



Department  
of Energy &  
Climate Change

# Approaches to ESOS audits

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Any enquiries regarding this publication should be sent to us at [ESOS@decc.gsi.gov.uk](mailto:ESOS@decc.gsi.gov.uk).

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# Foreword

The Energy Savings Opportunity Scheme (ESOS) is a mandatory energy measurement and auditing scheme that targets around 10,000 of the UK's largest undertakings.

DECC estimates that if participants in the scheme reduce energy consumption by an average of just 0.7%, this would reduce their total energy bills by over £250m per year, and save around 3TWh per year of energy.

DECC analysis also indicates that there is significantly greater energy efficiency potential across the UK economy. ESOS is intended to provide a framework to help participants achieve their full energy efficiency potential.

Guidance on how to comply with ESOS was published by DECC in June 2014. An updated version, taking account of feedback from participants was published in February 2015 by the Environment Agency on the behalf of the scheme's compliance bodies<sup>1</sup>. This is available [here](#).

However, during a series of roadshows promoting awareness of ESOS held in autumn 2014, a number of businesses asked for more detailed information on practical approaches to implementing ESOS compliant audits.

In response, DECC commissioned this document to provide practical advice for participants who may be newer to energy auditing on how to develop your approach to ESOS compliance.

*Approaches to ESOS audits* is not mandatory guidance, but is intended to help provide supportive 'best-practice' advice on how to exploit the flexible framework ESOS provides to maximise cost saving benefits for your organisation.

If you have any queries about ESOS compliance you can also contact the ESOS help-desk which the Environment Agency operates on a UK wide basis as the scheme administrator: [ESOS@environment-agency.gov.uk](mailto:ESOS@environment-agency.gov.uk).

**Department of Energy and Climate Change**  
March 2015

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<sup>1</sup> Environment Agency, Natural Resources Wales, Northern Ireland Environment Agency, Scottish Environment Protection Agency and DECC Offshore

# Introduction

## This document

This guide provides example approaches to consider when planning and undertaking energy audits under the Energy Savings Opportunity Scheme (ESOS).

This document is **not** a compliance guide and **does not** replace the Environment Agency's guide: '[Complying with the Energy Savings Opportunity Scheme](#)'.

ESOS offers a number of routes to compliance, including audits, Display Energy Certificates, and ISO50001. Participants should consider these carefully and select the option(s) that are most appropriate to them.

This guide focuses solely on ESOS compliant energy audits (hereafter referred to simply as 'ESOS audits'). It includes information on how to apply best practice when:

- **Developing audit plans** – how to; determine the scope of your ESOS audits, decide how many and what type of audits to undertake and who are the right people to do them
- **Delivering audits** – what the audits should include, how to prepare for them and the tools you may wish to draw upon
- **Reporting audits** – how to plan the report, structure it and what it should contain
- **Engaging Senior Management** – how to raise awareness of the importance of ESOS from the outset of the process and the best way to prepare for sign-off in order to encourage

The guide also contains templates to help plan and deliver audits and manage your evidence pack.

## Why read this guide?

The guide has been developed in response to business requests for more practical examples of how they could approach ESOS audits.

This guide is primarily intended for ESOS participants undertaking energy audits, and particularly those who have less experience of energy auditing. However, it may also be useful for anyone involved in planning or carrying out audits, whether undertaken in-house or involving a third party.

The approaches set out in this guide are intended to help you use ESOS audits to identify the most cost effective savings for your organisation. This includes selecting the right sites to visit in an audit, making the best use of existing data and past audit work and using the most appropriately qualified auditors.

**This guide is intended purely to give illustrative examples of possible ways to approach your ESOS audits. There is no requirement or expectation on businesses to follow the approaches or use the templates provided in the guide. It is up to individual ESOS participants to satisfy themselves that they are compliant with the scheme requirements as set out in the ESOS Regulations and Environment Agency Compliance Guidance.**

