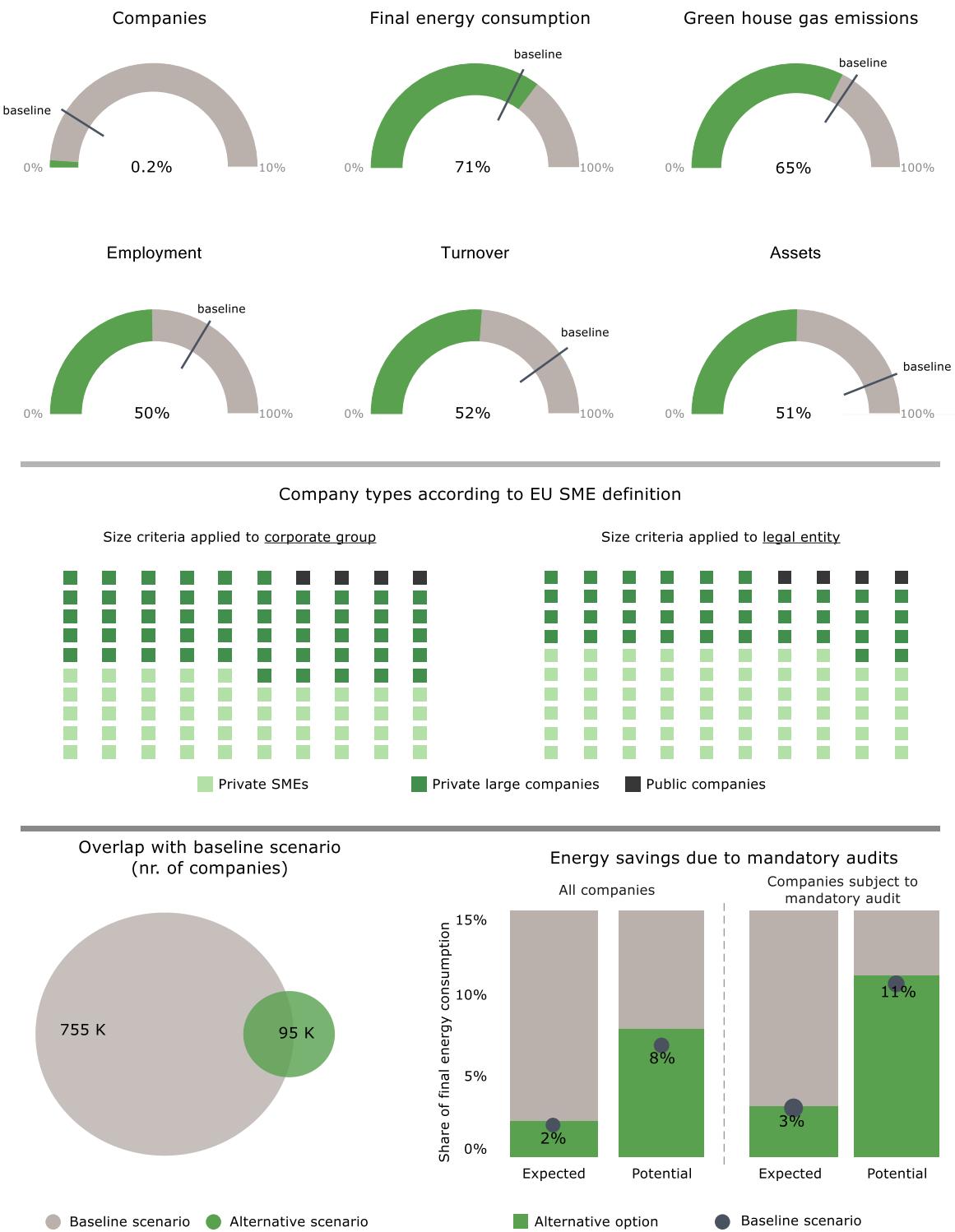
The majority of the companies under this option (51%) would be classified as private larger companies according to the EU Recommendation 2003/361 (corporate group perspective). In turn, about 45% of the companies in scope of option 3A would be classified as SMEs, while no SMEs are in the scope of the baseline option. Moreover, whereas under the baseline all publicly owned companies are within the scope, under Option 3A only the companies with a final energy consumption above 20 TJ are considered. The share of public companies within the scope is estimated at 4% under this option, compared with 6% under the baseline.

Interestingly, the share of large companies is much greater than under the baseline when the size criteria defined in EU Recommendation 2003/361 are applied to the entity instead of the corporate group (including partnerships and linked companies). Indeed, the share of private large companies is about three times larger under this option (38%) than under the baseline (12%). The share of private SMEs at the entity level is about significantly lower under this option (58%) than under the baseline (82%). The share of publicly owned companies by definition remains the same when considering the corporate group and entity level.

The overlap with the baseline is relatively limited. Option 3A covers about 5% of the companies within the scope of the baseline. These companies represent about 55% of the companies under Option 3A. The remaining 45% of the companies are not covered under the baseline.

In terms of energy savings, this option is likely to generate similar expected and potential energy savings compared with the baseline. The expected energy savings are 2% of total corporate energy consumption. The potential savings, at 8% of total corporate energy consumption (7% under the baseline). When just the companies within the scope of the option are considered, the expected energy savings are about 3% while the estimated potential savings are about 11%, in line with the baseline option.

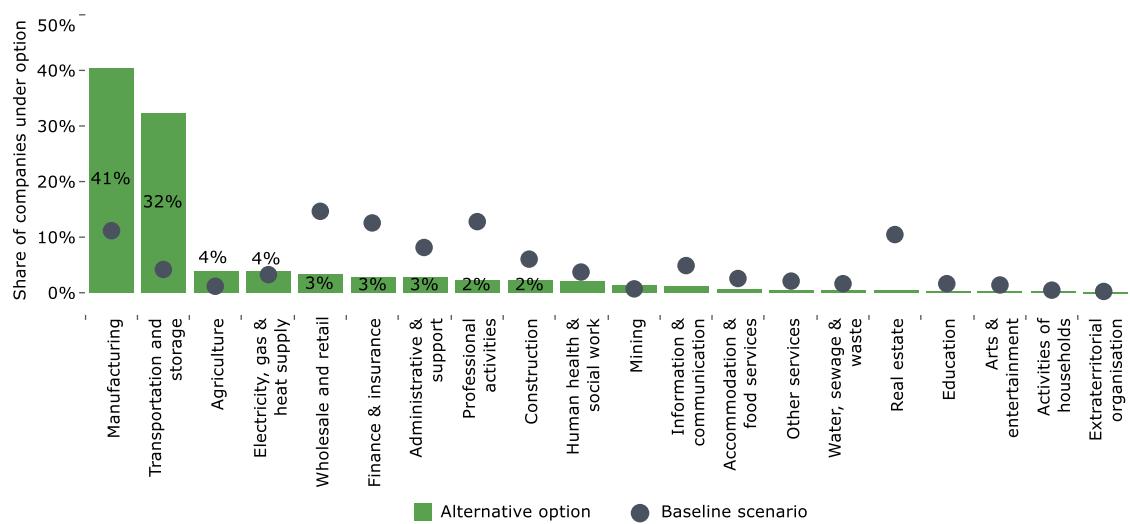
Figure 5.13 Overview of the key indicators for Option 3A



Source: CEPS' elaboration.

The differences with the baseline are to a large extent due to a different sectoral coverage. The application of an energy consumption threshold extends coverage of the energy audits to smaller energy-intensive companies that are not captured under the baseline scenario. The companies covered under this option are concentrated in two sectors. Cumulatively, manufacturing (41%) and transportation and storage (32%) account for about three fourths of the companies within the scope, whereas they only account for about 15% of the companies within the scope of the baseline.⁹¹ By contrast, relatively less energy-intensive sectors are less represented compared with the baseline. Most notable are the wholesale and retail (3%), financial and insurance (3%), administrative and support (3%), professional activities (2%) and real estate (<1%) sectors, which account for 12% of the companies under the option, compared with 58% under the baseline.

Figure 5.14 Sectoral distribution of companies within the scope of Option 3A

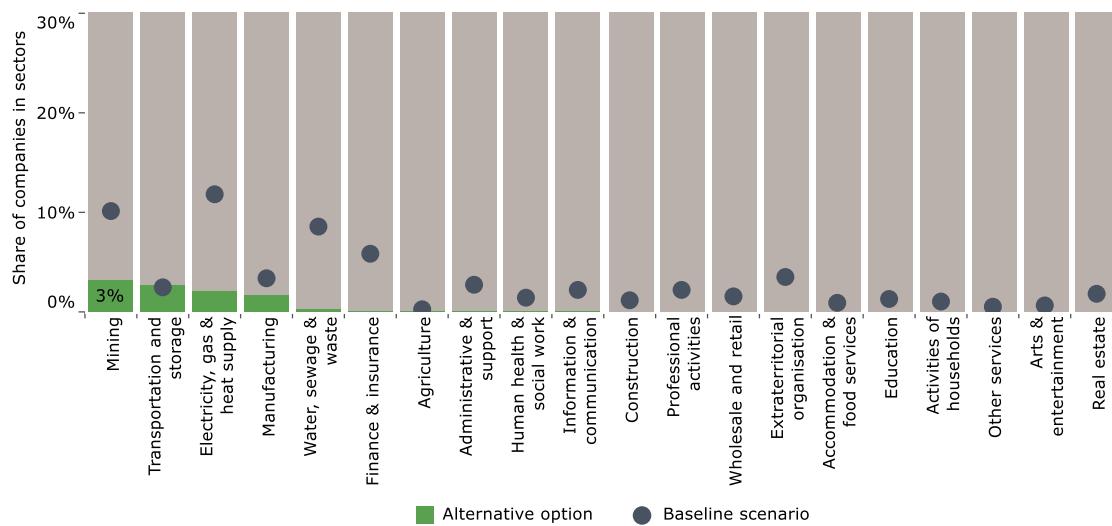


Source: CEPS' elaboration.

The relative share of companies subject to conducting an energy audit is in general limited to 1% or fewer of the companies in the sector covered. There are a few exceptions. The mining and quarrying sector as well as the transportation and storage sector are those with the largest share of companies under this option (3%). Finally, there are two more sectors with more than 1% of the companies covered, namely electricity, gas and heat supply (2%) and manufacturing (2%).

⁹¹ Under Option 3A, the number of companies subject to conducting energy audits is likely to be underestimated for the sectors mining and quarrying, electricity, gas and heat supply. For consistency across policy options, the final energy consumption takes into consideration electricity, natural gas, gasoline, gasoil and fuel oil, and jet fuels. The underestimation is due to the fact that these two sectors employ a significant share of other energy carriers that are not considered in this study (see Section 2.6).

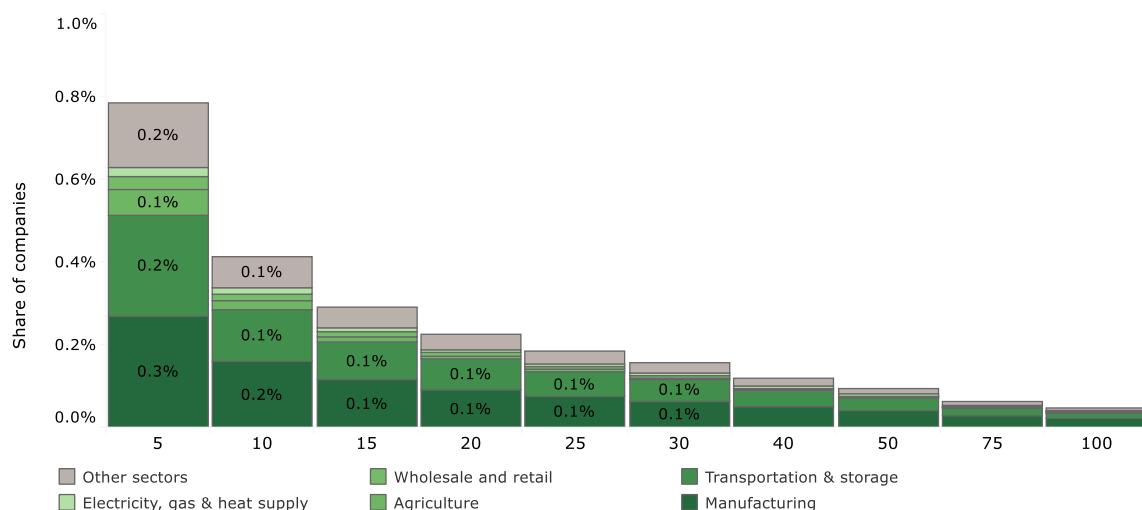
Figure 5.15 Companies within the scope of Option 3A, by sector



Source: CEPS' elaboration.

The threshold level selected to determine whether companies are within the scope has a large impact (see Figure 5.16). The number of companies under Option 3A would triple from about 95 000 companies under the currently assumed 20 TJ to 331 000 companies (0.8% of active companies) if the annual final energy-consumption threshold for mandatory energy audits was set at 5 TJ. Most of the companies subject to mandatory energy audits would operate in the manufacturing and the transportation and storage sectors. With a threshold of 10 TJ, the number of companies would be approximately 174 000 (0.4%). In turn, the number of companies would decrease to 65 000 entities (0.1% of active companies) if the threshold was set at 30 TJ. The companies within the scope would further decrease to 40 000 with a threshold of 50 TJ. Finally, the number within the scope of Option 3A would be approximately 20 000 with a threshold of 100 TJ per year, which is about a fifth less than the number of companies within the scope under the assumed 20 TJ.

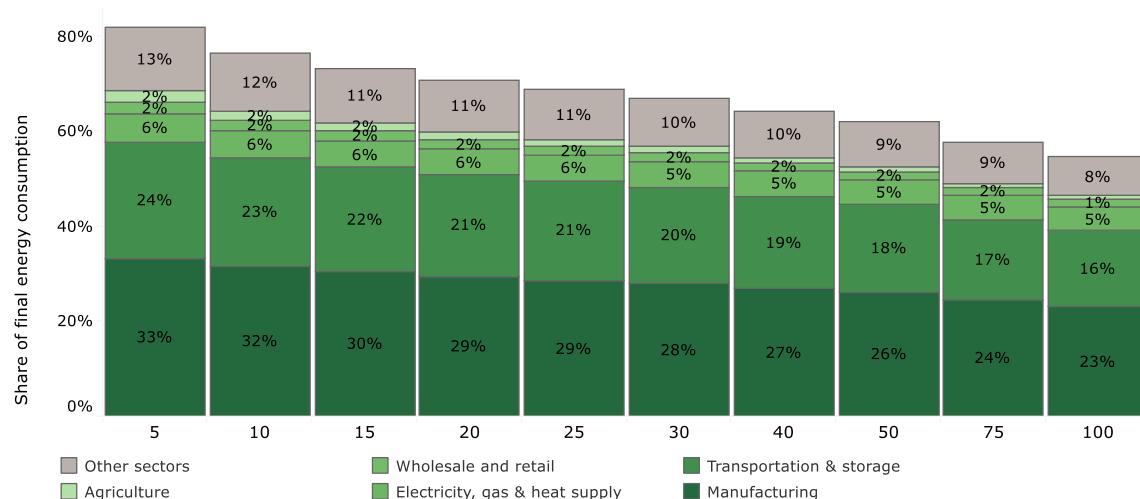
Figure 5.16 Share of companies covered by Option 3A under alternative final-consumption thresholds (TJ), by sector



Source: CEPS (2020) elaboration.

In terms of energy consumption, the differences among the various levels are significantly less. The share of final energy consumption covered by mandatory energy audits would decrease from 80% for a threshold of 5 TJ to 53% for a threshold of 100 TJ – a difference of 25% (see Figure 5.17). Looking at the sectoral distribution, about a third of the energy consumption would be related to manufacturing companies if the threshold was set at 5 TJ. About a fourth would be related to companies in the transportation and storage sector, while relatively smaller shares would be related to the remaining sectors. The share of energy consumption would decline to 23% for the manufacturing sector and to 16% for the transportation and storage sector if the threshold was set at 100 TJ.

Figure 5.17 Share of final energy consumption covered by Option 3A under alternative, final energy-consumption thresholds (TJ)



Source: CEPS (2020) elaboration.

5.3.2 Feasibility of the option

Option 3A only requires information on the final energy consumption of the entity in order to determine whether the threshold for inclusion is passed. This information is currently available to around 65% of the energy authorities interviewed⁹² (available to 47% of the energy authorities, while 18% indicated that they could obtain the final energy consumption figures at the company level). The authorities that do not have this information often lack the procedures or laws to gather it.

Even for authorities that already have or could potentially obtain final energy-consumption information, it might be difficult to identify all the companies within the scope of this option. Most importantly, data on energy consumption often stem from past audits. Such data can be out of date as they are only obtained once every four years and are just available for companies that conducted an energy audit and not those that are not classified as non-SMEs and do not meet the consumption threshold.

⁹² In at least 20 Member States there is a legal obligation for energy authorities to obtain data on energy consumption from the audit. JRC (2019), “Analysis on the practices to collect, store and assess information arising from Energy Audits in the EU-28”.

Table 5.4 Indicators required to determine whether companies are within the scope of Option 3A

Indicator	Availability	Option 1 (Baseline)	Option 3A
Number of employees	High (82%)	X	
Total assets	High (76%)	X	
Turnover	High (88%)	X	
Sectoral Information	High (76%)	X	
Ownership information	Moderate (65%)	X	
Domestic majority owners (50-100%)	Moderate (53%)	X	
Domestic minority owners (25-50%)	Moderate (47%)	X	
Foreign/EU majority owners (50-100%)	Low (24%)	X	
Foreign/EU minority owners (25-50%)	Low (18%)	X	
Domestic majority owned subsidiaries (50-100%)	Moderate (56%)	X	
Domestic minority owned subsidiaries (25-50%)	Moderate (50%)	X	
Foreign/EU majority owned subsidiaries (50-100%)	Low (29%)	X	
Foreign/EU minority owned subsidiaries (25-50%)	Low (29%)	X	
Final energy consumption	Moderate (65%)		X
Energy costs	Moderate (47%)		
Fuel consumption	Moderate (59%)		
Overall		Hard (18%)	Moderate (65%)

Note: The availability in the table indicates the relative (potential) availability of the respective indicator among the national energy authorities interviewed for this study (%). The overall assessment at the bottom of the table provides an indication about the feasibility of the option based on the required indicator that is least available, which is presented in **bold**.

Source: CEPS

Nevertheless, Option 3A can be more easily followed than the baseline (see Table 5.4). For authorities that already have the infrastructure and laws in place that allow them to accurately collect verifiable data on energy consumption, the process is easy once the energy consumption information is obtained. Only one threshold needs to be applied to identify companies required to conduct an audit. Additionally, no information on ownership is required. However, there are a few countries that report that they do not have the infrastructure to obtain high quality energy-consumption data.

5.3.3 Internal and external coherence

Focusing on the final energy consumption as the main criterion, Option 3A is considered more coherent with the objectives of the EED than the baseline scenario.

While excluding a significant number of companies (84% fewer than in the baseline) and consequently decreasing the number of energy audits conducted, Option 3A would also include energy-intensive enterprises that currently do not execute mandatory energy audits because of limited turnover, assets or employment and would exclude energy-extensive enterprises that are obliged to execute energy audits due to their economic scale. Thus, the share of corporate energy consumption covered by this option is 17% higher than estimated under the baseline scenario.

Even so, the threshold of 20 TJ may be too high, potentially excluding energy-intensive enterprises that could also benefit from an energy audit (see Figure 5.18). Most

respondents pointed out that this threshold would further reduce the scope of enterprises concerned that could benefit from the audit, which can be cost-effective with even lower consumption (e.g. in Italy, a 15 TJ threshold was proposed).

Companies that consume more than 20 TJ of energy are often large multinationals which would conduct an energy audit anyway and have already implemented an energy-efficiency management system. Therefore, the impact of energy audits could be less significant for them.

SMEs, for which energy consumption is a large part of their costs, would be covered by this definition (66% of the companies under this policy option according to the simulation results). Yet, such SMEs are often already very energy efficient, and their inclusion in a mandatory energy audit may not lead to further energy savings.

At the same time, this definition excludes large enterprises with very little energy consumption (e.g. in the residential sector or the bank insurance sector) which are currently under the obligation to do an energy audit. It is true that this would lead to fewer enterprises doing the audit but this exclusion does not necessarily lead to less energy savings.

Some respondents pointed to potential alternatives: for example, considering an energy-intensity threshold (i.e. energy consumption/annual turnover) or energy consumption per m² as a criterion instead of energy consumption. There were also some concerns about the measurement of energy consumption in TJ instead of GWh.

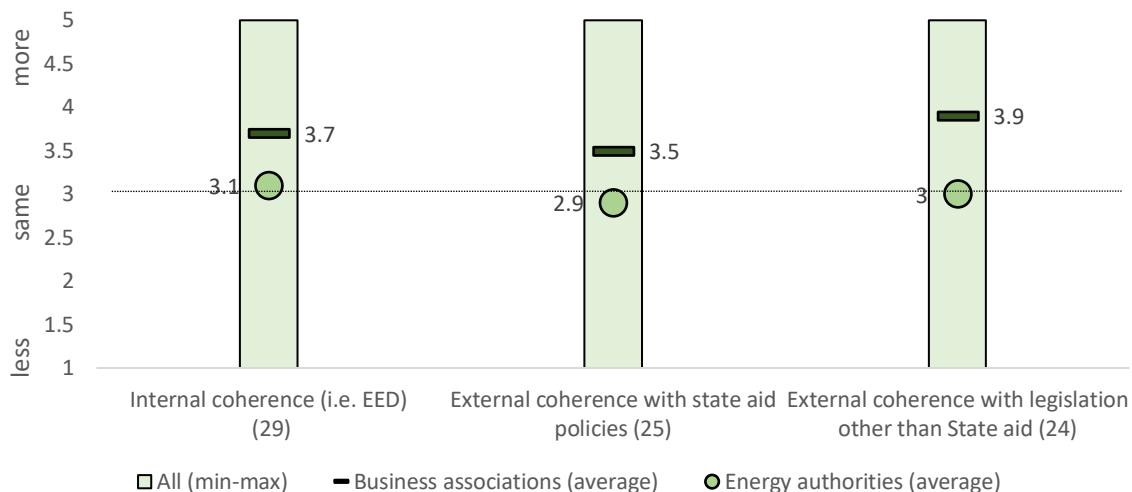
Option 3A would not be an alternative SME definition but a totally different definition based on energy consumption, and not the financial situation of enterprises. It would be more coherent with the ETS system, which also measures energy, although with regard to capacity.

The simulation results show that this option is likely to generate both higher expected and potential energy savings compared with the baseline. The expected and potential energy savings are about 1% higher than under the baseline. The companies covered by this option would be concentrated in two sectors – transportation and storage (46%) and manufacturing (31%). The results across Member States may also depend on their economic structures. If many energy-intensive sectors are present, especially those mentioned above, Option 2 would cover more companies.

At the same time, large energy consumers are likely to conduct audits already, irrespective of the audit obligations. Better results could also be realised if energy auditors just had to focus on energy-intensive industries.

Regarding GHG reductions, the simulation results for the total corporate GHG emissions under this option are similar to the baseline option. Still, the outcome is not that clear, because energy savings could also be made from renewable energy or nuclear energy or biomass energy, so the link is not direct.

Figure 5.18 Coherence with the EED goals of Option 3A compared with the baseline



Note: The figure above reflects the views of business associations and national energy authorities as expressed in the interviews. The rates indicate the coherence with the EED compared with the baseline, ranging from 1 – much less coherent to 5 – much more coherent.

Source: CEPS.

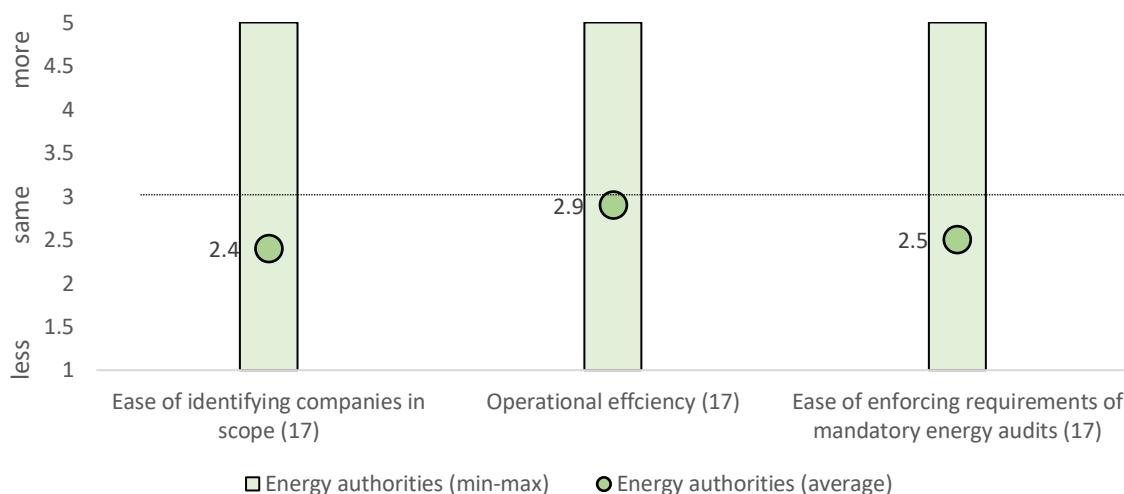
5.3.4 Effectiveness/efficiency for national authorities

The threshold is very clear, including all SMEs that meet this threshold. However, this option may not change a lot in terms of the lack of information about final energy consumption required to identify the companies (only for electricity and natural gas but not for other energy carriers). In addition, for many companies energy consumption is very confidential data, and there would be a need for new legislation to oblige companies to report such data. To complicate the identification, energy consumption might differ between the years, and data on energy consumption often stem from past audits.

Regarding operational efficiency, many pointed to potential problems with obtaining information about energy consumption (including issues with conversion factors or timing). Energy companies have this information only site by site and equally energy could be purchased from various suppliers. Operationally, at this stage this option would mean continually approaching companies in order to obtain their energy consumption. The solution would be to force companies to present a responsible declaration about their energy consumption. In that case, the operational efficiency could remain more or less the same.

Enforcement would be rather difficult given that the information should be received from companies. The latter may not be inclined to share this confidential information to prevent their competitors from comparing their cost-efficiency on energy costs. In addition, according to the voluntary agreements, authorities do not have any access to data on companies, and only receive compiled information at the sub-sectoral level. This option would have a declarative character and it would make it very hard to verify the real size/consumption of an enterprise. Since authorities do not have access to the energy consumption of enterprises, they would need to rely upon what is declared by the enterprises with no possibility to verify it.

Figure 5.19 Effectiveness/efficiency for national authorities of Option 3A compared with the baseline



Note: The figure above reflects the views of national energy authorities as expressed in the interviews. The rates indicate the effectiveness/efficiency for national authorities compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

5.3.5 Effectiveness/efficiency for companies

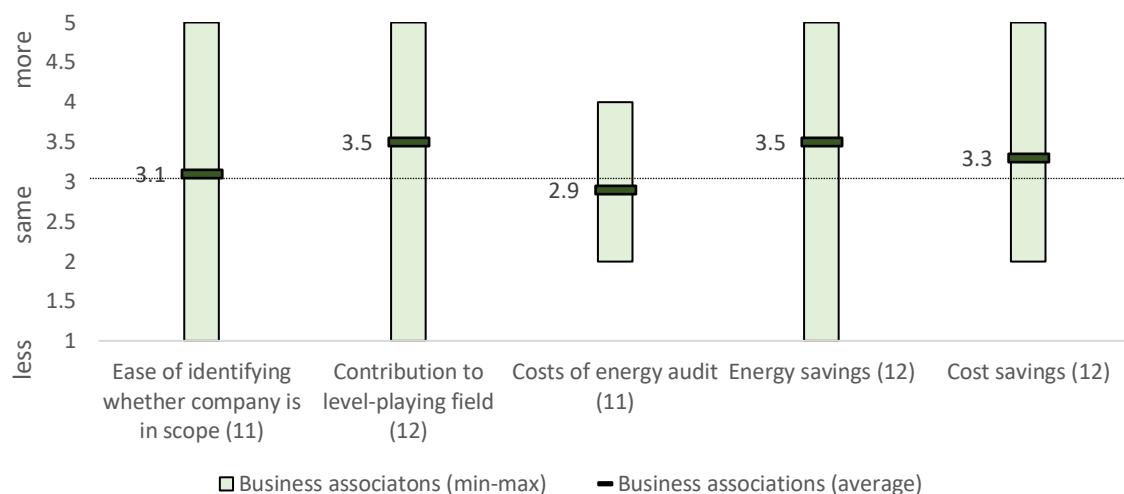
Most business associations expressed concerns about the difficulty of operationalising this definition compared with the baseline but especially the simplified definition (Option 2). It could also be more difficult to keep track of final energy consumption for companies, than the number of employees, for instance, particularly because of a need to account for energy consumed by transport (fuel) (instead of electricity, heating and fuel from a bill). In the case of transport, it is possible to know the consumption of company cars, but not travel expenses when coming from planes and trains or contracts with transport companies. Moreover, calculating energy consumed in TJ instead of MWh would be very confusing for enterprises.

Regarding the level playing field, on the one hand, only very energy-intensive enterprises would fall within the scope; on the other hand, companies with comparable energy use would be under the same obligation.

The costs of conducting an energy audit would be approximately the same for enterprises because all enterprises under this option would be within the scope of the requirement.

More energy-intensive companies would have to do energy audits, so there would likely be more energy savings.

Figure 5.20 Effectiveness/efficiency for enterprises of Option 3A compared with the baseline



Note: The figure above reflects the views of business associations as expressed in the interviews. The rates indicate the effectiveness/efficiency for business associations in comparison compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

5.3.6 SWOT analysis

Based on the assessment of the various relevant elements of the option in previous sections, the table below summarises the key strengths, weaknesses, opportunities and threats of Option 3A in comparison with the baseline scenario.

Table 5.5 Summary SWOT analysis for Option 3A

	Strengths	Weaknesses
Internal	<ul style="list-style-type: none"> Criteria are linked to the energy objective of the legislation Scope is the same across Member States (i.e. internal coherence) Fewer energy audits are required Fewer indicators are necessary to determine the companies within the scope A relatively larger share of the corporate final energy consumption and GHG emissions are covered 	<ul style="list-style-type: none"> Definition requires indicators that are not already used for legislative purposes Legal structure of a company will affect whether a company is within the scope (i.e. level playing field) A much smaller share of the corporate employment, turnover and assets are covered
External	<ul style="list-style-type: none"> Expected and potential energy savings are likely to be higher With more energy savings the GHG emissions are also likely to be reduced more It is relatively difficult for national energy authorities and companies to determine the companies within the scope Energy audits will cover more energy-intensive companies for which the energy audits are more cost-effective If available, the national energy authorities are more likely to apply the selection criteria consistently (i.e. level playing field) and enforce the audit requirement 	<ul style="list-style-type: none"> The required energy-based size criteria are more difficult to obtain for companies than accounting-based indicators The indicator required to determine companies within the scope is only available to national authorities in some Member States and some of the companies Less external coherence by providing a different definition compared with State Aid If not available, the national energy authorities are unable to apply the selection criteria consistently (i.e. distortion of the level playing field) or enforce the audit requirement

5.4 Option 3B: fuel consumption definition

Option 3B assumes a selection based on the energy consumed at the entity level. More specifically, the option only considers companies that have a **fuel consumption above 25 TJ**.

5.4.1 Companies within the scope

Under this option about 126 000 entities or 0.3% of EU-28 companies are covered. Indeed, this option covers 83% fewer companies than under the baseline scenario.

The companies under Option 3B capture a higher share of energy consumption compared with the baseline. They are responsible for 73% of the total final energy consumption, compared with 65% under the baseline option. Companies under Option 3B account for 69% of GHG emissions, in line with the baseline scenario.

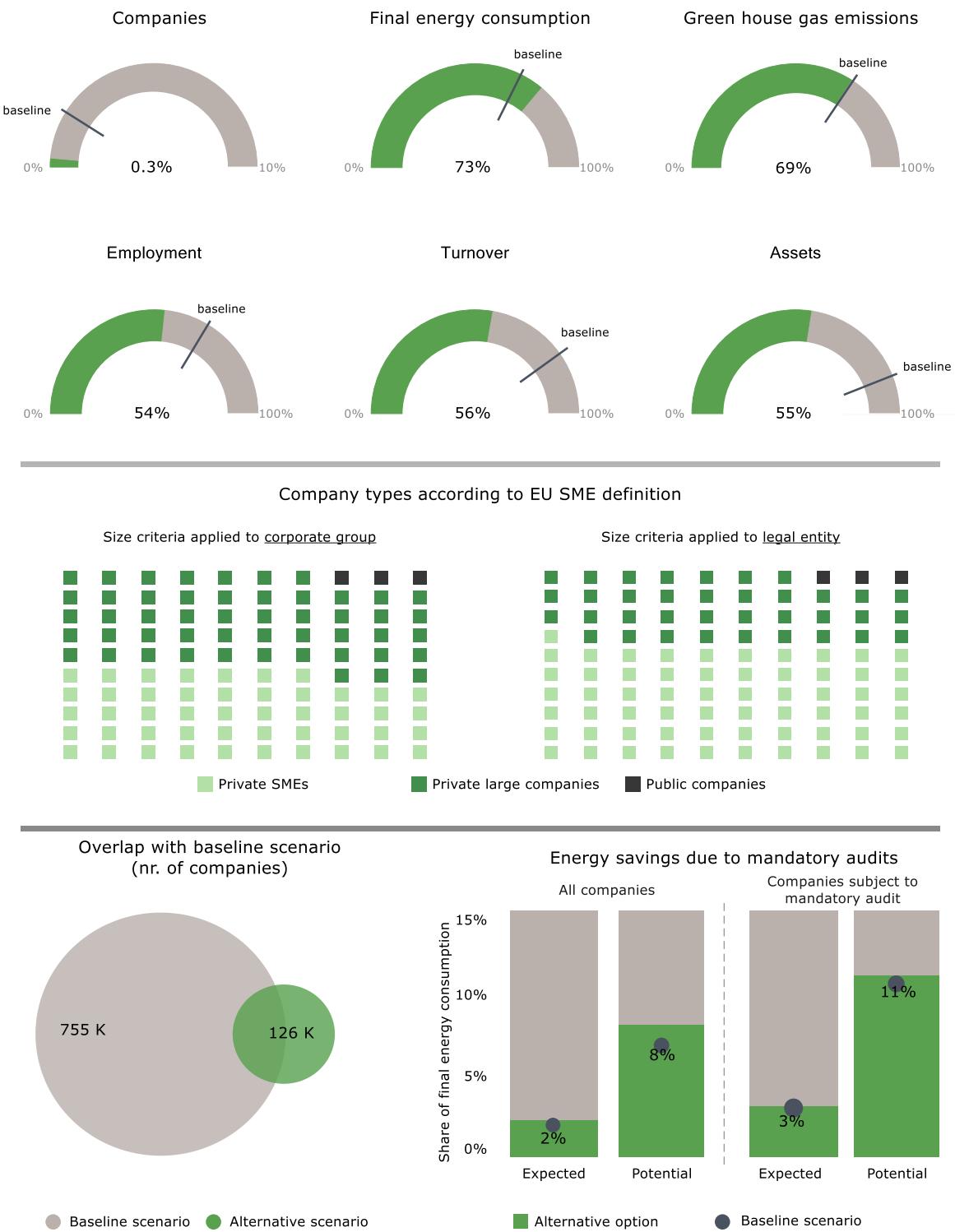
Regarding the socioeconomic indicators, companies under this option account for a lower share of employees, turnover and assets than under the baseline. The share of corporate employment related to the companies under Option 3B is estimated to be 54% (68% under the baseline). The share of total corporate turnover and assets under Option 3B is estimated at 56% and 55% respectively, compared with 80% and 88% under the baseline option.

Half of the companies under Option 3B (50%) would be classified as private large companies according to the size criteria laid down in EU Recommendation 2003/361 (corporate group perspective). Nevertheless, there are still about 47% of the companies that would also classify as SMEs, which are by definition excluded under the baseline option. Finally, about 3% of the companies would be classified as public companies, which compares with 6% under the baseline option. When applying the same size criteria to each individual entity instead of the corporate group, the share of private SMEs increases to 61%, while the share of private large companies declines to 36%. The share of large private companies at the entity level under Option 3B is about three times larger the share under the baseline option (12%), mostly due to relatively fewer large, private companies.

The overlap between the baseline option and Option 3B is relatively limited. Companies under Option 3B cover approximately 8% of the companies under the baseline. Differently stated, the companies under the baseline represent about half (52%) of all the companies within the scope of Option 3B.

The expected and potential energy savings under Option 3B are estimated to be in line with the baseline. The expected energy savings are 2% of total corporate energy consumption. The estimated potential savings (8%) are slightly higher than under the baseline (7%). When restricting the analysis of the savings to the companies within the scope of Option 3B, the expected energy savings are estimated to be about 3%, while the estimated potential savings are approximately 11%.

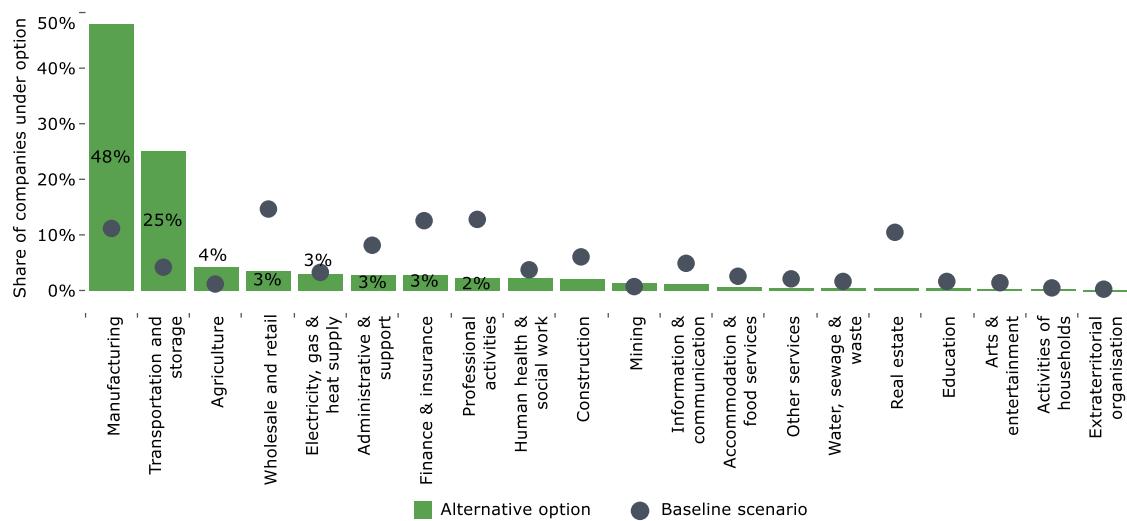
Figure 5.21 Overview of the key indicators for Option 3B



Source: CEPS' elaboration.

The large majority of the companies under Option 3B operate in two sectors, namely in the manufacturing sector (48%) and transportation and storage sector (25%).⁹³ Together these sectors account for 73% of the total companies under this option. There are five sectors that together account for 16% of the companies under Option 3B. These sectors are agriculture, wholesale and retail, electricity, gas and heat supply, administrative and support, and finance and insurance. Compared with the baseline scenario, Option 3B focuses on energy-intensive sectors. This explains the difference in the sectoral distribution compared with the baseline scenario. Sectors such as professional activities as well as financial and insurance account for a large share of economic activity. The energy consumption per unit of turnover, assets and employee is relatively low.

Figure 5.22 Sectoral distribution of companies within the scope of Option 3B

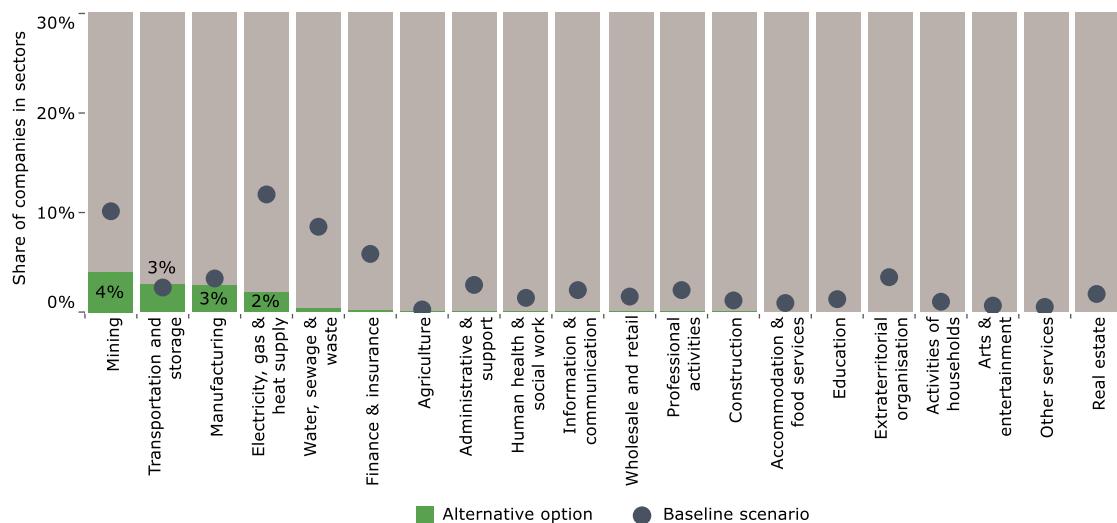


Source: CEPS' elaboration.

There is a significant share of companies in the mining sector, the transport and storage sector and the manufacturing sector covered under Option 3B. The shares of companies range between 4% and 3%, which less for the mining sector (10% under the baseline) and about the same for the transportation and the manufacturing sectors. Yet, for most sectors, the share of companies subject to mandatory energy audits is estimated to be equal to or less than 1% of the total number of companies operating in the sector. For all these sectors, this is less than under the baseline.

⁹³ Under Option 3B, the number of companies subject to conducting energy audits is likely to be underestimated for the sectors mining and quarrying, electricity, gas and heat supply. For consistency across policy options, the final energy consumption takes into consideration electricity, natural gas, gasoline, gasoil and fuel oil, and jet fuels. The underestimation is due to the fact that these two sectors employ a significant share of other energy carriers that are not considered in this study (see Section 2.6).