# Developing an audit plan

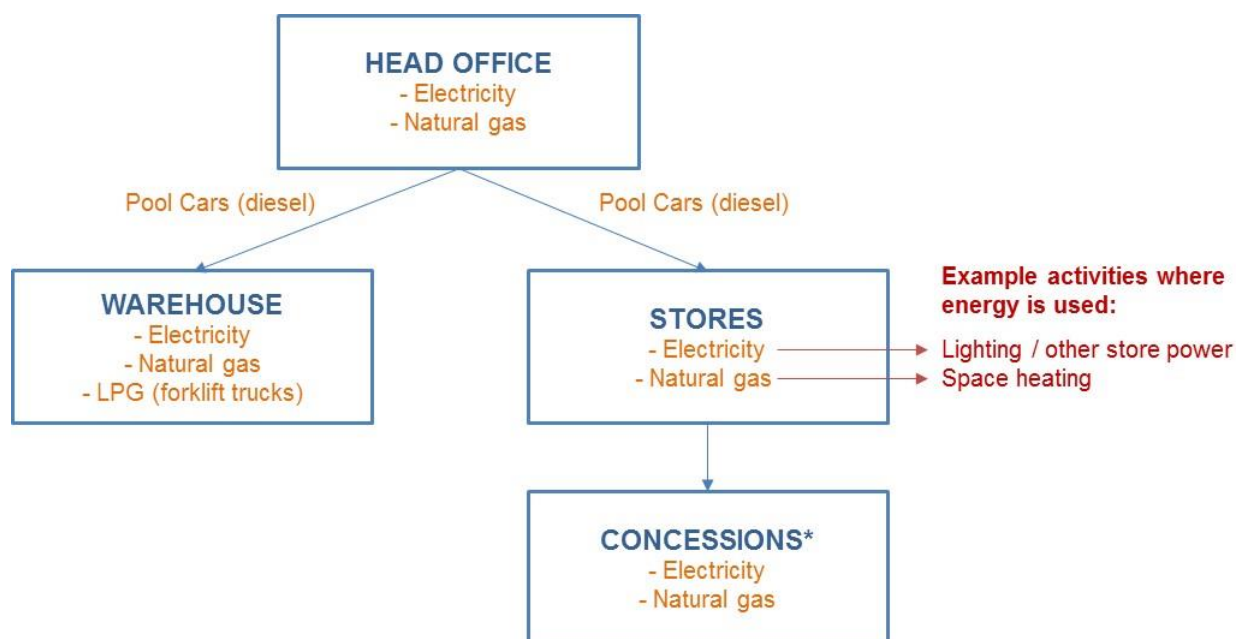
## Determining scope

Planning is essential to help you to determine where you will get best value from your ESOS audits. The first step in developing an audit plan is to decide which parts of your organisation need to be included under ESOS. After that you can look at which sites or activities to audit, as you may not have to audit them all.

A useful starting point is to map out the energy consuming activities that are undertaken at each of your sites and by your transport activities. This will help you to understand the extent of your operation to ensure that nothing is missed. It will form the basis for focussing your audits on the areas where you will get the most benefit.

You may find it helpful to involve others in this process such as members of your operations, property, maintenance and finance teams. This will help to ensure that you don't miss anything. Figure 1 shows what a map of your activities might look like.

**Figure 1: Example of mapping out activities and energy uses for a high street fashion retailer**



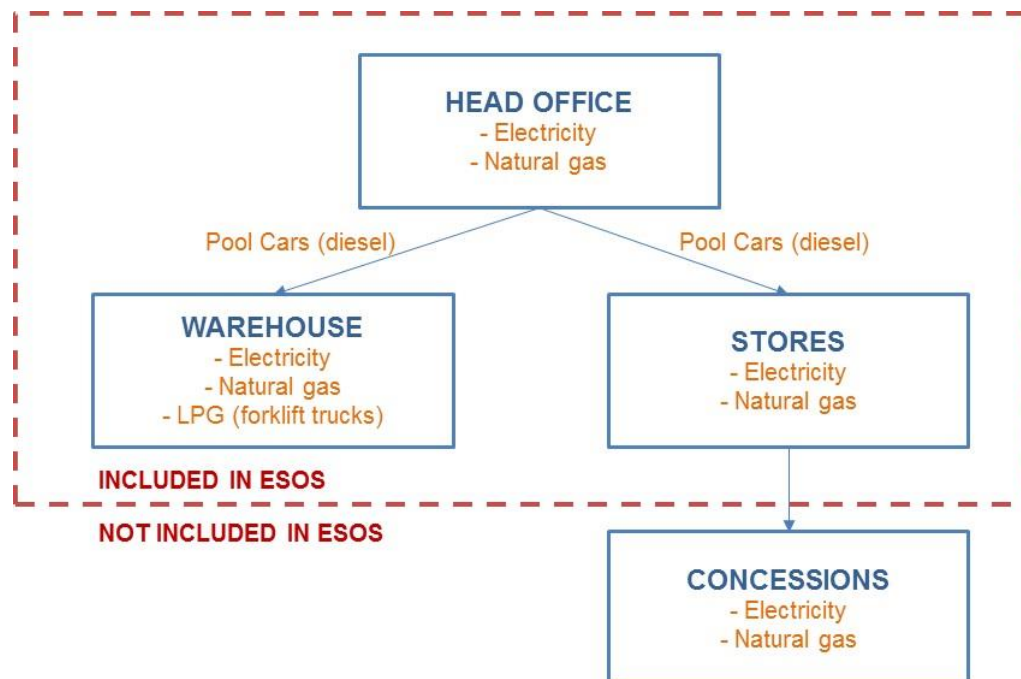
\* 'Concessions' in this example refers to the company's fashion outlets based in department stores where the company is a tenant of the department store operator.

The next step is to draw a boundary around the parts of your organisation that fall within the scope of ESOS<sup>2</sup>. This will show which elements of your operations need to be considered for audits.

<sup>2</sup> To understand which parts of your organisation are affected by ESOS, refer to Chapter 1 of the Environment Agency's guidance 'Complying with the Energy Savings Opportunity Scheme'.

In the example given, the concessions are out of scope because the department store is supplied with the energy and has taken responsibility for auditing it (see Figure 2).

**Figure 2: Example of drawing the scope boundary using ESOS supply rules**



## Using the de minimis rule

Once you understand the scope of ESOS coverage within your organisation, you can decide whether to exclude up to 10% of your identified total energy consumption under the de minimis rule.

If you do decide to exclude some energy consumption, you may wish to consider the following:

- Focus audits on areas where the greatest total energy savings can be made
- Consider if there are 'quick wins' within your assets or activities that may only contribute a relatively small percentage to your total energy consumption, but may present a more significant overall cost saving
- You may like to include more than 90% of your total energy consumption within the scope of your ESOS audit plan as a safety margin, in case you come across difficulties in obtaining verifiable data (e.g. data access issues, unavailability of key personnel, etc.).

Where specific energy use is not required to be included in your ESOS assessment (e.g. because of a change in ownership of an asset between the qualification and compliance date) it would be good practice to keep a note of the details in your evidence pack including why this energy consumption was excluded. This is because if your organisation's compliance is subsequently checked by the scheme regulators, you will be able to quickly explain the reason for excluding those supplies from the total energy consumption calculation.

### Example 1: Choosing to use the de minimis rule to exclude some energy use

Company 1 has four autonomous subsidiaries. They all undertake different types of activity and all fall under the scope of ESOS. Each subsidiary has good energy management processes in place.

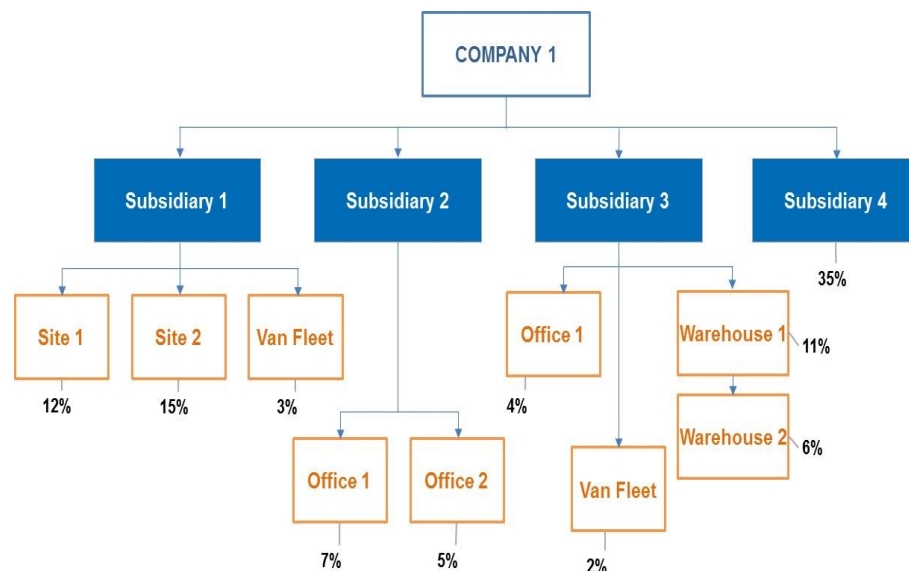
Company 1 must choose whether to use de minimis. It decides to identify and map its energy use and to determine what percentage each contributes to the total energy consumption of the group.

After carrying out this exercise, Company 1 can see that there are a range of energy uses that are small enough to be opted out under the de minimis (less than 10% of total energy consumption). After careful consideration, Company 1 decides to opt out its two van fleets, as these have recently been replaced and so offer limited opportunity to make energy savings.

Although this only amounts to a total opt out of 5% of total energy consumption, Company 1 decides that auditing the remainder of its operations is worthwhile, as it is keen to identify as many cost savings opportunities as possible.

Company 1 must retain the details of this exercise in its evidence pack to show which activities/assets are within the de minimis.

Figure 1: Corporate structure and activities of Company 1



### Making use of existing information

As part of developing an audit plan you should consider what information on your organisation's energy use and any past energy audits is already available to you.

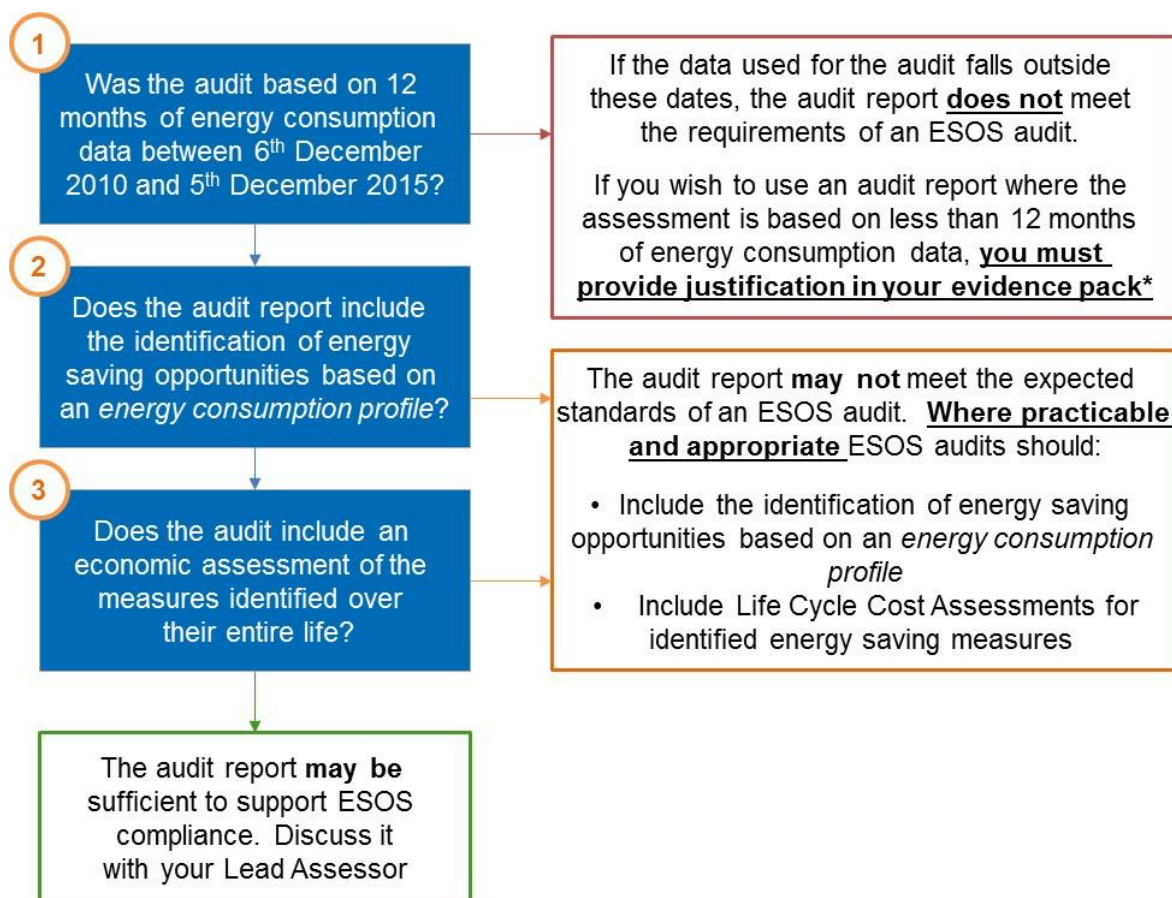


Because ESOS covers a wide scope of energy using activities you might find it helpful to speak to staff in different parts of your organisation to identify what work has already been carried out before planning your audits.