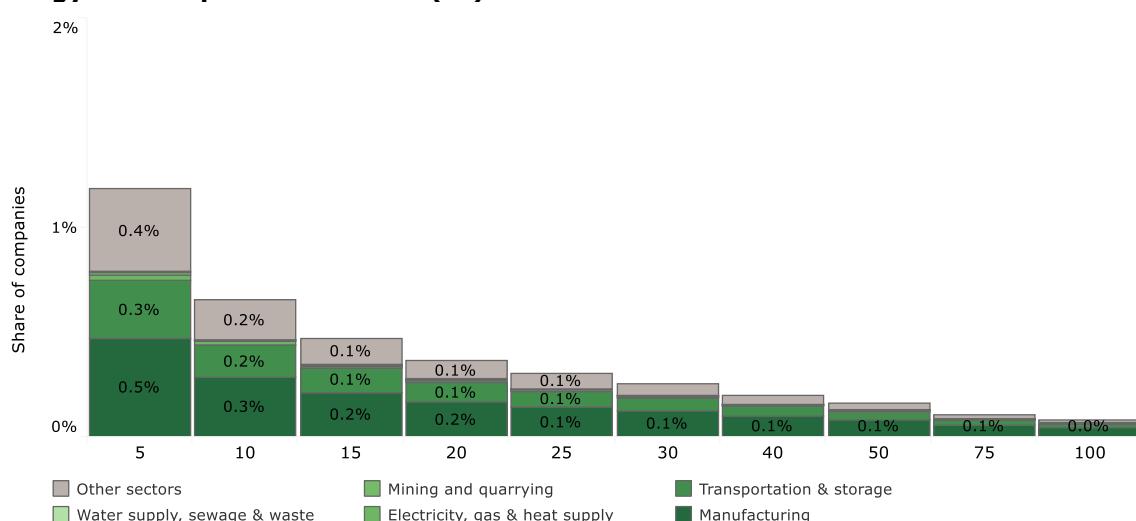
Figure 5.23 Companies within the scope of Option 3B, by sector



Source: CEPS' elaboration.

The fuel energy consumption threshold of 25 TJ assumed under this option could potentially be changed (see Figure 5.24). The number of companies under Option 3B would increase from 126 000 under the proposed threshold to 499 000 companies (1.2% of the total number of companies) if the annual primary energy-consumption threshold for mandatory energy audits was set at 5 TJ. This number would be approximately 276 000 (0.7%) if the threshold was 10 TJ. With a higher annual primary energy-consumption threshold of 30 TJ, the number of companies would decrease to 107 000 entities (0.3%). The number of companies covered would be approximately 67 000 (0.2%) if a threshold was set at 50 TJ. Finally, the number of companies covered would be approximately 34 000 (0.1%) with a primary energy threshold of 100 TJ.

Figure 5.24 Share of companies covered by Option 3B under alternative, primary energy-consumption thresholds (TJ)

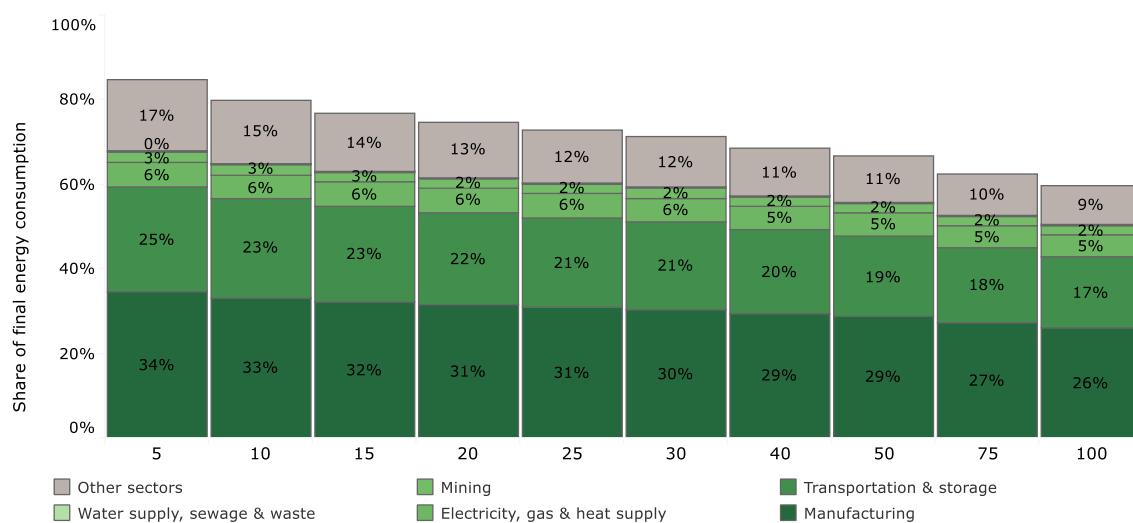


Source: CEPS (2020) elaboration.

Compared with the number of companies within the scope, the share of final energy consumption covered by Option 3B runs from 85% to 59%, with a change in the

threshold from 5 to 100 TJ (see Figure 5.25). This change in coverage of 26% is slightly less than that for Option 3A (change 27%). The relative importance of the sectors are fairly in line with policy Option 3A. In fact, with a threshold of 5 TJ, about a third and a fifth of the energy consumption would be related to manufacturing and transportation and storage respectively. If the threshold was set at 100 TJ, the share of energy consumption for the manufacturing sector would decrease to 26% and for the transportation and storage sector it would fall to 17%.

Figure 5.25 Share of final energy consumption covered by Option 3B under alternative, primary energy-consumption thresholds (TJ)



Source: CEPS (2020) elaboration.

5.4.2 Feasibility of the option

For Option 3B, energy authorities would only require information on the fuel consumption of companies. About 59% of the national energy authorities that participated in the interviews indicated that they did not have the required data, another 37% indicated that they had fuel consumption data readily available and another 12% reported that they could potentially obtain this information.

Overall, the feasibility of this option is very similar to Option 3A. Most of the authorities would have to obtain the fuel consumption information from energy audits, which can be out-dated and currently cover only a limited part of what would be within the scope of this option. The national energy authorities indicated that the processes and requirements to gather information on fuel consumption are comparable with the requirements for final energy consumption. In fact, a large share of the energy authorities would use final energy-consumption information to calculate the fuel consumption using conversion tables. In that sense, fuel consumption information is more difficult to obtain than final energy information (Option 3A).

Table 5.6 Indicators required to determine whether companies are within the scope of Option 3B

Indicator	Availability	Option 1 (Baseline)	Option 3B
Number of employees	High (82%)	X	
Total assets	High (76%)	X	
Turnover	High (88%)	X	
Sectoral Information	High (76%)	X	
Ownership information	Moderate (65%)	X	
Domestic majority owners (50-100%)	Moderate (53%)	X	
Domestic minority owners (25-50%)	Moderate (47%)	X	
Foreign/EU majority owners (50-100%)	Low (24%)	X	
Foreign/EU minority owners (25-50%)	Low (18%)	X	
Domestic majority owned subsidiaries (50-100%)	Moderate (56%)	X	
Domestic minority owned subsidiaries (25-50%)	Moderate (50%)	X	
Foreign/EU majority owned subsidiaries (50-100%)	Low (29%)	X	
Foreign/EU minority owned subsidiaries (25-50%)	Low (29%)	X	
Final energy consumption	Moderate (65%)		
Energy costs	Moderate (47%)		
Fuel consumption	Moderate (59%)		X
Overall		Hard (18%)	Moderate (59%)

Note: The availability in the table indicates the relative (potential) availability of the respective indicator among the national energy authorities interviewed for this study (%). The overall assessment at the bottom of the table provides an indication about the feasibility of the option based on the required indicator that is least available, which is presented in **bold**.

Source: CEPS

Compared with the baseline (see Table 5.6), the fuel consumption-based scope should be easier for the authorities to apply. If the authorities already have the required infrastructure and laws in place to collect data on fuel consumption, identifying the companies required to conduct audits would be easier. But, for most authorities this information would be very difficult to gather for all the companies within the scope.

5.4.3 Internal and external coherence

Option 3B is considered broadly more coherent with the objectives of the EED than the baseline scenario. Option 3B covers 75% fewer companies compared with the baseline but the shares of total energy consumption and GHG emissions increase respectively by 19% and 9%.

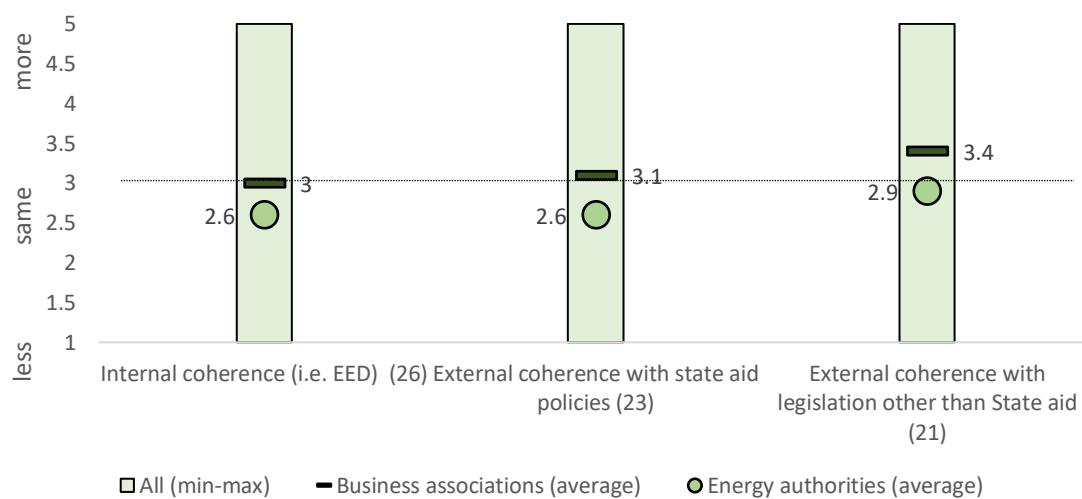
However, this option offers a high threshold (25 TJ), which would exclude large companies with less fuel consumption. It is also unclear whether the criterion includes energy production companies (e.g. power stations). Moreover, since companies often outsource transport and logistics to SMEs, a fuel threshold could send the wrong signal for companies' energy-consumption patterns. As observed for a case in Malta, a number of non-SMEs have elevated energy consumption, while their fuel consumption remains negligible, sometimes less than 10%. Applying a fuel threshold would exclude them from the scope of a mandatory audit.

A focus on the feedstock fuel leads to an assumption that no efficiency is needed at the level of consumption, particularly keeping in mind that renewable energy is often considered to be 'free' energy.

The impact on external coherence is ambiguous. On the one hand, the definition is completely different from the current SME definition that is used in various other legislation, including State Aid. On the other hand, the energy consumption-based target is more in line with other policies to reduce energy consumption and GHG emissions.

The GHG emissions reduction is unclear. Companies that have a high level of fuel consumption already fall under the obligation and have their own energy efficiency measures. A positive effect could result from consumption of more renewables, but should not be big in terms of overall annual GHG emissions.

Figure 5.26 Coherence with the EED goals of Option 3B compared with the baseline



Note: The figure above reflects the views of business associations and national energy authorities as expressed in the interviews. The rates indicate the coherence with the EED compared with the baseline, ranging from 1 – much less coherent to 5 – much more coherent.

Source: CEPS.

5.4.4 Effectiveness/efficiency for national authorities

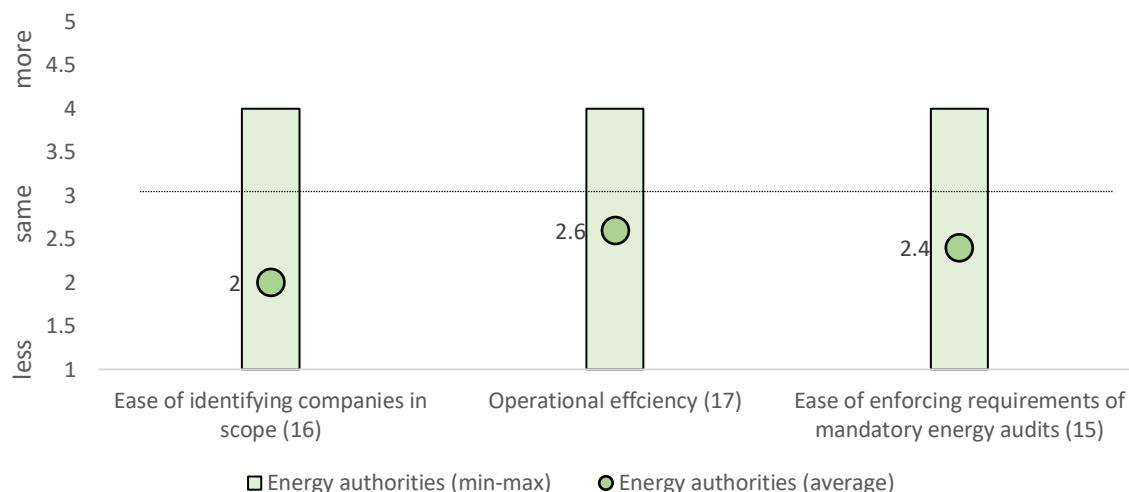
Identification and enforcement may be problematic because of a lack of required data on the fuel consumption of companies. About 59% of the national energy authorities that participated in interviews noted that they do not have the required data, and some mentioned that they have access only to generalised data at the sectoral level. This could require the creation of a separate database of companies with high levels of fuel consumption (above 25 TJ); additionally, one would need to convert final energy consumption to primary energy consumption.

Furthermore, many energy authorities obtain the fuel consumption data from energy audits if reported by companies. In most cases, companies report final energy consumption in heat and electricity bills. Most companies for which consumption is linked to the district heating are SMEs, which do not conduct mandatory energy audits.

Under Option 3B, they would likely fall under the obligation, and energy authorities would not be able to use conversion rates since they do not have any information on their energy consumption.

Since in most cases authorities do not have access to the fuel consumption of enterprises, they would have to rely solely on what is declared by the enterprises with no possibility to verify it.

Figure 5.27 Effectiveness/efficiency for national authorities of Option 3B compared with the baseline



Note: The figure above reflects the views of national energy authorities as expressed in the interviews. The rates indicate the effectiveness/efficiency for national authorities compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

5.4.5 Effectiveness/efficiency for companies

The ease of identifying whether a company is within the scope may be adversely affected since companies, even knowing how much they consume, may not know the power mix, and the fuel mix varies daily depending (among others) on coal and gas prices. It is difficult to control a company's primary energy consumption, as all energy generated is sold into a pool and all suppliers purchase from that pool. Therefore, the ratio of primary fuel to final energy consumption depends on whether it has been generated at the margin or on average with fossil fuel and renewables.

In terms of a level playing field, Option 3B sets different obligations for companies that have high fuel consumption and companies that consume many other forms of energy. It disadvantages electricity consumers against fuel users, because at least with fuel a company could switch to, for example, a more energy-efficient electricity boiler. Even so, when a company uses electricity directly, it can only expect steps in increasing the efficiency of power consumption, which is a final energy use instead of a primary one.

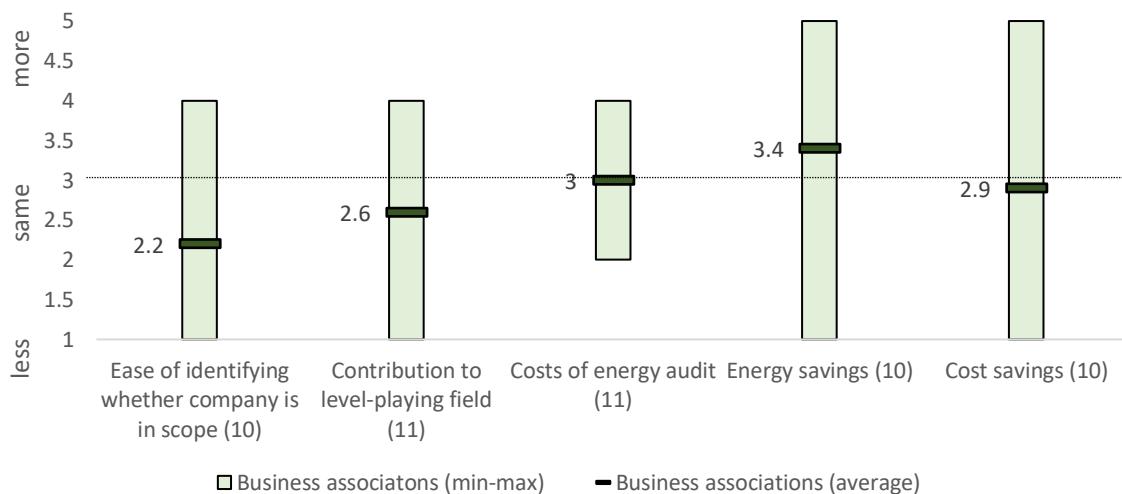
Additionally, this option could disproportionately hit companies in the transportation sector and enterprises that have a fleet of vehicles (not subcontracted vehicles, as they have to be audited according to the EED). At the same time, there are many large enterprises that consume a lot of energy but do not have many vehicles. While transport and fuel consumption usually make up the largest part of total energy consumption of enterprises (up to 50%), the 25 TJ threshold may be excessively high. An enterprise

usually has a fleet of around 20 vehicles, which comes to 1-2 MW of fuel consumption or 0.004–0.01 TJ.

The cost of conducting energy audits would make administration even more complex, as auditors would have to survey the energy market.

More companies would have to do energy audits, so there would be more energy savings.

Figure 5.28 Effectiveness/efficiency for enterprises of Option 3B compared with the baseline



Note: The figure above reflects the views of business associations as expressed in the interviews. The rates indicate the effectiveness/efficiency for business associations compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

5.4.6 SWOT analysis

Based on the assessment of the various relevant elements of the option in previous sections, the table below summarises the key strengths, weaknesses, opportunities and threats of Option 3B in comparison with the baseline scenario.

Table 5.7 Summary SWOT analysis for Option 3B

	Strengths	Weaknesses
Internal	<ul style="list-style-type: none"> Criteria are linked to the energy objective of the legislation Scope is the same across Member States (i.e. internal coherence) Fewer energy audits are required Fewer indicators are necessary to determine the companies within the scope A relatively larger share of the corporate final energy consumption and GHG emissions are covered 	<ul style="list-style-type: none"> The definition requires indicators that are not already used for legislative purposes The required indicators will in many cases be derived from the final energy consumption (Option 3A) Legal structure of a company will affect whether a company is within the scope (i.e. level playing field) A much smaller share of the corporate employment, turnover and assets are covered
External	<ul style="list-style-type: none"> The expected and potential energy savings are likely to be higher With more energy savings the GHG emissions are also likely to be reduced more It is relatively difficult for national energy authorities and companies to determine the companies within the scope Energy audits will cover more energy-intensive companies for which the energy audits are more cost-effective If available, the national energy authorities are more likely to apply the selection criteria consistently (i.e. level playing field) and enforce the audit requirement 	<ul style="list-style-type: none"> The required energy-based size criteria are more difficult to obtain for companies than accounting-based and final energy consumption-based indicators The indicators required to determine companies within the scope are only available to national authorities in some Member States and some of the companies Less external coherence by providing a different definition compared with State Aid If not available, the national energy authorities are unable to apply the selection criteria consistently (i.e. distortion of the level playing field) and enforce the audit requirement

5.5 Option 3C: energy cost definition

Option 3C assumes a selection of companies based on the energy consumed at the entity level. More specifically, companies that exceed an **energy cost of EUR 200 000 per year** are considered to be subject to mandatory energy audits under this option.

5.5.1 Companies within the scope

This option covers an estimated 141 000 entities, which represents approximately 0.3% of companies active in the EU-28. This means that the number of companies within the scope of Option 3C is approximately 81% lower than under the baseline.

Despite far fewer companies being within the scope, the estimated corporate final energy consumption covered by the companies under Option 3C is higher than that of the baseline. Companies under this option are responsible for 71% of the final energy consumption, compared with 65% under the baseline. Meanwhile, the share of corporate GHG emissions of companies under this option is estimated at 68%, which is substantially in line with the baseline (69%).

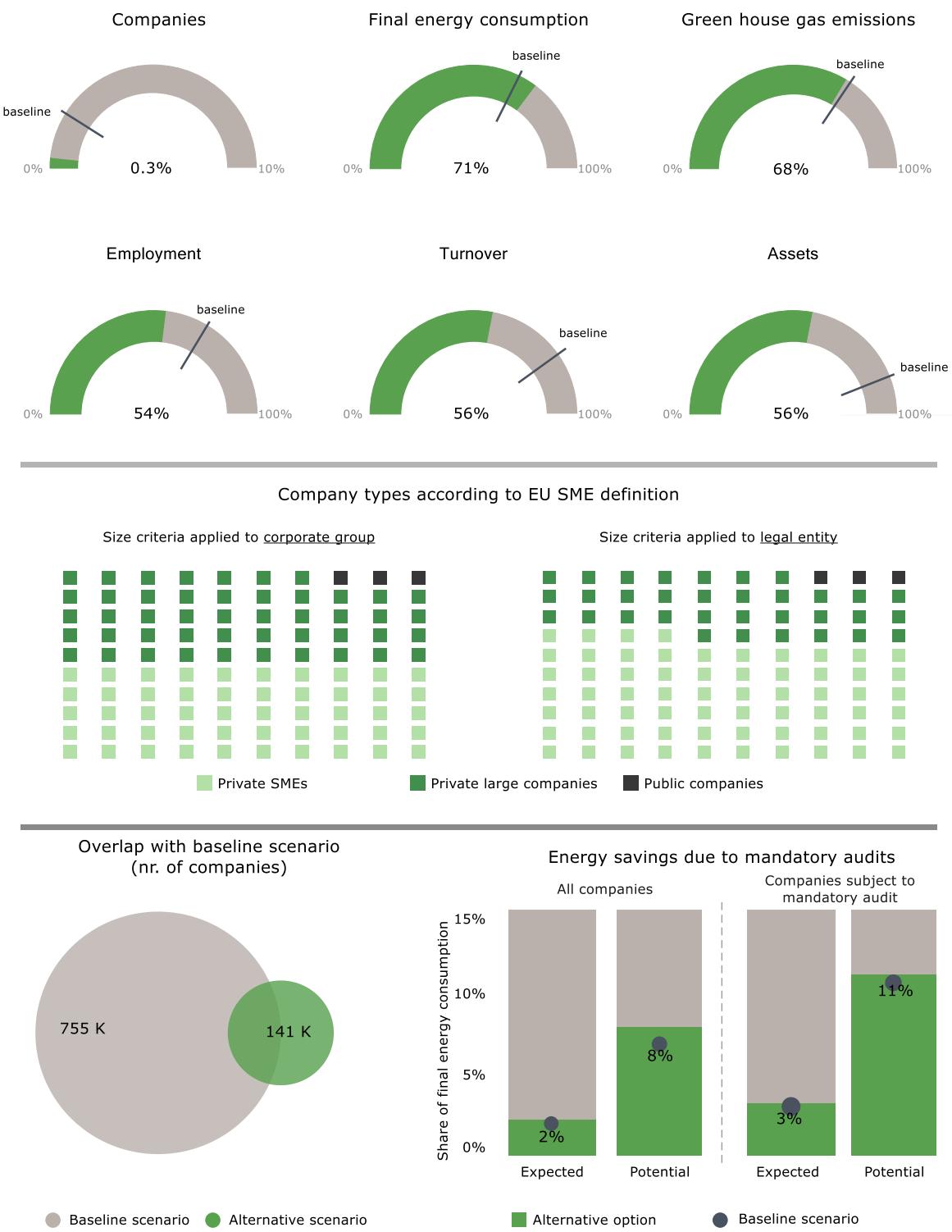
The companies covered under Option 3C account for 54% of the total corporate employment, and for a slightly larger share of corporate turnover (56%) and assets (56%). These shares are significantly lower than under the baseline option, where companies account for 68% of total corporate employment and for 80% and 88% of corporate turnover and corporate assets respectively.

According to the size criteria defined in EU Recommendation 2003/361 (corporate group perspective), the companies under Option 3C would be almost equally split between private SMEs (50%) and private large companies (47%). The remaining 3% of the companies would be public companies. The share of SMEs under Option 3C would be much higher compared with the baseline scenario, in which all companies are by definition non-SMEs. When applying the size criteria at the legal entity level, the share of private SMEs increases to 64%, compared with 82% under the baseline scenario. In turn, the share of private large companies is 33%, compared with 12% under the baseline scenario. The share of public companies at the entity level is the same as at the corporate group level.

The companies under Option 3C partially overlap with the baseline. More specifically, an estimated 9% of the companies under the baseline would also fall into the scope of Option 3C. These companies represent about half of the companies under Option 3C.

This option is estimated to result in higher energy savings compared with the baseline. The expected energy savings are estimated to be around 2% of total corporate energy consumption. The potential savings are estimated at 8%, somewhat higher than under the baseline (7%). When focusing only on the set of companies under Option 3C, the expected energy savings are estimated to be 3% of the total energy consumption of the companies in question, while the estimated potential savings are about 11%, in line with the baseline.

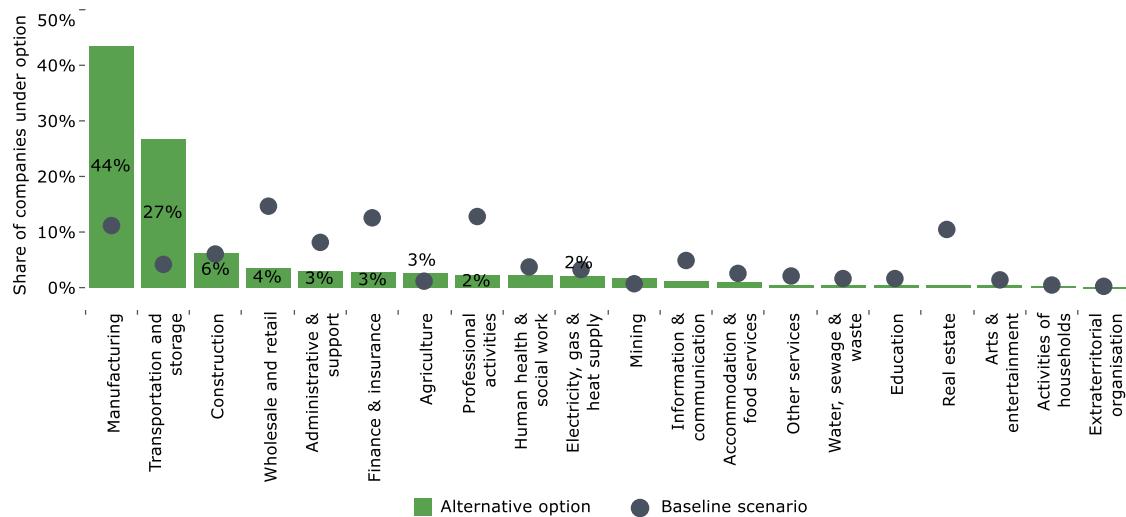
Figure 5.29 Overview of the key indicators for Option 3C



Source: CEPS' elaboration.

Under Option 3C, the large majority of companies subject to mandatory energy audits operate in the manufacturing sector (44%) and in the transportation and storage sector (27%). Together, the companies in these sectors account for about 71% of the companies under Option 3C, compared with 15% under the baseline option. In comparison with the baseline, the largest decreases are registered in the wholesale and retail, finance and insurance, professional activities and the real estate sectors, which account for 10% of the companies under this policy option and the majority of the companies under the baseline (50%).

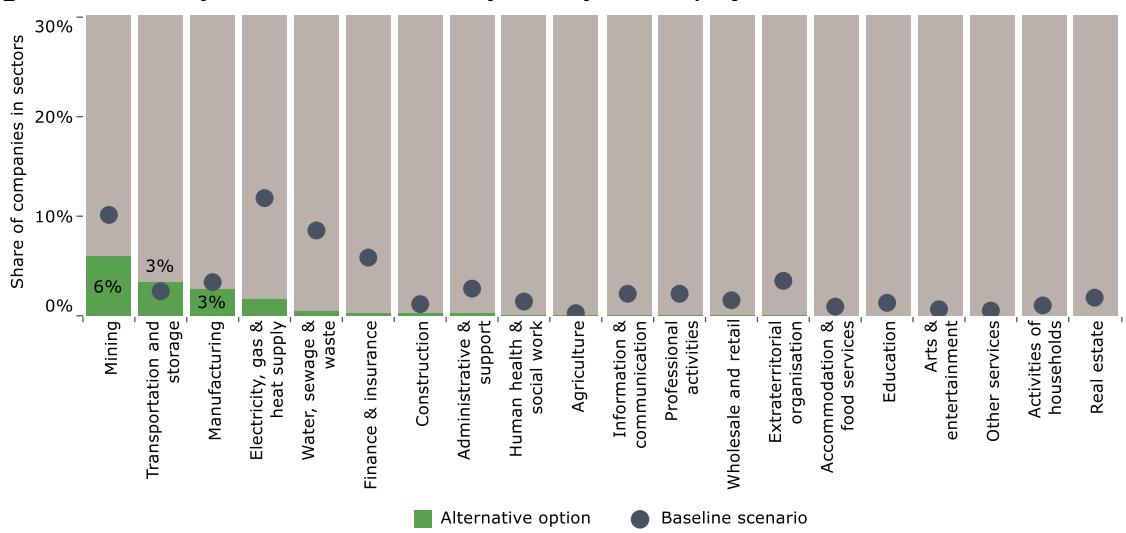
Figure 5.30 Sectoral distribution of companies within the scope of Option 3C



Source: CEPS' elaboration.

The share of companies subject to energy audits under Option 3C is estimated to be less than 1% for all sectors except for mining (6%), transport and storage (3%), manufacturing (3%) and electricity, gas and heat supply (2%). The share of companies in each of the sectors is less than under the baseline.

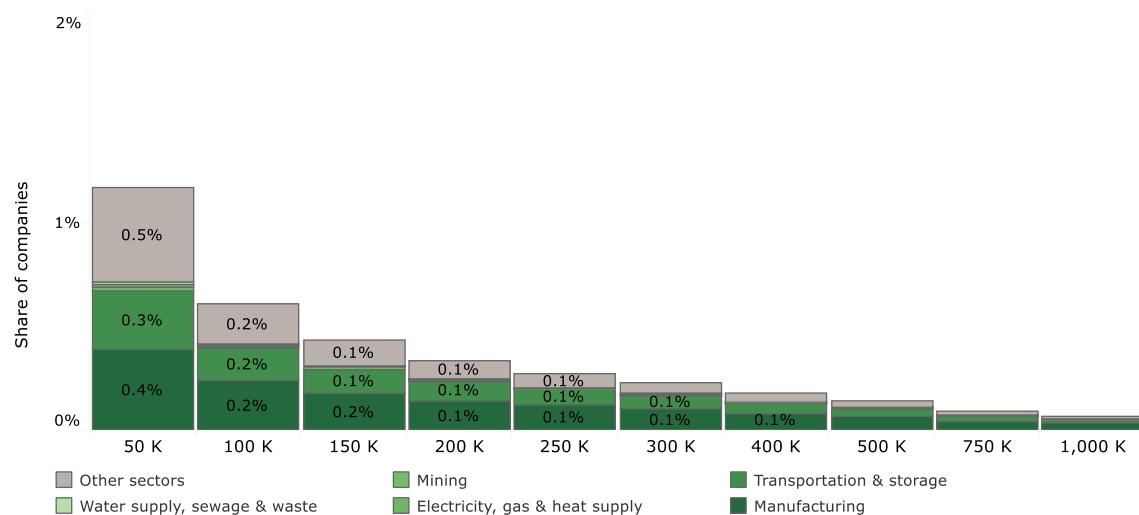
Figure 5.31 Companies within the scope of Option 3C, by sector



Source: CEPS' elaboration.

The energy-cost threshold influences the number of companies within the scope of Option 3C. The number of companies subject to energy audits would increase under the proposed threshold from 141 000 to 489 000 companies (1.2% of the total number of companies) if the energy costs was set at EUR 50 000 (see Figure 5.32). The total number of companies within the scope would decrease to 256 000 units (0.6%) if the threshold was EUR 100 000 and would further decline to 185 000 (0.4%) with a threshold of EUR 150 000. If this was set at EUR 500 000, the number of companies covered would be approximately 110 000 (0.2%).

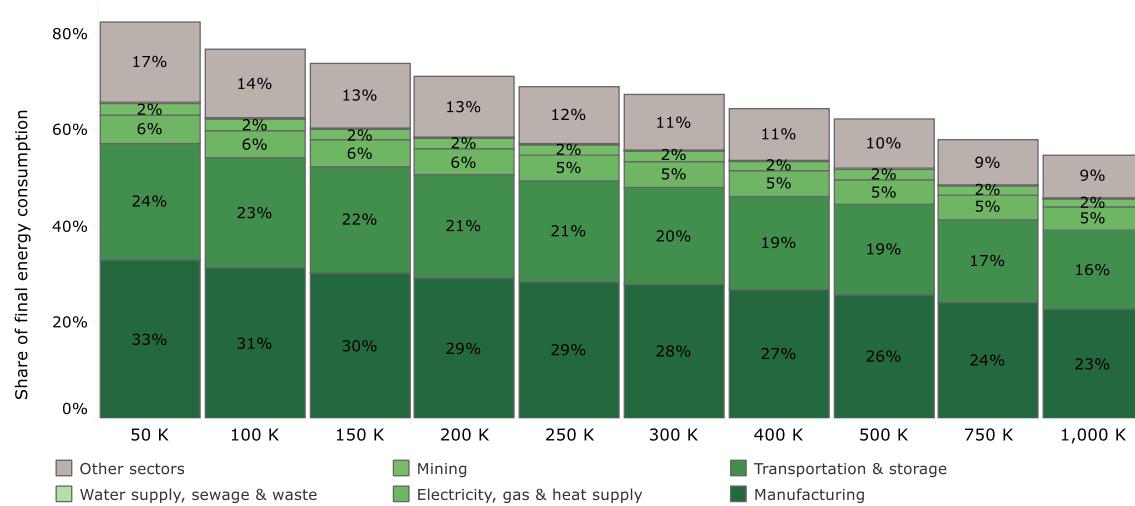
Figure 5.32 Share of companies covered under alternative thresholds for the total energy bill (EUR)



Source: CEPS (2020) elaboration.

The differences between the various thresholds are much smaller when looking at the share of final energy consumption that these companies represent (see Figure 5.33). The share of final energy consumption covered under Option 3C reduces from 82% to 55% if the threshold is increased from EUR 50 000 to EUR 1 000 000. More specifically, with a EUR 50 000 threshold, the share of final energy consumption covered by this option would be 82% of the corporate final energy consumption. If the annual energy cost threshold was set at EUR 1 000 000, then it is estimated that the share of final energy consumption would be 55%. For comparison purpose, the baseline option covers about 65% of the total energy consumption.

Figure 5.33 Share of final energy consumption covered by Option 3C under alternative thresholds for the total energy bill (EUR)



Source: CEPS (2020) elaboration.

5.5.2 Feasibility of the option

To determine whether companies are within the scope of Option 3C the national energy authorities require information on the energy costs of companies. About half of the authorities indicated that they could get this information (47%). They either already have this information (41%) or they could potentially obtain access to it (6%). They either do not know if the data are available to them or know that they are not available.

Similar to the other energy-consumption options (3A and 3B), for most of the energy authorities this information is not accessible, unless they derive it from past audits. Gathering information on energy costs requires infrastructure and legal requirements for companies to provide it to the authorities, which are not always in place.

Additionally, it is difficult to obtain reliable information on energy costs. The main issue indicated by the authorities in the interviews is that energy suppliers charge different rates to different customers, for example depending on the size of the company. Furthermore, the energy prices tend to fluctuate over time. This could be solved by using norm prices or calculating averages over a period of time. Yet, that would bring this option close to the other energy-consumption options.

Table 5.8 Indicators required to determine whether companies are within the scope of Option 3C

Indicator	Availability	Option 1 (Baseline)	Option 3C
Number of employees	High (82%)	X	
Total assets	High (76%)	X	
Turnover	High (88%)	X	
Sectoral Information	High (76%)	X	
Ownership information	Moderate (65%)	X	
Domestic majority owners (50-100%)	Moderate (53%)	X	
Domestic minority owners (25-50%)	Moderate (47%)	X	
Foreign/EU majority owners (50-100%)	Low (24%)	X	
Foreign/EU minority owners (25-50%)	Low (18%)	X	
Domestic majority owned subsidiaries (50-100%)	Moderate (56%)	X	
Domestic minority owned subsidiaries (25-50%)	Moderate (50%)	X	
Foreign/EU majority owned subsidiaries (50-100%)	Low (29%)	X	
Foreign/EU minority owned subsidiaries (25-50%)	Low (29%)	X	
Final energy consumption	Moderate (65%)		
Energy costs	Moderate (47%)		X
Fuel consumption	Moderate (59%)		
Overall		Hard (18%)	Moderate (47%)

Note: The availability in the table indicates the relative (potential) availability of the respective indicator among the national energy authorities interviewed for this study (%). The overall assessment at the bottom of the table provides an indication about the feasibility of the option based on the required indicator that is least available, which is presented in **bold**.

Source: CEPS

This option seems to be easier for national authorities to use than the baseline, but still difficult to obtain for many national authorities (see Table 5.8). Indeed, information on only one indicator is needed to determine whether companies are within the scope of Option 3C, which is easier than the many indicators (including ownership information) that are required for the baseline. Though, there are also many indicators under the baseline that would be easier to obtain (e.g. number of employees, total assets and turnover). In comparison with the other energy options, this option is more difficult for the authorities to apply, due to some methodological challenges (e.g. the volatility of energy costs, which may be more pronounced than the volatility of energy or fuel consumption).

5.5.3 Internal and external coherence

Option 3C is considered broadly less coherent with the objectives of the EED than the baseline scenario. Option 3C covers approximately 83% fewer companies than under the baseline; however, final energy consumption is approximately 6% higher.

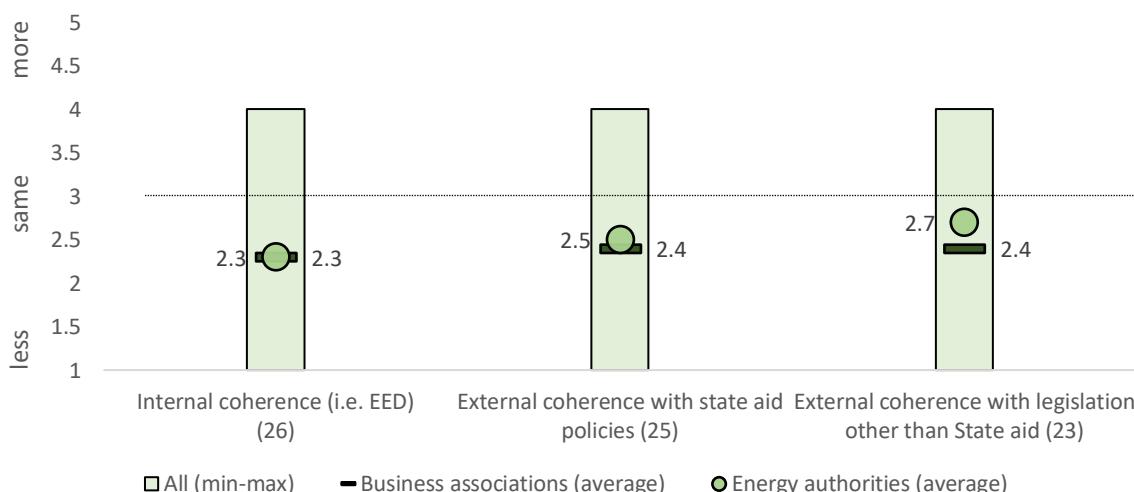
The main concern mentioned during the interviews was the volatility of energy prices and their differences across and within Member States. Also, cost by itself does not give a clear indication of the size of the company and the energy efficiency potential it can achieve. Energy prices can change 20–30% from one year to the other because of the fluctuations of global energy prices. Therefore, a company can be excluded from the audit obligation even if consumption increases, if energy prices are going down. In

addition, in the electricity bill, the fuel bill could be a very small component, as public service obligation and network charges are growing in proportion. Moreover, the bigger the company the lower the energy price it can negotiate with the supplier. For all these reasons, Option 3C might be less coherent. One respondent suggested that if such a criterion was applied, then would be preferable for an “energy cost/total operational cost” threshold to be used.

The threshold (EUR 200 000 per year) may also be too high. There might be fewer companies obliged to conduct energy audits and hence there would be more savings and it would be more coherent with the EED.

This option is relatively less externally coherent than the baseline scenario, because it is not directly related to the SME definition, which is relevant for State Aid purposes.

Figure 5.34 Coherence with the EED goals of Option 3C compared with the baseline



Note: The figure above reflects the views of business associations and national energy authorities as expressed in the interviews. The rates indicate the coherence with the EED compared with the baseline, ranging from 1 – much less coherent to 5 – much more coherent.

Source: CEPS.

5.5.4 Effectiveness/efficiency for national authorities

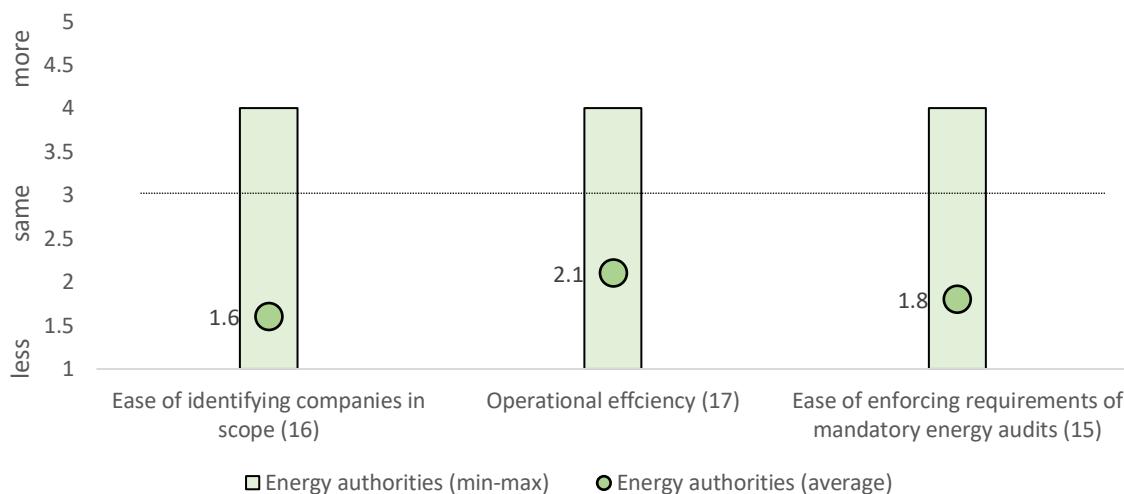
Identifying companies within the scope could be difficult when most of the energy authorities have no access to the data, unless they derive them from past audits. The lack of data regarding energy costs as well as the restrictions on sharing data due to confidentiality are major drawbacks. In many cases, there would be a need to establish new legal requirements and separate databases for companies in order to provide this information.