Where data on energy and fuel use has been collected, this can be reviewed against your scope boundary to help identify any gaps that will need to be filled.

In cases where previous audit work has been undertaken such as the development of investment cases and/or other business-as-usual assessments, these may be able to contribute to ESOS compliance. In order to assess whether these audits can be used in this way, they should be examined using the process like the one described in Figure 4.

**Figure 3: Does my existing audit report meet the requirements of ESOS?**



\* You must provide justification in your evidence pack about why the data used suitably reflects the average energy use of that asset/activity. In a review of compliance the regulator would evaluate your reasoning to determine whether they felt your approach was reasonable.

Although it is not required under the regulations, you may choose to carry out new ESOS audits, or to update existing audit calculations for assets/activities even if a compliant audit has been carried out since the 6<sup>th</sup> December 2011. This is because the opportunities for making energy savings will change with time. For example, as your operating practices or equipment are updated, the costs and benefits of savings measures may change due to changing technology costs or energy prices. Marginal

savings opportunities from a few years ago could be much more attractive now. So when considering the use of past audits, you might want to think about whether any significant changes have been made to your assets, process or operating practices that these previous audits may not have covered.

Where using previous site surveys or audits you may also wish to review these to understand what has already been implemented and what opportunities could not be implemented due to specific issues and barriers.

### How to gather information

Gathering information on energy and fuel use is an important part of audit planning. You should allow sufficient time to collect the necessary information in advance of your audits as this could take up to several months if you don't have detailed records in place.

#### Where to find energy consumption data

You may need to collect energy consumption data from a number of places within your organisation. This could include:

- Your finance team – *for copies of supplier invoices*
- Facilities managers – *for meter readings and invoices*
- Your travel team – *for information on journeys undertaken and distances travelled*
- A maintenance team – *for meter readings and invoices*
- Vehicle fleet managers – *for information on vehicles, fuel purchased and distance travelled*

Organisations adopting best practices in collecting and monitoring energy and fuel use data often have centralised systems in place. This allows them to collate and monitor information on a regular basis. If your organisation does not currently have such a system in place, it is worth considering how you can improve your data collection process as this can lead to cost savings in the future.

### Example 2: Information / data from previous audit activity

Company 2 has four subsidiaries.

There is no consistent energy management process across the company, but each subsidiary has well established energy data collection processes in place. Company 2 undertakes a mapping exercise and gap analysis and finds that all of the data that it requires for ESOS is readily available.

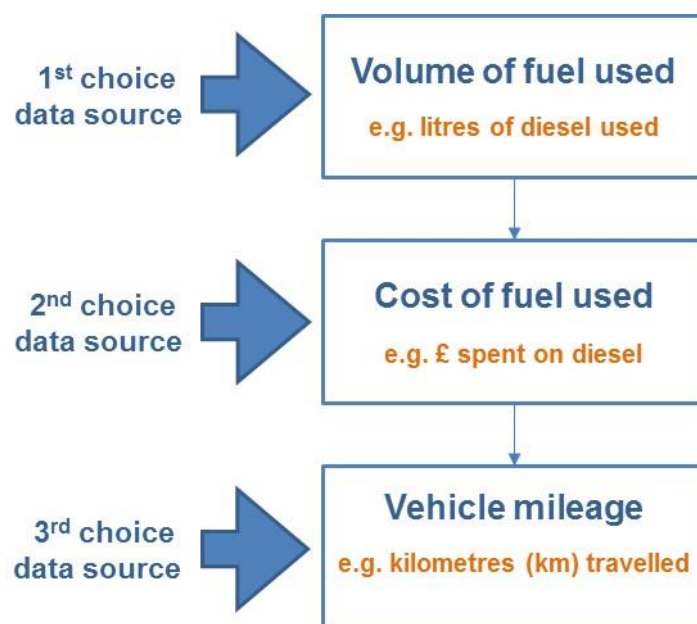
At the same time, Company 2 speaks to its subsidiaries to find out whether any audits have previously been carried out. This allows it to develop an audit plan which incorporates existing information where appropriate. The decisions taken for each subsidiary are summarised below.

| Subsidiary | Status  | Audit decision  |
|------------|---|---|
| 1          | Manufacturing company with no previous audits.  | ESOS audits must be carried out.  |
| 2          | Financial company. Audits carried out for all operations in January 2010.   | Audits previously carried out were not within the current ESOS cycle and cannot be used. New audits must be carried out.  |
| 3          | Storage company. Audits carried out at all sites in the last year as part of the introduction of a new energy management programme.                     | A review of reports produced for the recent audits shows that they contain the information needed to satisfy ESOS requirements. Implementation of some of the audit actions is underway. There is no business case for further audits at this time. |
| 4          | Single site manufacturer with an audit carried out 2 years ago. Since this audit some buildings on the site have undergone a substantial change of use. | The audit previously carried out at the site meets ESOS requirements, but the way the site is used has since changed. Company 2 decides a further audit will be valuable.   |

### Choosing the right energy consumption data source

You may find that there are a number of data sources available for a given fuel type. You will need to choose which source to use. Provided it would not be a disproportionate administrative burden, should make your selection on which to use based on level of accuracy. Figure 5 provides an example hierarchy of data sources based on accuracy, using the example of fuel use in a vehicle fleet.

Figure 4: Example of a data preference hierarchy for vehicle fuel



### Dealing with missing energy consumption data

If you have gaps in your energy consumption data, you can make an estimate. For example, you might estimate electricity use over a 12 month time period in a situation where you only have billing information available for only 5 months. More information on how to estimate energy consumption can be found in the Environment Agency's guidance '[Complying with the Energy Savings Opportunity Scheme](#)'.<sup>3</sup>

If there are a lot of gaps in your data, you might want to consider how to improve your collection processes in order to minimise these problems in future.