What is more, the energy price is volatile, and some companies generate their own energy. That makes it difficult to determine energy costs, frequently even for companies themselves. Information on electricity can be obtained from companies, but for transport companies and those with district heating it would be more complicated to gather. In addition, it would be very difficult to assess the accuracy of the data because of significant variations in what is paid per unit of energy.

In terms of operational efficiency, this option could be easier in comparison with the baseline, since the indicator could be determined from energy invoices without checking financial thresholds. But validation of the results could reduce operational efficiency.

Regarding enforcement, the authorities may have less control over the accuracy of the information, and would depend on the data provided by companies.

Figure 5.35 Effectiveness/efficiency for national authorities of Option 3C compared with the baseline



Note: The figure above reflects the views of national energy authorities as expressed in the interviews. The rates indicate the effectiveness/efficiency for national authorities compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

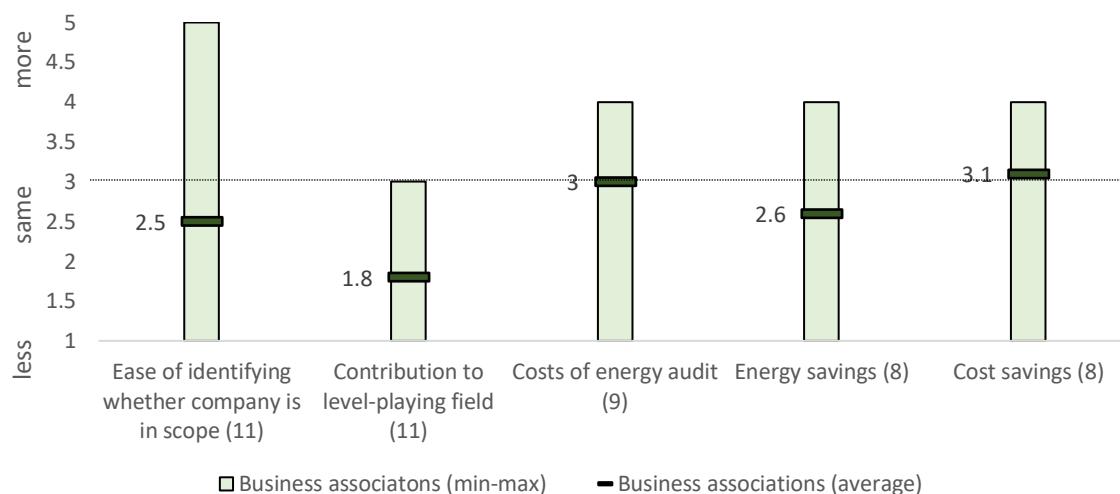
Source: CEPS.

5.5.5 Effectiveness/efficiency for companies

For companies, it may not be easy to identify whether they are within the scope since the total energy costs may be difficult to determine. These costs could include the connection, energy use, balancing, participation in the markets and penalties for the factor of electricity. In some Member States, the subsidies offered for energy-intensive sectors should be accounted for. Additionally, in most cases, energy costs are confidential information which companies remain reluctant to share.

The level playing field is likely to be affected given the difference in energy prices across and within Member States depending on company size, type of energy connector and whether they produce their own energy. What also needs to be taken into account is price volatility across countries and across time. This volatility, particularly across time (i.e. before/after lockdown) could result in more complexities in the system. On top of that, different enterprises have different prices for energy – it depends on the deal negotiated with the provider. This could lead to a risk that enterprises would prefer to strike better deals and optimise purchases rather than reduce energy consumption (the more consumed, the lower the price). Linked and partner enterprises could achieve lower prices as affiliates of larger groups compared with autonomous enterprises, which would hurt the level playing field.

Figure 5.36 Effectiveness/efficiency for enterprises of Option 3C compared with the baseline



Note: The figure above reflects the views of business associations as expressed in the interviews. The rates indicate the effectiveness/efficiency for business associations compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

5.5.6 SWOT analysis

Based on the assessment of the various relevant elements of the option in previous sections, the table below summarises the key strengths, weaknesses, opportunities and threats of Option 3C in comparison with the baseline scenario.

Table 5.9 Summary SWOT analysis for Option 3C

	Strengths	Weaknesses
Internal	<ul style="list-style-type: none"> Criteria are linked to the energy objective of the legislation Scope is the same across Member States (i.e. internal coherence) Fewer energy audits are required Fewer indicators are necessary to determine the companies within the scope A relatively larger share of the corporate final energy consumption is covered 	<ul style="list-style-type: none"> Definition requires indicators that are not already used for legislative purposes Energy costs are volatile and different across countries, sectors, energy carriers and companies, which decreases predictability (i.e. distortion of the level playing field) Legal structure of a company will affect whether a company is within the scope (i.e. level playing field) A relatively smaller share of GHG emissions is covered A much smaller share of the corporate employment, turnover and assets are covered

	Opportunities	Threats
External	<ul style="list-style-type: none"> • The expected and potential energy savings are likely to be higher • With more energy savings the GHG emissions are also likely to be reduced more • Energy audits will cover more energy-intensive companies for which the energy audits are more cost-effective • If available, the national energy authorities are more likely to apply the selection criteria consistently (i.e. level playing field) and enforce the audit requirement 	<ul style="list-style-type: none"> • The required energy-based criteria are more difficult to obtain for companies than accounting indicators, but should be available notwithstanding challenges with the definition • Energy costs are volatile, making the conduct of the energy audit for some companies less predictable • The indicator required to determine companies within the scope are only available to national authorities in some Member States and some of the companies • It is relatively much more difficult for national energy authorities and companies to determine the companies within the scope • Less external coherence by providing a different definition compared with State Aid • If not available, the national energy authorities are unable to apply the selection criteria consistently (i.e. distortion of the level playing field) and enforce the audit requirement

5.6 Option 4A: thresholds depending on sector energy intensity

Option 4A combines the indicators from the other policy options. More specifically, this option assumes that the thresholds are based on the energy intensity of the sector. The more energy intensive the sector is, the lower the thresholds (number of employees, turnover and assets).

5.6.1 Companies within the scope

Under this option, the number of companies subject to mandatory energy audits amount to 56 000 (see Figure 5.37). This is 92% lower than the number of companies covered under the baseline.

These companies account for a relatively smaller share of the other indicators compared with the baseline. These companies account for 55% of the final energy consumption and 52% of the GHG emissions (65% and 69% under the baseline).

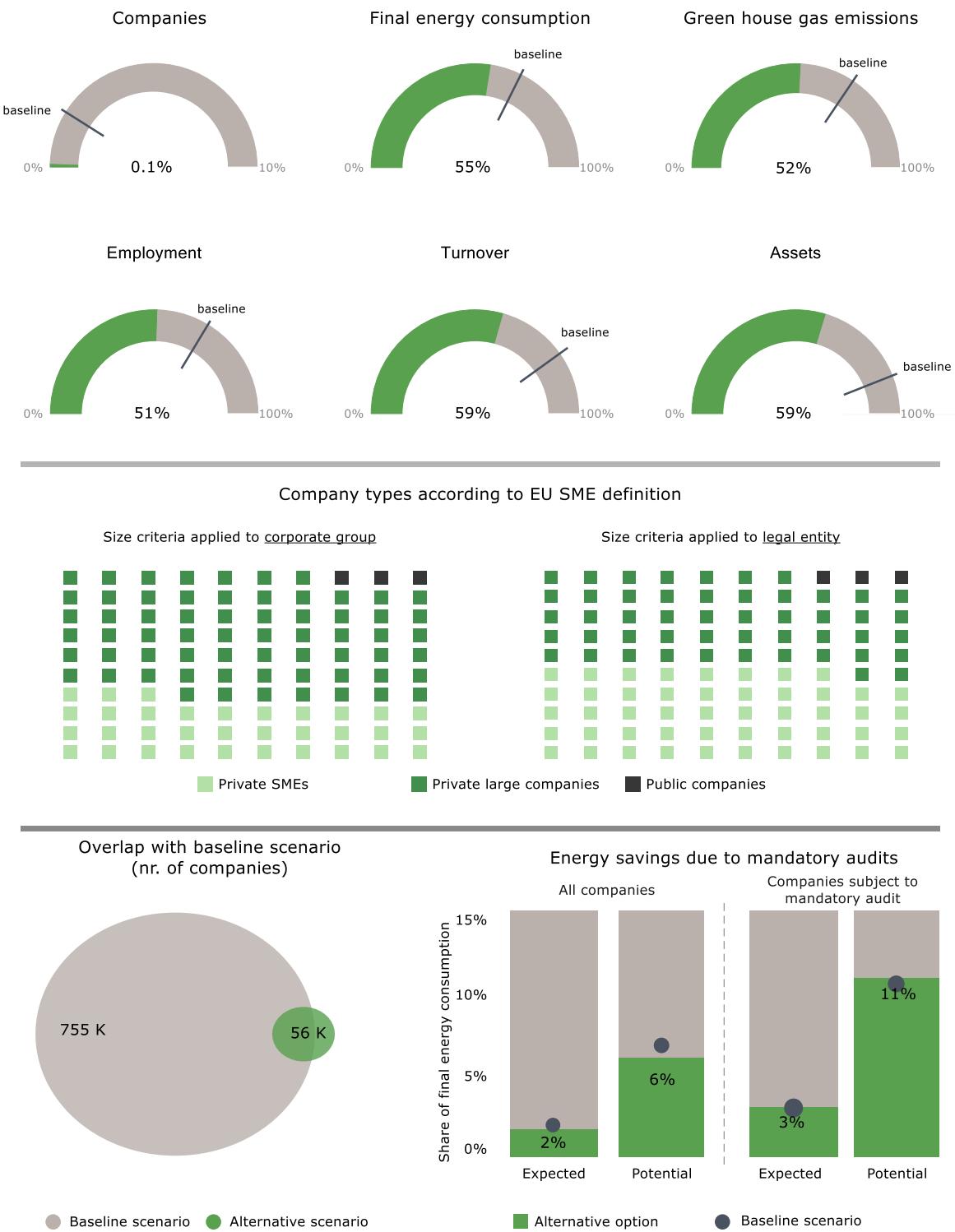
The shares of socioeconomic indicators covered by this option are also significantly lower than under the baseline. The companies under Option 4A are accountable for 51% of the total number of corporate employees (68% under the baseline). About 59% of the total corporate turnover is covered, compared with 80% under the baseline. The largest difference is found in assets. This option covers 59% of all corporate assets, while the baseline covers about 88%.

About two thirds of the companies meet the criteria for large companies as defined in EU Recommendation 2003/361 (corporate group perspective). A further roughly 33% are considered private SMEs, while the remaining 3% are publicly owned. The baseline consists by definition of just non-SMEs. Applying the same criteria at the legal entity level, the share of private large companies is about 49% (12% under the baseline). The share of private SMEs is estimated at 48% (82% under the baseline), while the share of public companies, at 3%. The share of public entities remains the same regardless of the definition and it is slightly lower than the baseline (6%).

There is a large overlap between Option 4A and the baseline. Of the companies identified under Option 4A, about 67% are also covered under the baseline. The share of companies covered under Option 4A and the baseline account for about 5% of all baseline companies.

The expected and potential energy savings under this option are slightly less than baseline scenario. The expected energy savings for all companies are estimated to be around 2%, which is about the same as under the baseline. Moreover, the potential energy savings across all companies amount to 6%, which is slightly lower than the baseline (7%). Considering only the companies covered under this option, the expected savings are estimated at 3% and potential savings at around 11%. These values are roughly identical to the baseline scenario.

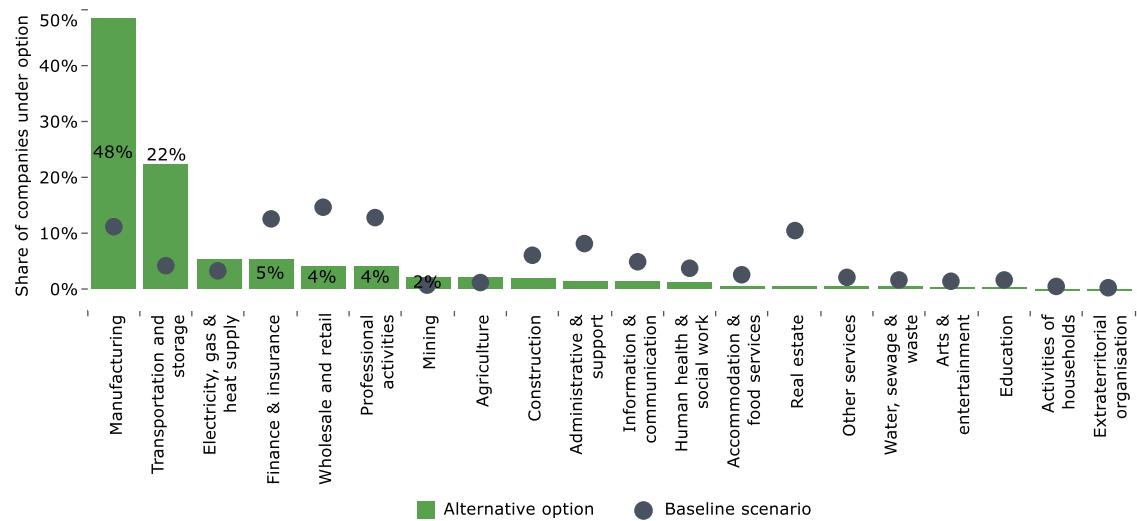
Figure 5.37 Overview of the key indicators for Option 4A



Source: CEPS' elaboration.

The large majority of the companies under Option 4A are concentrated in two sectors (see Figure 5.38). The manufacturing sector (48%) and transport and storage sector (22%) alone account for 70% of the companies under Option 4A. The remaining companies belong mostly to electricity, gas and heat supply, finance and insurance, wholesale and retail and professional activities. Each of these sectors accounts for between 4% and 5% of the companies under this option. The sectoral distribution of companies within the scope of Option 4A is less heterogeneous than the baseline and more skewed towards the two sectors representing the vast majority of companies. The share of companies belonging to the manufacturing sector is higher than in the baseline scenario (from 11% to 48%). The same applies to the transportation and storage sector (from 4% to 22%). The shares of the companies covered in the remaining sectors are, in almost all cases, lower than under the baseline.

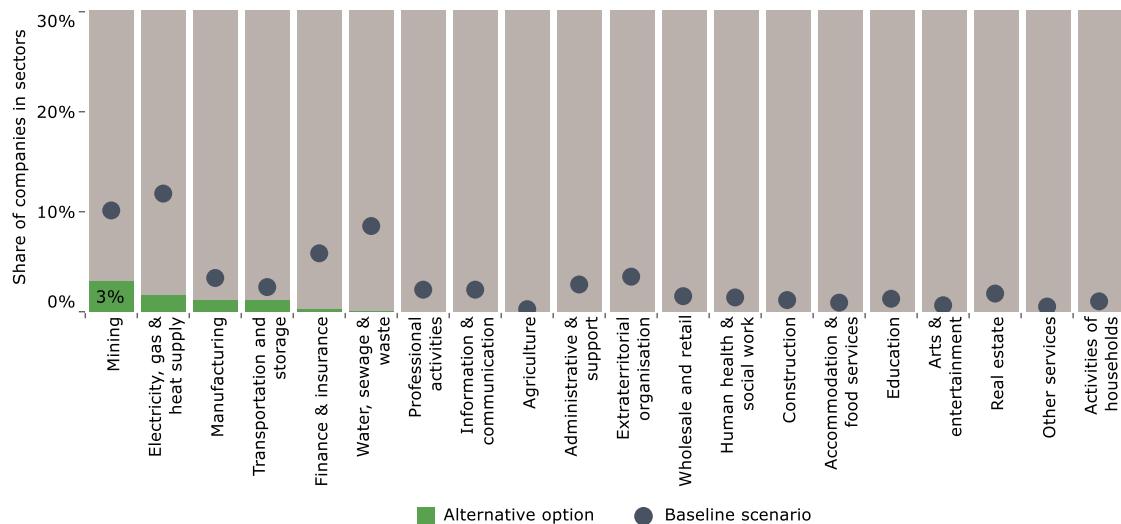
Figure 5.38 Sectoral distribution of companies within the scope of Option 4A



Source: CEPS' elaboration.

The share of companies covered in each sector is less than under the baseline (see Figure 5.39). Option 4A covers 3% of the companies in the mining sector and less than 2% of every other sector. The smaller share of companies under the option than under the baseline is almost entirely due to a smaller number of companies included.

Figure 5.39 Companies within the scope of Option 4A, by sector



Source: CEPS' elaboration.

5.6.2 Feasibility of the option

This option requires information on the size indicators (number of employees, total assets, turnover) and sector. The size indicators are the same as for Option 2. Most authorities have access to these indicators either via the national authorities or public registry. In fact, among authorities, only about 12% (turnover) to 24% (number of employees and total assets) of them either do not have access or do not know if they have access to such information. Additionally, this option also requires sectoral information for all companies instead of just those controlled by natural persons. The vast majority of authorities already have this information available to them or could potentially obtain it. The remaining 24% either do not know if this information is available or know that it is not available.

Although the sectoral indicator is widely available, there are concerns about the quality. It is often difficult to classify the sector in which a company is active. This is mainly because companies are often active in more than one sector. Moreover, the ownership data may be out of date or incorrect for some companies, as the data providers often only report the shareholders for a single date and based on various (non-official) sources.

Table 5.10 Indicators required to determine whether companies are within the scope of Option 4A

Indicator	Availability	Option 1 (Baseline)	Option 4A
Number of employees	High (82%)	X	X
Total assets	High (76%)	X	X
Turnover	High (88%)	X	X
Sectoral Information	High (76%)	X	X
Ownership information	Moderate (65%)	X	
Domestic majority owners (50-100%)	Moderate (53%)	X	
Domestic minority owners (25-50%)	Moderate (47%)	X	
Foreign/EU majority owners (50-100%)	Low (24%)	X	
Foreign/EU minority owners (25-50%)	Low (18%)	X	
Domestic majority owned subsidiaries (50-100%)	Moderate (56%)	X	
Domestic minority owned subsidiaries (25-50%)	Moderate (50%)	X	
Foreign/EU majority owned subsidiaries (50-100%)	Low (29%)	X	
Foreign/EU minority owned subsidiaries (25-50%)	Low (29%)	X	
Final energy consumption	Moderate (65%)		
Energy costs	Moderate (47%)		
Fuel consumption	Moderate (59%)		
Overall		Hard (18%)	Easy (76%)

Note: The availability in the table indicates the relative (potential) availability of the respective indicator among the national energy authorities interviewed for this study (%). The overall assessment at the bottom of the table provides an indication about the feasibility of the option based on the required indicator that is least available, which is presented in **bold**.

Source: CEPS

Given that this option is very similar to Option 2, a similar conclusion can be drawn when comparing it with the baseline scenario (see Table 5.10). As the size criteria are only required for domestic entities and not for linked and/or partner entities as in Option 1, accessing the required information is much easier. Similarly, no information on either domestic or foreign ownership is required. Sectoral information is also easily available, with the only drawbacks being issues related to the classification of companies and data quality.

5.6.3 Internal and external coherence

Option 4A focuses on energy-intensive sectors, targeting companies with higher energy consumption. Primarily, it targets the manufacturing sector (46%) and transport and storage sector (27%). The identification of sectors can vary across Member States, i.e. some sectors can be merged (for example, chemicals, machinery et al. as the industry). Depending on the size of sectors across Member States, thresholds can be too high (or too low) for individual Member States.

For instance, there might be firms within the non-metallic mineral sector that are distributors and thus not energy intensive, but they would fall under the obligation given these requirements. In addition, there could be unusual ad hoc classification of some companies into sectors in which they do not belong. One of the provided examples refers to a company that is one of the largest producers of non-metallic minerals in the world, and yet it is classified as a power station.

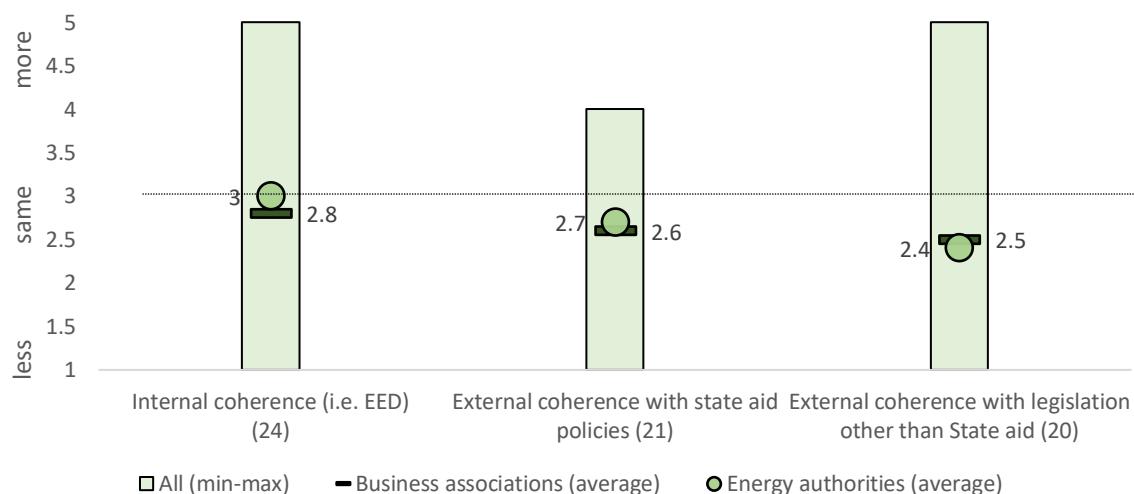
It is very difficult to compare the efficiency of companies that are in the same NACE sector without taking into account subsectors. It really depends on countries and how the industry is structured, as those sectors that are more energy intensive are different across countries. For instance, in the case of food, the energy intensity can differ depending on the type of food. Also, this sectoral classification does not correspond to NACE, so it would be more difficult to identify companies subject to the mandatory energy audit for both regulators and companies themselves.

Companies in the East or West would have different turnover for similar production for example, so it would not be coherent at the EU level when using economic indicators. Equally, over-specific legislation can become very complex, difficult to understand and to comply with.

Option 4A would oblige companies in energy-intensive sectors like iron and steel to conduct audits. Smaller companies that are very energy intensive would enter into the scope, so it would be good for the coverage of energy consumption per energy audit.

With this approach, industries with high emissions could be specifically targeted, so in principle it could enhance the reduction of GHG emissions, given the number of audits. Still, these very energy-intensive sectors are also regulated by the ETS system and consequently have already applied very specific, industrial processes. Because of that they could do the mandatory audit but the potential to reduce their energy consumption would not be very high.

Figure 5.40 Coherence with the EED goals of Option 4A compared with the baseline



Note: The figure above reflects the views of business associations and national energy authorities as expressed in the interviews. The rates indicate the coherence with the EED in compared with the baseline, ranging from 1 – much less coherent to 5 – much more coherent.

Source: CEPS.

5.6.4 Effectiveness/efficiency for national authorities

It is relatively easy to apply the threshold levels and the sectoral information is widely available. The only big challenge is that some companies are active in multiple sectors and the sectoral information is not always correct/up to date.

It would mean more administrative burdens when the real gain is not clear. Equally, there might be disputes with companies over which sector they belong to, or a company

could belong to several sectors. This information is not available and many energy authorities have no way of knowing whether a certain portion of turnover comes from a part of the company that belongs to another sector or what certain employees are working on.

While processing the information would be complicated (looking at what sector a company belongs to, which would be an extra parameter and involve more work), this option would be more straightforward, since authorities would not need to know energy consumption.

Enforcement would be more difficult, as discussions would be needed with companies about whether they are obliged to do the audit; it would also be difficult to enforce for some authorities with the information they have.

Figure 5.41 Effectiveness/efficiency for national authorities of Option 4A compared with the baseline



Note: The figure above reflects the views of national energy authorities as expressed in the interviews. The rates indicate the effectiveness/efficiency for national authorities compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

5.6.5 Effectiveness/efficiency for companies

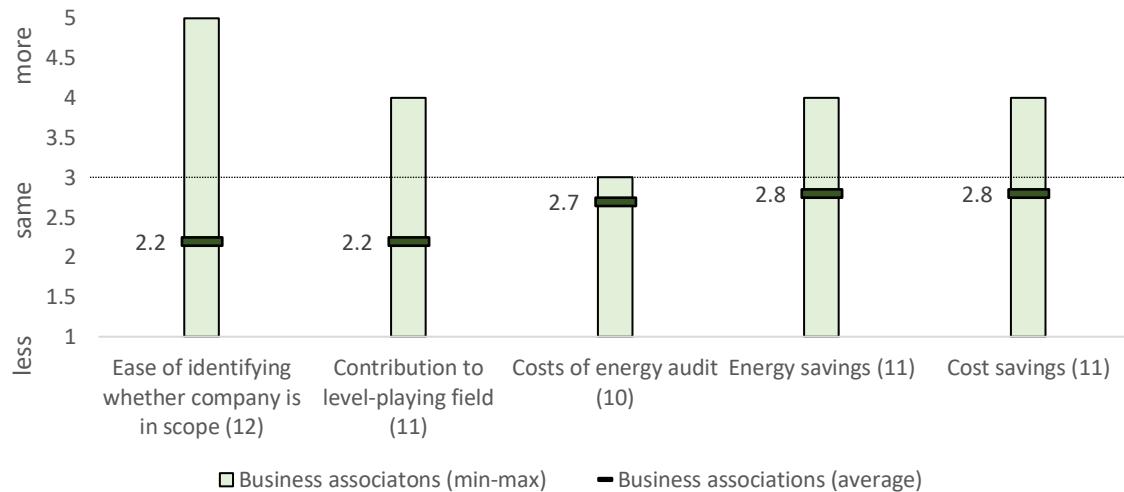
This aspect is too subject to interpretation. To the extent that the current system is hard to operationalise, this option could be even harder. There are many differences across Member States and comparing companies of the same sector may be difficult. The table above presents an average, but this average is not favourable for companies located in the tails of the distribution. Having 20 different thresholds is very burdensome and it would be very challenging to identify the companies within each sector.

It is also less easy because while a company might be classified under one particular NACE code, that might not actually be relevant for any subsidiary within the group.

This criterion may contain anomalies, which would lower the level playing field. It could lead to inefficiencies where distributors are compelled to do audits simply because they are classified under a NACE code, not because they have significant energy use. This would mean different criteria for different companies.

The energy audits are likely to target more energy-intensive sectors, which is likely to contribute to more energy savings and cost savings.

Figure 5.42 Effectiveness/efficiency for enterprises of Option 4A compared with the baseline



Note: The figure above reflects the views of business associations as expressed in the interviews. The rates indicate the effectiveness/efficiency for business associations compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

5.6.6 SWOT analysis

Based on the assessment of the various relevant elements of the option in previous sections, the table below summarises the key strengths, weaknesses, opportunities and threats of Option 4A in comparison with the baseline scenario.

Table 5.11 Summary SWOT analysis for Option 4A

	Strengths	Weaknesses
Internal	<ul style="list-style-type: none"> • Criteria are indirectly linked to the energy objective of the legislation • Scope is the same across Member States (i.e. internal coherence) • Far fewer energy audits are required • Fewer indicators are necessary to determine the companies within the scope • The definition has indicators that must be reported for other legislative requirements 	<ul style="list-style-type: none"> • Legal structure of a company will affect whether a company is within the scope (i.e. level playing field) • A relatively smaller share of the corporate final energy consumption and GHG emissions are covered • A much smaller share of corporate employment, turnover and assets are covered
External	<p align="center">Opportunities</p> <ul style="list-style-type: none"> • Required energy-based size criteria are easier to obtain for companies • It is relatively easy for national energy authorities and companies to determine those within the scope • Energy audits will cover more energy-intensive companies for which the energy audits are more cost-effective • National energy authorities are more likely to apply the selection criteria consistently (i.e. level playing field) and enforce the audit requirement 	<p align="center">Threats</p> <ul style="list-style-type: none"> • Expected and potential energy savings are likely to be slightly less • Less external coherence by providing a different definition compared with State Aid

5.7 Option 4B: two-stage selection with current and energy-related thresholds

Option 4B combines the indicators from the other policy options. More specifically, this option is restricted to non-SMEs according to EU Recommendation 2003/361 with the possibility for companies with a final energy consumption below 20 TJ per year to obtain an exemption. In the assessment of this option, only entities with a final energy consumption above 20 TJ per year are considered to be subject to mandatory audits.

5.7.1 Companies within the scope

The number of companies under this option amounts 39 000, which is around 95% below the number of companies covered under the baseline (see Figure 5.43).

All the size indicators under this option are below the baseline. In all cases, the drop in the number of companies covered is less than the drop in the coverage by size indicators. This is understandable as Option 4B is a subset of the baseline scenario. Moreover, this option is also a subset of Option 2 and Option 3A.

Around 55% of the corporate final energy consumption is covered under this option, compared with 65% under the baseline. The GHG emissions captured by this option amount to about 57%, compared with 69% under the baseline.

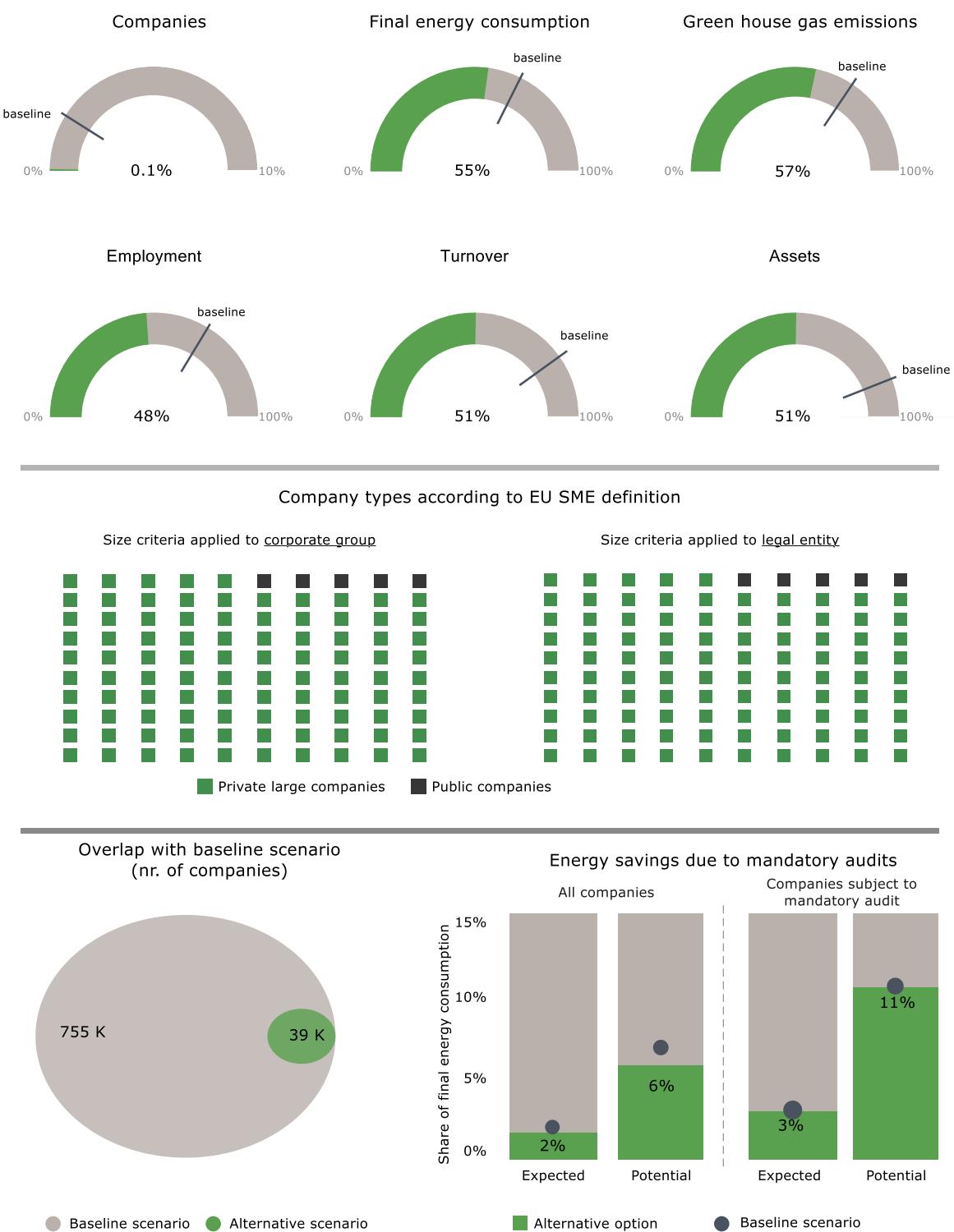
Turning to socioeconomic indicators, this option covers 48% of total employment and 51% of both total turnover and assets. All indicators are significantly lower than the baseline, which cover 68% of the total employment, 80% of turnover and 88% of total assets.

Given that the criteria in EU Recommendation 2003/361 are applied to the legal entity in this scenario, only private large companies and public companies are covered considering both the corporate group (including partnerships and links) and entity. The companies included under this option consist of private large companies (95%) and public companies (5%).

All the companies identified under this option are also covered under the baseline. In turn, of the companies under the baseline about 5% are covered under Option 4B.

The expected energy savings for all companies, at 2%, are almost equal to the baseline, while potential savings are estimated at 6% (7% under the baseline). The energy savings for all companies under Option 4B are estimated to be about 3% for expected energy savings and 11% for potential savings. Both values are about the same as under the baseline.

Figure 5.43 Overview of the key indicators for Option 4B

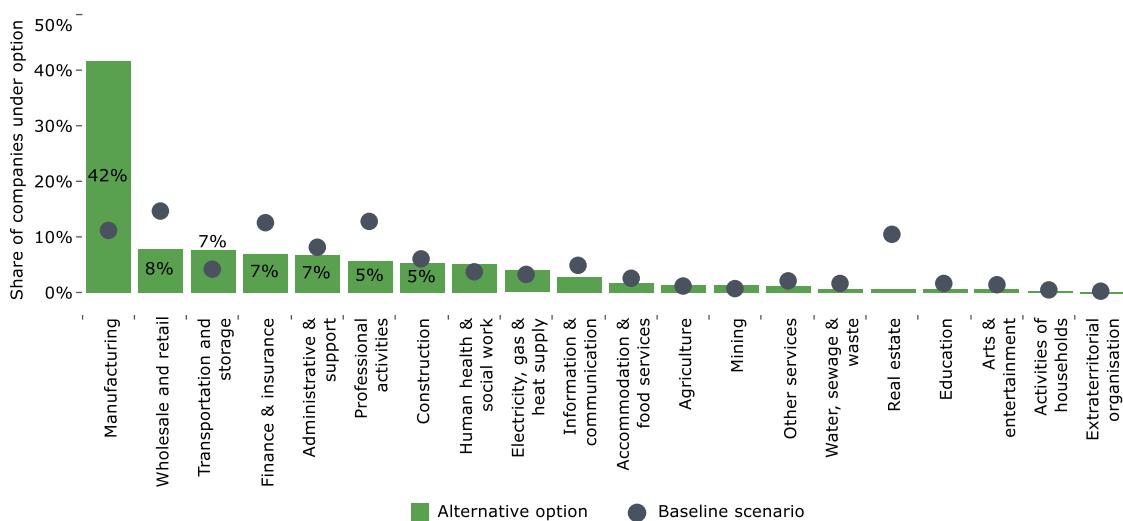


Source: CEPS' elaboration.

The companies covered under this option are more concentrated than the baseline (see Figure 5.44), but less so than under the energy-consumption options (3A, 3B and 3C). Under the latter, about two thirds of the companies are active in the manufacturing sector and transportation and storage sector. Under this option, companies in the manufacturing sector represent about 42% of all the companies covered, while the transportation and storage sector only accounts for about 7% of the companies.

Looking at the remainder of the sectors with a significant share of companies, these are primarily energy-intensive sectors or those with very large companies. In turn, sectors that are less energy-intensive and those with more compact large companies represent a smaller share.

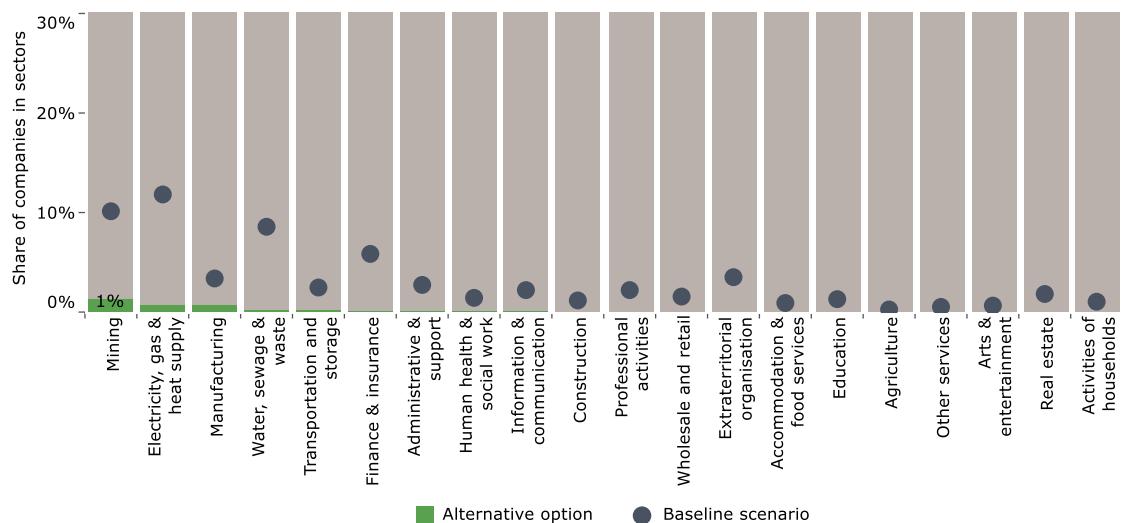
Figure 5.44 Sectoral distribution of companies within the scope of Option 4B



Source: CEPS' elaboration.

Turning to the share of companies covered in each sector, only very small shares of the respective sectors are covered (see Figure 5.45). This is due to the relatively low number of companies covered under this option. In fact, none of the sectors exceed 1% of the companies active in the sector, apart from mining. The overall coverage for all sectors is lower than in the baseline. The largest differences are noted in electricity, gas and heat supply sector (from 12% under the baseline to about 1%), mining sector (from 10% to 1%), water, sewage and waste (from 8% to about 1%) and finance and insurance sector (from 6% to less than 1%).

Figure 5.45 Companies within the scope of Option 4B, by sector



Source: CEPS' elaboration.

5.7.2 Feasibility of the option

The identification of companies under this option requires the same company size and ownership indicators required under the baseline. However, as the size criteria ultimately need to be met at the entity level, the required indicators are de facto the same as for Option 2. The companies that apply for an exemption further require information on their final energy consumption.

Considering that ultimately only the size indicators (number of employees, total assets, turnover) are necessary for the energy authorities to identify the companies within the scope (see Table 5.12), determining the companies is relatively easy. The main advantage compared with the baseline is that the ownership information is not required. In comparison with the energy consumption options, this option has the advantage that it is the company instead of the energy authority that is required to obtain the final energy-consumption information.

Table 5.12 Indicators required to determine whether companies are within the scope of Option 4B

Indicator	Availability	Option 1 (Baseline)	Option 4B
Number of employees	High (82%)	X	X
Total assets	High (76%)	X	X
Turnover	High (88%)	X	X
Sectoral Information	High (76%)	X	
Ownership information	Moderate (65%)	X	
Domestic majority owners (50-100%)	Moderate (53%)	X	
Domestic minority owners (25-50%)	Moderate (47%)	X	
Foreign/EU majority owners (50-100%)	Low (24%)	X	
Foreign/EU minority owners (25-50%)	Low (18%)	X	
Domestic majority owned subsidiaries (50-100%)	Moderate (56%)	X	
Domestic minority owned subsidiaries (25-50%)	Moderate (50%)	X	

Indicator	Availability	Option 1 (Baseline)	Option 4B
Foreign/EU majority owned subsidiaries (50-100%)	Low (29%)	X	
Foreign/EU minority owned subsidiaries (25-50%)	Low (29%)	X	
Final energy consumption	Moderate (65%)		x
Energy costs	Moderate (47%)		
Fuel consumption	Moderate (59%)		
Overall		Hard (18%)	Easy (76%)

Note: The availability in the table indicates the relative (potential) availability of the respective indicator among the national energy authorities interviewed for this study (%). The overall assessment at the bottom of the table provides an indication about the feasibility of the option based on the required indicator that is least available, which is presented in **bold**.

Source: CEPS

Overall, it is much easier for the national energy authorities to determine whether companies are within the scope of this option than under the baseline scenario.

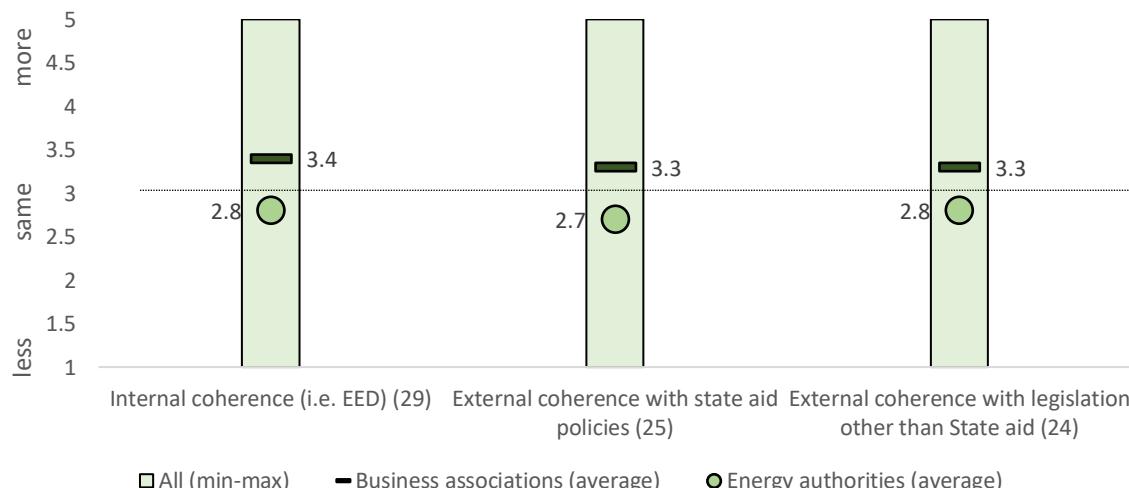
5.7.3 Internal and external coherence

The internal and external coherence of Option 4B is broadly comparable with the baseline scenario.