### Planning your ESOS audits

Once you have determined which parts of your organisation need to be audited and what information is already available, you can begin planning your audits.

#### Creating an audit plan

An audit plan ensures that all parties, including the Lead Assessor, the auditor(s) and the business being audited have a clear understanding and common expectation of the audits, including the format of the report and the information to be contained in it.

The more information you can collate in advance the better, as it will help to focus the audits.

You will want to consider including the following information in your audit plan:

- Name and details of the Lead Assessor

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<sup>3</sup> Section 3.8 – 'How to estimate'

- The name of the auditors that will be used along with their skills and experience
- The assets and activities of the organisation including name, location(s) and basic details such as building use, type of construction and age
- The categorisation (if applicable of the different assets/activities)
- The sites to be visited
- The assigned auditor for each site visit.
- The date and time of the site visit
- The site personnel assigned to accompany the auditor in each instance
- Any comments regarding the site visit e.g. required personal protective equipment, site access arrangements
- Details of the required audit outputs including the availability of a report template and the required timescales for writing up the report
- Proposed methodologies for profiling the energy use at sites which are not subject to a site visit
- Proposed methodologies for how the energy saving opportunities at sites not subject to a site visit will be deduced/estimated

Annex I provides an example template that can be used for creating audit plans.

The audit plan should be developed before any of the audits begin and should be retained in the ESOS evidence pack.

### Site visit sample sizes

Many organisations own a range of similar operations, such as similar retail units or offices. In these circumstances it will not be necessary to visit every site and participants should choose an appropriate sample of their portfolio for audit.

The number of site visits proposed should preferably be discussed and agreed with the Lead Assessor at the audit planning stage. There is no mandatory ESOS requirement on what percentage of a population of buildings, industrial processes or transport fleet should be sampled. This is because the level that is appropriate will depend on an organisation's specific circumstances.

The sample of operations selected for audit should be representative of the range of different sites/vehicles etc. operated across the organisation. It must be sufficient to provide confidence that the audit findings and recommendations for the participant will be complete, applicable and accurate.

This means that the first step in determining an audit sample size is to categorise your assets. Categories will vary widely between different types of organisation. Examples could include:

- Function of the building (e.g. office, manufacturing facility, retail store)
- Building fabric and type of construction
- Building age

- Building occupancy and usage, including number of occupants and usage patterns
- Size of building (e.g. internal floor area)
- Processes and equipment operated
- Location of building
- Fuel types used
- Current energy/fuel use
- Vehicle type and age

It may be appropriate to use categories such as this individually, or in combination, to divide up your portfolio to form an audit sampling plan. It is best practice to ensure sampling covers all types of category. Justification of your selection will need to be included in your evidence pack.

The more information you are able to provide to your auditor about your assets and activities then the easier it will be to draw audit conclusions from a relatively small sample. Examples of information you might be able to provide include types of technical systems in use such as heating, ventilation and air conditioning (HVAC), lighting, etc., details of maintenance requirements and schedules, and details of past investments in fabric improvements, etc.

### **Different types of audit**

In cases where there are a large number of very similar buildings e.g. 200 shops, it may be useful to consider the level of detail of the audits within the sample. For example, you may want to undertake detailed audits of a small number of shops, and visit another few to carry out a higher level review. The small audit sample size will minimise the level of effort required by the auditor and visiting additional shops will allow both the auditor and Lead Assessor (if different) to satisfy themselves that the similarity of the shops is sufficient to justify the sample size.

### Example 3: Creating a sampling plan

Company 3, a housing developer, created its audit sample plan by looking at the different types of developments and site energy supply that it had in its portfolio. These two groups were:

Activity based:

- Multi-storey developments
- Brick built developments
- Timber frame developments
- Mixed use development
- Large infrastructure sites

Energy supply based.

- Sites using diesel generation
- Sites connected to mains power

Company 3 knew that it wanted to audit each type of site, but that it also wanted audits to cover a wide geographical area and to focus on some of its higher energy consumers. It undertook an exercise to map its areas of operation against the proportion of energy consumed:

| Region  | Sub-region         | % of total energy consumed |
|---------|--------------------|----------------------------|
| North   | Scotland           | 10%                        |
|         | Northern England   | 7%                         |
| Central | Midlands           | 11%                        |
|         | Wales              | 4%                         |
| East    | East Anglia        | 8%                         |
| West    | West Midlands      | 20%                        |
|         | Devon and Somerset | 6%                         |
| South   | London             | 28%                        |
|         | Southampton        | 6%                         |

Finally, Company 3 reviewed its sampling approach against its business plan. It concluded that only developments with two or more years to go until completion should be visited. A final sample of 11 sites was selected, including one of each type and at least one visit per sub-region. In London and the West Midlands, the highest energy consumers, two developments were selected for audit.

Using this approach, Company 3 was able to scale up its findings to identify the scale of the opportunity for the entire portfolio and general activities of the group.

## Integrating your audit plan with your business strategy

When you plan your audits it may be helpful to consider what future changes might be made to your property portfolio, industrial processes and transport fleets.

Examples of factors you may wish to take into consideration include:

### 1. Cases where leases will expire in the next year

In this circumstance, find out whether the lease is likely to be renewed and for what term. This will influence your decision to visit a particular asset, or simply make inferences about the energy saving opportunities from other site visits at assets you will hold for a longer period.

### 2. Plans to sell buildings

In cases where a business plans to dispose of a building shortly after the compliance deadline, better long term value may be achieved by completing a Display Energy Certificate (DEC) assessment, rather than an ESOS audit. This will achieve ESOS compliance and could provide useful information to potential buyers.