The impact of Option 4B on internal coherence is ambiguous in comparison with the baseline scenario in terms of realising energy savings cost-effectively. Option 4B covers a subset of the companies currently within the scope of the EED. In effect, this would lower the number of audits and thus the energy savings and GHG reductions. Yet, Option 4B would allow the exclusion of smaller companies, which do not exceed the consumption threshold of 20 TJ per year. This means that mostly companies for which audits are cost-effective would be obliged to conduct them. The energy authorities interviewed on average considered the internal coherence to be similar to the baseline. The business associations attached relatively more value to the cost-effectiveness of the energy audits, which was expressed in the fact that they considered Option 4B more coherent.

As this option is based on the non-SME definition, its external coherence is in principle similar or greater. More specifically, it is still in line with the State Aid policies and other policies regarding the SME definition.

Figure 5.46 Coherence with the EED goals of Option 4B compared with the baseline



Note: The figure above reflects the views of business associations and national energy authorities as expressed in the interviews. The rates indicate the coherence with the EED compared with the baseline, ranging from 1 – much less coherent to 5 – much more coherent.

Source: CEPS.

5.7.4 Effectiveness/efficiency for national authorities

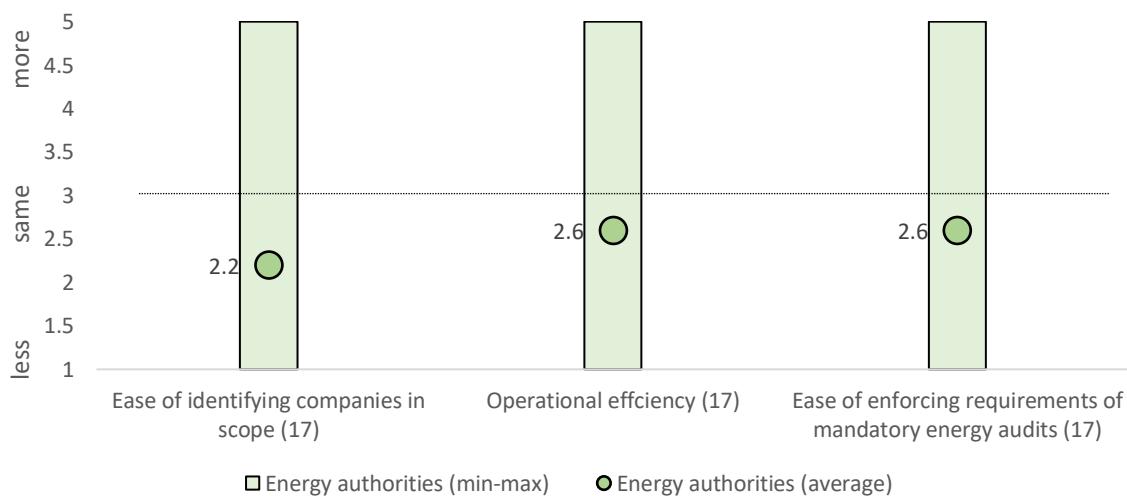
Energy authorities considered the effectiveness and efficiency of this option to be less than in the current scenario.

Especially the ease of identifying companies within the scope is considerably less than in the baseline. Authorities mentioned that they often did not have access to the necessary energy-consumption data, which is required for this option. In addition, the two-stage process could further confuse authorities and companies as to whether they are obliged to conduct audits.

The authorities regarded this option in general as less operationally efficient. Gathering the necessary data would involve frequently contacting companies and verifying the submitted values concerning energy consumption. The application for an exemption is likely to create an administrative burden for the energy authorities, which have to assess and accept the requests. But in turn, they might have to treat a lower number of energy audits.

Most energy authorities thought that enforcement would be more difficult, noting in particular the lack of access to energy-consumption data to validate the exemption requests.

Figure 5.47 Effectiveness/efficiency for national authorities of Option 4B compared with the baseline



Note: The figure above reflects the views of national energy authorities as expressed in the interviews. The rates indicate the effectiveness/efficiency for national authorities compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

5.7.5 Effectiveness/efficiency for companies

The impacts of Option 4B on the efficiency and effectiveness for companies is somewhat ambiguous.

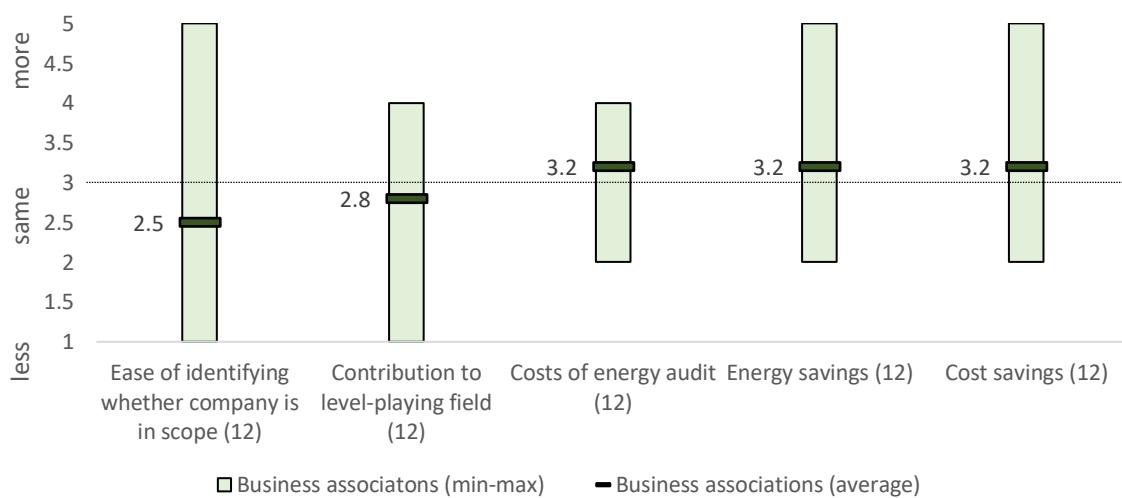
Business associations shared the concerns of energy authorities regarding the ease of identification. The two-step approach potentially confuses companies as to whether they are covered under this option. It makes those companies with energy consumption below the threshold dependent on approval by the energy authorities. Moreover, concerns were voiced specifically for companies with more volatile energy-consumption patterns. These companies might have to reevaluate yearly if they are obliged to conduct an audit, thus putting an additional burden on them.

The impact on the level playing field is in general considered limited in comparison with the baseline. On the one hand, all the companies with an energy consumption below the threshold can apply for an exemption. On the other hand, it introduces different treatment for less energy-consuming companies.

Business associations expected a decrease in the costs of audits. Due to the exemption, fewer audits need to be conducted, which might fuel the competition between auditors.

The energy savings were expected to be only slightly less compared with the baseline, as there are fewer energy audits. Nevertheless, some businesses thought that the focus of the energy audits on larger energy users might reduce the time pressure on auditors and allow them to concentrate more on supporting implementation.

Figure 5.48 Effectiveness/efficiency for enterprises of Option 4B compared with the baseline



Note: The figure above reflects the views of business associations as expressed in the interviews. The rates indicate the effectiveness/efficiency for business associations compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

5.7.6 SWOT analysis

Based on the assessment of the various relevant elements of the option in previous sections, the table below summarises the key strengths, weaknesses, opportunities and threats of Option 4B in comparison with the baseline scenario.

Table 5.13 Summary SWOT analysis for Option 4B

	Strengths	Weaknesses
Internal	<ul style="list-style-type: none"> • Scope is the same across Member States (i.e. internal coherence) • Far fewer energy audits are required • Basic indicators required remain the same to determine the companies within the scope • Definition requires indicators that are already used for the current EED and other legislation • Definition considers indicators linked to the energy savings objective of the legislation 	<ul style="list-style-type: none"> • Information on the ownership (links and partners) is still required to determine whether a company is within the scope • A smaller share of the corporate final energy consumption and GHG emissions are covered • A much smaller share of the corporate employment, turnover and assets are covered
External	<ul style="list-style-type: none"> • Energy audits will cover more energy-intensive companies, for which the energy audits are more cost-effective, despite the administrative burden of exemptions • External coherence is largely unaffected, as still only non-SMEs are concerned • More insight on the energy consumption of larger users due to the exemption of information from companies 	<ul style="list-style-type: none"> • Ownership information is still required to determine companies within the scope • National energy authorities will be confronted with a larger administrative burden to assess and grant the exemptions • It will remain difficult for national authorities to determine the companies within the scope and enforce the audit requirement (i.e. level playing field) • Expected and potential energy savings are likely to be slightly less • With less energy savings, the reduction of GHG emissions might also be less

5.8 Option 5: selection at the national level given minimum energy coverage

Option 5 assumes that each Member State selects companies that represent at least 60% of total corporate energy consumption. The option follows the criteria formulated by the national energy authority if provided or the current option considering the available data sources, topped up to reach at least 60% of the total corporate energy consumption.

5.8.1 Companies within the scope

This option covers 418 000 companies or about 1% of all active companies (see Figure 5.49). The number of companies is 44% lower than the number of companies covered in the baseline.

The companies within the scope of Option 5 cover an estimated 64% of the final energy consumption (65% under the baseline). The share of GHG emissions covered under this option is estimated at 66%, compared with 69% under the baseline.

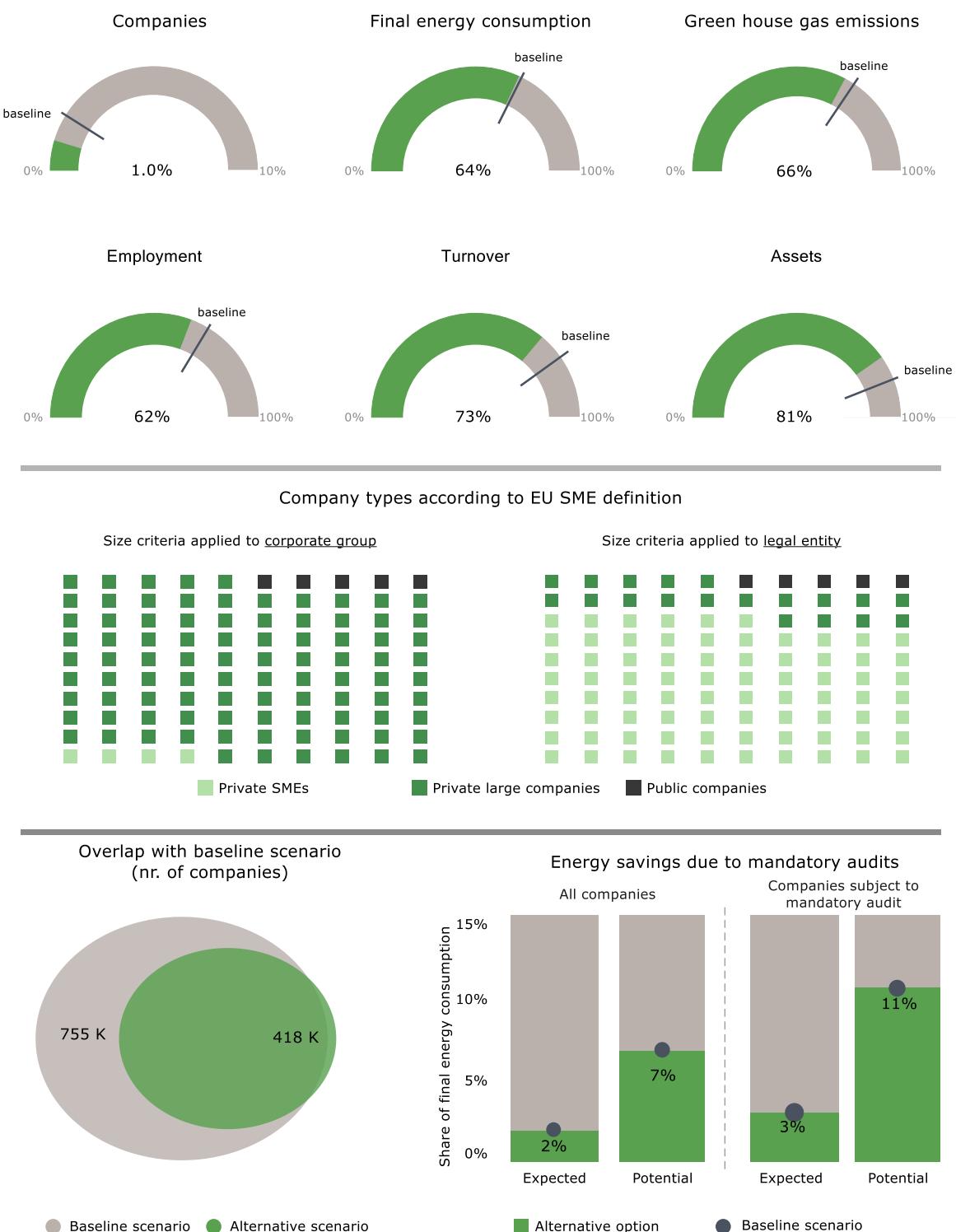
Considering socioeconomic indicators, the shares captured by this option are lower than in the baseline. Option 5 covers an estimated 62% of total employment (68% under the baseline), 73% of the corporate turnover (80% under the baseline) and 81% of total corporate assets (88% under the baseline).

Looking at the corporate structures, 91% of all companies under Option 5 are private large companies according to EU Recommendation 2003/361 (corporate group perspective). The remaining companies consist of 4% private SMEs and 5% public companies. When applying the size criteria at the legal entity level, 76% of all companies are private SMEs and 19% are private large companies. The share of public companies remains the same.

About 96% of the companies captured under this option are also covered under the baseline scenario. This is explained by the large overlap in definition, with the baseline option as the assumed option for most countries (see Section 4.3.5).

Due to the large overlap, energy savings are estimated to be roughly same as the baseline scenario. Expected savings across all companies are estimated at around 2%, while potential savings are estimated at 7%. Considering only the companies subject to mandatory audits under this option, the expected savings are 3%, while savings are estimated to be around 11%.

Figure 5.49 Overview of the key indicators for Option 5

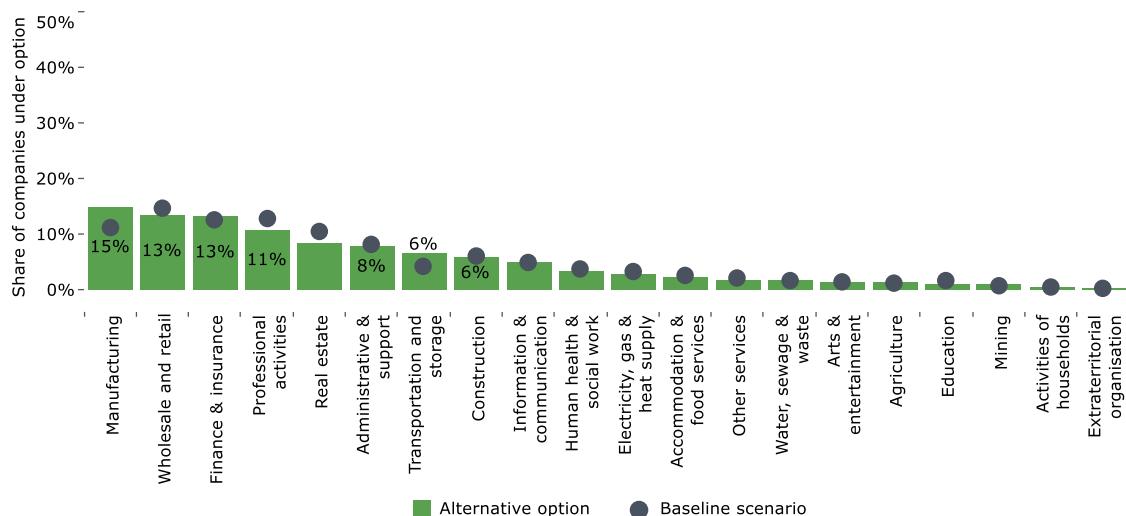


Source: CEPS' elaboration.

The sectoral distribution of the companies covered under this option is very similar to the baseline (see Figure 5.50). Both options are heterogeneous, covering equal numbers of companies across different sectors. Small differences can be detected in

manufacturing, wholesale and retail, finance and insurance as well as in the professional activities sectors. Manufacturing and the finance and insurance sectors are slightly more represented than in the baseline. Similarly, 6% of the companies belong to the transportation and storage sector, while the share of companies in the baseline is roughly 5%. The wholesale, professional activities and real estate sectors are slightly less well represented. The higher shares in energy-intensive sectors can be explained by countries that might switch to an energy consumption threshold and the assumed topping up with the most energy-consuming companies to meet the required threshold.

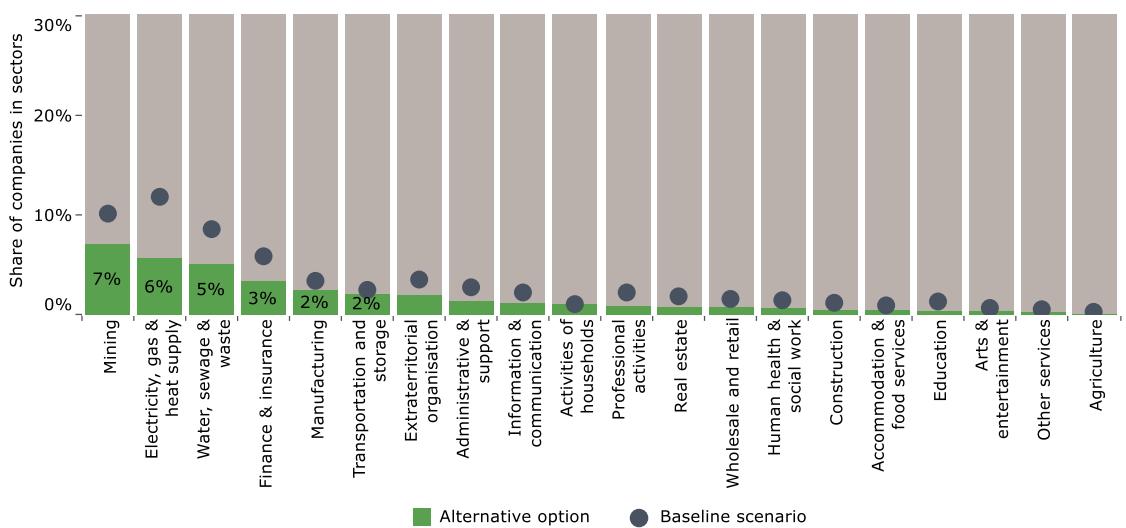
Figure 5.50 Sectoral distribution of companies within the scope of Option 5



Source: CEPS' elaboration.

This option covers a lower share of most sectors compared with the baseline (see Figure 5.51). For example, 7% of mining and 6% of electricity, gas and heat supply are covered under this scenario. Under the baseline, these sectors account for 10% and 12% respectively. The same applies to the share for the water, sewage and waste sector (from 8% under the baseline to 5% under Option 5). Differences exist also in the remaining sectors.

Figure 5.51 Companies within the scope of Option 5, by sector



Source: CEPS' elaboration.

5.8.2 Feasibility of the option

The required indicators for this option depend on the scope defined at the national level. For most countries, this option is likely to require information on the company size indicators (number of employees, total assets and turnover), domestic ownership information and/or final energy consumption. It is expected that most Member States would choose a definition that is aligned with the available selection indicators or might require companies to report the necessary indicators to identify the companies covered.

Size indicators are widely available, ranging from 76% to 88% in terms of national authorities' access to them. Ownership information is less available, specifically concerning domestic minority owners. Here, only 47% of authorities either have or potentially have access to such data. Final energy consumption is also fairly available (65%), with the numbers being derived from past audits.

Overall, this option is more feasible than the baseline scenario (see Table 5.14). That is primarily because countries have the possibility to choose a definition that matches the available indicators.

Table 5.14 Indicators required to determine whether companies are within the scope of Option 5

Indicator	Availability	Option 1 (Baseline)	Option 5
Number of employees	High (82%)	X	X
Total assets	High (76%)	X	X
Turnover	High (88%)	X	X
Sectoral Information	High (76%)	X	
Ownership information	Moderate (65%)	X	X
Domestic majority owners (50-100%)	Moderate (53%)	X	X
Domestic minority owners (25-50%)	Moderate (47%)	X	X
Foreign/EU majority owners (50-100%)	Low (24%)	X	
Foreign/EU minority owners (25-50%)	Low (18%)	X	
Domestic majority owned subsidiaries (50-100%)	Moderate (56%)	X	X
Domestic minority owned subsidiaries (25-50%)	Moderate (50%)	X	X
Foreign/EU majority owned subsidiaries (50-100%)	Low (29%)	X	
Foreign/EU minority owned subsidiaries (25-50%)	Low (29%)	X	
Final energy consumption	Moderate (65%)		X
Energy costs	Moderate (47%)		
Fuel consumption	Moderate (59%)		
Overall		Hard (18%)	Moderate (47%)

Note: The availability in the table indicates the relative (potential) availability of the respective indicator among the national energy authorities interviewed for this study (%). The overall assessment at the bottom of the table provides an indication about the feasibility of the option based on the required indicator that is least available, which is presented in **bold**.

Source: CEPS

5.8.3 Internal and external coherence

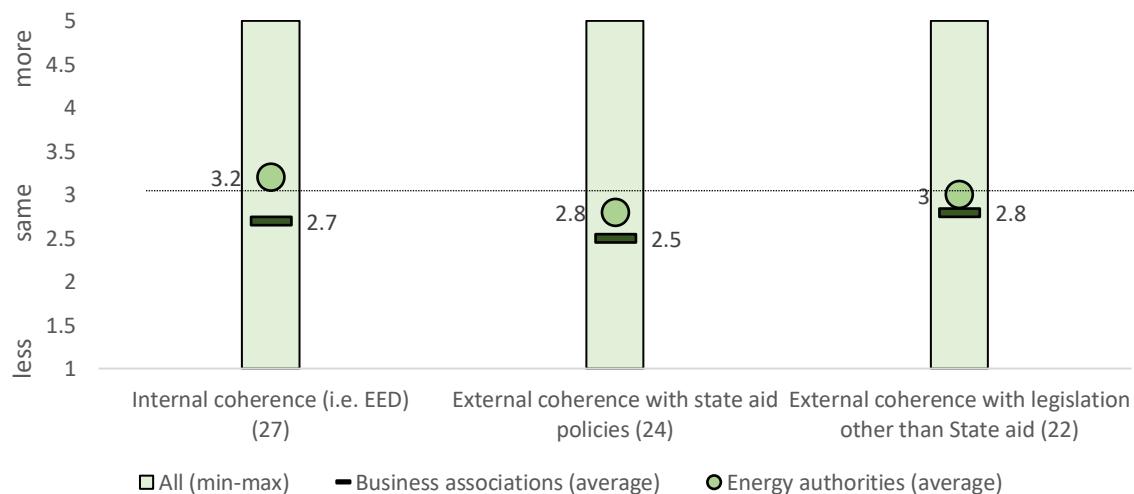
There was not much disparity in the average assessment of internal coherency (e.g. with the EED) of Option 5 by business associations and energy authorities. Both marked Option 5 as more or less the same as the baseline option, while around a half of

respondents from business associations mentioned that internal coherence would decrease. First, this option is expected to narrow the scope of enterprises subject to an audit (however, by only 23% fewer companies than those covered in the baseline). Second, while adding flexibility in setting thresholds, this option may also increase the disparities among the approaches chosen by Member States. Therefore, while internal coherence could increase at the national level, it is likely to be lowered at the EU level. This option may also incentivise Member States to offer exceptions, for example for sectors that are crucial for their economies.

Regarding external coherence with State Aid policies, this option was viewed as less coherent with EED goals on average. Companies that are not required to do an energy audit would be allowed to get subsidies, and different criteria adopted by Member States would reduce coherence with State Aid. Moreover, approximately a third of the respondents mentioned that they did not know how this option would affect coherence with State Aid and other legislation. But among the positive aspects is an opportunity for governments to adopt definitions that are more coherent with their own policies. It would also allow them to exempt from mandatory audits those companies that already have an energy-management system. However, some respondents thought that it might be unlikely for Member States to establish higher targets than those in the EED; it might also be expected that thresholds would usually be lowered, as one respondent noted.

Around 30% of energy authority respondents mentioned that this definition could increase reductions in energy consumption and GHG emissions, but the effects are likely to be limited and largely depend on the chosen scope for the energy audit. According to the simulation results, the expected and potential savings are estimated to be 3% and 9% respectively. In both cases, that is more than is estimated for the baseline scenario, with the differences being 1% for expected savings and 2% more for potential savings.

Figure 5.52 Coherence with the EED goals of Option 5 compared with the baseline



Note: The figure above reflects the views of business associations and national energy authorities as expressed in the interviews. The rates indicate the coherence with the EED compared with the baseline, ranging from 1 – much less coherent to 5 – much more coherent.

Source: CEPS.

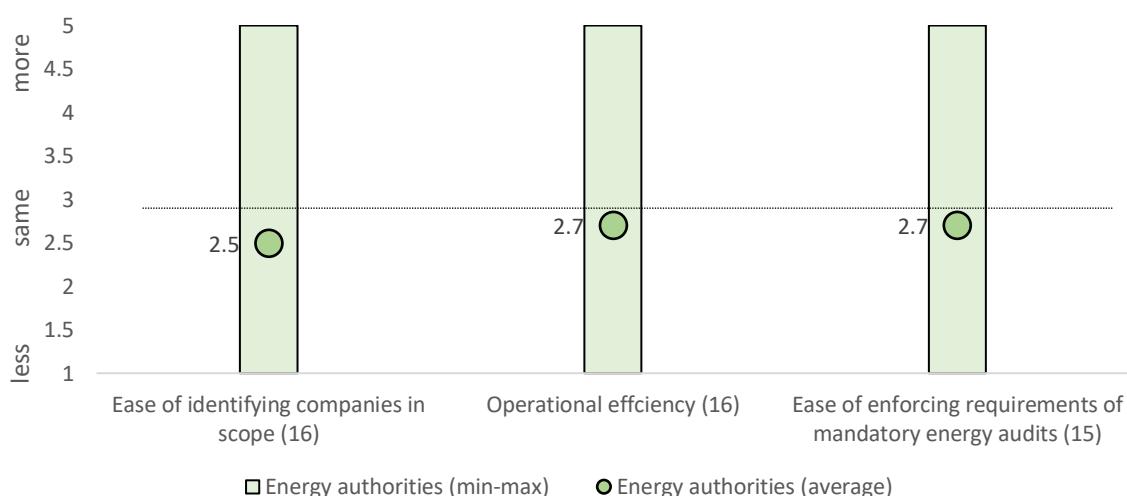
5.8.4 Effectiveness/efficiency for national authorities

Regarding all three indicators, when assessing the effectiveness/efficiency of Option 5 for national energy authorities it was seen as likely to reduce the ease of identifying companies within the scope, operational efficiency and enforcement.

While each Member State would be able to set up those indicators that it considers most relevant, any need to elaborate new criteria may cause some difficulties (for example, due to understaffed authorities in some Member States), contrary to uniform criteria elaborated by the Commission.

Another challenge could be identifying individual energy consumption and the percentage of the total energy consumption that each company represents and companies that fall under the scope to reach the 70% target. It could also be challenging to determine the enterprises that would be obliged to do an audit in a particular year. Probably, after one round of audits in which enterprises indicated their energy consumption this could be possible. Equally, operationally it would be more complicated as energy authorities would need to establish the threshold levels. Still, this option would allow the authorities to set their own indicators. Enforcement would be difficult because of a lack of data and would depend on a particular system adopted by a Member State.

Figure 5.53 Effectiveness/efficiency for national authorities of Option 5 compared with the baseline



Note: The figure above reflects the views of national energy authorities as expressed in the interviews. The rates indicate the effectiveness/efficiency for national authorities compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

5.8.5 Effectiveness/efficiency for companies

The average assessment of the effectiveness/efficiency of Option 5 for enterprises by business associations was lower in comparison with the baseline.

The ease of identifying whether company is within the scope is likely to remain the same for the companies operating within one Member State; however, it would be more difficult for international companies with subsidiaries in different Member States given

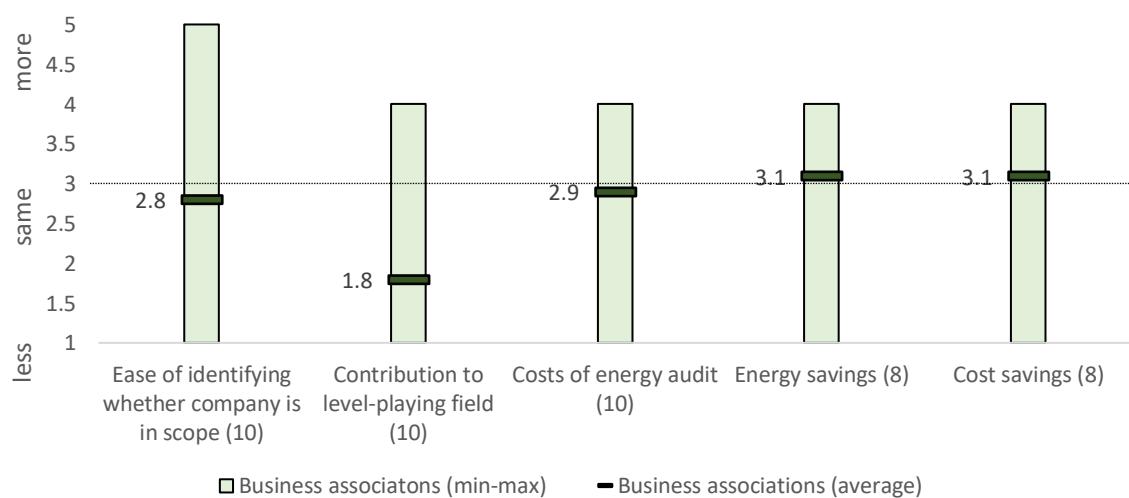
that each Member State would be free to establish its own criteria for identifying the scope of enterprises subject to a mandatory energy audit. Consequently, establishing national approaches that may significantly vary would undermine a level playing field across the EU. Different obligations would apply to companies in different countries, creating additional burdens especially for companies with subsidiaries in more than one Member State.

At the same time, it could be favourable for the level playing field within EU countries to provide better calibration for the needs of a particular country. But this could also add hurdles. For instance, Member States could decide to exclude from the scope those companies that belong to, for example, key sectors of the economy even if they have a high level of energy consumption. Equally, sectors experiencing economic troubles could exert some pressure on the governments to be excluded from the obligation.

The costs of conducting an audit, on the one hand, were expected to remain the same on average by business associations. On the other hand, the cost-effectiveness of the audits would be affected given that companies would need to adapt to criteria different scope for audits in each Member State. This is likely to mostly affect companies with subsidiaries in different Member States; they are likely to lose the advantage of dealing with audit criteria at the company level in the same way across Member States.

The expected energy savings are estimated to be around 3%, which is slightly higher than the baseline. The potential savings are also slightly higher than under the baseline (9%). Companies could concentrate on improving their energy efficiency in significant areas and would not have to invent measures by force where there is no longer any possibility of influencing.

Figure 5.54 Effectiveness/efficiency for enterprises of Option 5 compared with the baseline



Note: The figure above reflects the views of business associations as expressed in the interviews. The rates indicate the effectiveness/efficiency for business associations compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

5.8.6 SWOT analysis

Based on the assessment of the various relevant elements of the option in previous sections, the table below summarises the key strengths, weaknesses, opportunities and threats of Option 5 in comparison with the baseline scenario.

Table 5.15 Summary SWOT analysis for Option 4B

		Strengths	Weaknesses
Internal			
		<ul style="list-style-type: none"> • Fewer energy audits are likely to be required • The requirements necessary to determine the companies within the scope might already be available for other legal requirements • The definition may consider indicators linked to the energy savings objective of the legislation • A larger share of the corporate final energy consumption and about the same GHG emissions are covered 	<ul style="list-style-type: none"> • Scope is different across Member States (i.e. level playing field) • Information on the ownership (links and partners) may still be required to determine whether a company is within the scope • A smaller share of the corporate employment, turnover and assets are covered
External		Opportunities	Threats
		<ul style="list-style-type: none"> • Expected and potential energy savings are likely to be slightly more, as each Member State needs to meet at least the minimum coverage • With higher energy savings the GHG emissions reductions might also be more • Energy audits will cover more energy-intensive companies, for which the energy audits are more cost-effective, despite the administrative burden of exemptions • Definition is more likely to be aligned with other national legislation • Size criteria are likely to be easier to operate for national energy authorities 	<ul style="list-style-type: none"> • For companies, it might be more difficult to determine whether they are within the scope as the requirements are likely to differ across Member States • Definition might be less aligned with other EU legislation

5.9 Alternate timing for the energy audits

Besides various options for the companies within the scope of mandatory energy audits, this study also considers various options related to the timing of the energy audits. These options can be applied to all the assessed policy options above.

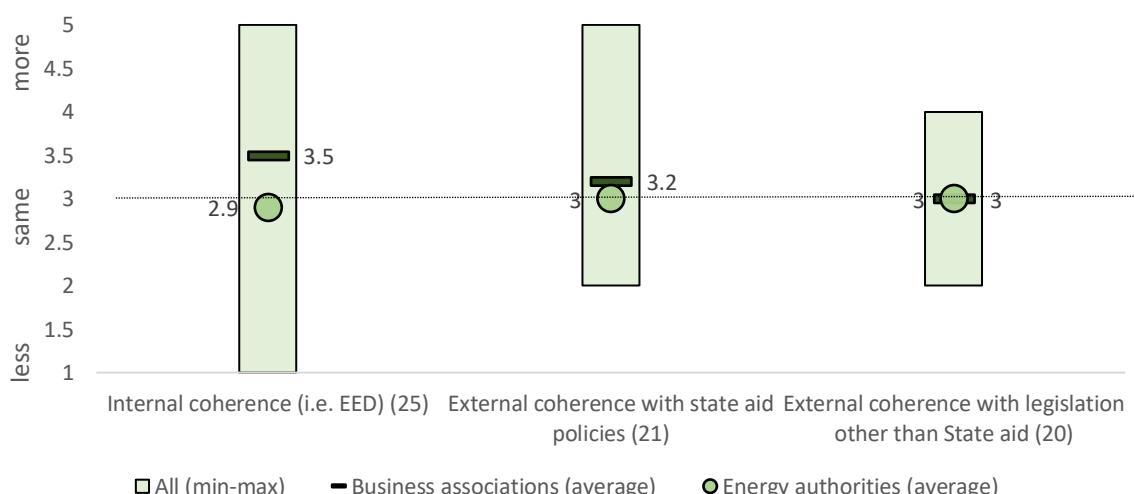
5.9.1 Spreading out the audits

This timing option would allow the national energy authorities to delay some of the audits, so that all mandatory audits are spread out more evenly across time. Indeed, in most Member States there is currently a spike every fourth year. Spreading out the mandatory audits would contribute to an improvement in the availability of auditors and likewise enable the work of energy authorities to be spread out.

The authorities interviewed in some Member States already indicated that they have a natural spread because of delays in previous energy audits or they introduced a spread of the audit cycles after the first audit in 2015. Some others indicated that such a spread is likely to happen naturally over time, with some new companies becoming subject to mandatory audits and some of the existing companies with an audit requirement no longer meeting the criteria for mandatory audits.

Energy authorities and business associations rated the internal and external coherence of this timing option as largely similar to the baseline scenario (see Figure 5.55). Energy authorities in particular rated this option on average as almost exactly the same as the baseline scenario. Similarly, business associations considered spreading out the audits to be largely in line with EED goals. Only for internal coherence did the business associations rate this timing option as slightly better than the baseline. They indicated that spreading out audits would allow auditors to spend more time on the energy audits and engage with companies on implementation of the advised energy-saving measures.

Figure 5.55 Spreading out audits – coherence with the EED goals compared with the baseline



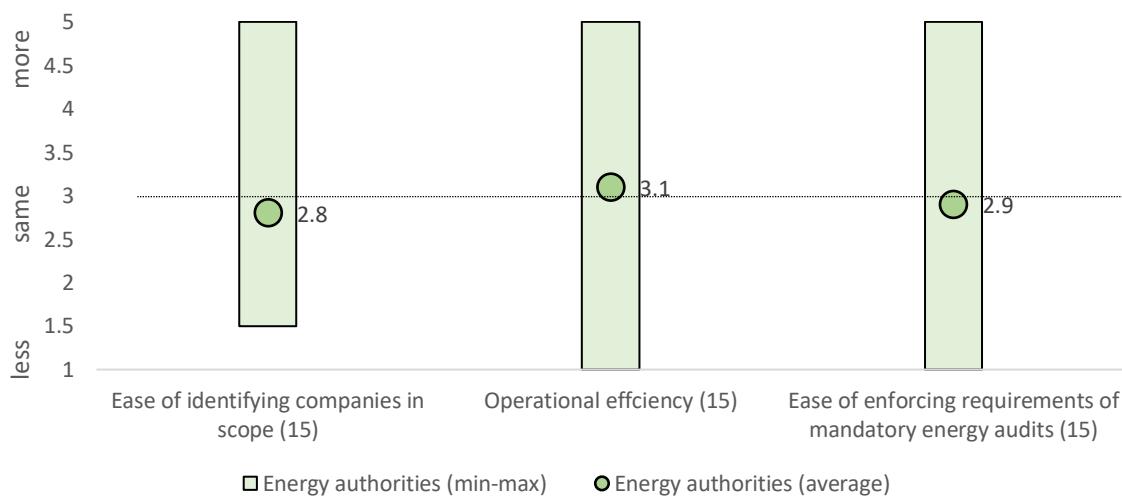
Note: The figure above reflects the views of business associations and national energy authorities as expressed in the interviews. The rates indicate the coherence with the EED compared with the baseline, ranging from 1 – much less coherent to 5 – much more coherent.

Source: CEPS.

The national energy authorities on average considered spreading out the audits to be similarly effective and efficient as the baseline scenario (see Figure 5.56). However,

there were divergent views among them. A group of energy authorities indicated that such a spread would ease their work, as it would distribute it across the entire four-year cycle instead of concentrating it around the end of each four-year cycle. By contrast, another group of energy authorities indicated that spreading out the audits would increase their administrative burden, as they would have to inform each company of when it had to conduct an energy audit and ensure that the company does it. Finally, a further group of energy authorities indicated that there would not be much change.

Figure 5.56 Effectiveness/efficiency for national authorities of spreading out audits compared with the baseline

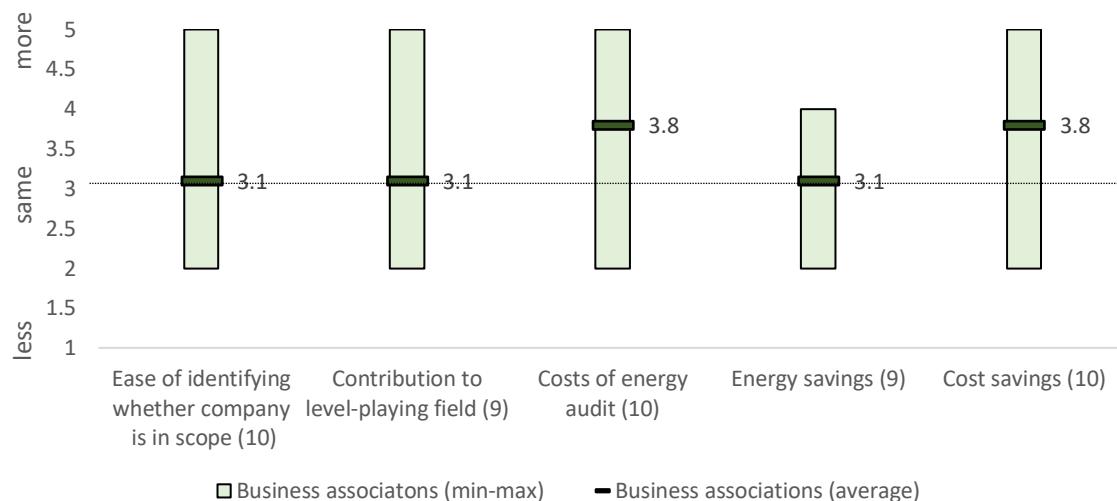


Note: The figure above reflects the views of national energy authorities as expressed in the interviews. The rates indicate the effectiveness/efficiency for national authorities compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

Business associations indicated that in a broad sense the efficiency and effectiveness of this option would be similar to the baseline scenario (see Figure 5.57). There are two important exceptions: the costs of the energy audit and cost savings. Associations argued that spreading out the audits would increase competition among auditors, which might result in lower prices for energy audits. As auditors would have more time to conduct them, they could produce higher-quality audits, resulting in greater cost savings for the companies.

Figure 5.57 Effectiveness/efficiency for enterprises of spreading out audits compared with the baseline



Note: The figure above reflects the views of business associations as expressed in the interviews. The rates indicate the effectiveness/efficiency for business associations compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

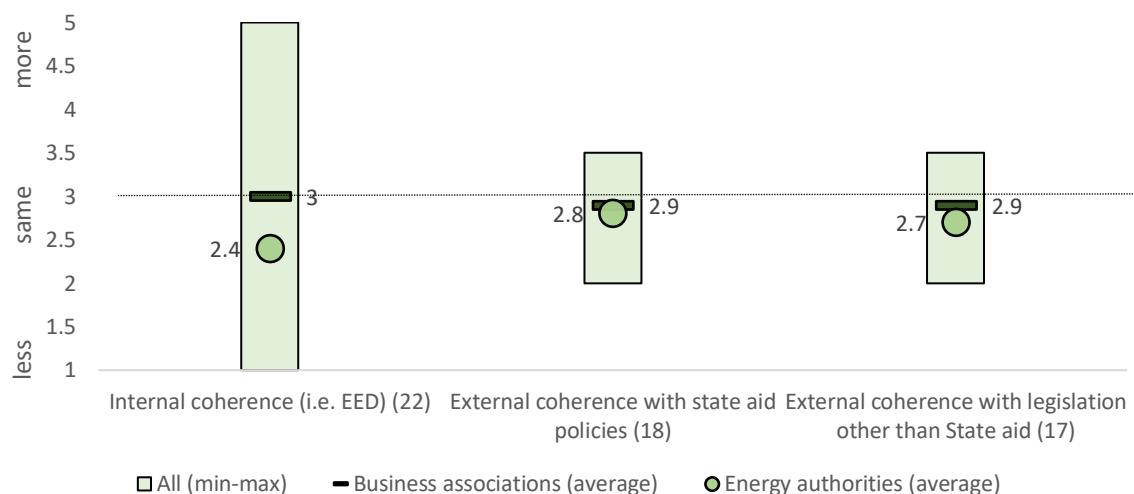
5.9.2 Flexibility in audit frequency

This option allows Member States to vary the frequency of audits for all companies. For example, the first and second energy audit might need to be done every four years, while the third and fourth audit might need to be done during a six-year period.