### 3. Buildings which will undergo a change of use

Some of the buildings in your portfolio may have planned refurbishment or change of use. This can be factored into any decision on which to visit and when to audit them.

### 4. Expansion plans

It may be helpful to make your auditor aware of any expansion plans for your business. This will allow him or her to make recommendations related to future assets. For example, this could include new equipment you are planning to purchase, or changes to the layout of your building which could have implications for systems such as heating and cooling.

### 5. Are your sites affected by any other legislation?

Your approach to auditing and upgrading some of your buildings may be influenced by other energy efficiency legislation. For example, you may have buildings that you plan to let in the future which are impacted by minimum energy performance standards imposed by the Energy Act. You may want to factor the implications of this into your approach to ESOS audits.

**You do not have to audit any assets that you will not hold on 5 December 2015 or include these in your calculation of total energy consumption.**

## Identifying appropriate personnel

A registered Lead Assessor must oversee your ESOS assessment, but individual audits can be carried out by suitably skilled people who are not Lead Assessors.

The skills and experience of the people who carry out your audits, and of your Lead Assessor, will be a key factor in the value that you get from ESOS. When deciding whether to use in-house personnel, or to find an external contractor to carry out the work, there are a number of questions you should ask:



- What register is the Lead Assessor qualified under? Have you checked the evidence for this?
- What qualifications do your auditors have? Can they provide evidence of this?
- How familiar are they with the type of site that is being audited?
- What is their experience and track record in carrying out audits in your sector?
- Do you have any specialist equipment that is a major energy consumer at your site? If so, are they familiar with it?

Depending on the number of assets that need to be visited, you may require more than one auditor. You may also need to consider factors such as travel time between sites, availability of on-site personnel, production schedules and any planned works which may prevent access to site should all be considered when planning site visits.

Once the audits have been completed, you will need to allow time for the Lead Assessor to review the reports. The length of time that this takes will be dependent on the number of sites, their complexity and the nature of the programme agreed.

Remember that you will also need to allow time for a Company Director to sign-off the reports (two if you use an internal Lead Assessor) and to notify the Environment Agency that you have complied by 5<sup>th</sup> December 2015.

If possible you should engage the Lead Assessor, and any additional auditors from the outset of the audit planning process. Depending on your approach, this may involve engaging one person or several people. If you have a team of several people undertaking auditor and Lead Assessor roles, it will be important to bear in mind that coordination of efforts could be more time consuming. Agreeing the audit approach at an early stage will minimise the risk that a lead assessor reviews your audit report and considers that it does not meet the minimum standards of ESOS.

# Delivering best practice audits

An energy audit is only going to offer you value if it is completed to a sufficient level of detail. This section focuses on providing guidance around how you can ensure your audit will meet your needs.

The audit process you adopt will depend on the type and profile of your organisation and its maturity in terms of energy efficiency. Whatever the approach, all significant energy that is included in the audit route to ESOS compliance should be covered by at least a high level audit (a Type 1<sup>4</sup> audit as defined in ISO 50002).

Some organisations which have just started to look at identifying energy reduction opportunities may benefit from an audit which covers the whole organisation in same detail. In this instance it should look to identify generic low cost, short payback measures as well as highlighting potential areas for longer-term investment.

More mature organisations may have already captured all the low cost measures through business as usual activity and may also benefit from audits which focus on specific high energy using equipment that require more investment and planning.

## Audit approach

ESOS does not require the use of a specific audit methodology but the [Environment Agency compliance guidance](#) does suggest standards that could be adopted.

Before carrying out the audit, the approach and format for reporting should be agreed. That way all parties will understand the outcome and the level of detail and value to expect. The Lead Assessor must be satisfied that the methodology used is appropriate.

In addition to the methodologies suggested in the Environment Agency guidance, (Appendix A.4.4), these are some additional sources of best practice guidance on carrying out audits. Many of these are similar to the standards highlighted by the Environment Agency but offer more guidance on why and when you should adopt certain approaches.

- CIBSE guidance:
  - TM22 Energy Assessment and Reporting Methodology;
  - TM39 Building energy metering;
  - TM46 Energy benchmarks
- ASHRAE: Procedures for commercial buildings energy audits
- EU Code of Conduct for Data Centres<sup>5</sup>

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<sup>4</sup> Type 1: a basic energy audit which identifies high level opportunities and has enough detail to develop low cost/short payback opportunities.

<sup>5</sup> EU Code of Conduct, Data Centres. European Commission Joint Research Centre, Institute for Energy and Transport.

## Scope of each audit

Before commencing with each audit in earnest, the audit plan and supporting information should be reviewed by all parties (the host organisation, Lead Assessor, and auditors) to ensure that everyone has a mutual understanding of the objective of the exercise and the expected outcomes. Areas that should be considered include:

- The aims, needs and expectations of each audit
- The audit depth and focus
- The scopes and boundaries of the audit and within that the site visits
- The provision of any data and information that has already been collected
- Whether there are specific access requirements (e.g. out of working hours or to restricted areas)
- Contact details for any support staff, e.g. for specific activities
- The criteria for evaluating energy efficiency measures
- The timescale to complete the audit and for providing a report

## Data collection and analysis

**Building and process energy consumption data** can be obtained from invoices (gas and electricity), meter readings or from supplier annual statements. For liquid and solid fuel, data will come from delivery notes or from storage tank level readings. Within the site or building additional data may be available from sub-metering of specific areas or buildings or of specific equipment. If there are gaps in the data then reasonable estimates should be made based on best practice methods and recorded, with assumptions in the evidence pack.

As part of the site visit the auditor(s) may need to take spot measurements of energy use for specific energy using equipment or for particular areas of buildings.

The collection of **transport data** may be harder as it could be something that the company hasn't scrutinised before or only has information for certain parts of its transport activities. For example energy use data for a fleet can be calculated from fuel receipts and from mileage claims. However in some instances for company cars, it may be difficult to separate mileage covered on business (covered under ESOS) and mileage covered commuting to and from work (not covered).

In this case a calculation will need to be made to separate the two types of mileage. The method of calculation will vary from case to case. For example, you could collect data from a sample of company car users to develop the ratio of business and commuting use and extrapolate this to your whole company car fleet. Again this calculation, and any assumptions made, should be documented within the ESOS evidence pack. Recommendations identified on the data quality and recording procedures could form part of your audit findings.

You might also want to verify data from a second source. For example electricity invoices could be checked against the site's own meter readings or annual supplier statements. This activity can, in itself, identify financial savings as you may find mistakes in the way that invoices have been calculated.

#### Example 4: Collecting transport data

Company 4 has to determine its transport energy consumption. It has a mixture of its own freight transport, company cars and private cars used for business purposes. The freight transport mileage is available from fuel invoices. For company cars the mileage is available but not the fuel use so the energy consumption is estimated from [UK Government conversion factors](#), which provide CO<sub>2</sub> emissions per mile depending on type of car and fuel. A further calculation is needed to convert these CO<sub>2</sub> emissions into units of energy (e.g. kWh) for the purpose of ESOS reporting. Standard conversion factors are available in the UK Government conversion factors for company reporting. The company were able to split their company car use into small, medium and large cars and this enabled them to use specific emission factors for those classes. They could have used an emission factor for an average car but this would have been less accurate. For private cars, employees have to submit claims based on fuel purchase receipts and so the fuel use can be determined.

#### Example 5: Using existing data collection practices

Company 5 has never participated in any other energy or carbon schemes and as a result has not had to collate its energy data from verifiable sources. As a start it gathers energy data from invoices for gas, electricity and other fuels over its ESOS compliant time period, and then collates consumption in a spreadsheet. To collaborate its energy consumption it uses the company's own energy and gas meter records, and asks the utility suppliers to provide an annual statement of energy use. It also looks to find delivery notes for any solid and liquid fuel use during the period. Where the company doesn't have data it then looks to apply estimates. To do so they consider the amounts of fuel purchased over preceding time periods. They are able to detect a purchasing pattern and usage can then be estimated (see section 3.8 of the [ESOS compliance guidance](#) for further details of how to apply estimation techniques). They then record the estimates and their calculation method in the evidence pack. The company will need to keep all proof of energy use as part of their evidence pack. They also plan to implement better metering and recording processes for future years.

## Consumption Profiling, including benchmarking and intensity metrics

Consumption profiling is the analysis of energy use over a given period. It is based on frequent and continuous measurements of energy use (e.g. half-hourly meter reads) over that period to identify consumption patterns to identify possible wastage and inefficiencies. These can form the basis for energy savings.

In addition to analysing the energy use of a whole site, an analysis of specific types of energy use might be valuable. For instance looking at the energy use for heating against time may show when the system is being used inefficiently during periods of low occupancy. Similarly, analysing the energy use by air compressors with time may show excessive energy use out of peak operating hours due to leakage.

This analysis may be in terms of the variation of energy use:

- With time ( over a year, a month, over a week, or daily)
- With a metric such as production, floor area, occupancy, degree days

Looking at energy use with time will allow you to see the differences during working and non-working hours and identify if equipment is being left on out of hours. This is only possible if data is available at a granular level – i.e. you have measurement instruments (e.g. half-hourly meters, Smart meters or sub-meters with data loggers) or processes (e.g. an hourly manual meter reading protocol) that provide frequent data points regarding actual energy use.

If you do not have suitably granular data, additional data may need to be collected from regular manual readings of local sub-meters. It should also be possible to use spot meters to monitor electrical use in specific areas or for specific pieces of equipment.

If you do not have the granularity of data available, then this in itself may be an energy saving opportunity to note. Active monitoring of energy use can in itself lead to energy savings by supporting identification of energy inefficiencies.

Looking at seasonal variation of energy use can also help you decide which areas of energy use are significant – e.g. by helping you determine if heating and/or cooling, are key factors or are insignificant compared to the energy use of other equipment.

Energy can also be plotted against a metric to assess variations in energy use. The metric used will depend on the site. For offices it is likely to be floor area, for hotels it could be occupancy levels, and for industrial processes it is likely to be production. For transport it may be the number of miles/kilometers travelled or units transported.

When looking at energy use for heating or cooling, then another useful tool is to apply degree days. Degree days is a measure of the difference between the baseline and the actual outdoor temperature multiplied by the number of days. The base temperature used to calculate heating degree days in the UK is 15.5°C, because at this temperature most UK buildings do not need supplementary heating. It therefore takes into account any external temperature variations that could impact on energy

consumption. This can be used to identify when building energy consumption is higher than it need be.

If you need further information and guidance on how to apply degree days to your data, you may wish to refer to [CIBSE TM41 Degree Days: Theory and Application](#) by The Chartered Institution of Building Services Engineers (CIBSE), which is a free guide to the theory and application of degree days.

Energy use analysis can be carried out for the whole organisation, or can be enhanced by looking at each building, site, or specific assets and activities.

Where the information is available you should break down the energy use in terms of the type of energy use (e.g. heating, HVAC, compressed air, lighting). If it is not available then an experienced energy auditor will be able to use 'rule of thumb' estimates. This breakdown or split of energy consumption can be based on information provided by other sites with metering operated by the company, by other companies operating similar sites, or from sector benchmarks. Some other more generic 'rule of thumb' estimates for building services are published by BSRIA<sup>6</sup>.

Energy use can also be estimated from knowledge of the equipment rating and the run hours. This will not give an accurate split of energy use but will enable the larger energy uses to be identified and focussed on.