Energy authorities generally considered this timing option to be less internally coherent than the baseline scenario, while business associations generally regarded the option as similar in internal coherence as the baseline scenario (see Figure 5.58). The expected, slightly lower internal coherence is because fewer energy audits would be conducted, which is likely to result in less energy savings and related GHG emissions reductions.

External coherence was considered by both energy authorities and business associations to be slightly less than the baseline scenario.

Figure 5.58 Flexibility in audit frequency – coherence with the EED goals compared with the baseline



Note: The figure above reflects the views of business associations and national energy authorities as expressed in the interviews. The rates indicate the coherence with the EED compared with the baseline, ranging from 1 – much less coherent to 5 – much more coherent.

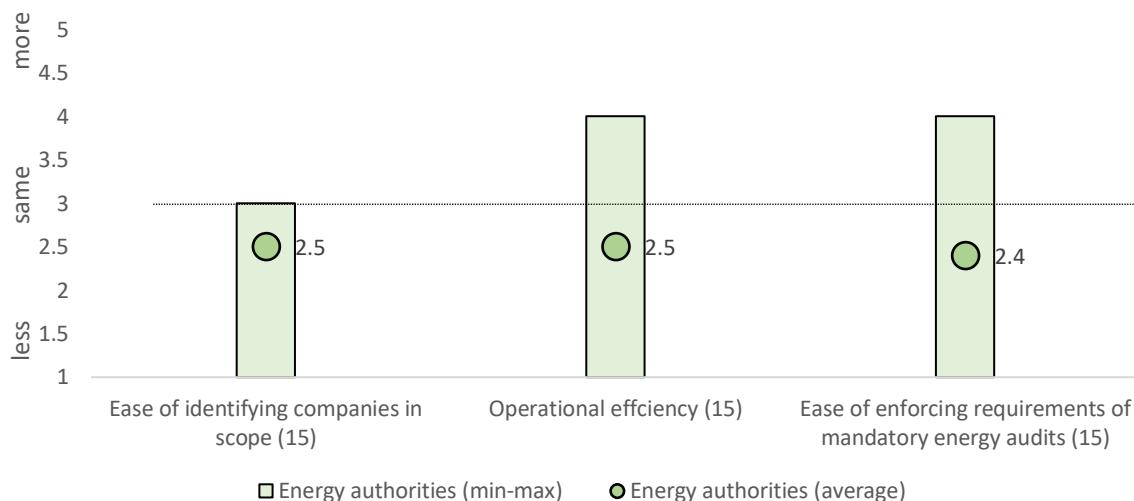
Source: CEPS.

The effectiveness and efficiency for energy authorities was overall rated to be somewhat lower than the baseline (see Figure 5.59).

While the ease of identifying companies within the scope was rated as equal to the baseline on average, no authority judged it to be preferable to the baseline scenario.

Operational efficiency and the ease of enforcement were expected to be less than in the baseline scenario. Authorities indicated that having to keep track of the time at which different companies have to conduct their audits would place an additional burden on them, especially as they would not only need to consider when the previous energy audits were conducted, but also how many previous energy audits were conducted.

Figure 5.59 Effectiveness/efficiency for national authorities of flexibility in audit frequency compared with the baseline



Note: The figure above reflects the views of national energy authorities as expressed in the interviews. The rates indicate the effectiveness/efficiency for national authorities compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

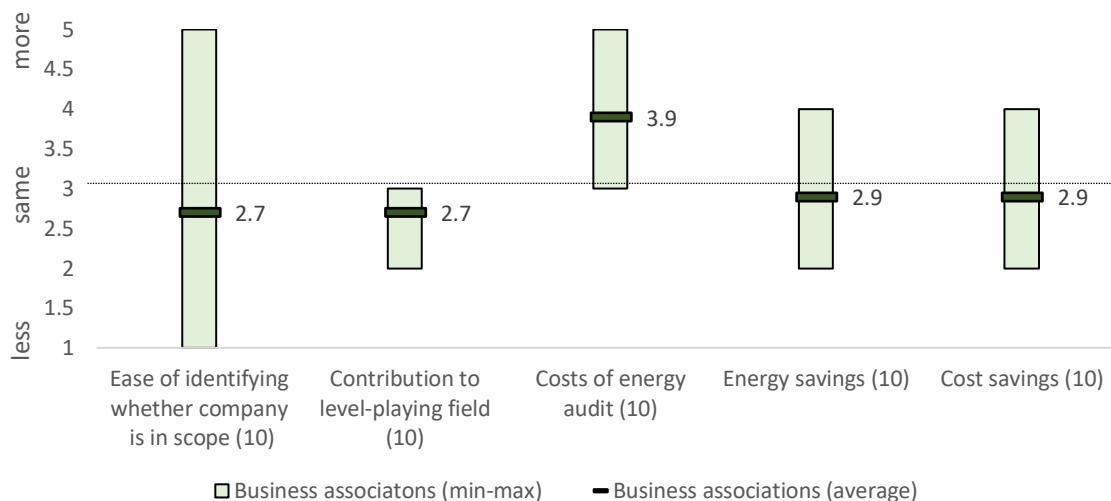
The business associations also considered this option to be largely comparable with the baseline in terms of effectiveness and efficiency. Notably, the business associations expected the costs of the energy audits to be clearly less, while the energy savings and related cost savings were likely to be only slightly less.

The determination of whether a company needs to conduct an energy audit was, on average, regarded as being slightly more difficult than under the baseline scenario. The main reason mentioned was that companies may not be aware of when exactly they have to conduct their audit due to the different intervals.

The level playing field might be slightly distorted. Indeed, companies with the same activities might have to conduct audits at different frequencies depending on their previous experiences.

Having to conduct fewer audits would effectively reduce the overall costs of the audits, which were judged to be lower than under the baseline scenario. The business associations thought the impact on the energy savings and cost savings would be limited. One of the main factors for the limited impact on energy savings is that the replacement period for most equipment, such as heating systems, is longer than the current four-year interval.

Figure 5.60 Effectiveness/efficiency for enterprises of flexibility in audit frequency compared with the baseline



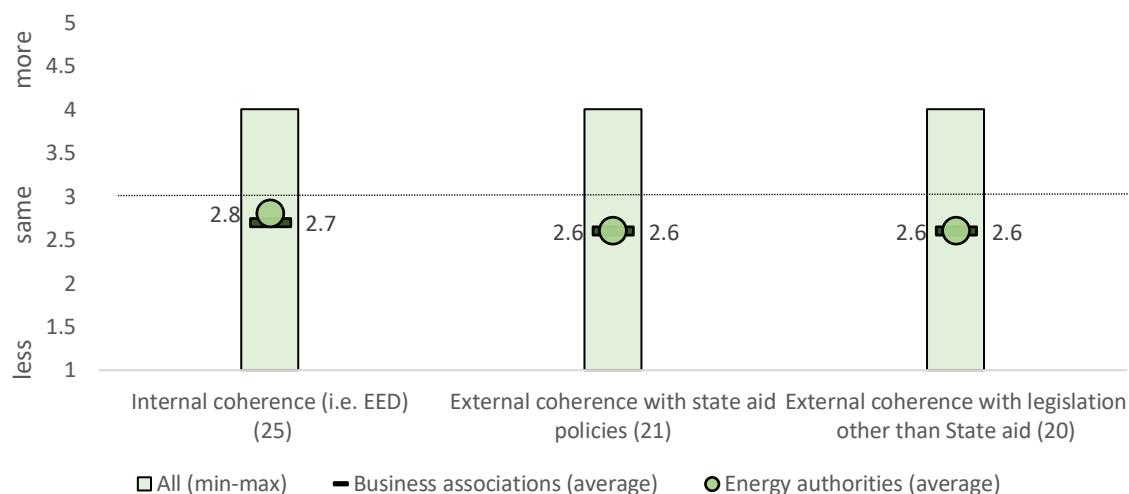
Source: CEPS.

5.9.3 Audit frequency based on energy consumption

This option would allow authorities to differentiate the frequency of audits depending on the size and sector of companies. In effect, larger and more energy-consuming companies would be obliged to conduct energy audits more frequently than smaller companies.

National energy authorities and business associations judged the coherence of this option with EED goals to be slightly worse than the baseline scenario (see Figure 5.61). National energy authorities expected that the variation in the frequency of audits would introduce confusion among companies and the potential exploitation of loopholes. More specifically, some of the companies are active in multiple sectors and might try to be categorised under sectors with the fewest required audits. In addition, business associations argued that obliging the largest companies to conduct audits more frequently would not be effective, as most of the largest companies are obliged to have energy-management systems in place.

Figure 5.61 Energy consumption-based audit frequency – coherence with the EED goals compared with the baseline

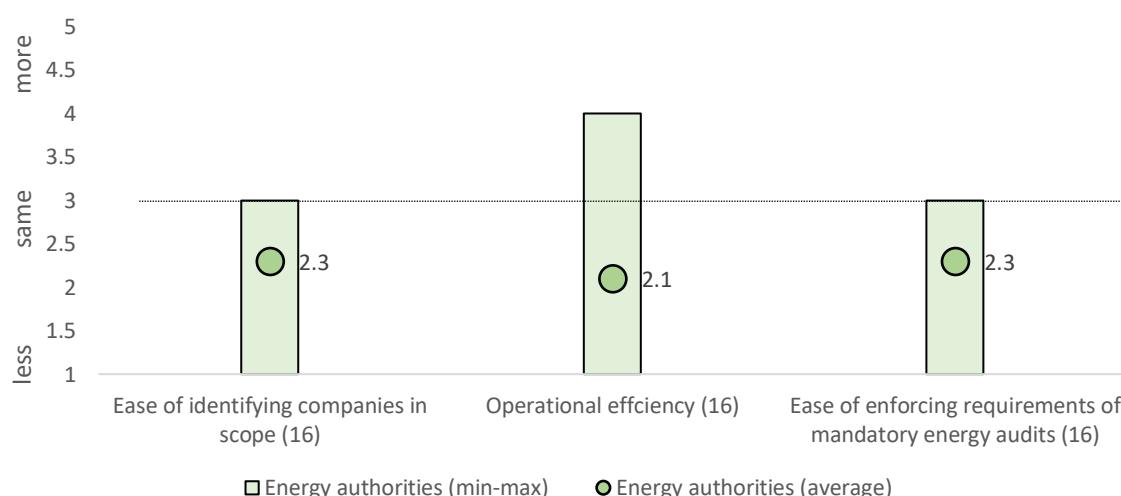


Note: The figure above reflects the views of business associations and national energy authorities as expressed in the interviews. The rates indicate the coherence with the EED compared with the baseline, ranging from 1 – much less coherent to 5 – much more coherent.

Source: CEPS.

The national energy authorities considered the varied frequency to be less efficient than the baseline scenario (see Figure 5.62). They thought this option would make it more difficult to identify companies within the scope and complicate enforcement. This flexibility with the audits would likely increase the administrative burden. Some authorities mentioned that they simply lacked the required information entirely and thus could not enforce this option easily.

Figure 5.62 Effectiveness/efficiency for national authorities of an energy consumption-based audit frequency compared with the baseline

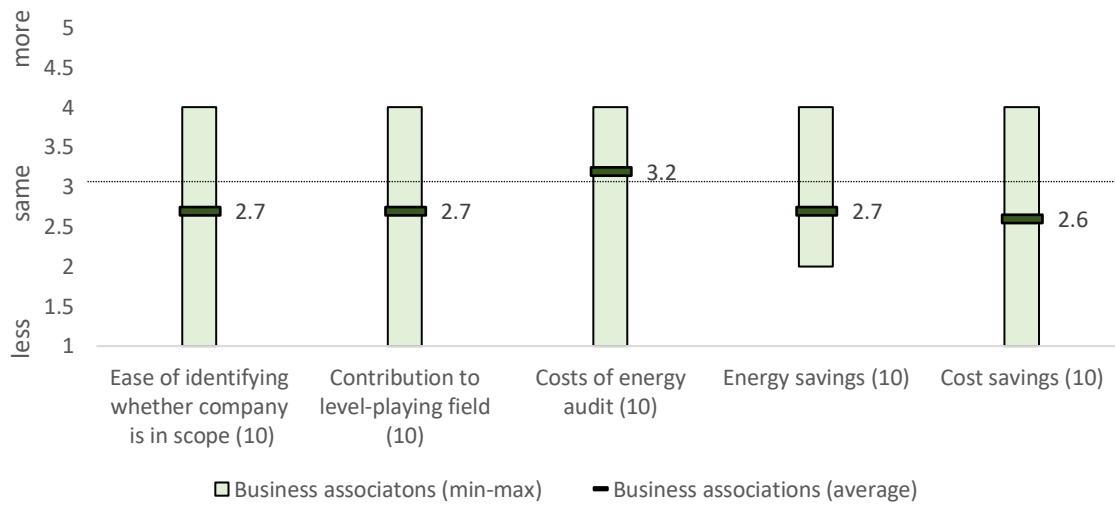


Note: The figure above reflects the views of national energy authorities as expressed in the interviews. The rates indicate the effectiveness/efficiency for national authorities compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

Like energy authorities, the business associations believed this option would be less effective and efficient than the baseline scenario (see Figure 5.63). Only the costs of energy audits were judged to be slightly more favourable than in the baseline, as the option would reduce the number of required audits for some companies. Business associations mentioned that the flexibility might add to the confusion for companies regarding whether they are obliged to conduct an audit, which was shared by the authorities interviewed. Moreover, some authorities also remarked that they would not like to have another information obligation put on the companies, which might be required in order to accurately determine the audit frequency.

Figure 5.63 Effectiveness/efficiency for enterprises of an energy consumption-based audit frequency compared with the baseline



Note: The figure above reflects the views of business associations as expressed in the interviews. The rates indicate the effectiveness/efficiency for business associations compared with the baseline, ranging from 1 – much less effective/efficient to 5 – much more effective/efficient.

Source: CEPS.

6 Conclusions

This section provides a comparison of the various alternative policy options based on their impacts. Moreover, it draws conclusions concerning the preferred policy options.

6.1 Obstacles in current implementation

The study finds that there are four important obstacles in the application of the EU SME definition for energy audits.

First, the definition of non-SMEs is very complex. It requires information on the assets, turnover and employees of the entity concerned, but also on the entities partnering and linked with it. The definition additionally calls for information on the type of ownership, as publicly owned companies are considered non-SMEs by definition, as well as sectoral information if a company is controlled by one or more natural persons.

Second, the definition is not directly linked to the objectives of the EED. Indeed, the definition of non-SMEs captures large companies that can have higher energy consumption than smaller companies, but not necessarily.

Third, the non-SME definition requires information from foreign owners, which is not available to many of the authorities.

Fourth, nearly all of the energy authorities lack some or all of the information required to determine whether a company qualifies as a non-SME.

The obstacles with the application of the definition also lead to uncertainty about the actual number of companies conducting energy audits. There is a significant difference between the operational definition applied by national authorities and the ability to identify these companies using the available instruments. Especially the inclusion of companies that become non-SMEs due to partnerships and foreign-ownership relations is uncertain.

6.2 Comparison of alternative policy options

Seven potential, alternative options and sub-options have been formulated, including a simplified definition, an energy consumption definition (final energy, fuel and energy costs), a mixed simplified/energy consumption-based definition (sector-specific and two-stage) and a national energy consumption-based definition.

The alternative definitions have been assessed against the current definition of non-SMEs (baseline). Table 6.1 summarises the main results for the key impacts, for both the baseline and alternative (sub-)options.

The current official definition requires a large number of companies to conduct an energy audit (see the baseline). All the assessed alternative policy options require fewer companies to conduct an energy audit. Leaving Option 5 aside, the reduction in the number of companies is substantial (-83% under Option 3B) to extreme (-95% under Option 4B).

Most of the energy is presently consumed by the manufacturing sector, which accounts for about 11% of all audits. This fraction increases for all the alternative policy options. Again, this is substantial for all the alternative policy options.

The share of public entities varies significantly, but it concerns a small share of all companies under both the baseline and alternative policy options.

Preferably, the alternative policy option should be somewhat consistent with the baseline. This is the case for the simplified options, where the remaining enterprises are currently also those chosen (Options 2 and 4B). The overlap with the baseline is

markedly lower for policy measures based on energy-related thresholds (Options 3A, 3B and 3C). This means that some SMEs would have to conduct an energy audit.

The results for the socioeconomic indicators show a similar pattern across the options. The baseline covers about two thirds, which is more than any of the alternative policy options (between 48% under Option 4B and 62% under Options 5 and 2).

There are alternative policy options that cover respectively less and more energy consumption than the baseline. This is the case for Options 2, 4A and 4B. Some of these options cover less by definition, as they are subsets of the baseline (Options 2 and 4A). The other options depend on the threshold level that has been specified.

The general objectives of the EED are related to energy savings. For all cases, the expected savings concern only about a quarter of the potential savings. This is consistent with a situation where there is no obligation to implement the savings measures specified in the audit. The differences between the savings figures are limited, but this is partly due to presenting the savings as a fraction of total energy consumption. The highest figures result for the options with energy-related thresholds (Options 3A, 3B, 3C and 4A).

Under the baseline coverage, the GHG emissions are higher than that for energy consumption. The same holds for the alternative Options 2, 4B and 5, while it is the reverse for the energy-related options (Options 3A, 3B and 3C) as well as for Option 4A.

The administrative burden of EU policies for enterprises should be kept as low as possible. Because the burden is linked to the number of audits, it is rather high in the baseline. For the alternative policy options, the numbers of audits are (much) lower than the baseline.

SMEs that are part of large corporate groups have to perform energy audits at present, while their expected energy savings are often too small to justify the costs of the audit. The simplified definition (Option 2) addresses this by applying the size indicators at the entity level. The options with energy-related thresholds (Options 3A, 3B and 3C) address the obstacle by using a threshold for actual energy consumption that excludes most SMEs.

Companies that are large in socioeconomic terms, but which do not use much energy, are forced to execute audits while the expected energy savings are rather low. The simplified option does not solve this problem, as the companies at stake are still classified as non-SMEs. Options with energy-related thresholds solve this problem through a check on energy/fuel consumption or energy costs (Options 3A, 3B and 3C). The energy-intensity option scores only slightly higher than the baseline, as lowering the socioeconomic thresholds limits the number of large companies with less energy-intensive savings to gain, but does not exclude these companies from the audit requirement.

As to complexity, most options score better than the baseline. They apply one threshold related to an energy quantity (Options 3A, 3B and 3C) and do not take into account combinations of companies. For the two-stage option (Option 4B), the baseline approach can be avoided when the energy-consumption threshold is decisive. The energy-intensity definition (Option 4A) is less complex due to the application at the entity level (exclusion of the ownership information).

Self-identification means that enterprises should be able to know whether they are required to perform an audit. The burden concerns gathering socioeconomic data on the company and related enterprises. For companies, under most of the options the gathering of energy-related data or socioeconomic data would be less complex (Options 2, 3A, 3B, 3C, 4A and 4B). The national selection process (Option 5) depends on the definition chosen at the national level to cover 60% of energy consumption. Therefore, the score is considered comparable with the baseline.

The costs of performing audits considers the number of audits required and the costs of these audits (where the cost of conducting an audit may be compensated by the cost savings due to the audit). The numbers are lower for all options and cost-effectiveness is often higher due to using an energy threshold. However, for the national selection process (Option 5) it will depend on the definition determined at the national level.

The goal of the EED is to achieve as much energy savings as possible in a cost-effective way. This means the policy option would have to cover the largest number of energy audits with a large savings potential. For the simplified definition (Option 2), the score is slightly better due to the lower number of audits but higher savings per audit. The energy consumption-based definitions (Options 3A, 3B and 3C) have a higher score because the enterprises with a large savings potential are selected and the savings per audit are higher. Among the energy definitions, the score for the fuel-based definition (Option 3B) is relatively less positive because savings on fuels through substitution with electricity could be contradictory with the EED goals. For the mixed definitions (Options 4A and 4B), the score is slightly positive due to much lower audit numbers, but higher savings per audit.

More savings could be realised by including those SMEs with substantial energy consumption that did not pass the size thresholds. This is possible for the definitions based on energy thresholds (Options 3A, 3B, 3C and 4A). It is not possible for the simplified definition (Option 2), where socioeconomic thresholds are still applied. In the two-stage definition (Option 4B), these SMEs are already left out in the first step (with the same score as the baseline).

More savings could also be realised for non-SMEs beyond the scope that have substantial energy consumption but which would not be selected because the company did not meet the socioeconomic thresholds. The score is more positive for the national energy-based definition (Option 5), because the flexible approach will enable a special focus on these outside-the-scope cases.

Overall, the options with energy-related thresholds (Options 3A, 3B and 3C) show the most positive scores with regard to a better focus on enterprises with enough savings potential.

The EED allows Member States to calculate energy savings also in primary terms, with differences mostly due to electricity and heat consumption. In the baseline, Member States that go for a primary energy definition make a distinction between energy carriers in order to calculate primary savings due to audits. For most policy options, Member States could calculate their savings in the same way, and thus score neutral for fitting the EED goal formulation (Options 2, 3A, 3C, 4A and 4B). Yet, for the fuel consumption definition (Option 3B), there would not be a need to discern among energy carriers when calculating primary savings (thus resulting in a positive score).

The State Aid rules follow the SME definition as defined in EU Recommendation 2003/361. In this sense, today's definition is fully aligned with the State Aid rules. All

the alternative options assessed deviate from the SME definition, and hence would not be fully aligned with the State Aid rules. This is not problematic, as the financial support for the audits and related measures covered under the State Aid rules could be separated from the audit obligation. The options considering a subset of non-SMEs (Options 2 and 4B) might be easier to implement, as the same State Aid requirements would apply to all companies within their scope, than those options considering also SMEs (Options 3A, 3B, 3C and 4A).

The implementation of the EED in the various Member States under the current definition is not fully aligned with the legal requirements (e.g. socioeconomic thresholds, sectoral information and ownership information). Most of the alternative policy options ease the implementation, as they require fewer indicators (Options 2, 4A and 4B) or one threshold related to energy (Options 3A, 3B and 3C). The national option makes transposition fuzzy, as Member States could freely choose their own approach within some restrictions.

Data on employment, turnover and assets per enterprise (or combinations) and sectoral information are available in nearly all Member States (Option 2 and 4A), while most Member States only have some of the ownership information (Option 4B). Policy options with an energy-related threshold (Options 3A, 3B and 3C) score slightly better than those requiring ownership information, but worse than the options just requiring socioeconomic indicators.

The application of the current definition in practice distorts the level playing field. Moreover, the scope can lead to differences between comparable enterprises – one obliged to perform an energy audit and the other not. This might just be due to being seen as a stand-alone or seen as part of a conglomerate. The policy options with energy-related thresholds provide a more level playing field because differences in energy consumption determine whether they have to perform an energy audit. The sector-based threshold (Option 4A) has the same approach as the baseline but the level playing field is distorted more because socioeconomic thresholds differ per sector. The national option is the most distortive for the level playing field among Member States, which can choose their own selection system.

The mandatory energy audits should lead to the implementation of cost-effective savings measures that at least compensate for the costs of the audit system. At present, not all audits are likely to identify sufficient measures for cost-effective energy savings. All the alternative policy options are likely to cover companies for which the energy audits would probably identify more measures for cost-effective savings.

Table 6.1 Overview of impacts compared with the baseline across policy options

Criteria	1 Base-line	2 Simpli-fied	3A Final energy	3B Fuel	3C Energy costs	4A Sector-specific	4B Two stage	5 Nation-al
Scope								
Number of companies (x 1 000)	755	94	95	126	141	56	39	418
Of which manufacturing	11%	23%	41%	48%	44%	48%	42%	15%
Of which public bodies	6%	4%	4%	3%	3%	3%	5%	5%
Overlap with baseline cases	100%	100%	55%	53%	50%	67%	100%	96%
Coverage								
Employment	68%	62%	50%	54%	54%	51%	48%	62%
Final energy	65%	57%	71%	73%	71%	55%	55%	64%
GHG emissions	69%	61%	65%	69%	68%	52%	57%	66%
Energy savings								
Expected	1.9%	1.7%	2.2%	2.3%	2.3%	1.7%	1.6%	1.9%
Potential	6.8%	6.0%	7.9%	8.1%	8.0%	6.1%	5.8%	6.9%
Administrative burden								
Scores relative to baseline								
Audits to be performed	N/A	++	++	++	++	+++	+++	+
SME part of a large company	N/A	+++	+++	+++	+++	+	+++	++
Low energy non-SME	N/A	0	++	++	++	0	+++	++
Complex selection process	N/A	++	+	+	+	-	++	+
Self-identification	N/A	+	+	+	+	-	+	0
Cost of audits	N/A	+	++	++	+++	++	+++	+
Energy audit focus								
Meeting EED savings objectives	N/A	-	++	+	++	0	-	+
Includes high energy SMEs	N/A	0	++	++	+	+	0	+
Includes outside-the-scope non-SMEs	N/A	0	++	++	+	+	0	+++
Regulatory issues								
Fits EED goal formulation	N/A	0	0	+	0	0	0	+
Aligned with State Aid policies	N/A	-	--	--	--	-	0	-
Harmonised transposition	N/A	+	+	++	+	-	+	---
Enforcement	N/A	++	+	+	+	+	+	++
Economic issues								
Level playing field	N/A	+	++	+	+	-	++	-
Total cost savings	N/A	+	++	++	++	++	++	++

Note: For the qualitative indicators, only the difference with the baseline is shown, where '+' stands for a positive change, '0' for no change and '-' for a negative change of the option compared with the baseline.

Source: CEPS.

6.3 Preferred policy option

Taking all the assessed impacts into account, the current definition of non-SMEs is not optimal. In fact, any of the alternative policy options could be an improvement compared with today's definition.

The simplified definition (Option 2), based on just socioeconomic indicators, could limit the administrative burden and contribute to more cost-efficient audits. The main reason is that this alternative does not select more eligible enterprises – such as high energy-consuming SMEs or non-SMEs – that do not pass socioeconomic thresholds. The simplified option just cuts back the number of enterprises subject to audits, possibly including some enterprises with enough savings potential. However, this option does not consider the energy intensity of the companies.

The two-stage option (Option 4B) only removes the already selected enterprises that have too little energy consumption (and did not contribute to savings in the baseline). Correcting the current thresholds for energy intensity per sector could lead to slightly better savings performance and coherence with other legislation.

An alternative threshold type should preferably be an energy-related one. These options show large reductions in the number of energy audits and contribute most to the general objectives of the EED, with the highest expected energy savings. These could be further increased by lowering the respective energy thresholds.

The choice between these three energy consumption options is rather arbitrary, given a comparable impact and small differences for the scores on coherence. Still, final energy consumption (Option 3A) has advantages with respect to its connection with the EED's approach and availability of data. Fuel consumption (Option 3B) has a closer connection to GHG emission policies. But it has the same data problems as final energy, less connection with the EED format and the fuel savings are susceptible to substitution between fuels and heat/electricity. Energy costs (Option 3C) have a more direct relation to the cost-effectiveness of the audit, but price differences and price fluctuations make application of this option more complex. Therefore, the final energy alternative (Option 3A) is preferred among the three energy-consumption options.

A drawback of the energy options is the lower availability of energy data compared with socioeconomic data. At the same time, there are proven examples of national policy instruments, such as long-term agreements on energy efficiency for companies, that have solved the problems of gathering and using (confidential) energy data. The set-up of such systems may be a burden for some Member States but may also serve other corporate energy and climate action policies.

Most alternatives differentiate significantly from the current EU SME definition, which is also applied for State Aid. If the revised definition has to follow the EU SME definition, only the two-stage option (Option 4B) remains as an alternative, at the cost of meeting the EED's general objectives. Defining the definition at the national level (Option 5) is not preferred, as it would likely distort the level playing field.

Finally, in order to reduce the costs of energy audits and improve their quality it is recommended to allow the energy audits be spread out across the four-year cycle. There might be a need for additional research to determine the most optimal interval between energy audits.

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List of abbreviations

Abbreviation	Full form
BRRD	Bank Recovery and Resolution Directive
CEPS	Centre for European Policy Studies
CLRTAP	Convention on Long-range Transboundary Air Pollution
CMOR	Common Organisation of the Markets Regulation
CO2	Carbon dioxide
CPR	Common Provisions Regulation on five European Structural and Investment Funds
CRR	Capital Requirements Regulation
CSDR	Regulation on Settlement and Central Securities Depositories
DG AGRI	Directorate-General for Agriculture and Rural Development
DG COMP	Directorate-General for Competition
DG ECFIN	Directorate-General for Economic and Financial Affairs
DG ENER	Directorate-General for Energy
DG ENV	Directorate-General for Environment
DG FISMA	Directorate-General for Financial Stability, Financial Services and Capital Markets Union
DG GROW	Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs
DG JUST	Directorate-General for Justice and Consumers
DG RTD	Directorate-General for Research and Innovation
EBA	European Banking Authority
EBF	European Banking Federation
EC	European Commission
ECOs	Energy Conservation Opportunities
ECMs	Energy Conservation Measures
EDIDP	European Defence Industrial Development Programme
EED	Energy Efficiency Directive
EEG	Erneuerbare-Energien-Gesetz (Renewable energy law)
EFSI	European Fund for Strategic Investments Regulation
EMAS	Eco-Management and Audit Scheme
ESI	European Structural and Investment Funds
ETS	Emissions Trading System
EU	European Union
EuSEF	European Social Entrepreneurship regulation
EUR	Euro
EuVECA	European Venture Capital Funds regulation
GBER	General Block Exemption Regulation
GHG	Greenhouse gas
GJ	Gigajoule
GWh	Gigawatt hours
HRK	Hrvatska Kuna
IAF	International Accreditation Forum
ISO	International Organization for Standardization
kWh	Kilowatt hours

Abbreviation	Full form
LCCA	Life-cycle cost analysis
M2	Square meter
M3	Cubic meter
MAR	Market Abuse Regulation
MECS	Manufacturing Energy Consumption Survey
MiFID	Markets in Financial Instruments Directive II
MJ	Megajoule
MS	Member states
MTF	Multi-Trading Facilities
MW	Megawatt
MWh	Megawatt hours
NACE	Nomenclature statistique des activités économiques dans la Communauté européenne (Nomenclature of Economic Activities)
NFBS	Non-financial business sector
OECD	Organisation for Economic Co-operation and Development
PR	Prospectus Regulation
PwC	PricewaterhouseCoopers
SBS	Structural Business Statistics
SEAI	Sustainable Energy Authority of Ireland
SEDA	Sustainable Energy Development Agency
SGCIE	Sistema de Gestão dos Consumos Intensivos de Energia
SMEs	Small and medium-sized enterprises
SPP	Simple payback periods
SRD	Shareholder Rights Directive
SWOT	Strengths, weaknesses, opportunities and threats
TFEU	Treaty on the Functioning of the European Union
toe	Tons of oil equivalent
TJ	Terajoule
UNFCCC	United Nations Framework Convention on Climate Change
UTPD	Unfair Trading Practices Directive

Annex 1. Article 8 on energy audits and energy-management systems

1. Member States shall promote the availability to all final customers of high quality energy audits which are cost-effective and:
 - (a) carried out in an independent manner by qualified and/or accredited experts according to qualification criteria; or
 - (b) implemented and supervised by independent authorities under national legislation.

The energy audits referred to in the first subparagraph may be carried out by in-house experts or energy auditors provided that the Member State concerned has put in place a scheme to assure and check their quality, including, if appropriate, [a] annual random selection of at least a statistically significant percentage of all the energy audits they carry out.

For the purpose of guaranteeing the high quality of the energy audits and energy management systems, Member States shall establish transparent and non-discriminatory minimum criteria for energy audits based on Annex VI.

Energy audits shall not include clauses preventing the findings of the audit from being transferred to any qualified/accredited energy service provider, on condition that the customer does not object.

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

On the basis of transparent and non-discriminatory criteria and without prejudice to Union State aid law, Member States may set up support schemes for SMEs, including if they have concluded voluntary agreements, to cover costs of an energy audit and of the implementation of highly cost-effective recommendations from the energy audits, if the proposed measures are implemented.

Member States shall bring to the attention of SMEs, including through their respective representative intermediary organisations, concrete examples of how energy management systems could help their businesses. **The Commission shall assist Member States by supporting the exchange of best practices in this domain.**

3. Member States shall also develop programmes to raise awareness among households about the benefits of such audits through appropriate advice services. Member States shall encourage training programmes for the qualification of energy auditors in order to facilitate sufficient availability of experts.

4. **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.**

5. Energy audits shall be considered as fulfilling the requirements of paragraph 4 when they are carried out in an independent manner, on the basis of minimum criteria based on Annex VI, and implemented under voluntary agreements concluded between organisations of stakeholders and an appointed body and supervised by the Member State concerned, or other bodies to which the competent authorities have delegated the responsibility concerned, or by the Commission. Access of market participants offering energy services shall be based on transparent and non-discriminatory criteria.

6. Enterprises that are not SMEs and that are implementing an energy or environmental management system - certified by an independent body according to the relevant European or International Standards - shall be exempted from the requirements of paragraph 4, provided that Member States ensure that the management system concerned includes an energy audit on the basis of the minimum criteria based on Annex VI.
7. Energy audits may stand alone or be part of a broader environmental audit. Member States may require that an assessment of the technical and economic feasibility of connection to an existing or planned district heating or cooling network shall be part of the energy audit.

Without prejudice to Union State aid law, Member States may implement incentive and support schemes for the implementation of recommendations from energy audits and similar measures.

Note: Emphasis added.

Source: Energy Efficiency Directive (2012/27/EU).

Annex 2. Estimating the number of companies

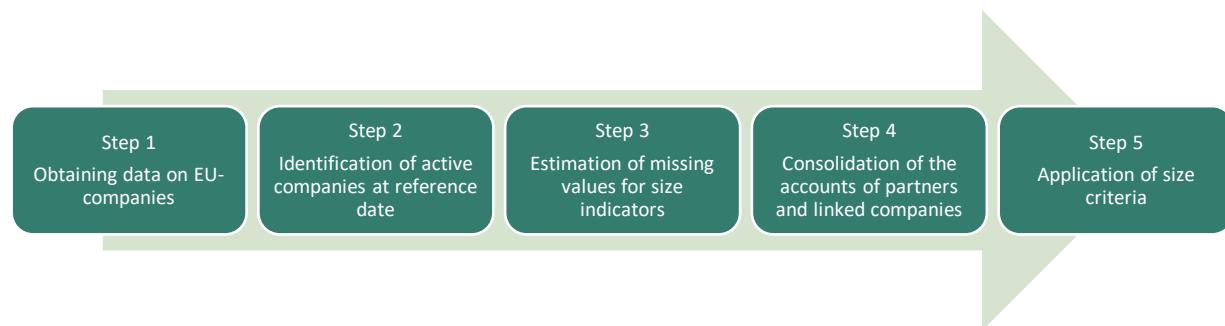
Firm-level data are used to determine the number of non-SMEs in the EU. All active companies in each EU Member State are classified as either SMEs or non-SMEs according to the definition laid down in EU Recommendation 2003/361/EC.

The EU Recommendation provides that – to be classified as an SME – a company must not exceed certain staff headcount and financial thresholds. In particular, according to Article 2 of the EU Recommendation, a company is an SME if it employs fewer than 250 people and its annual turnover is lower than or equal to EUR 50 million and/or annual balance sheet total is lower than or equal to EUR 43 million.

Furthermore, the assessment of whether a company is an SME or not must take into consideration the shareholders and the subsidiaries of the company in question, to ensure that companies are not classified as an SME only because of their ownership structure.

The companies that are not meeting the conditions for an SME are classified as non-SME.

Figure A2.1 Methodology to determine the number of non-SMEs in the EU



Source: Elaboration on CEPS (2019).

The approach to determining the number of non-SMEs in the EU consists of five steps:

- First, all companies registered in each EU Member State are identified and all relevant firm-level data are obtained from Orbis Europe.
- Second, for the companies identified under the first step, whether they were active on 31 December 2016 (reference date) is ascertained. Only these active companies are retained for the next steps.
- Third, for the active companies for which only partial information is available, missing values for the total assets, total turnover and number of employees are estimated.
- Fourth, depending on the ownership structure of each active company, staff and financial indicators are calculated for all active companies, consolidating the accounts of partner and linked companies according to the rules laid down in the EU Recommendation.
- Fifth, the SME size criteria are applied to all the active companies to identify the total number of non-SMEs.

These five steps of the methodology are discussed in detail below.

Step 1: obtaining data on EU companies

The first step consists of identifying all companies registered in each EU Member State and collecting the relevant firm-level data. The main source is the Orbis Europe database of Bureau van Dijk, which is a commercial database containing updated information on most companies operating in Europe.

During data collection, the information on identification, ownership and financial is retrieved. The financial information includes the number of employees, total turnover and total assets for the period 2010-2019. Additionally, sectoral, geographical, legal and status

information is obtained. The data are collected for all active and inactive companies in the EU.⁹⁴ All the collected variables are then used to determine the size of each individual company according to the SME definition laid down in the EU Recommendation.

Step 2: identifying active companies at the reference date

For EU business registers it takes up to 18 months between the end of a financial period and inclusion of the related company information. Against this background, the reference date for determining the number of active companies in the EU is set at 31 December 2016.

Based on the information provided by Orbis Europe on the status of each EU company, all businesses that were incorporated after 2016 are excluded from the dataset. Companies deactivated after the end of 2016 are included in the database. For a portion of the EU companies, the information related to the status date is not available. In these cases, companies reported as active are automatically included in the dataset.

Finally, as the SME definition applies exclusively to businesses, public administration bodies (i.e. municipalities, public consortia and other public entities listed in the national business registers) have been identified and excluded from the population of EU active companies.

Step 3: estimating missing values for size indicators

Approximately 44% of the total active companies reported at least one indicator among total turnover, total assets and total employees for the reference year (2016). However, for most of the active companies, 2016 size indicators are not available.

The absence of financial and employee indicators is due to three main reasons. First, a portion of the companies listed in the business registers is not engaged in any business activity. In certain Member States, companies are automatically incorporated into the business registers at the time of their creation. A portion of these companies is legally alive but remains permanently dormant.⁹⁵ Second, in several Member States, certain legal forms or companies below a certain financial threshold are exempted from submitting their size indicators to the national business registers.⁹⁶ Finally, the level of reporting and the quality of the information contained in the business registers varies significantly across countries. In Cyprus and Greece, financial and employee indicators are available for less than 5% of the total active companies. In Austria, Belgium, Bulgaria, Denmark, Finland, France, Croatia, Luxembourg and Malta, size indicators are missing for more than 50% of the active companies listed in the registers.

To determine the number of companies that are engaged in business activity and derive the estimated indicators used in the study (i.e. employment, financial and energy-related measures), the analysis takes into consideration the availability of size indicators and the reporting time. More specifically, a company is considered to carry out business activity if it reports at least one size indicator over the period 2015-2017. The remaining companies, for which all indicators are missing for these three years, are considered legally alive but not engaged in any business activity at the reference date. Thus, financial and employee indicators of these companies are set at zero. The lack of size indicators for these companies is expected to have only a limited impact on the identification of the number of non-SMEs obliged to conduct energy audits. Indeed, a large portion of the non-reporting entities are sole proprietors that are on average smaller companies compared with other legal forms. A comparison with the number of people employed as reported in the Eurostat SBS further confirms the limited impact of missing information on the identification of

⁹⁴ Nearly all active companies are included in Orbis Europe, with the exception of Luxembourg and Poland (i.e. 50–75%).

⁹⁵ Eurostat–OECD (2007), “Manual on Business Demography Statistics”, p. 17.

⁹⁶ Sole proprietors are not obliged to file annual accounts in Germany, Lithuania or Poland; this exemption is extended to micro-companies in Germany.

SMEs, as it shows that companies with missing information are mostly smaller entities (up to 20 employees).⁹⁷

Overall, based on the size indicators reported between 2015 and 2017, this study identifies approximately 22 million companies that are engaged in business activity, which accounts for 53% of the legally active companies (see Table A2.1).

Table A2.1 Reporting active companies by country

Country	Reporting companies*	Active companies	Share of reporting companies
			%
Austria	281 305	594 268	47.3
Belgium	582 790	1 464 156	39.8
Bulgaria	735 363	1 450 973	50.7
Cyprus	5 690	272 000	2.1
Czech Republic	1 824 662	1 906 300	95.7
Germany	1 589 306	2 293 583	69.3
Denmark	712 325	764 140	93.2
Estonia	155 179	245 468	63.2
Greece	46 331	789 203	5.9
Spain	1 485 516	2 384 699	62.3
Finland	577 708	1 250 091	46.2
France	3 618 546	8 806 878	41.1
Croatia	136 239	273 850	49.7
Hungary	620 205	768 163	80.7
Ireland	173 213	212 872	81.4
Italy	3 105 922	3 899 487	79.6
Lithuania	129 529	156 007	83.0
Luxembourg	42 056	158 884	26.5
Latvia	140 653	248 306	56.6
Malta	24 558	45 772	53.7
Netherlands	2 372 771	2 906 797	81.6
Poland	1 627 054	1 779 823	91.4
Portugal	426 235	559 912	76.1
Romania	761 780	1 298 420	58.7
Sweden	1 463 911	1 515 458	96.6
Slovenia	140 810	267 522	52.6
Slovakia	583 341	604 612	96.5
United Kingdom	4 369 537	5 360 346	81.5
Total EU Companies	27 732 535	42 277 990	65.6

* Number of active companies with at least one size indicator between 2011 and 2019.

Source: CEPS' elaboration based on Orbis Europe data.

⁹⁷ Based on the available information from the business registers, this study finds that the total number of employees for the companies employing fewer than 20 employees in the EU amounts to 28 million people, which is approximately half of the total number of people employed – including paid working proprietors as well as seasonal workers – for the same class category reported by Eurostat SBS.

For a number of companies engaged in business activities, information on the three size indicators are not complete and thus insufficient to determine the size category for the company. In these cases, the missing values are imputed based on historic or estimated values.

The indicators that determine the size category are fairly stable over time for most companies. Therefore, historic values are preferred over estimated values. For about 12% of all active companies, missing values for at least one of the three size indicators (i.e. turnover, assets and/or number of employees) is replaced with the historic values (mostly the year 2015 or 2017).

For companies with one or two missing indicators and no historic records, missing values are estimated based on an empirical model. As there is a strong relation between the number of employees, turnover and assets of a company,⁹⁸ it is possible to estimate the missing values for the companies based on the value for at least one of these three size indicators. Hence, active companies reporting values for at least two of the three size indicators are identified and used to calibrate the econometrical model (approximately 15 million companies).

Overall, the missing values for each of the three size indicators are estimated using the information that is available on the remaining size indicators, country and sector information. For example, if total assets is missing for a company but total number of employees, total turnover and sectoral specifications are available, the coefficient to estimate the total assets of the company is based on the companies for which all the three indicators (i.e. total assets, total turnover and total employees) and sectoral information are available. For approximately 25% of all active companies, the missing values of at least one size indicator is estimated.

To account for the fact that certain sectors employ significantly more or fewer employees per unit of assets or turnover, the coefficients are derived for each sector separately. In addition, it is observed that the correlation between total employment and turnover is significantly higher than the correlation between total assets and employment, and total assets and turnover. Thus, when estimating the number of employees or the total turnover, preference is given to the available indicator between these two. If assets is the only indicator available, this is used to estimate the missing values.

Following this logic, the model used for the estimation has 133 different specifications.⁹⁹ Considering the limited information available for companies operating in 'Agriculture', 'Activity of households' and 'Activity of extraterritorial organisations', the coefficients for these sectors are derived using all companies across all sectors. The same approach is used for companies for which sector information is missing.

Another important variable influencing the relation between the size indicators is the companies' legal form. Limited liability and public limited liability companies are usually larger than sole proprietors. Similarly, the country in which the company operates also contributes to explaining the relation between the three size indicators. Differences in average salaries, productivity and capital intensity influence the units of assets and turnover per employee across different countries. To account for these differences, the model includes dummy variables for countries and legal forms.

The model uses the Ordinary Least Squares method. The size indicators are transformed using the natural logarithmic scale to capture the non-linear relationship existing between the size indicators. Additionally, outlier companies are excluded from the sample used for the estimation of the parameters. To this end, the shares between the three financials are calculated and compared against the overall sample using the mean and the standard

⁹⁸ Companies with more employees in a particular sector and country are likely to have a higher turnover and total assets.

⁹⁹ For total number of employees and total turnover, there are two times nineteen (i.e. one for each economic sector) potential specifications. For total assets total number of specification are three times nineteen (133 model specifications in total).

deviation. Companies with a clearly unrepresentative high (or low) unit of assets (or turnover) per employee are excluded from the model sample. Finally, companies with consolidated accounts are excluded, as the reported indicators do not necessarily reflect the staff headcount and financials of the legal entity but rather those of the corporate group (i.e. the company in question plus the controlled subsidiaries).

The prediction power of the model is high across all sectors and specifications (see Table A2.2). As expected, the estimation for number of employees and total turnover show higher predicting power when one of these two indicators is used to estimate the other one, while the predicting power is less when just assets is used to estimate the number of employees and total turnover.

Table A2.2 Econometric model for the estimation of the missing values, sample size and predicting power

	Number of employees				Turnover				Assets					
	Specification 1 Based on Turnover		Specification 2 Based on Assets		Specification 1 Based on Employees		Specification 2 Based on Assets		Specification 1 Based on Employee and Turnover		Specification 2 Based on Employee		Specification 3 Based on Turnover	
	Sample (th)	R ²	Sample (th)	R ²	Sample (th)	R ²	Sample (th)	R ²	Sample (th)	R ²	Sample (th)	R ²	Sample (th)	R ²
B – Mining and quarrying	8	83%	10	80%	9	86%	11	69%	8	78%	10	82%	11	75%
C – Manufacturing	504	78%	604	68%	509	81%	652	83%	521	87%	609	73%	652	89%
D – Electricity, gas & steam s.	16	84%	24	80%	16	82%	45	72%	15	75%	24	75%	45	75%
E – Water, sewage, & waste	22	81%	27	73%	21	77%	30	76%	23	84%	27	76%	30	83%
F – Construction	551	73%	707	75%	564	69%	864	62%	597	69%	707	49%	864	69%
G – Wholesale & retail	1 133	79%	1 404	72%	1 094	70%	1 566	78%	1 178	81%	1 405	61%	1 566	85%
H – Transportation & storage	220	80%	266	73%	220	75%	288	81%	230	84%	266	63%	288	86%
I – Accommodation & food	305	73%	365	46%	312	74%	418	69%	317	72%	368	59%	418	77%
J – Information & comms	186	87%	261	87%	200	73%	322	73%	203	87%	266	76%	322	83%
K – Financial & insurance	84	85%	349	83%	93	79%	214	40%	89	79%	349	78%	214	53%
L – Real estate	230	86%	320	90%	238	59%	557	50%	232	55%	320	81%	557	55%
M – Professional activities	487	89%	759	90%	529	73%	844	62%	532	87%	750	77%	845	84%
N – Administrative & support	203	73%	294	77%	217	82%	337	70%	221	74%	294	49%	337	77%
O – Public administration	1	80%	2	58%	1	85%	2	82%	1	83%	2	66%	2	85%
P – Education	57	78%	76	61%	64	73%	100	81%	64	81%	76	61%	100	83%
Q – Human health & social w.	129	81%	177	63%	136	84%	191	80%	141	81%	178	60%	191	86%
R – Arts, & entertainment	71	88%	97	85%	79	67%	129	71%	80	82%	100	71%	129	78%
S – Other service	109	78%	143	71%	121	72%	200	80%	122	79%	143	58%	200	82%
All sectors*	4 502	80%	6 199	82%	4 812	82%	7 099	67%	4 825	78%	6 198	77%	7 099	74%

* Coefficients derived from the model including all sectors are used to estimate financials in 'Agriculture', 'Activity of households' and 'Activity of extraterritorial organisations'.
Source: CEPS' elaboration based on Orbis Europe data.

The parameters obtained from the regression results are applied to the companies engaged in business activity with one of two missing values. The best possible specification is used for the estimation depending on the available information.

Table A2.3 Share of actual, historical and estimated values for companies engaged in business activity

	Number of employees	Turnover	Assets
Actual value (2016)	58%	63%	54%
Historical values (2014-2015, 2017)	17%	15%	8%
Estimated			
Of which using			
Specification 1	25%	22%	38%
Specification 2	24%	21%	13%
Specification 3	1%	1%	13%
N.A.	N.A.	N.A.	12%
Total	100%	100%	100%

Note: The estimations for number of employees and total turnover show higher predicting power when one of these two indicators is used to estimate the other one. For this reason, the model for the number of employees and turnover is composed of two specifications.

Source: CEPS' elaboration based on Orbis Europe data.

Overall, taking into consideration the EU companies engaged in business activities, the exercise is conducted on actual values reported in 2016 for approximately a quarter of the companies. For less than a fifth of the companies, the missing values for number of employees and turnover are replaced with historic values. Regarding total assets, the share of historic values is equal to 8%. For a share of companies ranging between 25% and 38%, missing values across the three size indicators are estimated using the other available size information. The proportion of companies with estimated values is 25% for the number of employees, 22% for turnover and 38% for total assets.

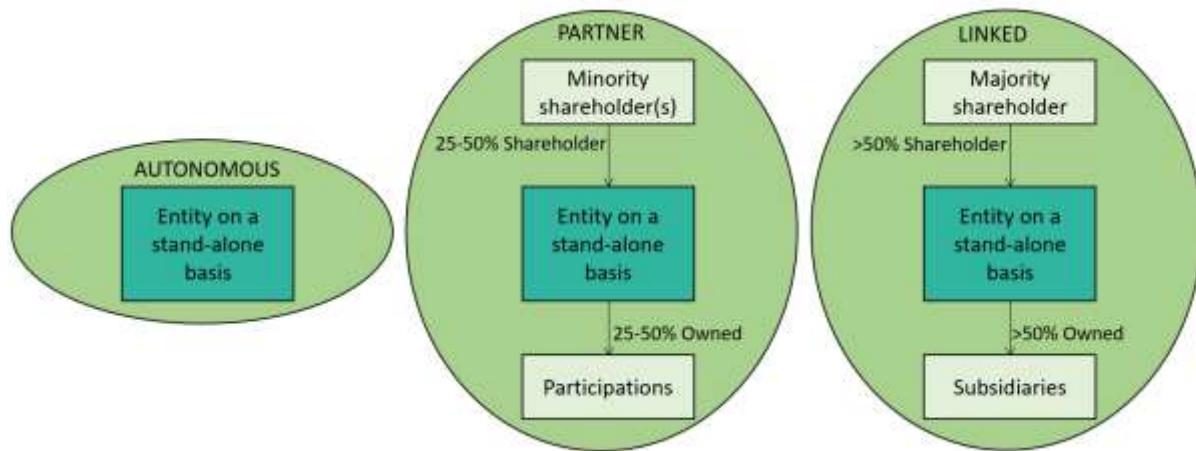
Step 4: consolidating the accounts of partners and linked companies

Article 3 of the EU Recommendation provides that when calculating the number of employees and financial indicators to assess the SME status, a company must consolidate on a pro rata basis the accounts of all its *partner enterprises* and fully the accounts of all its *linked enterprises*.

Partner enterprises refer to third enterprises that either control or are controlled by the company in question for more than 25% and up to 50% of its capital or voting rights (see Figure A2.2). When a third enterprise either controls or is controlled by the company in question for more than 50% of its capital or voting rights, this company is considered a linked enterprise. When one or more natural persons control more than one company operating in adjacent/relevant markets, the controlled companies are considered linked enterprises.¹⁰⁰ Finally, a company that does not have any partner or linked enterprises is considered *autonomous*. In this case, the number of employees and the financial thresholds will be verified solely on the accounts of the company in question.

¹⁰⁰ According to the Commission notice on the definition of relevant market for the purposes of Community competition law, a "relevant market comprises all those products and/or services which are regarded as interchangeable or substitutable by the consumers" (OJ C372, 9.12.1997, p. 6). In this study, companies that are controlled by the same natural person(s) are considered linked if they operate in the same sector according to the NACE 4-digit classification.

Figure A2.2 Ownership structure



Source: CEPS' elaboration based on the EU Recommendation.

Article 3(2) of the EU Recommendation provides exemptions in the case of partnerships with certain types of investors. In particular, a company is considered an autonomous enterprise even if venture capital companies, universities, research centres, institutional investors or small local authorities hold between 25% and 50% of the capital or voting rights of the company in question.

Article 6(2) of the EU Recommendation provides that partners of a partner enterprise are excluded from the computation of the staff headcount and financial indicators of the company in question. However, all the linked enterprises (direct or indirect) of the company in question must be taken into account for the calculation.

To perform this computation, detailed information on both shareholders and subsidiaries is collected for all the EU active companies. Based on this information, companies are divided into two groups: (i) companies without significant relationships with third entities (autonomous enterprises) and (ii) companies with significant relationships with third entities (partner and/or linked enterprises).

For the companies included in the latter group, each of their shareholders and subsidiaries is classified as either a partner or linked entity. Based on this classification, staff and financial indicators are consolidated as described below.

For a start, the consolidation is performed for all linked companies. The computation depends on the type of accounts available (consolidated vs unconsolidated). When the group parent reports consolidated accounts, the size indicators are applied to all the controlled entities of the group. But when consolidated accounts are not available, the size indicators of all linked enterprises are summed up and applied to all the controlled entities of the corporate group. When consolidated accounts are available for a company that is not the parent company, the group ownership network is reconstructed and the size indicators of all the controlled subsidiaries of the company with consolidated accounts are set at zero. The consolidation is then performed upwards, summing up the consolidated accounts with the unconsolidated accounts of the controlling entities.

Subsequently, the consolidation is performed for all partner enterprises. The proportional consolidation between two partner entities that do not belong to a corporate group is performed taking into account the accounts of both individual companies. Notably, if the partner companies are part of two corporate groups, the consolidation is performed on the consolidated accounts of the respective corporate groups. Partnerships within a corporate group are not excluded to avoid double counting.

Step 5: applying the size criteria

The fifth and last step consists of applying the size thresholds laid down in the EU Recommendation (see Table A2.4) to each of the size indicators to determine their size category and derive the population of non-SMEs in the EU.

Table A2.4 SME thresholds

Company category	Staff headcount	Turnover	or	Balance sheet total
Large	≥ 250	EUR >50 million		EUR >43 million
Medium-sized	< 250	EUR ≤50 million		EUR ≤43 million
Small	< 50	EUR ≤10 million		EUR ≤10 million
Micro	< 10	EUR ≤2 million		EUR ≤2 million

Source: EU Recommendation 2003/361.

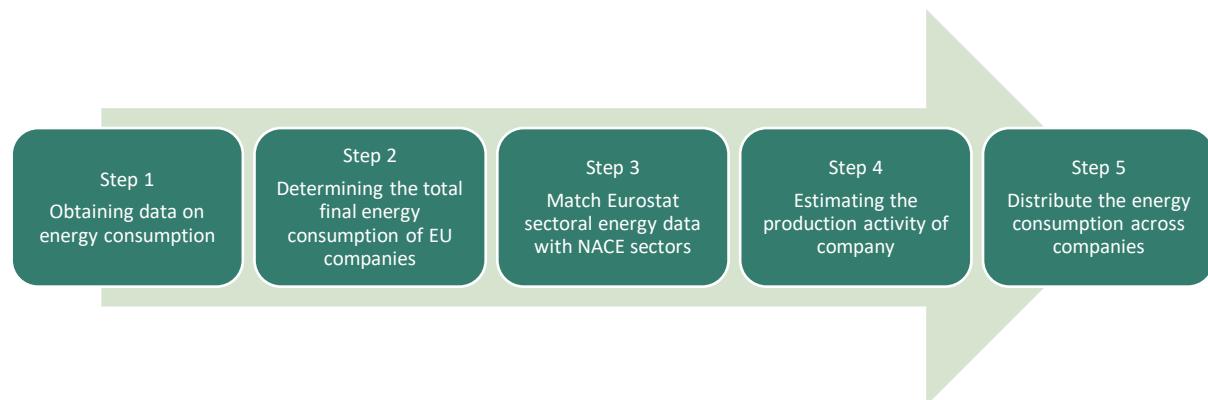
Annex 3. Estimating energy-related indicators

The assessment performed in this study takes into consideration four different energy-related indicators, namely (i) final energy consumption, (ii) primary energy consumption, (iii) energy costs, and (iv) GHG emissions. This section provides an overview of the methodology adopted to calculate these indicators.

Final energy consumption

The methodology to estimate the final energy consumption of each EU company consists of five steps (see Figure A3.1). The latter are explained in details hereafter.

Figure A3.1 Methodology to calculate the final energy consumption



Source: CEPS (2020) elaboration.

Step 1: obtaining data on energy consumption

The first step consists of collecting data on energy consumption. This study uses the energy balance published by Eurostat, which "presents all statistically significant energy products (fuels) of a country and their production, transformation and consumption by different type of economic actors (sectors)".¹⁰¹ The Eurostat energy balance data are compiled using specific questionnaires submitted by all reporting countries. Eurostat is responsible for checking the completeness of the questionnaires, validating the data and publishing the final statistics.

The complete energy balance contains statistics on more than 50 energy products. However, this study takes into account only the EU companies' preferred energy carriers, namely electricity, natural gas, gasoline, diesel, fuel oil and jet fuels.

The remaining energy products are not considered in this study. Some of them are excluded because they account for a marginal share of the total. Others are not taken into consideration because it would not be possible to determine their primary energy consumption and energy costs. In fact, some energy products reported in the energy balance are by-products. In other words, they are the result of industrial processes. For example, blast furnace gas is a significant source of energy for companies operating in the iron and steel sector. Similarly, wood residues is a very important energy product for the wood and wood products sector.

Cumulatively, the energy carriers considered in this study account for about 80% of the EU final energy consumption (see Table A3.1). In 14 out of the 25 sectors, the main energy carriers cover between 80% and 100% of the sectoral energy consumption.¹⁰² The same

¹⁰¹ Eurostat (2019), "Energy balance guide", p. 4.

¹⁰² These sectors are pipeline transport, domestic navigation, rail transport, domestic aviation, construction, fishing, machinery, textile and leather, road transport, non-ferrous metals, transport equipment, mining and

set of energy products covers between 60% and 80% of the sectoral consumption in six sectors, including the chemical and petrochemical and the iron and steel sectors.¹⁰³ The range of total energy consumption covered by the main energy carriers decreases to 50–60% in four sectors, including the non-metallic minerals, paper, pulp and printing and in the energy sectors.¹⁰⁴ Finally, the main energy products account for about 34% of the energy consumed in the wood and wood products, as almost 50% of the energy used in this sector comes from wood residues.

Table A3.1 Corporate final energy consumption by sector and set of energy carriers

Sector	Final energy consumption (TJ)		Share of final energy consumption covered by main energy carriers
	All energy carriers	Main energy carriers	
	TJ	TJ	%
Energy production	3 332 664	1 690 437	51%
Construction	345 056	332 883	96%
Chemical and petrochemical	2 160 207	1 448 223	67%
Food, beverages and tobacco	1 236 217	1 063 395	86%
Iron and steel	1 149 500	762 476	66%
Machinery	804 648	757 180	94%
Mining and quarrying	152 062	133 442	88%
Non-ferrous metals	415 708	383 193	92%
Non-metallic minerals	1 462 443	848 036	58%
Paper, pulp and printing	1 405 484	720 868	51%
transport equipment	354 040	312 304	88%
textile and leather	177 362	166 041	94%
Wood and wood products	356 199	121 852	34%
Other industrial activities	741 062	534 129	72%
Domestic aviation	277 031	274 690	99%
Domestic navigation	209 109	208 778	100%
Pipeline transport	73 300	73 300	100%
Rail transport	273 611	271 753	99%
Road transport	12 580 402	11 762 900	94%
Other transportation activities	37 289	29 894	80%
Agriculture and forestry	1 094 220	876 208	80%
Commercial and public sector	6 282 736	5 449 930	87%
Fishing	64 785	62 241	96%
Other activities	192 237	116 680	61%
Households	12 093 263	8 308 518	69%
All sectors	47 270 634	36 709 351	78%

* Main energy carriers refer to electricity, natural gas, diesel, gasoline, fuel oil and jet fuels.

Source: Eurostat, "Complete energy balance".

quarrying, commercial and public sector, food, beverages and tobacco, other transportation activities, agriculture and forestry.

¹⁰³ The remaining three sectors are other transportation activities, other industrial activities and households.

¹⁰⁴ The fourth sector in this category is *other activities*.

Step 2: determining the final energy consumption of EU-28 companies

The second step consists of determining EU corporate energy consumption. To this end, four adjustments are performed.

The first adjustment concerns the energy consumed by households. Mandatory energy audits in the context of the EED are applicable only to companies. Therefore, statistics related to the consumption of households are excluded from the computation of the final consumption of companies residing in the EU-27 and the UK. By excluding households' energy consumption, approximately 8.3 million TJ are deducted from the total energy consumption (see Table A3.2).

Table A3.2 Determining EU corporate energy consumption, exclusion of household sector

Sectors	Final energy consumption
	TJ
All sectors	36 709 351
Household residential sector	8 308 518
Economic sectors	28 400 833

Source: CEPS (2020) elaboration based on Eurostat data.

The second adjustment concerns the commercial and the public sector. In the energy balance, the energy consumed by these sectors are reported jointly. However, the provisions contained in the EED on mandatory energy audits are not applicable to public administration entities.¹⁰⁵ To account for this, the energy consumption of the commercial and the public sector are separated.

In order to estimate the energy consumed by the commercial sector and by the public sector, this study attributes the sectoral total (5.4 million TJ) proportionally to the share of employees in the two sectors. According to Eurostat, the public sector accounts for about 30% of total employees, while the commercial sector accounts for the remaining 70% (see Table A3.3). This share is calculated at the country level and then used as an energy consumption factor to calculate the final energy consumption of the commercial sector. In practice, the final energy consumption of the commercial and public sector is multiplied by the energy consumption factor of the commercial sector. As a result, the final energy consumption of the commercial sector is estimated to be 3.7 million TJ, while the remaining 1.8 million TJ is assigned to the public sector.

¹⁰⁵ The SME definition is applicable to entities engaged in economic activity, thus excluding public administration entities (Article 1 of 2003/361/EC).

Table A3.3 Determining EU corporate energy consumption, calculation of the commercial sector

Country	Number of employees Commercial and public sector		Share of consumption factor of the commercial sector	Final energy consumption Commercial and public sector	
	TJ	of which commercial sector		TJ	of which commercial sector
Austria	3 195	2 171	68.0	61 680	41 914
Belgium	3 790	2 362	62.3	185 993	115 904
Bulgaria	1 963	1 419	72.3	35 756	25 844
Cyprus	309	229	74.1	8 248	6 110
Czech Republic	3 165	2 228	70.4	103 302	72 740
Germany	32 478	21 762	67.0	1 188 501	796 359
Denmark	2 317	1 428	61.6	46 706	28 792
Estonia	424	285	67.3	15 039	10 115
Greece	3 044	2 157	70.9	78 904	55 915
Spain	14 875	10 661	71.7	442 121	316 871
Finland	1 872	1 141	60.9	76 042	46 344
France	22 185	13 863	62.5	889 674	555 941
Croatia	1 049	719	68.5	29 124	19 962
Hungary	3 090	2 052	66.4	81 612	54 190
Ireland	1 598	1 086	68.0	53 647	36 483
Italy	18 172	13 427	73.9	609 987	450 704
Lithuania	920	606	65.8	14 646	9 636
Luxembourg	335	249	74.4	14 107	10 488
Latvia	618	436	70.6	15 068	10 632
Malta	166	115	69.2	4 639	3 208
Netherlands	7 461	5 094	68.3	260 653	177 961
Poland	9 395	6 140	65.4	267 789	175 016
Portugal	3 151	2 179	69.1	72 792	50 335
Romania	3 913	2 768	70.7	65 281	46 186
Sweden	3 832	2 149	56.1	116 762	65 498
Slovenia	605	423	69.9	18 476	12 920
Slovakia	1 527	1 057	69.3	47 520	32 918
United Kingdom	26 265	18 350	69.9	645 862	451 242
EU-28	171 710	116 556	67.9	5 449 930	3 680 225

Source: CEPS (2020) elaboration based on Eurostat data.

In the third adjustment, the portion of fuels consumed by households is excluded from the road transportation sector. Eurostat statistics on motorvehicle fuels are not broken down by user. This means that the energy consumption statistics for the road transportation sector cover fuels used by both households and companies.

To avoid an overestimation due to the inclusion of household consumption, this study estimates the share of energy in the road transportation sector consumed by companies using the statistics published by the United Nations Framework Convention on Climate Change (UNFCCC). As part of the National Inventory Submissions, the UNFCCC publishes statistics on fuel consumption in the road transportation sector by type of vehicle. The classification includes cars, motorcycles, light-duty trucks, heavy-duty trucks and other vehicles.

In the absence of more accurate statistics on fuel usage by the business sector, this study assumes that the latter is responsible for the consumption of all fuels used to power light- and heavy-duty trucks, while households are responsible for all fuels used in cars, motorcycles and other vehicles. Results shows that, light- and heavy-duty trucks (i.e. the

business sector) across the EU are responsible for the consumption of 2.8% and 52.1% of gasoline and diesel respectively (see Table A3.4).

Table A3.4 Consumption of diesel and gasoline used in light- and heavy-duty trucks in 2016

Country	Gasoline			Diesel		
	All vehicles	Light- and heavy-duty trucks	% of all vehicles	All vehicles	Light- and heavy-duty trucks	% of all vehicles
	Th litres	Th litres		Th litres	Th litres	
Austria	1 409	23	1.7	5 523	2 514	45.5
Belgium	1 347	31	2.3	6 562	3 253	49.6
Bulgaria	465	38	8.1	1 786	944	52.9
Cyprus	354	8	2.1	233	160	68.6
Czech Republic	1 517	42	2.8	3 958	1 837	46.4
Germany	16 009	96	0.6	32 407	17 802	54.9
Denmark	1 223	42	3.4	2 505	1 594	63.6
Estonia	233	10	4.3	471	238	50.6
Greece	2 310	269	11.6	2 075	1 749	84.3
Spain	4 431	17	0.4	20 831	8 966	43.0
Finland*	1 249	41	3.3	2 340	1 294	55.3
France	6 705	607	9.1	32 277	15 655	48.5
Croatia	525	9	1.8	1 271	569	44.8
Hungary	1 306	25	1.9	2 483	1 754	70.7
Ireland	947	1	0.1	2 754	1 338	48.6
Italy	7 079	144	2.0	20 632	9 182	44.5
Lithuania	204	9	4.5	1 333	652	48.9
Luxembourg	267	1	0.3	1 443	1 023	70.9
Latvia	189	8	4.3	674	375	55.6
Malta	74	1	0.8	88	40	45.2
Netherlands	3 640	10	0.3	5 362	3 515	65.5
Poland	3 648	239	6.6	11 262	6 821	60.6
Portugal	1 024	5	0.5	3 907	1 970	50.4
Romania	1 251	90	7.2	3 365	2 205	65.5
Sweden	2 118	33	1.6	2 886	1 599	55.4
Slovenia	415	4	1.0	1 349	604	44.8
Slovakia	499	38	7.6	1 676	987	58.9
United Kingdom	11 720	207	1.8	24 222	13 346	55.1
EU-28	72 158	2 048	2.8	195 675	101 985	52.1

* For Finland, gasoline and diesel consumption for light- and heavy-duty trucks is estimated based on the EU average, as data by type of vehicle are not available in the UNFCCC tables.

Source: CEPS (2020) elaboration based on UNFCCC data (2019 edition).

After splitting the fuels used by households and companies, the final energy consumption of corporate in the road transportation sector is estimated to be 4.6 million TJ, which is approximately 40% of the final energy consumed by all road vehicles (see Table A3.5).

Table A3.5 Final energy consumption in road transportation by type of vehicles

Country	Duty Vehicles			Cars, motorcycles and other vehicles	Total
	Light-duty vehicles (LDV)	Heavy-duty vehicles (HDV)	All duty vehicles		
	TJ	TJ	TJ	TJ	TJ
Austria	21 071	93 190	114 261	197 236	311 497
Belgium	41 391	100 010	141 401	200 658	342 059
Bulgaria	18 529	27 107	45 635	55 237	100 872
Cyprus	4 800	3 313	8 112	18 922	27 034
Czech Republic	23 438	59 957	83 395	157 349	240 743
Germany	101 375	685 210	786 586	1 341 360	2 127 946
Denmark	21 455	43 274	64 728	91 556	156 284
Estonia	3 274	7 700	10 974	20 236	31 210
Greece	33 012	55 363	88 375	107 901	196 277
Spain	65 004	326 026	391 030	709 783	1 100 813
Finland	19 050	38 746	57 797	98 637	156 433
France	331 709	358 973	690 682	964 457	1 655 139
Croatia	9 211	15 841	25 051	53 108	78 159
Hungary	33 429	43 438	76 867	88 331	165 198
Ireland	26 864	30 778	57 642	102 902	160 544
Italy	150 926	296 380	447 306	816 719	1 264 025
Lithuania	3 464	25 460	28 924	37 913	66 838
Luxembourg	1 876	43 029	44 904	30 304	75 208
Latvia	4 859	11 813	16 672	20 883	37 556
Malta	1 077	875	1 953	5 578	7 531
Netherlands	60 921	93 767	154 688	242 715	397 403
Poland	65 629	239 191	304 821	342 235	647 055
Portugal	51 509	33 911	85 420	128 345	213 765
Romania	32 668	76 046	108 715	106 657	215 372
Sweden	22 770	54 633	77 402	154 319	231 722
Slovenia	5 647	20 665	26 312	50 082	76 394
Slovakia	10 780	26 913	37 693	48 501	86 194
United Kingdom	264 783	327 855	592 638	1 000 991	1 593 629
EU-28	1 430 519	3 139 466	4 569 985	7 192 915	11 762 900

Source: CEPS (2020) elaboration based on UNFCCC data (2019 edition).

The last adjustment concerns the economic activities within the road transportation sector. According to a study conducted by the AEA, 12.5% of the fuel consumed by heavy-duty vehicles are related to construction activities.¹⁰⁶

To account for this, 392 000 TJ (i.e. 12% of the fuel consumed by heavy-duty trucks) is deducted from the road transportation sector and attributed to the construction sector. As a result, the total energy consumption for the road transportation sector excluding fuels used in heavy-duty trucks for construction activities is estimated to be 4.2 million TJ (see

¹⁰⁶ AEA (2011), "Reduction and Testing of Greenhouse Gas (GHG) Emissions from Heavy Duty Vehicles", ED46904/Final Report – Issue Number 4, https://ec.europa.eu/clima/sites/clima/files/transport/vehicles/docs/ec_hdv_ghg_strategy_en.pdf.

Table A3.6). The estimated energy consumption of the construction sector, including fuels used by heavy-duty trucks, for construction activities is equal to 725 000 TJ (see Table A3.7).

Table A3.6 Total energy consumed in the transportation sector, excluding the adjustment for heavy-duty vehicles employed in construction activities

Country	Light-duty vehicles	Heavy-duty vehicles		Total energy consumption**
			of which used in the construction sector*	
	TJ	TJ	TJ	TJ
Austria	21 071	93 190	11 649	102 612
Belgium	41 391	100 010	12 501	128 900
Bulgaria	18 529	27 107	3 388	42 247
Cyprus	4 800	3 313	414	7 698
Czech Republic	23 438	59 957	7 495	75 900
Germany	101 375	685 210	85 651	700 935
Denmark	21 455	43 274	5 409	59 319
Estonia	3 274	7 700	962	10 012
Greece	33 012	55 363	6 920	81 455
Spain	65 004	326 026	40 753	350 277
Finland	19 050	38 746	4 843	52 953
France	331 709	358 973	44 872	645 810
Croatia	9 211	15 841	1 980	23 071
Hungary	33 429	43 438	5 430	71 437
Ireland	26 864	30 778	3 847	53 795
Italy	150 926	296 380	37 048	410 259
Lithuania	3 464	25 460	3 183	25 742
Luxembourg	1 876	43 029	5 379	39 526
Latvia	4 859	11 813	1 477	15 196
Malta	1 077	875	109	1 843
Netherlands	60 921	93 767	11 721	142 967
Poland	65 629	239 191	29 899	274 922
Portugal	51 509	33 911	4 239	81 181
Romania	32 668	76 046	9 506	99 209
Sweden	22 770	54 633	6 829	70 573
Slovenia	5 647	20 665	2 583	23 729
Slovakia	10 780	26 913	3 364	34 329
United Kingdom	264 783	327 855	40 982	551 656
EU-28	1 430 519	3 139 466	392 433	4 177 552

* Based on the analysis of the AEA (2011), this study attributes 12.5% of the fuel consumed in heavy-duty trucks to construction.

** Total energy consumption of the road transportation sector excludes fuels used by heavy-duty trucks.

Source: CEPS (2020) elaboration.

Table A3.7 Total energy consumed in the construction sector, including the adjustment for heavy-duty vehicles employed in construction activities

	Energy consumption	Energy consumed by heavy-duty vehicles for construction activities*	Total energy consumption **
		TJ	
Austria	10 395	11 649	22 043
Belgium	8 445	12 501	20 946
Bulgaria	2 451	3 388	5 840
Cyprus	437	414	851
Czech Republic	7 738	7 495	15 233
Germany	35 376	85 651	121 027
Denmark	6 653	5 409	12 062
Estonia	2 338	962	3 300
Greece	4 584	6 920	11 504
Spain	39 203	40 753	79 956
Finland	14 052	4 843	18 895
France	77 894	44 872	122 766
Croatia	3 964	1 980	5 945
Hungary	9 013	5 430	14 443
Ireland	263	3 847	4 110
Italy	14 825	37 048	51 873
Lithuania	1 436	3 183	4 618
Luxembourg	927	5 379	6 306
Latvia	1 259	1 477	2 736
Malta	130	109	239
Netherlands	24 271	11 721	35 992
Poland	5 834	29 899	35 733
Portugal	5 964	4 239	10 203
Romania	12 957	9 506	22 463
Sweden	12 659	6 829	19 488
Slovenia	1 141	2 583	3 725
Slovakia	1 132	3 364	4 496
United Kingdom	27 541	40 982	68 523
EU-28	332 883	392 433	725 316

* Based on the analysis of the AEA (2011), this study attributes 12.5% of the fuel consumed in heavy-duty trucks to construction.

** Total energy consumption of the construction sector includes fuels used by heavy-duty trucks.

Source: CEPS (2020) elaboration.

To summarise, Eurostat reports that the EU final energy consumption in 2016 amounted to 47.2 million TJ (see Table A3.8). Considering the EU companies' preferred energy carriers (i.e. electricity, natural gas, gasoline, diesel, fuel oil and jet fuels), the energy consumption amounts to 36.7 million TJ. To determine how much is consumed by companies, it is necessary to exclude the energy consumption of households in residential buildings (8.3 million TJ) and in private road vehicles (7.2 million TJ). In addition, the public sector is also excluded (1.8 million TJ). Finally, as 12.5% of the energy consumed by heavy-duty trucks is related to construction activities, it is possible to deduct a proportionate share from the road transportation sector and attribute it to the construction sector. As a result, the final energy consumption of EU companies in 2016 is estimated at 19.4 million TJ.

Table A3.8 Final consumption of companies in the EU-28 (2016)

	Final energy consumption TJ
EU final energy consumption (all energy carriers)	47 270 634
EU final energy consumption (main energy carriers)	36 709 351
Household residential sector	-8 308 518
Energy consumed by households in the road transportation sector	-7 192 915
Energy consumption of public sector	-1 769 705
Road transportation sector (deduction for construction activities)	-392 433
Construction sector (attribution for construction activities)	+392 433
Final energy consumption of companies in the EU-28	19 438 213

* The EU final energy consumption is calculated taking into consideration the EU companies' preferred energy carriers, namely electricity, natural gas, gasoline, diesel, fuel oil and jet fuel.

Source: CEPS (2020) elaboration.

Step 3: matching Eurostat sectoral energy data with NACE sectors

After determining the total energy consumption of EU companies in 2016, the next step consists of matching the energy sectoral classification with the standard one. The sectoral classification of the energy balance that follows is performed in accordance with the Regulation (EC) No 1099/2008 on Energy Statistics. The latter differs from the NACE sectoral classification, which tends to be used in the Member States' business registers and in the Structural Business Statistics published by Eurostat.

To match the two sectoral classifications, the reconciliation tables provided in the Eurostat energy guide are used (see Table A3.9).¹⁰⁷ The Eurostat guide does not indicate specific NACE divisions for the transportation sector. For this category, the corresponding NACE division(s) is assigned by the researched team based on the description of the activities.

Table A3.9 Sectoral classification in energy statistics and corresponding NACE division(s)

Sector	Corresponding NACE division(s)
Energy production	05, 06, 19, 35, 09.1, 07.21 and 08.92.
Construction	41, 42 and 43
Chemical and petrochemical	20 and 21
Food, beverages and tobacco	10, 11 and 12
Iron and steel	24.1, 24.2, 24.3, 24.51 and 24.52
Machinery	25, 26, 27 and 28
Mining and quarrying	07 (excluding 07.21), 08 (excluding 08.92) and 09.9
Non-ferrous metals	24.4, 24.53 and 24.54
Non-metallic minerals	23
Paper, pulp and printing	17 and 18
Transport equipment	29 and 30
Textile and leather	13, 14 and 15
Wood and wood products	16
Other industrial activities	Industrial activities not included anywhere else
Domestic aviation	51
Domestic navigation	50
Pipeline transport	49.5
Rail transport	49.1, 49.2
Road transport	49.3, 49.4
Other transportation activities	Transportation activities not included elsewhere
Agriculture and forestry	01 and 02
Commercial and public sector	33, 36, 37, 38, 39, 45, 46, 47, 52, 53, 55, 56, 58, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 71, 72, 73, 74, 75, 77, 78, 79, 80, 81, 82, 84 (excluding 84.22), 85, 86, 87, 88, 90, 91, 92, 93, 94, 95, 96 and 99.
Fishing	03
Other activities	Activities not included elsewhere

* The Eurostat manual on energy balance does not indicate specific NACE divisions for the transportation sector. For this category, the corresponding NACE division(s) is assigned by the researched team based on the description of the activities.

Source: Eurostat (2019) and CEPS (2020) elaboration.

Overall, manufacturing, transportation and storage as well as electricity, gas and steam supply account for the largest shares of energy consumption. Cumulatively, these sectors account for 13.7 million TJ, or some 70% of the total (see Table A3.10). Electricity, natural gas and diesel are by far the companies' preferred energy products, as each of them accounts for about a third of the total energy consumption. Cumulatively, energy consumption of these fuels amounts to 18.7 million TJ, or some 96% of the total. The remaining fuels – gasoline, fuel oil and jet fuels – account for about 4% of the total and their energy consumption amount to approximately 0.8 million TJ.

¹⁰⁷ Eurostat (2019), "Energy balance guide", section on "Final energy consumption", pp. 31-34.

Table A3.10 Final energy consumption by NACE sector and fuel

Sector	Electricity TJ	Natural gas TJ	Gasoline TJ	Diesel TJ	Fuel oil TJ	Jet Fuel TJ	Total TJ
A – Agriculture, forestry and fishing	201 894	156 980	3 986	570 825	5 168	1	962 750
B – Mining and quarrying	230 162	201 273	19	44 185	22 989	10	517 386
C – Manufacturing	3 502 816	3 249 666	9 914	181 987	154 762	20 793	7 147 385
D – Electricity, gas, steam supply	659 157	443 117	65	14 385	91 880	0	1 207 136
E – Water supply; sewage, waste	29 587	18 812	97	4 251	71	0	52 719
F – Construction	84 962	98 040	8 439	522 626	5 334	0	729 591
G – Wholesale and retail, repair	519 391	325 136	1 865	87 252	1 733	0	930 403
H – Transportation and storage	296 182	187 621	98 953	4 278 736	49 267	275 313	5 212 544
I – Accommodation and food service	146 300	90 945	371	19 527	559	0	257 442
J – Information and communication	143 194	88 287	522	24 891	455	0	256 497
K – Financial and insurance activities	238 873	159 678	498	34 882	759	0	431 716
L – Real estate activities	60 267	38 549	217	11 172	161	0	109 834
M – Professional, scientific activities	245 505	166 964	1 133	58 673	759	0	469 220
N – Administrative and support activities	242 804	154 081	919	43 591	899	0	439 955
O – Public administration and defence	8 405	5 415	20	1 891	78	1	13 620
P – Education	38 255	23 445	119	5 455	221	0	67 207
Q – Human health and social work	142 993	95 852	640	33 778	458	0	271 233
R – Arts, entertainment and recreation	33 610	21 225	125	5 220	162	0	60 033
S – Other service activities	57 929	37 937	283	13 027	243	0	108 756
T – Activities of households as employers	1 119	738	2	516	58	31	947
U – Extraterritorial organisations	93	49	0	15	2	0	153
Information not available	145 818	65 516	603	45 444	5 725	10 564	191 688
All sectors	7 029 315	5 629 326	128 789	6 002 329	341 742	306 713	19 438 213

Source: CEPS (2020) elaboration.

Step 4: estimating the production activity of companies

In order to estimate the final energy consumption for all companies residing in the EU-27 and in the UK, it is first necessary to determine a proxy for their production activity.

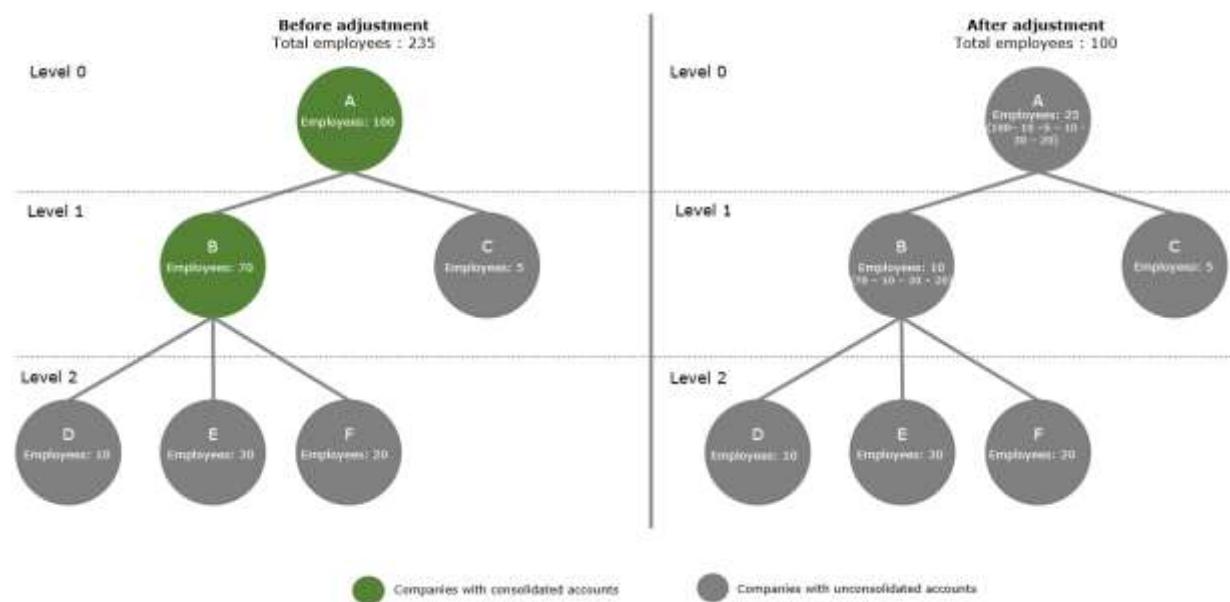
For this purpose, the number of employees is considered a preferred indicator over the other available company data, namely total assets and turnover. Total assets is not considered an accurate indicator because not all assets are used for production activity. Companies often use a portion of their assets as stock and liquidity reserves. Turnover measures business operations but it is often distorted by changes in prices and intra-group financial transactions. Intra-group transactions or changes in prices of raw materials would increase the level of turnover and entail an overestimation of the production activity.

To ensure accurate estimations, the number of employees is determined at the entity level (i.e. the most granular level available). For about 50 000 companies or 0.1% of the active companies, data on the number of employees were only available at the consolidated level. Without any specific adjustment for consolidation, the energy consumption of these companies is likely to be overestimated. This is due to two main reasons. Often, the number of employees is reported in both the consolidated accounts of the reporting entities and in the unconsolidated accounts of the controlled subsidiaries. In addition, the consolidated accounts of certain corporate groups include figures of entities established outside the EU. Therefore, the unavailability of unconsolidated accounts is particularly relevant for large multinational companies, which often control entities domestically, in other Member States and outside the EU.

For the purpose of this study, the consolidated accounts of entities that could lead to a material change in the results were adjusted. More specifically, the about 250 entities reporting consolidated accounts and employing more than 5% of the total domestic employment of the sector in which they operate were identified. Each of these entities employ on average 40 000 employees on a consolidated basis and cumulatively control more than 500 000 subsidiaries worldwide.

For each of the entities, detailed ownership information was used to reconstruct the legal structure of the entities that were covered by the consolidated accounts of the reporting entity as well as the relationship with one another. This is necessary as some of the entities with consolidated accounts cover other entities also reporting consolidated accounts. The number of employees on an unconsolidated basis of all the entities with consolidated accounts were derived by deducting the number employees of subsidiaries on an unconsolidated basis, starting at the ownership level furthest away from the parent. Indeed, the consolidated figures of the subsidiary entity are converted first into unconsolidated figures, before the unconsolidated figures of the parent entity are calculated (see Figure A3.2).

Figure A3.2 Graphic example showing the adjustment applied to large entities reporting consolidated accounts



Source: CEPS (2020) elaboration.

Step 5: distributing energy consumption across companies

The energy consumption at the country and sectoral levels is distributed across the active companies based on the share of the company in the total employees of all companies active in the NACE sector combined. In practice, the final energy consumption of each EU company is estimated by multiplying the aggregate energy consumption statistics at the country and sector levels by the company's share of employment in the specific country and sector in which it operates.

Primary energy consumption

The methodology to estimate the primary energy consumption of each EU companies consists of three steps (see Figure A3.3). The approach varies by type of energy product.

For electricity, the primary consumption is calculated based on the transformation inputs used to generate the electricity utilised by businesses, adjusted for imports and exports. For natural gas and oil products, the primary consumption is calculated by multiplying the final consumption of EU-28 companies by the well-to-tank (WTT) factors (JEC, 2020).¹⁰⁸ The latter expresses how much energy is spent to create one MJ of fuel.

Figure A3.3 Methodology to estimate primary energy consumption



Source: CEPS (2020) elaboration.

¹⁰⁸ The report and annexes are available at <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/jec-well-tank-report-v5>.

Step 1: estimating primary electricity consumption

The primary energy consumption of electricity is based on the transformation inputs used for its generation. The statistics on the transformation inputs are collected at the country level from the "Supply, transformation and consumption" table from Eurostat. According to Eurostat, the EU-28 Member States use about 27.9 million TJ as transformation inputs for electricity generation, as of 2016 (see Table A3.11). The large majority is used to generate public electricity (25.5 million TJ), while a small fraction is used by autoproducers (2.4 million TJ).

Table A3.11 Transformation inputs for electricity generation

Country	Transformation inputs autoproducers	Transformation inputs main producers	Total transformation inputs
	TJ	TJ	TJ
Austria	67 029	348 488	415 517
Belgium	58 580	729 457	788 038
Bulgaria	5 735	461 021	466 755
Cyprus	455	43 640	44 096
Czech Republic	97 016	819 129	916 145
Germany	409 391	5 030 271	5 439 662
Denmark	42 402	250 019	292 421
Estonia	2 463	136 228	138 691
Greece	26 031	353 991	380 021
Spain	203 579	1 816 689	2 020 267
Finland	64 883	593 820	658 703
France	192 478	5 272 630	5 465 108
Croatia	2 698	78 787	81 485
Hungary	7 943	345 794	353 736
Ireland	12 719	191 008	203 727
Italy	200 003	2 098 767	2 298 770
Lithuania	16 580	54 917	71 497
Luxembourg	1 752	12 473	14 225
Latvia	3 632	59 105	62 737
Malta	503	7 215	7 717
Netherlands	190 743	737 676	928 419
Poland	99 198	1 615 258	1 714 456
Portugal	79 708	304 392	384 099
Romania	57 742	476 436	534 179
Sweden	52 238	1 176 831	1 229 069
Slovenia	3 320	125 933	129 253
Slovakia	23 827	260 316	284 142
United Kingdom	501 772	2 085 221	2 586 993
EU-28	2 424 420	25 485 511	27 909 931

Source: CEPS (2020) elaboration based on Eurostat data.

The transformation inputs used to generate public electricity are adjusted for national imports and exports. In some EU countries, the domestic production of electricity is greater than the domestic demand. By contrast, in several countries domestic production is insufficient to meet the demand of the domestic economy. Without adjusting for cross-border trade in electricity, the primary energy consumption of companies would be overestimated in net electricity-exporting countries and underestimated in net electricity-importing ones.

To perform this adjustment, the methodology consists of four steps. First, the information on cross-border electricity trade is collected using the import and export tables provided by Eurostat. Information is collected for all the reporting countries (both EU-28 and other non-EU countries, e.g. Russia and Switzerland). Second, the share of exported electricity

is obtained by dividing the amount of exported electricity by the gross electricity production. This calculation is performed separately for each EU-28 Member State. Third, the share of exported electricity is multiplied by the total transformation inputs to obtain the transformation inputs related to the exported electricity. The latter are then subtracted from the total transformation inputs of the exporting country and attributed to the importing one. Finally, the net transformation inputs due to electricity trade is obtained by subtracting the transformation inputs related to imported electricity from the ones related to the exported electricity.

In 2016, the EU-28 Member States exported to other EU and non-EU partners about 2.8 million TJ of electricity, while they imported approximately 2.7 million TJ. (see Table A3.12) The top three net exporting countries of electricity are France (464.5 Th TJ), Germany (263.7 Th TJ) and the Czech Republic (122.9 Th TJ). In turn, the top three net importers of electricity are the UK (146.7 Th TJ), Italy (144.9 Th TJ) and Austria (125.7 Th TJ). Overall, approximately 105 Th TJ are exported to non-EU countries and therefore are deducted from the primary energy consumption of EU-28 companies.

Table A3.12 Transformation inputs adjusted for electricity trade

Country	Transformation inputs related to exported electricity	Transformation inputs related to imported electricity	Net transformation inputs due to electricity trade
	TJ	TJ	TJ
Austria	97 987	223 673	125 685
Belgium	71 957	107 892	35 934
Bulgaria	111 394	33 758	-77 635
Cyprus*	n.a.	n.a.	n.a.
Czech Republic	243 756	120 775	-122 981
Germany	430 186	166 482	-263 704
Denmark	81 210	87 989	6 779
Estonia	62 761	31 078	-31 683
Greece	6 743	77 596	70 852
Spain	93 740	162 360	68 621
Finland	27 283	124 217	96 934
France	573 856	109 327	-464 530
Croatia	42 202	113 300	71 098
Hungary	56 798	164 703	107 905
Ireland	9 909	5 271	-4 638
Italy	44 573	189 434	144 861
Lithuania	36 444	57 823	21 380
Luxembourg	8 058	61 766	53 708
Latvia	34 914	42 860	7 946
Malta*	n.a.	11 058	11 058
Netherlands	123 848	172 889	49 040
Poland	116 495	118 195	1 700
Portugal	48 946	30 519	-18 427
Romania	67 283	42 374	-24 909
Sweden	196 292	76 833	-119 459
Slovenia	72 774	47 692	-25 082
Slovakia	101 937	129 828	27 891
United Kingdom	13 751	160 495	146 744
EU-28	2 775 098	2 670 186	-104 912

Notes: Data on Cyprus are not available. No adjustment is performed for Cyprus. Data for Malta are partial. Net transformation inputs refer to the amounts of transformation inputs related to electricity trade. Countries with negative net transformation inputs are net exporters of electricity. Countries with positive net transformation inputs are net importers of electricity.

Source: CEPS (2020) elaboration based on Eurostat data.

The next step to calculate the primary electricity consumption of the EU-28 companies consists of excluding the household sector. To this end, the transformation inputs adjusted for the electricity trade of each EU-28 Member State is multiplied by the share of electricity consumption of non-household sectors. This share is computed by dividing the final electricity consumption of all sectors excluding the household sector by the total final electricity consumption. Overall, the share of electricity used by businesses in the EU-28 is approximately 71% (see Table A3.13). Accordingly, the transformation inputs for electricity generation used by businesses is estimated at 18 million TJ.

Table A3.13 Calculation of transformation inputs for electricity generation used by EU-28 companies, adjustment for household consumption (2016)

Country	Transformation inputs adjusted for electricity trade	Share of electricity consumption of non-household sectors	Transformation inputs for electricity generation used by businesses
	TJ	%	TJ
Austria	474 173	71.2	337 507
Belgium	765 392	77.0	589 644
Bulgaria	383 385	62.9	240 992
Cyprus	43 640	64.0	27 918
Czech Republic	696 149	73.3	509 996
Germany	4 766 568	75.2	3 585 872
Denmark	256 798	66.9	171 765
Estonia	104 545	73.8	77 145
Greece	424 843	62.5	265 639
Spain	1 885 309	70.0	1 320 580
Finland	690 754	72.2	498 613
France	4 808 100	63.9	3 070 591
Croatia	149 885	59.9	89 853
Hungary	453 699	70.5	319 929
Ireland	186 370	69.2	128 997
Italy	2 243 629	77.5	1 739 221
Lithuania	76 296	71.5	54 581
Luxembourg	66 182	84.7	56 032
Latvia	67 050	72.3	48 503
Malta	18 272	68.5	12 525
Netherlands	786 717	78.6	618 242
Poland	1 616 958	78.2	1 265 067
Portugal	285 964	72.0	206 002
Romania	451 527	72.1	325 569
Sweden	1 057 372	65.1	688 159
Slovenia	100 851	75.0	75 609
Slovakia	288 207	79.6	229 416
United Kingdom	2 231 964	64.5	1 439 212
EU-28	25 380 599	71.2	17 993 180

Notes: Transformation inputs for electricity generation used by businesses excludes household consumption. It is calculated multiplying transformation inputs adjusted for electricity trade by the share of electricity consumption of non-household sectors.

Source: CEPS (2020) elaboration based on Eurostat data.

An additional adjustment is performed to account for the fact that the provisions on mandatory energy audits contained in the EED are not applicable to public administration bodies. The approach is consistent the adjustment performed to estimate the final energy consumption. In practice, the transformation inputs for electricity consumed by the commercial and public sector is multiplied by share the energy consumption of the commercial sector.¹⁰⁹

Overall, the transformation inputs for electricity consumed by the commercial sector is estimated to be 4.2 million TJ, while the remaining 2 million TJ is assigned to the public sector (see Table A3.14).

Table A3.14 Calculation of transformation inputs for electricity generation used by EU-28 companies, adjustment for consumption by public administration (2016)

Country	Transformation inputs for electricity used in the commercial and public sector	Share of energy consumed by the commercial sector	Transformation inputs for electricity generation used in the commercial sector
	TJ	%	TJ
Austria	105 260	68.0	71 528
Belgium	143 673	62.3	89 532
Bulgaria	76 839	72.3	55 538
Cyprus	18 891	74.1	13 994
Czech Republic	178 918	70.4	125 985
Germany	986 067	67.0	660 718
Denmark	101 859	61.6	62 790
Estonia	36 340	67.3	24 441
Greece	136 862	70.9	96 987
Spain	536 656	71.7	384 625
Finland	128 048	60.9	78 038
France	1 159 640	62.5	724 638
Croatia	41 481	68.5	28 433
Hungary	71 860	66.4	47 715
Ireland	42 963	68.0	29 217
Italy	526 557	73.9	389 060
Lithuania	24 063	65.8	15 831
Luxembourg	19 136	74.4	14 228
Latvia	27 479	70.6	19 388
Malta	7 810	69.2	5 401
Netherlands	207 451	68.3	141 637
Poland	448 407	65.4	293 061
Portugal	95 892	69.1	66 308
Romania	75 328	70.7	53 293
Sweden	207 873	56.1	116 607
Slovenia	21 674	69.9	15 156
Slovakia	64 930	69.3	44 978
United Kingdom	698 253	69.9	487 845
EU-28	6 190 209	67.2	4 156 972

Notes: Transformation inputs for electricity generation used by businesses excludes household consumption. It is calculated multiplying transformation inputs adjusted for electricity trade by the share of electricity consumption of non-household sectors.

Source: CEPS (2020) elaboration based on Eurostat data.

¹⁰⁹ The energy consumption of the commercial sector is estimated by the share of employees of the commercial sector over the employees of the commercial and public sector.

To summarise, data on transformation inputs for electricity generation are used to estimate the primary electricity consumption of the EU-28 companies.

Eurostat reports that in 2016 the transformation inputs for electricity generated by main producers amounted to 25.5 million TJ (see Table A3.15). Approximately 105 000 TJ are deducted from this amount to account for the exports of electricity from EU countries to non-EU countries. Similarly, the transformation inputs for electricity used by the household sector (7.4 million TJ) are also subtracted from the total. Furthermore, as mandatory energy audits are not applicable to the public sector, transformation inputs for about 2 million TJ are also excluded. Finally, transformation inputs for electricity generated by autoproducers is added to the total (2.4 million TJ). As a result, the primary electricity consumption of EU-28 companies in 2016 is estimated at 18.4 million TJ.

Table A3.15 Calculation of transformation inputs for electricity generation used by EU-28 companies, adjustments for public administration and autoproducers

Sector	Transformation inputs
	TJ
Transformation inputs for electricity generated by main producers	25 485 511
Adjustment for electricity trade	(-)104 912
Transformation input for electricity used in the household sector	(-)7 387 419
Transformation input for electricity used by the public sector	(-)2 033 237
Transformation inputs for electricity generated by autoproducers	(+)2 424 420
Primary electricity consumption of EU-28 companies	18 384 362

Notes: Transformation inputs for electricity generation used by businesses excludes household consumption. It is calculated multiplying transformation inputs adjusted for electricity trade by the share of electricity consumption of non-household sectors.

Source: CEPS (2020) elaboration based on Eurostat data.

Step 2: estimating primary energy consumption for natural gas and oil products

To determine the primary energy consumption for natural gas and motor fuels, the final energy consumption is multiplied by fuel-specific WTT factors (JEC, 2020). The latter express how much energy is spent to create one MJ of the relevant fuel. The WTT factors for natural gas, considering the current mix for the EU-28, is estimated at 0.28, while it is 0.24 for gasoline and 0.26 for diesel (see Table A3.16). In the absence of specific WTT factors for fuel oil and jet fuel, this study applies the WTT factor reported for diesel (0.26).

The first step to calculate the primary consumption of each fuel consists of multiplying the fuel-specific WTT factor by the final energy consumption. This amount is then added to the final energy consumption to obtain primary energy consumption.

Table A3.16 Calculation of primary energy consumption for natural gas and oil products

Energy product	Final energy consumption	Well-to-tank factor	Primary energy consumption
	TJ		TJ
Natural gas	5 629 326	0.21	6 811 484
Gasoline	128 789	0.24	159 699
Diesel	6 002 329	0.26	7 562 934
Fuel oil	341 742	0.26	430 594
Jet fuel	306 713	0.26	386 458

Notes: Well-to-tank factors: natural gas pathway – GMGC2b; gasoline pathway – COG1; diesel, fuel oil and jet fuel pathway – COD1. The primary energy consumption is calculated multiplying the fuel-specific WTT factor by the final energy consumption. This amount is then added to the final energy consumption and refers to the amount of energy spent to produce one unit of fuel.

Source: CEPS (2020) elaboration based on Eurostat and JRC data.

Step 3: distributing primary energy consumption across companies

The last step consists of determining the total primary energy consumption of the EU-28 companies. Consistent with the approach used for the other energy-related indicators, the primary energy consumption of each EU company is determined by multiplying the aggregate primary energy consumption at the country and sector levels by the company's share of employment in the specific country and sector in which it operates.

Overall, the primary energy consumption of the EU-28 companies is estimated to be 33.7 million TJ (see Table A3.17). Most of this is covered by electricity (18.4 million TJ). Diesel and natural gas cover a large share, as they account for 7.6 and 6.8 million TJ respectively. Gasoline, fuel oil and jet fuel account for a significantly smaller share, cumulatively accounting for less than 1 million TJ.

Table A3.17 Primary energy consumption by NACE sector and fuel

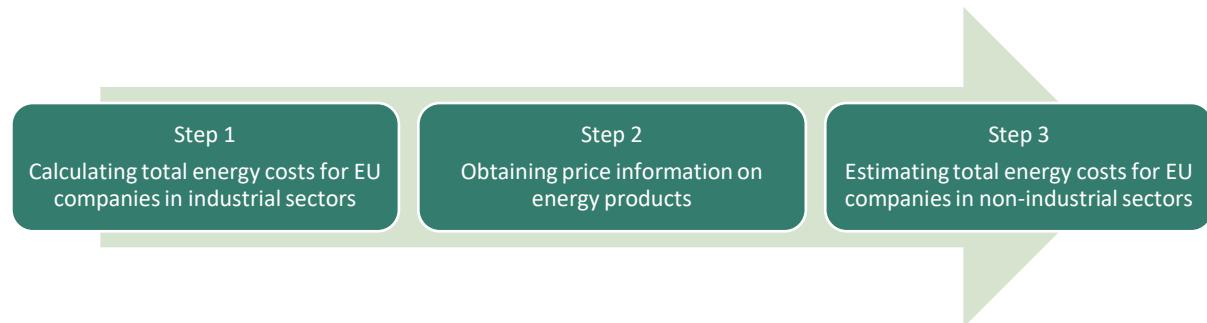
Sector	Electricity	Natural Gas	Gasoline	Diesel	Fuel oil	Jet fuel	Total
	TJ	TJ	TJ	TJ	TJ	TJ	TJ
A – Agriculture, forestry and fishing	567 866	189 946	4 943	719 239	6 511	1	1 488 506
B – Mining and quarrying	437 761	243 540	24	55 673	28 966	13	765 977
C – Manufacturing	10 997 303	3 932 095	12 294	229 304	195 000	26 199	15 392 196
D – Electricity, gas, steam supply	886 627	536 172	81	18 126	115 769	0	1 556 774
E – Water supply; sewage, waste	64 153	22 763	120	5 356	90	0	92 482
F – Construction	247 347	118 629	10 464	658 509	6 720	0	1 041 670
G – Wholesale and retail, repair vehicles	1 086 339	393 415	2 313	109 938	2 183	0	1 594 187
H – Transportation and storage	759 199	227 021	122 702	5 391 207	62 076	346 894	6 909 099
I – Accommodation and food service	300 991	110 044	460	24 604	705	0	436 803
J – Information and communication	301 696	106 827	647	31 363	573	0	441 106
K – Financial and insurance activities	479 661	193 211	618	43 952	956	0	718 397
L – Real estate activities	125 931	46 644	269	14 077	203	0	187 124
M – Professional, scientific activities	501 640	202 026	1 404	73 928	956	0	779 955
N – Administrative and support activities	506 679	186 438	1 140	54 924	1 133	0	750 315
O – Public administration and defence	20 475	6 552	25	2 383	98	2	29 535
P – Education	81 207	28 369	147	6 874	279	0	116 876
Q – Human health and social work	290 941	115 981	794	42 560	577	0	450 853
R – Arts, entertainment and recreation	68 738	25 683	155	6 577	204	0	101 356
S – Other service activities	118 925	45 903	350	16 414	307	0	181 899
T – Activities of households	3 776	893	3	650	73	39	5 433
U – Extraterritorial organisations	193	59	0	19	2	0	274
Information not available	536 912	79 274	747	57 259	7 213	13 310	694 716
All sectors	18 384 362	6 811 484	159 699	7 562 934	430 594	386 458	33 735 532

Source: CEPS (2020) elaboration.

Energy costs

The methodology to estimate the total energy cost of each EU company comprises three steps. To make best use of the existing official statistics, the approach varies for companies operating in industrial and in non-industrial sectors.

Figure A3.4 Methodology to estimate energy costs



Source: CEPS (2020) elaboration.

Step 1: calculating total energy costs for EU companies in industrial sectors

For the companies operating in mining and quarrying, manufacturing, and construction, the energy costs are determined based on the Eurostat SBS indicator for total purchased energy goods.¹¹⁰ The data are collected through surveys and validated by Eurostat. Therefore, the 'total purchased energy good' indicator is a better indicator compared with estimated values.

The same indicator is also available for the electricity, gas and steam supply as well as for the water, sewage and waste sectors. Yet, for most EU countries, information is missing. For this reason, the energy costs for such sectors are estimated using the alternative approach (see step 2).

The data are aggregated at the country and sectoral levels. To limit data availability issues, information is retrieved for each NACE sector at the three-digit level. Based on Eurostat data, the total energy cost for the mining and quarrying sector in 2016 amounted to EUR 2.6 bn (see Table A3.18). This amount increases up to EUR 110.5 bn for the manufacturing sector, while energy costs are estimated at EUR 16.8 bn for the construction sector.

The total purchased energy goods statistics by country and sector are distributed for the companies operating in that specific country and sector based on their share of total energy consumption. For a number of three-digit NACE codes, information is not available. To overcome limitations in data availability, energy costs are estimated using the alternative approach (see step 2) when official statistics are not available.

¹¹⁰ The indicator published by Eurostat takes into consideration only purchased energy goods, and therefore does not take into consideration energy which is auto-produced or results from industrial processes.

Table A3.18 Energy costs for specific industrial sectors

Country	Total energy cost Mining and quarrying	Total energy cost Manufacturing	Total energy cost Construction
	Mio EUR	Mio EUR	Mio EUR
Austria	80	3 585	575
Belgium	30	4 548	1 311
Bulgaria	103	875	136
Cyprus	0	82	27
Czech Republic	35	2 796	135
Germany	504	33 599	3 955
Denmark	11	854	65
Estonia	27	286	77
Greece	47	1 842	809
Spain	202	9 661	1 638
Finland	22	2 429	174
France	284	12 664	105
Croatia	16	677	174
Hungary	24	1 845	292
Ireland	0	464	121
Italy	99	4 838	1 255
Lithuania	11	362	111
Luxembourg	5	156	138
Latvia	6	514	0
Malta	0	2	0
Netherlands	8	4 047	350
Poland	334	4 575	191
Portugal	28	2 111	406
Romania	25	2 293	414
Sweden	133	3 145	518
Slovenia	15	565	105
Slovakia	14	1 269	117
United Kingdom	540	10 672	3 620
EU-28	2 602	110 754	16 817

Notes: Energy costs are calculated using 3-digit NACE codes.

Source: Eurostat (2020).

Step 2: obtaining price information on energy products

For the companies operating in sectors not covered under step 1, the energy costs are estimated based on the energy consumption and price by carrier. For each economically active company, the estimated final energy consumption of electricity, natural gas, gasoline, gasoil and oil fuel is multiplied by the average price of the respective energy carrier in 2016.

Price data are retrieved using different sources depending on the energy product. For electricity, data are retrieved from Eurostat. Price levels are retrieved at the national level. They refer to non-household consumers and exclude taxes and levies. Prices levels are obtained also for different consumption bands. Overall, the average electricity price for companies consuming less than 20 MWh is reported to be EUR 133.3/MWh. Prices decrease as electricity consumption increases. For example, companies that consume between 2 000 and 20 000 MWh pay on average EUR 72.8/MWh. Finally, companies consuming at least 150 000 MWh pay about EUR 58/MWh.

Table A3.19 Costs of electricity excluding taxes and levies (EUR per MWh)

Consumption Country code	Electricity						
	< 20 MWh	20 – 500 MWh	500 – 2 000 MWh	2 000 – 20 000 MWh	20 000 – 70 000 MWh	70 000 – 150 000 MWh	> 150 000 MWh
AT	116.3	88.6	69.4	57.0	51.5	46.4	46.3
BE	150.7	119.9	86.5	76.8	61.7	56.1	57.1
BG	105.6	99.8	88.5	72.3	65.6	60.3	58.8
CY	145.1	130.1	108.3	97.1	87.9	80.5	80.5
CZ	159.9	115.6	72.1	62.3	64.4	66.5	66.5
DE	127.0	98.5	79.1	67.4	53.7	42.9	42.9
DK	76.2	66.7	61.1	60.3	48.2	47.1	47.1
EE	92.6	80.6	74.6	66.7	58.4	55.7	55.7
EL	147.8	115.0	90.2	72.1	64.1	51.5	51.5
ES	235.6	136.8	101.5	84.0	71.0	65.2	55.4
FI	80.9	76.6	61.9	58.9	46.0	43.5	43.5
FR	112.0	86.4	68.5	61.0	56.6	51.6	51.6
HR	118.8	100.0	83.8	72.6	61.4	62.3	62.2
HU	96.1	85.3	72.4	68.0	65.6	65.1	65.8
IE	161.0	140.7	115.7	92.9	81.1	76.0	75.9
IT	161.9	102.1	86.0	79.1	71.9	59.1	57.6
LT	107.6	86.9	75.4	65.8	58.8	56.0	56.0
LU	134.9	92.8	77.6	51.5	45.0	45.0	45.0
LV	141.1	105.5	91.5	80.5	73.4	56.6	56.6
MT	215.3	156.8	141.1	122.7	112.4	99.1	99.1
NL	107.0	79.6	65.5	61.4	57.4	58.2	57.2
PL	135.0	102.1	76.6	66.8	60.3	55.0	52.0
PT	158.6	123.8	94.6	85.8	69.2	54.8	54.8
RO	89.6	78.7	63.9	57.5	50.0	48.9	48.9
SE	135.0	73.5	63.1	53.9	48.3	40.9	40.9
SI	104.3	86.2	67.2	59.4	53.1	51.6	51.6
SK	196.1	130.3	105.7	93.8	84.4	80.6	66.2
UK	121.3	112.0	100.6	91.4	89.4	87.8	85.6
EU-28	133.3	102.5	83.6	72.8	64.7	59.4	58.3

Source: Eurostat.

As for electricity, price levels for natural gas are obtained from Eurostat. Similarly, price levels refer to non-household sectors and exclude taxes and levies. Prices levels are available also for different consumption bands.

Overall, the average price applied to companies consuming less than 1 000 GJ of natural gas is 10.5 EUR/GJ. For companies consuming between 10 000 and 100 000 GJ, the average price is 7.3 EUR/GJ. Finally, companies that consume more than 4 000 000 GJ pay about 5.6 EUR/GJ.

Table A3.20 Costs of natural gas excluding taxes and levies (EUR per GJ in gross calorific value)

Consumption Country code	Natural Gas					
	< 1 000 GJ	1 000 – 10 000 GJ	10 000 – 100 000 GJ	100 000 – 1 000 000 GJ	1 000 000 – 4 000 000 GJ	> 4 000 000 GJ
AT	12.59	9.67	7.53	5.96	5.54	5.54
BE	10.75	8.45	6.56	5.54	4.63	3.98
BG	6.79	6.19	5.57	4.54	4.31	4.31
CZ	10.33	7.66	6.91	5.98	6.10	6.10
DE	11.34	8.66	8.20	6.24	5.15	4.73
DK	8.80	8.05	5.77	5.41	5.08	5.08
EE	6.63	6.24	5.85	5.72	5.59	5.59
EL	7.46	7.51	6.49	5.43	5.43	5.43
ES	12.20	9.71	7.37	6.57	5.67	5.72
FI	6.22	8.55	7.50	6.84	6.22	6.22
FR	11.87	9.88	8.58	6.06	5.31	5.30
HR	10.37	9.36	8.25	6.87	6.87	6.87
HU	8.74	7.92	7.69	6.80	5.91	5.83
IE	13.30	10.48	8.25	6.62	5.38	5.38
IT	12.40	9.90	7.55	6.56	6.23	6.05
LT	8.80	7.64	7.13	5.51	5.51	5.51
LU	10.51	10.57	9.16	6.91	6.91	6.91
LV	8.26	7.57	6.69	6.22	5.87	5.87
NL	10.16	8.40	6.27	5.76	5.49	5.49
PL	10.01	9.46	7.24	6.08	4.66	4.66
PT	16.59	10.70	8.38	7.05	6.70	6.70
RO	6.35	5.91	5.18	4.75	4.50	3.60
SE	15.36	11.37	8.12	7.26	7.29	7.29
SI	11.58	11.12	7.93	6.44	6.44	6.44
SK	11.86	9.60	8.21	7.39	7.53	7.53
UK	13.36	7.88	7.09	5.55	4.70	4.70
EU-28	10.5	8.8	7.3	6.2	5.7	5.6

Source: Eurostat.

Price information for gasoline and diesel is obtained from the *Oil Bulletin* published by the European Commission. Prices refer to the retail sector and exclude taxes and levies. Prices levels are annualised based on the average of the prices reported by week. Overall, the price for gasoline and diesel is 449.1 and 455 EUR/thousand litres.

Table A3.21 Cost of motor gasoline and road diesel excluding taxes and levies (EUR per Th L)

Country	Motor gasoline	Road diesel
	EUR / Th L	EUR / Th L
Austria	432.8	448.9
Belgium	428.6	434.2
Bulgaria	456.8	464.5
Cyprus	472.6	485.0
Czech Republic	399.8	432.2
Germany	442.5	439.7
Denmark	514.6	512.8
Estonia	459.4	466.4
Greece	448.6	528.9
Spain	488.1	468.4
Finland	460.8	474.6
France	436.7	407.5
Croatia	434.3	452.7
Hungary	447.7	471.1
Ireland	435.4	434.0
Italy	454.6	432.5
Lithuania	444.6	452.6
Luxembourg	470.1	452.6
Latvia	440.7	435.7
Malta	541.5	518.8
Netherlands	442.8	443.4
Poland	427.0	432.6
Portugal	451.0	465.3
Romania	452.8	467.5
Sweden	440.6	480.6
Slovenia	415.3	393.7
Slovakia	435.0	456.2
United Kingdom	399.6	414.0
EU-28	449.1	455.9

Source: CEPS' elaboration based on the European Commission's *Oil Bulletin*.

Finally, prices for fuel oil and jet fuels are set at EUR 250/thousand litres. For these energy products, prices are based on the average prices available in the *Oil Bulletin* published by the European Commission and on the Platts website.

Table A3.22 Cost of fuel oil and jet fuel excluding taxes and levies (EUR per Th L)

	Fuel oil	Jet fuel
	EUR / Th L	EUR / Th L
EU-28	250	250

Source: CEPS' elaboration based on the European Commission's *Oil Bulletin* and on Platts data.

Step 3: estimating total energy cost for EU companies

The last step consists of estimating the total energy costs for each company in the EU-28. To this end, the fuel consumption is multiplied by the relevant prices to obtain the energy costs. Following this approach, energy costs are derived separately for each energy product. Fuel costs are then aggregated to obtain the total energy costs of companies.

This approach is used to calculate the energy costs for all companies operating across all economic sectors, except for mining and quarrying, manufacturing and construction (see step 1). For these companies, energy costs are estimated based on Eurostat official statistics on the cost of energy products. For certain subsectors of the three sectors abovementioned, Eurostat data are missing or confidential. For companies operating in these subsectors, the energy costs are estimated by multiplying fuel consumption by the relevant price. The energy costs are then consolidated at the NACE level.

Overall, the total energy costs of EU-28 companies in 2016 is estimated at approximately EUR 276 bn (see Table A3.23). This amount excludes taxes and levies and refers only to the companies' preferred energy carriers, namely electricity, natural gas, gasoline, diesel, fuel oil and jet fuel. The manufacturing sector takes the lion's share, as energy costs amount to about EUR 115 bn. It is followed by the transportation sector, whose energy costs are estimated at EUR 62 bn. The construction sector and wholesale and repair sector rank third and fourth respectively, as their estimated energy costs range between EUR 16 to 17 bn.

Moving to fuels, electricity is estimated to be the most significant energy expenditure by EU-28 companies. Cumulatively, companies spent about EUR 64 bn on electricity, excluding taxes and levies. The total cost for diesel consumption is estimated at EUR 62 bn, while the energy cost related to natural gas amounted to EUR 19.3 bn. Finally, the costs of gasoline, fuel oil and jet fuels are relatively low, as they add up to less than EUR 4 bn.

Table A3.23 Energy cost by NACE sector and fuel

Sector	Electricity	Natural gas	Gasoline	Diesel	Fuel oil	Jet fuel	Total
	Mio EUR	Mio EUR	Mio EUR	Mio EUR	Mio EUR	Mio EUR	Mio EUR
A – Agriculture, forestry and fishing	5 038	1 518	55	2 349	0	0	8 960
B – Mining and quarrying*	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	4 176
C – Manufacturing*	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	114 938
D – Electricity, gas, steam	3 951	3 062	1	33	0	0	7 046
E – Water supply; sewage, waste	648	176	1	7	0	0	833
F – Construction*	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	16 902
G – Wholesale and retail, repair	12 877	3 217	26	236	0	0	16 356
H – Transportation and storage	4 962	1 571	1 354	52 505	0	1 977	62 369
I – Accommodation and food service	3 884	942	5	35	0	0	4 866
J – Information and communication	3 123	803	7	62	0	0	3 995
K – Financial and insurance activities	4 806	1 337	7	86	0	0	6 236
L – Real estate activities	1 750	413	3	32	0	0	2 198
M – Professional, scientific activities	5 657	1 539	16	210	0	0	7 421
N – Administrative and support activities	5 380	1 418	13	120	0	0	6 931
O – Public administration and defence	168	44	0	3	0	0	216
P – Education	1 050	249	2	13	0	0	1 313
Q – Human health and social work	3 305	924	9	119	0	0	4 356
R – Arts, entertainment and recreation	901	227	2	14	0	0	1 143
S – Other service activities	1 542	401	4	49	0	0	1 995
T – Activities of households as employers	30	7	0	0	0	0	37
U – Extraterritorial organisations and bodies	3	1	0	0	0	0	4
Information not available	3 019	474	8	124	0	76	3 702
All sectors	64 401	19 377	1 628	61 659	0	2 054	275 996

Notes: For the companies operating in mining and quarrying, manufacturing and construction, energy costs are determined based on the Eurostat SBS indicator for total purchased energy goods. The latter is available only at the aggregate level. For the companies operating in other sectors, the energy costs are estimated based on the energy consumption and price by carrier.

Source: CEPS (2020) elaboration based on Eurostat data.

Greenhouse gas emissions

The methodology to estimate the GHG emissions for each EU company consists of three steps.

Figure A3.5 Methodology to estimate greenhouse gas emissions



Source: CEPS (2020) elaboration.

Step 1: obtaining data on GHG emissions

This study estimates the GHG emissions for all EU-28 companies. To perform this task, this study uses the air emission accounts published by Eurostat. According to Eurostat, GHG emissions in the EU-28 in 2016 amounted to 3.6 bn tons. Germany (21.5%), the UK (11%) and Poland (9.8%) rank first in terms of the share of GHG emissions. Each of all the remaining countries contribute to the total by less than 10%.

Table A3.24 Greenhouse gas emissions in the EU-28

Country	GHG emissions Th tons	Share of total GHG emissions EU-28 %
Austria	57 872	1.6
Belgium	90 522	2.5
Bulgaria	48 659	1.3
Cyprus	6 817	0.2
Czech Republic	106 204	2.9
Germany	783 638	21.5
Denmark	79 407	2.2
Estonia	18 870	0.5
Greece	76 390	2.1
Spain	269 585	7.4
Finland	55 019	1.5
France	343 366	9.4
Croatia	18 589	0.5
Hungary	48 669	1.3
Ireland	58 195	1.6
Italy	329 059	9.0
Lithuania	23 183	0.6
Luxembourg	8 346	0.2
Latvia	10 660	0.3
Malta	3 183	0.1
Netherlands	180 404	5.0
Poland	357 418	9.8
Portugal	56 861	1.6
Romania	102 471	2.8
Sweden	52 117	1.4
Slovenia	14 626	0.4
Slovakia	36 185	1.0
United Kingdom	401 780	11.0
EU-28	3 638 096	100.0

Source: Eurostat.

Step 2: adjusting for GHG emissions from the public sector

The provisions on mandatory energy audits are not applicable to public administration bodies. Thus, before calculating the emissions for all the EU companies, it is necessary to perform an adjustment.

Three NACE sectors (i.e. O, P and Q) covering public administration, education and healthcare host – without surprise – a large number of public entities. To calculate the GHG emissions of EU-28 companies, it is necessary to determine what portion of GHG emissions from NACE sectors O, P and Q are due to commercial entities and what to public entities. To do this, this study computes the share of employees in commercial entities (from Orbis) over the total employees of these three sectors. These shares are obtained at the country level and then multiplied by the total GHG emissions of NACE sectors O, P and Q to obtain the GHG emissions from the commercial entities alone.

Overall, GHG emissions from the NACE sectors O, P and Q account for 84.9 million tons (see Table A3.25). It is estimated that 17.8 million tons are due to commercial entities while the remaining 67 million tons are due to public administration entities.

Table A3.25 Computation of GHG emissions, adjustment for public sector

Country	GHG emissions in NACE sectors O, P, Q	Share of employees in commercial entities in NACE categories O, P, Q	GHG emissions from commercial entities in NACE sectors O, P, Q
	Th Tons		%
Austria	811	16.9	137
Belgium	3 051	49.5	1 511
Bulgaria	133	66.9	89
Cyprus	79	8.4	7
Czech Republic	825	25.9	214
Germany	17 273	30.0	5 187
Denmark	697	5.5	39
Estonia	284	12.4	35
Greece	3 512	5.7	201
Spain	5 142	16.3	836
Finland	818	25.6	209
France	14 528	7.6	1 104
Croatia	267	8.9	24
Hungary	1 381	7.5	104
Ireland	1 279	23.3	298
Italy	7 110	13.8	979
Lithuania	156	44.2	69
Luxembourg	123	15.2	19
Latvia	188	28.1	53
Malta	39	2.0	1
Netherlands	3 370	32.1	1 083
Poland	5 888	13.6	803
Portugal	1 321	22.7	299
Romania	1 105	7.8	87
Sweden	913	16.5	150
Slovenia	411	4.5	19
Slovakia	611	68.2	416
United Kingdom	13 552	28.2	3 817
EU-28	84 867	21.0	17 789

Source: CEPS (2020) elaboration based on Eurostat and Orbis data.

Step 3: distributing the GHG emissions across companies

The third and last step involves distributing the GHG emissions across companies.

Overall, the amount of GHG emissions in the EU are estimated to be 3.5 bn tons. The electricity, gas, steam and air conditioning supply sector ranks first in terms of GHG emissions, as it accounts for 30.1% of the total. The manufacturing sector ranks second, with 24% of the total, followed by agriculture, forestry and fishing (14.5%) and transportation and storage (14.4%).

Table A3.26 GHG emissions by NACE sector

Sector	GHG emissions	
	Th Tons	%
A – Agriculture, forestry and fishing	517 185	14.5%
B – Mining and quarrying	80 029	2.2%
C – Manufacturing	855 449	24.0%
D – Electricity, gas, steam and air conditioning supply	1 073 842	30.1%
E – Water supply; sewage, waste	170 815	4.8%
F – Construction	66 027	1.8%
G – Wholesale and retail, repair	107 741	3.0%
H – Transportation and storage	513 569	14.4%
I – Accommodation and food service activities	19 971	0.6%
J – Information and communication	10 236	0.3%
K – Financial and insurance activities	10 279	0.3%
L – Real estate activities	6 596	0.2%
M – Professional, scientific and technical activities	21 866	0.6%
N – Administrative and support service activities	21 706	0.6%
O – Public administration and defence	6 685	0.2%
P – Education	3 545	0.1%
Q – Human health and social work activities	7 219	0.2%
R – Arts, entertainment and recreation	8 665	0.2%
S – Other service activities	10 716	0.3%
T – Activities of households as employers	342	0.0%
U – Extraterritorial organisations and bodies	1	0.0%
Information not available	58 533	1.6%
All sectors	3 571 018	100.0%

Source: CEPS (2020) elaboration based on Eurostat and Orbis data.

Annex 4. The State Aid aspect

The Member States are by means of Article 8(2) of the EED encouraged to develop programmes for SMEs to undergo energy audits and implement the recommendations in these audits. Member States may set up support programmes for SMEs on “transparent and non-discriminatory criteria and without prejudice to Union State aid law”. This may comprise covering the costs of energy audits, for which it is important that the support is not considered State Aid. Financial assistance under these provisions can only be granted to SMEs “on the basis of transparent and non-discriminatory criteria without prejudice to the EU State Aid rules”.¹¹¹

Under the De minimis Regulation, Member States can avoid notification or any administrative procedures when granting aid to SMEs, subject to a maximum threshold of EUR 200 000 per company.

Additionally, the General Block Exemption Regulation (GBER) exempts certain types of State Aid from the notification requirement to accelerate State Aid decision-making. Also the aid exempted under the GBER¹¹² needs to be reported to the Commission through a separate *ex post* procedure.¹¹³ More specifically, Member States must indicate the SME status of the aid recipient, while no justification or elaboration is needed.

The EU spending programmes (Competitiveness and Innovation Programme, the Research Framework Programme) support the innovative activities of SMEs.¹¹⁴ These simplifications apply to individual State Aid measures within different legislation.

According to the Treaty on the Functioning of the European Union (TFEU), State Aid measures must be compatible with the internal market. State Aid in the fields of environmental protection and energy is only compatible with the internal market if it has an incentive effect. Because energy audits are only mandatory for non-SMEs, the Commission argues that subsidies would incentivise more SMEs to conduct an energy audit.¹¹⁵ Indeed, this would change if some of the SMEs were required to conduct an energy audit.

The maximum aid that is exempted is capped. The maximum threshold for aid granted depends on the type of aid granted and its beneficiary. The aid for environmental studies¹¹⁶ must be below EUR 7.5 million per undertaking per investment project for SMEs and EUR 15 million for non-SMEs to qualify for the exemption. The maximum aid can cover a maximum of 50% of the total costs, which may be increased to 60% for medium-sized enterprises and 70% for small enterprises.

If these conditions are fulfilled, the aid to SMEs for energy audits is compatible with Article 107(3) of the TFEU and is exempted from the notification requirement.¹¹⁷ Large enterprises do not qualify for this type of aid “unless the energy audit is carried out in addition to the mandatory energy audit under the EED”.¹¹⁸ Hence, the limitations of the State Aid requirements in the context of the EED primarily depend on the legal requirement. Indeed, the companies that are not required to conduct an energy audit are exempted from the State Aid limitations.

The use of an alternative SME definition does not appear to conflict with the State Aid rules, largely due to the recently implemented simplification measures. Looking at EU

¹¹¹ European Commission (2012), Directive 2012/27.

¹¹² European Commission (2014), Regulation No 651/2014.

¹¹³ Only a short summary of information is required. The summary form is available in the Annex II of the GBER.

¹¹⁴ European Commission (2009), Handbook on community state aid rules for SMEs.

¹¹⁵ European Commission (2014), Communication on the Guidelines on State aid for environmental protection and energy 2014-2020.

¹¹⁶ Including energy audits under Article 8 of the EED.

¹¹⁷ Article 49 (1), European Commission (2014), Regulation No 651/2014.

¹¹⁸ Article 49 (5), European Commission (2014), Regulation No 651/2014.

legislation, 4 out of 21 pieces of legislation that employ alternative SME definitions (see Section 4.2.1) have State Aid provisions (EMAS III, European Structural and Investment Funds Regulation, Common Organisation of the Markets Regulation and Horizon 2020). They define SMEs as a mix of current and topic-specific definitions. Three of them fully qualify for the notification exemption under the GBER or Commission guidelines.

EMAS III requires Member States to facilitate the access of SMEs to support funds and subsidise their participation in the scheme. These provisions are very similar to the EED, as they aim to encourage SMEs to register and undergo eco-management and audits by means of financial assistance. State Aid under EMAS III also applies to small public authorities. The State Aid granted to SMEs under EMAS III could qualify for a notification exemption as investment aid, enabling undertakings to go beyond Union standards for environmental protection.¹¹⁹ The incentive effect in this case can be confirmed if a company submits a written application before start of the project.¹²⁰ This exemption is not limited to SMEs, hence aid granted to small public authorities does not need to be reported as well.

Aid to enterprises within the scope of the alternative definition under the Common Organisation of the Markets Regulation (CMOR) is also exempt from the notification. Under the new CMOR, Member States may offer support¹²¹ to SMEs and non-SMEs with fewer than 750 employees or turnover of less than EUR 200 million¹²² in the wine sector. According to Commission Regulation (EU) No 702/2014, this type of aid is exempted from the notification procedure for all aid recipients.¹²³ The maximum amounts and share of total costs that can be covered by aid varies, depending on the activity aid was granted for.

Aid to enterprises within the scope of the alternative definition under Horizon 2020 is relieved from any administrative procedure. The definition is extended to account for the intermediate category of enterprises (with fewer than 3 000 employees) only with respect to its "access to risk finance" provisions.¹²⁴ The funding under Horizon 2020 is designed to take EU State Aid rules into account to maintain the level playing field.¹²⁵

The only legislation where the alternative SME definition might conflict with State Aid rules is the European Structural and Investment Funds Regulation. Under the ESI Funds Regulation, Member States may use the European Regional Development Fund or European Agriculture Fund for Rural Development to support SMEs and entities with a headcount of fewer than 500 people through financial instruments.¹²⁶ This type of aid qualifies as risk finance aid according to the Commission's Guidance on State Aid in ESI Funds.¹²⁷ However, the notification exemption under the risk finance aid of the GBER only applies to aid to SMEs below EUR 15 million per eligible undertaking.¹²⁸ Aid to entities with a headcount of fewer than 500 people will have to be notified to the Commission. As of 2019, no investigations or authorisations were identified with respect to this provision.

¹¹⁹ Article 36, European Commission (2014), Regulation No 651/2014.

¹²⁰ Article 6 (2), European Commission (2014), Regulation No 651/2014.

¹²¹ Only investment for processing facilities, infrastructure, marketing structures and tools constitutes State Aid (Article 50 of the Regulation No 1308/2013).

¹²² For this category of enterprises, the State Aid amount should be halved.

¹²³ Article 20, European Commission, Regulation (EU) No 702/2014 of 25 June 2014 declaring certain categories of aid in the agricultural and forestry sectors and in rural areas compatible with the internal market.

¹²⁴ Under these provisions, SMEs receive public funding through risk-sharing mechanisms (debt and equity facilities).

¹²⁵ Recital 42 of the Regulation (EU) No 1291/2013 establishing Horizon 2020.

¹²⁶ Securitisation of existing portfolios of SMEs and entities with a headcount of fewer than 500 people.

¹²⁷ European Commission (2017), Guidance on State aid in European Structural and Investment (ESI) Funds Financial instruments in the 2014-2020 programming period.

¹²⁸ Article 21, European Commission (2014), Regulation No 651/2014.

Annex 5. Intervention logic

Energy audits and energy-management systems (Article 8 EED)

Needs, problems and drivers

The Energy Efficiency Directive (EED; and the amendment to the Directive)¹²⁹ identified three **main needs** linked to the energy audits of enterprises:

- to ensure 20% primary energy savings by 2020 as part of the Europe 2020 Strategy;¹³⁰
- to contribute to realising the EU's 2050 vision of a resource efficient and low carbon economy as set out in the Low Carbon Roadmap 2050;¹³¹ and
- to achieve further savings in energy supply and use.

The **mid-term evaluation** of the EED identified **one main problem**, namely the fact that the energy-efficiency frameworks did not deliver sufficient energy savings to meet the agreed targets at the EU and international levels.¹³² The frequently 'soft' and open wording of the Directive on end-use energy efficiency and energy services (ESD) and the Directive on promotion of co-generation (CHP Directive) were not sufficient to overcome the main barriers to energy efficiency.¹³³

Going more in detail, **two main drivers** feed into this problem:

- increasing dependence on energy imports,¹³⁴ and
- rising energy prices.

¹²⁹ Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC Text with EEA relevance <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32012L0027>.

¹³⁰ See <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2011:0370:FIN>. Other options with a considerable positive impact compared with their costs are those that aim to promote the energy services market, provide improved and more frequent information to households and companies on their actual energy consumption through billing and smart meters, and mandatory energy audits for large companies. It requires regular, mandatory energy audits for large companies and lays down a series of requirements on energy companies regarding metering and billing.

¹³¹ Commission Staff Working Paper Impact Assessment /* SEC/2011/0779 final – COD 2011/0172 *, p. 8 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011SC0779>.

¹³² Proposal for a Directive of the European Parliament and of the Council on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC /* COM/2011/0370 final – COD 2011/0172, p.6; <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52011PC0370&from=EN>.

Commission Staff Working Paper Impact Assessment /* SEC/2011/0779 final – COD 2011/0172 * <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011SC0779> pp. 8, 15.

¹³³ Commission Staff Working Paper Impact Assessment /* SEC/2011/0779 final – COD 2011/0172 * <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011SC0779>, p. 13.

¹³⁴ Proposal for a Directive of the European Parliament and of the Council on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC /* COM/2011/0370 final – COD 2011/0172 p.1; <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52011PC0370&from=EN>.

Objectives

The EED aims to contribute to achieving 20% primary energy savings in 2020. The long-term objectives refer to economic growth and job creation, reduction of energy poverty and improving the EU's industrial competitiveness given them the lead in the global markets for energy-efficiency technologies.¹³⁵ The directive identifies the following two general objectives:

- **general objective 1** – to enhance the achievement of 20% primary energy savings in 2020 to close the gap of the unsatisfactory progress towards the target of 20%; and
- **general objective 2** – to contribute to the EU Roadmap 2050.

The directive emphasises the specific objective targeted by this piece of legislation:

- **specific objective 1** – to trigger measures to reap the remaining cost-effective potential on the energy demand side, particularly in building and industry.¹³⁶

In addition, **two** operational objectives can be identified:

- **operational objective 1** – to introduce mandatory energy audits and energy-management systems for industry; and
- **operational objective 2** – to introduce voluntary systems to promote energy audits and the use of energy-management systems in industry.

Inputs

The directive contains **four measures** targeting the increase of energy savings:

- an obligatory audit for large enterprises every four years;
- a voluntary audit for SMEs;
- State Aid for incentivising SMEs to undergo energy audit; and
- State Aid for SMEs and large enterprises to implement audit recommendations.¹³⁷

¹³⁵ Proposal for a Directive of the European Parliament and of the Council on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC /* COM/2011/0370 final – COD 2011/0172, p. 1; <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52011PC0370&from=EN>.

¹³⁶ Commission Staff Working Paper Impact Assessment /* SEC/2011/0779 final – COD 2011/0172 * <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011SC0779>, p. 47.

¹³⁷ Opinion of the European Economic and Social Committee on the "Proposal for a directive of the European Parliament and of the Council on energy efficiency and repealing Directives 2004/8/EC and 2006/32/EC" COM(2011) 370 final — 2011/0172 (COD) OJ C 24, 28.1.2012, pp. 134–138.

Results

The following output (i.e. immediate result) related to the directive can be identified:

- transposition of the provisions in Article 8 of the EED.

The expected short to medium-term results (**outcomes**) corresponding to the specific objectives of the EED can be formulated as follows:¹³⁸

- decrease of energy consumption as a result of audit measures;¹³⁹
- reduction of the energy costs for companies;¹⁴⁰ and
- a common EU approach to energy audits of large enterprises.

Regarding the long-term results, the EED lists three global **impacts**:

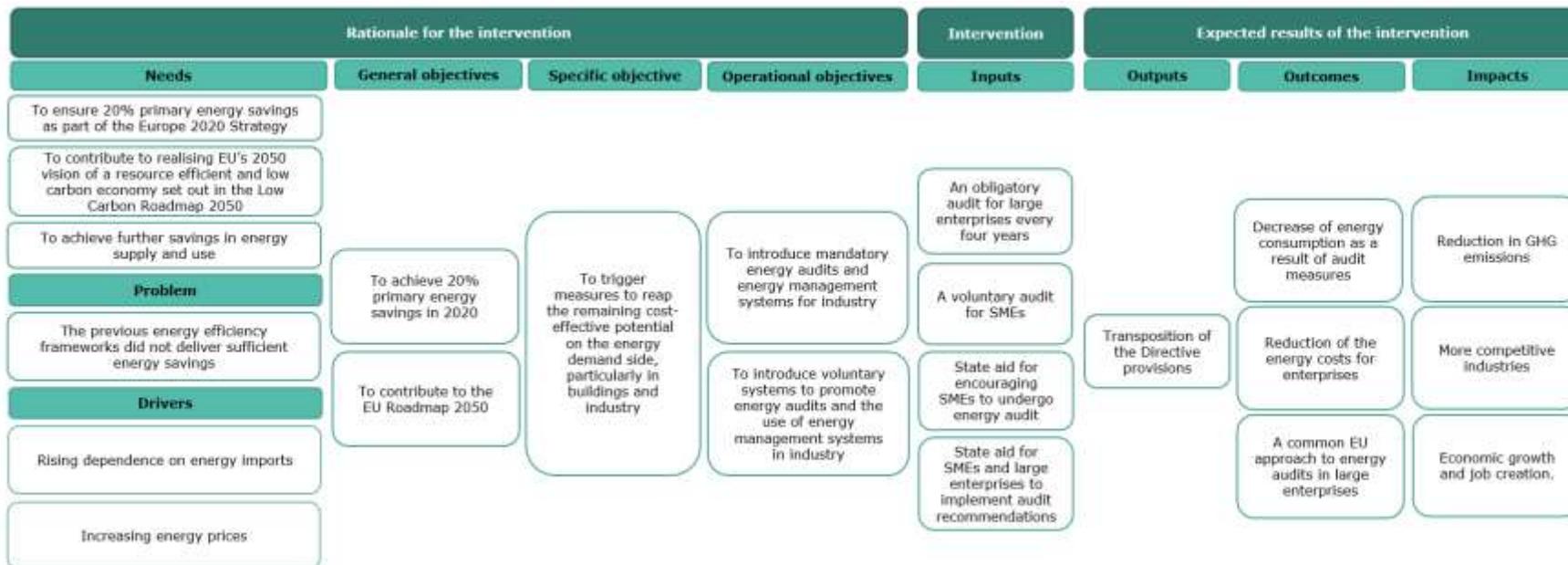
- reducing GHG emissions by decreasing energy consumption;
- making industry more competitive by producing more with less energy; and
- economic growth and job creation.

¹³⁸ Commission Staff Working Paper Impact Assessment /* SEC/2011/0779 final – COD 2011/0172 *, p. 8, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011SC0779>, pp. 47-51.

¹³⁹ The impact assessment foresees extra savings in the range between about 0.4% and 5.0% of the total industrial energy consumption realised in 2020. See the Commission Staff Working Paper Impact Assessment /* SEC/2011/0779 final – COD 2011/0172 *, p. 8 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011SC0779>, pp. 47-51

¹⁴⁰ “An average company spends 2-4% of its turnover on energy. A typical audit results in saving 20% of the energy bill”. Ibid.

Figure A5.1 Graphic representation of the intervention logic of the EED

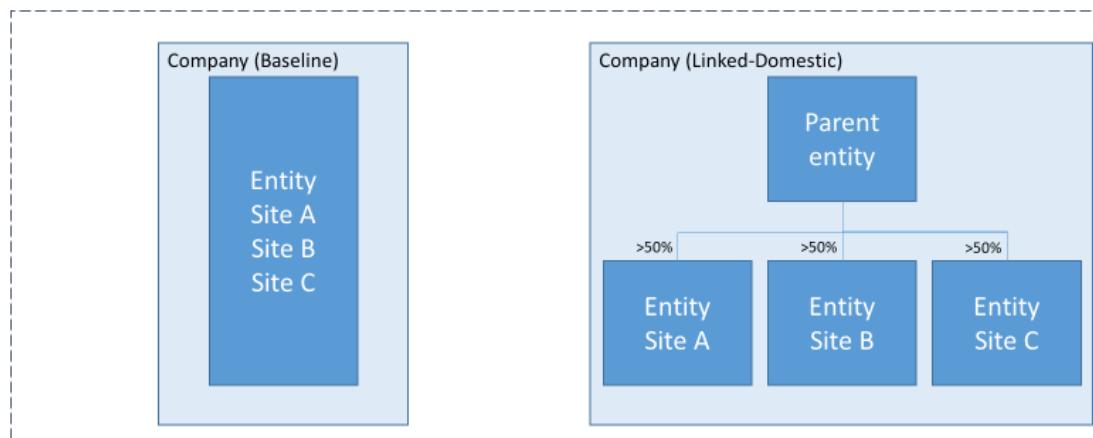


Annex 6. Case studies

Case I – domestic linked companies

All company entities of an enterprise belonging to Case I are located at multiple sites in the same country and do not meet the SME criteria at the entity level. The parent entity owns/controls more than 50% of the equity/voting rights of the subsidiary entities. The baseline against which the implementation of Article 8(4) by a Case I company is compared is a company undertaking the same activities but operating as a single domestic site (see Figure A6.1).

Figure A6.1 Graphic impression – linked domestic



Source: CEPS' elaboration.

The domestic linked companies form an important share of the number of non-SMEs. The number of non-SMEs increases by an additional 386 000 companies if domestically linked companies that do not meet the SME size criteria on a stand-alone basis are added. The domestic linked companies account for about 51% of the total number of non-SMEs and 8% of the estimated final energy consumption of non-SMEs (\approx 5% of the total, corporate final energy consumption). Indeed, the average final energy consumption of the domestic linked companies is less than a sixth of the average non-SMEs.

The main identified challenges to the scope of Article 8(4) of the EED for domestic linked companies are:

- the coverage of entities that on a stand-alone basis meet the SME size criteria. The direct energy auditing may (be perceived to) pose disproportionate demands in terms of specialised staff time or costs to these entities;
- the coverage of companies/entities with limited energy consumption. Again, the staff or budgetary demands might be (perceived as) disproportionate for these entities; and
- the divergencies in implementation practices across EU Member States. In practice, domestic partner companies are not subject to an energy audit in all countries, as several national authorities only consider company entities within their respective national jurisdiction, which may lead to unequal treatment of similar companies across countries.

The linked companies considered under Case I are all active domestically, which means that there are no issues with cross-country information exchange for the competent national energy authority.

Representatives of four domestic linked companies from four different EU Member States were interviewed for this case. All the interviewed companies are characterised by strongly centralised management and facing significant – i.e. from a business management perspective, non-negligible – energy costs. Not surprisingly, all had implemented the energy audit obligation. In three out of four companies interviewed, all entities are directly involved in energy audits with an emphasis on the entities with the highest energy consumption. Energy audit practices in these companies are unlikely to be robustly different from their respective baseline. In the fourth company interviewed, a regional water and sewerage company in the UK with several thousand of mostly small operations/installations spread out all over the region, a proportionate clustered approach is followed in energy audits, where for each cluster of company entities a sample of entities with highest energy consumption is directly covered. A single-sited baseline for this water and sewerage company is not realistic in practice; in the baseline quite some costs would be saved outweighing the extra costs of full direct coverage of all activities. An entirely direct energy auditing approach would be rather cost-inefficient for this company. In the two smaller companies interviewed – a tomato growing/processing distribution company and a small, regional bread bakery chain – most of the energy audit work is outsourced to external accredited energy auditors, whereas in the two larger companies all or most of the energy audit work is performed by certified internal employees. In all four companies interviewed, the organisation/supervision of the auditing work tends to be centralised, i.e. the audits are in most cases centrally arranged for both the parent and subsidiaries.

The interviewees tended to deem energy auditing useful. The recommended energy saving actions tended to be cost-effective when the type of business activity of the company entity concerned is of an energy-intensive nature. Also the vagaries of changing energy policies can significantly impact the cost-effectiveness of recommended actions, e.g. in the Netherlands, energy taxes are frequently changed on short notice with a strong impact on the gas/electricity price ratio, rendering it hard for a horticulture company to assess *ex ante* the long-term feasibility of an investment in geothermal heating for replacing natural gas in meeting its low-temperature heat demand.

In the four countries covered, no relevancy criteria in terms of an energy consumption threshold level has been reported to be applied to approve exclusion of low-energy entities of linked domestic companies. Yet indirect sampling auditing through the clustering of company entities does occur. The interviews did not expose EU-wide internal market issues resulting from diverging national implementation practices, as Case I company representatives did not tend to be well-informed about implementation practices in other Member States.

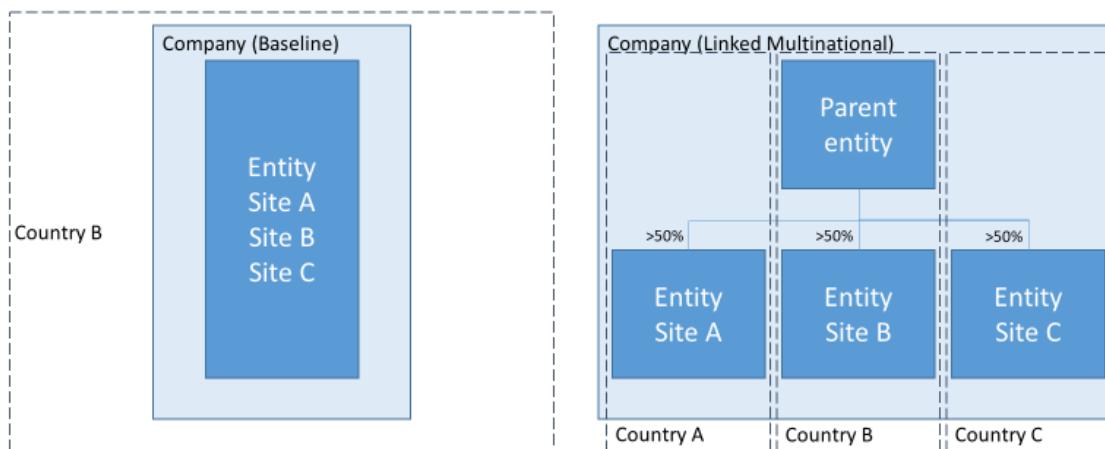
In general, it is sensible to have these companies covered under the energy audit obligation. No major implementation would seem to hinder such prescription. From a market functioning perspective and for mitigating black holes in the implementation of Article 8(4) EED, this prescription is desirable. For economic efficiency reasons, consideration could be given to allowing an energy-specific waiver for non-SME companies, including Case I companies, for the energy audit obligation, i.e. it should be proven that the whole set of linked company entities of a Case I company fail **on aggregate** in meeting a certain, pre-defined – EU-wide sectoral or general – company energy-consumption threshold to be applied across the EU to linked domestic companies.

Granted that the suggestions above are properly implemented, the existing differences in treatment between Case I companies and their notional baseline companies would largely disappear.

Case II – multinational linked companies

All linked entities of a company pertaining to Case II are located at multiple sites in at least two countries and at the entity level meet the SME size criteria, but when combined they exceed the SME size criteria (see Figure A6.2). The parent entity owns/controls more than 50% of the equity/voting rights of the subsidiary entities. The baseline against which the Case II companies are compared is a company with the same activities but located jointly as one united entity in a specified EU Member State.

Figure A6.2 Graphic impression – multinational linked



Source: CEPS' elaboration.

Multinational linked companies form an important part of the non-SMEs. There are in total about 155 000 additional linked non-SMEs due to the consideration of international linkages. These companies account for approximately 21% of the total non-SMEs. The multinational linked companies account for about 2% of the final energy consumption of non-SMEs (\approx 1% of the total corporate final energy consumption). This means that the final energy consumption of multinational linked companies is about a tenth of the non-SMEs' average.

The main identified challenges to the scope of Article 8(4) EED for multinational linked companies are the following:

- the coverage of entities that on a stand-alone basis meet the SME size criteria. The direct energy auditing may (be perceived to) pose disproportionate demands in terms of specialised staff time or costs to these entities;
- the coverage of companies/entities with limited energy consumption. Again, the staff or budgetary demands might be (perceived as) disproportionate for these entities; and
- different treatment of companies that have their activities distributed across countries and those that have the same activities in a single EU Member State. In practice, the multinational linked companies might not be subject to an energy audit in all countries, as several authorities do not consider linked company entities abroad, which may lead to unequal treatment of similar companies across countries.

Five out of six Case II companies participating in the interviews are complying with the energy audit obligation, at least in the Member State where the company's headquarter is located. The interviewee of one participating company stated that the Member State of the company headquarter, Ireland, is rather lenient in overseeing compliance with

the energy audit obligation, only considering the obligation scope at a company entity level and relying entirely on the employment criterion. The company's main assets are two rather energy-intensive installations, one in the Irish Republic, the other in Northern Ireland and a number of low-capital, low-energy distribution points on both sides of the border. The company conducts (centrally arranged) internal energy audits focused on the two energy-intensive company entities. As the energy-intensive entity within Irish jurisdiction is in the process of being phased out and the energy bill of the other Irish Republic entities together is low, the company feels fine not being covered by the energy audit obligation in the Irish Republic because of low cost-effectiveness. In contrast, in Northern Ireland all entities are covered by the energy audit obligation overseen by the UK competent energy authority, the Environment Agency. All energy-intensive production will be realised in the one energy-intensive installation in Northern Ireland after the phase-out of the counterpart installation in the Irish Republic. Therefore, coverage of the company's entities in Northern Ireland makes sense, with emphasis on the one and only energy-intensive plant of the company in this region. That is the more so as the aggregate of the Northern Irish entities do not meet the SME criteria, whereas after the aforementioned phase-out the company's operations in the Irish Republic will not.

For cost-effectiveness reasons, three out of the five compliant Case II companies interviewed (of which one is a very large and one a medium-large multinational company) meet the energy audit obligation through the certification process with respect to a relevant ISO, such as notably 50001 (Energy Management) or 14001 (Environmental Management) and do (or are preparing to) organise the certification process centrally across company entities at least in the home country of the interviewees. Again for cost reasons as well as for company-reputational value considerations, the large and energy-intensive multinational company organises the relevant certification process across Member States and third countries. This company faces streamlining problems, though, foremost because of divergencies in national regulations and the rigidity of the distinct, competent national energy authorities. In this respect, it is also not very helpful for fostering more harmonisation of the relevant ISO certification across different jurisdictions that not all competent national energy authorities in the EU, let alone at the global level, are members of the International Accreditation Forum (IAF).

The linked multinational companies interviewed that do not belong to the largest ones in size (in terms of total balance sheet or market capitalisation) organise energy auditing across cross-border entities in a decentralised way for reasons of cost-effectiveness. Several interviewees mentioned some significant divergence in the rigidity of regulatory supervision of energy auditing compliance among Member States.

Notably in Germany, the implementation burden of the energy audit obligation is high according to several interviewees. For instance, a large energy-intensive company headquartered in Germany mentioned that they were forced to hire expensive external auditors, whereas their certified internal employees have to do all the content work. The signing off by external auditors is required in order to become eligible for an attractive partial waiver for the EEG Umlage (renewable energy surcharge on the electricity bill).

It makes sense to implement the energy audit obligation in relation to linked multinational companies cross-border within the EU meeting a relevant energy consumption threshold to be defined a priori. Yet, to date, differences in national regulatory environments reduce the effectiveness and internal market functioning regarding the de facto scope of implementation. That holds even more when the national aggregation of company entities in one or more countries has low energy bills and/or meets the SME criteria and in several Member States the competent national energy authority implements the obligation in relation to company entities within their own jurisdiction. Also, the need for data exchange between competent national energy

authorities on SME parameters and energy consumption values inhibits application of the energy audit obligation to linked multinational company entities cross-border.

The interviewees of Case II companies tended to deem energy auditing useful. This holds especially for the ones representing energy-intensive companies. The six interviews with linked multinational companies suggested that large energy-intensive ones favour a centralised approach across all company entities, while the other linked multinational companies tended to favour a more decentralised approach among entities located in different Member States and third countries. Whether or not the recommended energy savings actions are cost-effective depends mainly on whether the type of business activity is of an energy-intensive nature. Among the energy-intensive companies interviewed, typically in-house energy auditing is done anyhow for economic reasons. When the company entities in a certain country have, on aggregate, a modest energy bill – the amount regarded as such and/or considered relative to total operating costs – then it is less attractive for linked multinational companies to extend mandatory energy audits cross-border to these entities when they do not have to.

For economic efficiency reasons, consideration could therefore be given to introducing EU-wide general or sector-specific energy consumption threshold(s) to be **mandatorily applied to all non-SME companies, including all entities of a linked multinational company, across the EU** and voluntarily – given the jurisdiction of EU law – including company entities in third countries as well. Case II companies that can prove failure to meet **on a consolidated basis** the applicable energy consumption threshold would then be eligible for a waiver of the energy audit obligation. If the suggestions above are properly implemented, the existing differences in treatment between Case II companies and their notional baseline companies would largely disappear.

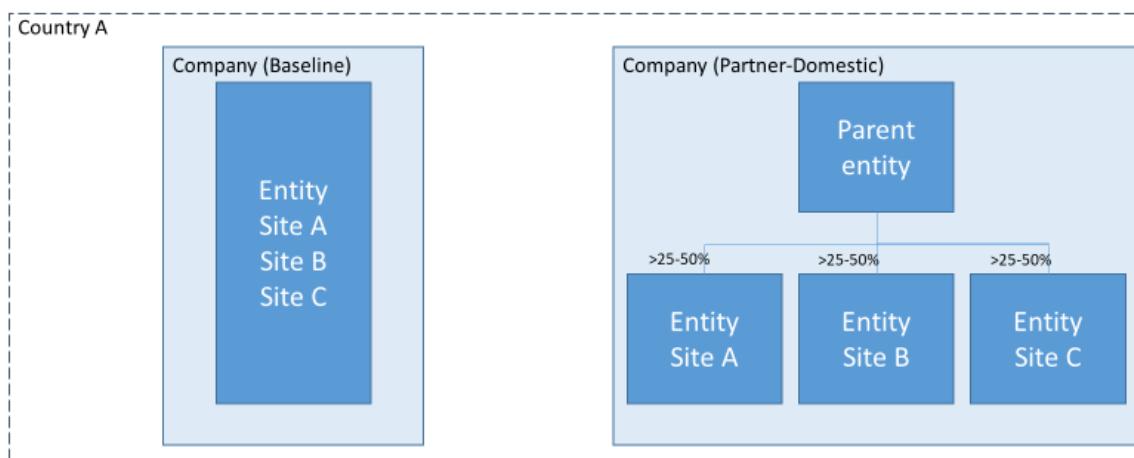
For this to happen, existing issues with cross-country information exchange for the competent national energy authorities in the Member States should be solved with urgency for proper implementation. This could be arranged either through providing mutual horizontal access to national databases or by means of an obligation for the national competent energy authorities to share their company databases with a dedicated EU agency mandated to set up an EU company database in exchange for the access of cooperating national energy authorities to the designated EU agency.

Case III – domestic partner companies

All partner companies pertaining to Case III are located at multiple sites in the same country and do not meet **on aggregate** the SME criteria (see Figure A6.3). One partner company owns/controls at least 25% up to 50% of the equity/voting rights of one or more other partner company(ies).

The baseline against which the implementation of Article 8(4) by the Case III partner companies are compared is the expected implementation by the counterfactual situation in which all partner companies are subsumed into one united company at one site in the same country.

Figure A6.3 Graphic impression – domestic partner



Source: CEPS' elaboration.

Domestic partner companies form a significant share of the non-SMEs. There are in total about 61 000 additional non-SMEs due to the consideration of the domestic partners. These companies account for approximately 8% of the total non-SMEs. The domestic partner companies account for less than 1% of both the final energy consumption of non-SMEs and total corporate final energy consumption. This means that the final energy consumption of the domestic partner companies is only a fraction of the non-SMEs' average.

The main identified challenges to the scope of Article 8(4) of the EED for domestic partner companies are similar to those of linked domestic companies by nature, but to a greater degree:

- the coverage of entities that on a stand-alone basis meet the SME size criteria. The direct energy auditing may (be perceived to) pose disproportionate demands in terms of specialised staff time or costs to these entities;
- the coverage of companies/entities with limited energy consumption. Again, the staff or budgetary demands might be (perceived as) disproportionate for these entities; and
- the divergencies in implementation practices across EU Member States. In practice, the domestic partner companies are not subject to an energy audit in all countries, as several national authorities only consider company entities within their respective national jurisdiction, which may lead to unequal treatment of similar companies across countries.

The partner companies considered under Case III are all active domestically, which means that there are no issues with cross-country information exchange for the competent national energy authority.

Prima facie, we would expect that those affiliated domestic partner companies which on a stand-alone basis meet the SME criteria would be granted a waiver with respect to the energy audit obligation, even more often than is already the case with entities of groups of affiliated domestic partner companies that meet the SME criteria and which are modest energy consumers. This is for reasons of absence of operational control by the affiliated companies having at least 25% minority stakes in other affiliated domestic partner companies. Moreover, statistics about SME criteria parameter and energy consumption values for minority holdings available to the competent national authorities might well be wanting, the more so about minority holdings abroad. Indeed, numerically modest evidence is provided by the outcomes of the interview with the only partner domestic company participating in this study.

All Case III companies covered under the energy audit obligation that are non-SMEs on a stand-alone basis should be covered by the energy audit obligation anyhow. However, an extension of this rule to those Case III companies that meet the SME criteria on a stand-alone basis is hard to implement in practice for reasons mentioned in the previous paragraph. This is in spite of the considerations that from a market functioning perspective and to mitigate black holes in the implementation of Article 8(4) EED, this prescription is desirable. Again, consideration could be given to allowing an energy-specific waiver for non-SME companies, including Case III companies, for the energy audit obligation, i.e. the partner company within the national jurisdiction should prove failure to meet a certain, pre-defined – EU-wide sectoral or general – company energy-consumption threshold to be applied across the EU to domestic partner companies. As distinct from Case I and Case II companies, and allowing for implementation issues, consideration could also be given to implementing the threshold for the entities of a Case III company on a stand-alone basis.

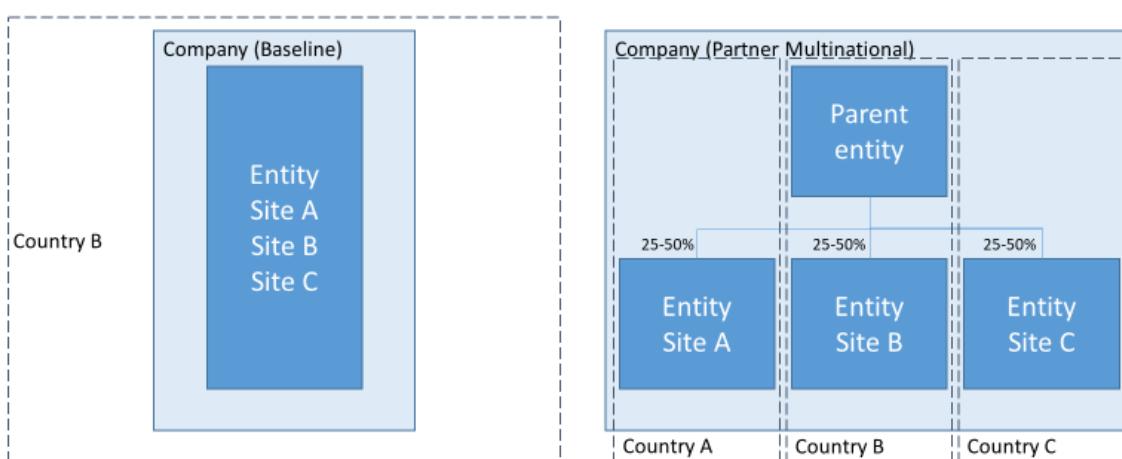
Given the implementation issues regarding Case III companies, the differences in treatment between them and their notional baseline companies would be mitigated but would not totally disappear. In view of their tiny share of energy consumption and direct carbon emissions attributable to all EU non-SME companies, the energy efficiency benefits forgone and associated market distortions are of minor significance.

Case IV – multinational partner companies

All affiliated partner companies pertaining to Case IV are located at multiple sites in at least two countries, at least one of which is an EU Member State (see Figure A6.4). Moreover, affiliated partner companies pertaining to Case IV meet **on aggregate** the non-SME criteria and one partner company owns/controls at least 25% up to 50% of the equity/voting rights of one or more other partner companies.

The baseline against which the implementation of Article 8(4) by the affiliated Case IV partner companies are compared is the expected implementation by the counterfactual situation in which all these partner companies are subsumed into one company at one site in a specified Member State.

Figure A6.4 Graphic impression –multinational partner



Source: CEPS' elaboration.

There are in total approximately 16 000 additional non-SME companies due to the inclusion of multinational partner companies. This group of companies represents about 2% of the total non-SMEs according to the definition in EU Recommendation 2003/361 and accounts for less than 1% of the total corporate final energy consumption. Multinational partner companies are responsible for a similar share of the non-SMEs' energy consumption.

The main identified challenges to the scope of Article 8(4) of the EED for multinational partner companies are similar to domestic partner companies by nature but to a greater extent:

- the coverage of entities that on a stand-alone basis meet the SME size criteria. The direct energy auditing may (be perceived to) pose disproportionate demands in terms of specialised staff time or costs to these entities;
- the coverage of companies/entities with limited energy consumption. Again, the staff or budgetary demands might be (perceived as) disproportionate for these entities; and
- different treatment of companies that have their activities distributed across countries and those that have the same activities in a single EU Member State. The multinational partner companies, in practice, might not be subject to an energy audit in all countries, as several authorities do not consider partner company entities abroad, which may lead to unequal treatment of similar companies across countries.

Prima facie, we would expect that those affiliated partner multinational companies which on a stand-alone basis meet the SME criteria and are low energy consumers would tend to get a waiver for the energy audit obligation. This is for reasons of absence of operational control by the affiliated companies having at least 25% minority stakes in other affiliated multinational partner companies. Moreover, statistics about SME criteria parameter and energy consumption values for minority holdings available to the competent national authorities might well be wanting. This holds the more so when it concerns partner multinational companies abroad. Numerically modest evidence regarding the waiver for the energy audit obligation is provided by the interview outcomes of the only multinational partner company participating in the company interviews for this study. Remarkably, the Danish multinational partner company concerned, meeting itself the SME criteria, stated that it would profit from research on energy-saving production technology undertaken by its affiliated non-SME (on stand-alone basis) multinational partner company in the UK.

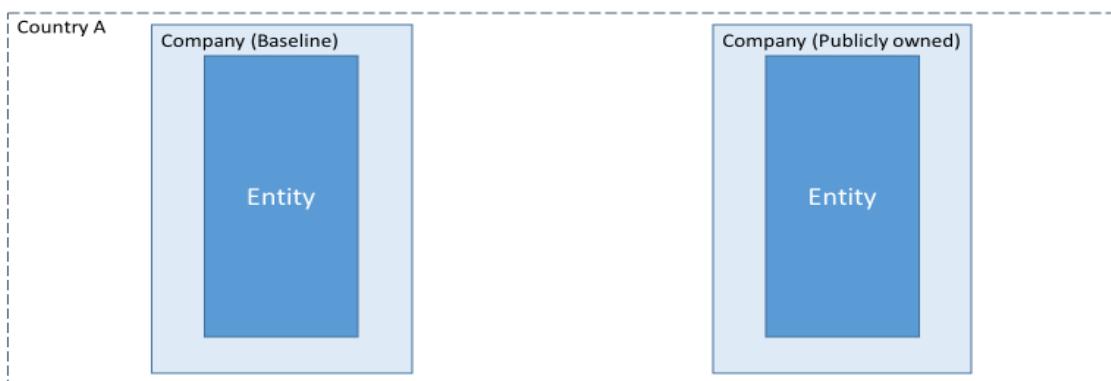
All Case IV companies covered under the energy audit obligation that are non-SMEs on a stand-alone basis should be covered by the energy audit obligation anyhow. However, an extension of this rule to those Case IV companies that meet the SME criteria on a stand-alone basis is hard to implement in practice for reasons mentioned in the previous paragraph. This is in spite of the considerations that from a market functioning perspective and to mitigate black holes in the implementation of Article 8(4) EED, this prescription is desirable. Again, for economic efficiency reasons, consideration could be given to allowing an energy-specific waiver for all non-SME companies, including Case IV companies, for the energy audit obligation. If allowed indeed, a multinational partner company should prove to its national energy authority the failure to meet a certain, pre-defined – EU-wide sectoral or general – company energy-consumption threshold to be applied across the EU to non-SME companies. As distinct from Case I and Case II companies, and allowing for the implementation issues described above, consideration could also be given to implementing the threshold for the entities of a Case IV company, just like a Case III company, on a stand-alone basis.

In light of the implementation issues regarding Case IV companies, the differences in treatment between them and their notional baseline companies would be mitigated but would not totally disappear. Given their tiny share of energy consumption and direct carbon emissions attributable to all EU non-SME companies, the energy efficiency benefits forgone and associated market distortions are of minor significance.

Case V – publicly owned companies

A company pertaining to Case V is owned/controlled for at least 25% of the shares or voting rights by public-sector bodies. As distinct from the other cases, a Case V company (broadly defined) that meets the SME criteria of Commission Recommendation 2003/361/EC also has the obligation to undertake an energy audit. The baseline against which the Case V company is compared is the same type of company that is autonomous and privately owned (see Figure A6.5).

Figure A6.5 Graphic impression – publicly owned



Source: CEPS' elaboration.

This population of non-SMEs in the EU consists of 43 000 companies, when considering public owned companies. These companies account for approximately 6% of the total non-SMEs in the EU according to the definition in EU Recommendation 2003/361. They account for about 2% of total corporate final energy consumption and for 1% of corporate direct GHG emissions in the EU. As for total energy consumption of non-SME corporates in the EU, publicly owned companies account for about 5%.

For Case V, publicly owned companies, the same Article 8(4) implementation challenges hold as the ones for Case I, linked domestic companies:

- the coverage of entities that on a stand-alone basis meet the SME size criteria. The direct energy auditing may (be perceived to) pose disproportionate demands in terms of specialised staff time or costs to these entities;
- the coverage of companies/entities with limited energy consumption. Again, the staff or budgetary demands might be (perceived as) disproportionate for these entities; and
- the divergencies in implementation practices across EU Member States. In practice, the public owned companies are not subject to an energy audit in all countries, as several national authorities only consider company entities within their respective national jurisdiction, which may lead to unequal treatment of similar companies across countries.

The publicly owned companies considered under Case V are all active domestically, which means that there are no issues with cross-country information exchange for the competent national energy authority.

As almost all the public agencies with holdings in Case V publicly owned companies tend to be located in the same country as the publicly owned company itself, no cross-country issues with information exchange or limitations to the supervisory competency of the relevant national regulatory agency occur regarding Case V companies. In principle, all

publicly owned business organisations have to lead by example. Consequently, these 'companies' have to comply with the energy auditing obligation, whether or not they meet the SME criteria.

Interviews were held with representatives of five publicly owned companies in four Member States. Among them, one does not meet the SME criteria and, hence, has to comply with the energy audit obligation anyhow. Indeed, this business organisation does so. **As for the other four, meeting the SME criteria, none of them currently faces the imposition of the energy audit obligation.** One of them, a Swedish company managing public real estate, has to obtain an Energy Declaration every 10 years; that obligation comes close to an energy audit obligation, if every 10 years instead of every 4 years. All real estate-managing companies in Sweden – public and private, SMEs and non SMEs – face this obligation. Hence, interview results suggest that in practice, in at least four Member States, many SME-scale publicly owned companies get an energy audit obligation waiver. Although the Case V companies interviewed are relatively modest energy consumers with one exception – a tiny Swedish municipal district-heating company – **this does not necessarily relate to the application of an energy consumption threshold, but in most cases appears to be rather related to their SME scale as such.** Yet the Brussels energy regulator provides a peculiar case of a publicly owned non-SME 'company', that based on failing to meet the applicable sectoral energy threshold (for office buildings 128 kWh-equivalents per square meter per year) derogates itself in line with Belgian national law for the energy audit obligation.

To the extent that data on at least 25% holdings by public agencies are available to the national competent authorities, it makes sense to impose an EU-wide energy audit obligation on publicly owned companies, including SME ones. Indeed, the public sector should lead by example and demand Green Deal compliance, including compliance with the energy audit obligation, by companies in which the public sector has significant holdings. This also contributes to an expanding implementation scope of the energy audit obligation. Should EU-wide sectoral thresholds for energy consumption be introduced, allowing along with non-SME companies in general, also (SME scale) Case V companies to get a waiver for the energy auditing obligation, it is suggested to introduce a very low threshold for publicly owned companies (including public agencies). Assuming the Brussels case mentioned above represents an exception to general practices across the EU, no major differences in treatment between SME-scale Case V companies and their notional baseline companies would exist at present. Upon putting into practice the aforementioned suggestions made in this paragraph, Case V companies would excel regarding energy audit implementation as compared with non-SME companies in general.



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