You should compare your energy use against that used in similar buildings; similar processes; or similar sites within your portfolio to identify good and bad performers. You can then try to identify the reasons for these differences with a view in the first instance of making them all as good as the best.

While there might be value in trying to benchmark your energy performance with other organisations, this can be difficult. The Carbon Trust has published guidance on benchmarking<sup>7</sup>. This highlights the pitfalls of assuming that similar organisations can be directly compared in terms of energy consumption. However, benchmarking of building energy performance can be more successful. As a result, you may like to look at the range of benchmarks that are available for buildings that is published by CIBSE (ref. CIBSE TM46 Energy benchmarks).

#### **Examples 6, 7 and 8: Use of profiling**

When Company 6 compared the energy use per square metre for each of its office blocks, significant differences were found between the good and bad performers. The energy manager followed this up and while there were a number of differences, one of the main differentiators was the age and type of heating installation. Due to this the company was able to prioritise the replacement of the aging boilers in the poor performing buildings, resulting in

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<sup>6</sup> <https://www.bsria.co.uk/download/product/?file=zxrulZgWBrY%3D>

<sup>7</sup> <http://www.carbontrust.com/resources/faqs/sector-specific-advice/energy-benchmarking>

much improved energy efficiency.

Company 7 has many buildings of varying size and function. An audit at one of the buildings identified an opportunity to replace old inefficient T8 lighting in the offices with LEDs. Walk through audits by energy champions at many of the other buildings established that these also had the same lighting. Hence the opportunity identified at one building along with its business case (modified for each building) was rolled out to most of other buildings within the company's portfolio.

Company 8 has several production lines which are run continually through shift work. Curious to understand what the energy consumption pattern was the energy manager installed sub-meters on each line. Over a period of a month the data showed that the energy consumption varied significantly dependent upon the shift team operating the line. Upon further scrutiny the energy manager was able to show that this was due to some teams leaving lines running and heaters switched on during breaks and through partial shut-downs. The energy manager shared the data collected and challenged all shifts to achieve the lower level. Using the sub-metered data he was also able to continue to inform the teams and highlight improvements.

## Determining audit depth and focus

It is important to base your ESOS audit process on recognised standards.

ISO 50002 defines three types of audit:

1. **Type 1:** a basic energy audit which identifies high level opportunities and has enough detail to develop low cost/short payback opportunities
2. **Type 2:** an energy audit with enough detail to implement medium cost opportunities, and identify specific opportunities to which to apply a Type 3 audit.
3. **Type 3:** a detailed energy audit to allow the feasibility and viability of high cost/longer payback opportunities

All the significant energy use covered by an ESOS audit should be covered by at least a Type 1 audit.

Based on the energy profiling you may find that specific buildings, processes, services or systems require greater focus. Here a Type 2 audit can be applied. Opportunities that may require larger investments or longer payback periods are best subjected to a Type 3 audit to provide the necessary detail.

For example a Type 1 audit can be carried out across a whole industrial site. A type 2 audit could focus on heat generation and distribution, while specific opportunities like a steam boiler replacement would require a Type 3 audit.

Generally, the amount of detail within an audit should be enough to give confidence that an identified energy saving opportunity will be cost effective.

### Examples 9, 10 and 11: Determining the level of audit depth and focus

Company 9 is a small company on the cusp of the participation threshold requirements. It is new to energy efficiency and hasn't ever identified or implemented any measures. It is decided that the whole site should be audited using a Type 1 audit to identify where the priority measures are likely to be, and develop a cost effective implementation plan.

Company 10 has multiple similar sites but hasn't previously carried out any benchmarking of energy performance. During the energy profiling it is notable that a number of the sites have significantly worse energy performance than others. Therefore it would seem logical to ensure that these sites are included in the surveys and for the surveys to include identification of human factors that might be contributing to the differences in energy performance across different sites.

Company 11 is a manufacturer that is already participating in other regulatory schemes. It has already implemented all the easy measures and future measures are likely to be related to its operations and manufacturing process. It carries out a high level (Type 1) audits to review its business as usual energy efficiency activities including its energy team meetings, continuous improvement activities and work with suppliers to reduce energy use in compressed air generation. This high level audit identifies three potential longer payback/high capital cost opportunities which are then subject to Type 3 audits to provide the necessary detail on costs and savings to produce business cases. The Type 3 audits take place over a couple of weeks and involve site engineers plus specialist consultants.

## Site survey planning and delivery

Planning is an essential part of successful audit delivery.

Prior to site visits, the Lead Assessor or auditor should request all relevant information that can be used to develop a picture of energy use and identify any areas of potential areas for savings.

Relevant information will depend on the type of facility being audited but could include:

**Table 1: Audit information and usage** (continues on next page)

| Description of information  | To be used for  |
|---|---|
| Energy consumption data for buildings, process use and company vehicles (for at least 12 months, over the reference period) and energy tariffs. | Energy analysis. Should have already been used to inform choice of buildings site visits. |



| Description of information   | To be used for   |
|--|--|
| Site plan (including position of energy meters).   | Allowing the auditor to carry out a systematic audit.  |
| Floorplans of sites to be audited.   | Allowing a systematic audit to be undertaken but also may be used for benchmarking.  |
| Floor areas (or if not calculated from above).   | Benchmarking. kWh (heating)/m <sup>2</sup> .   |
| Information on the building envelope (e.g. building plans, insulation levels, types of windows, roller doors). | Identifying opportunities for reducing heat losses due to poor insulation or air tightness.  |
| Use patterns of the buildings and major process uses.  | Calculations of specific heat use/benchmarking.  |
| Production data, occupancy, working hours/opening times.   | Calculating specific energy consumption (e.g. kWh/tonne).  |
| Lists of equipment at the site.  | Determining energy use, areas of specific focus for audit. Could be required in determining energy savings (e.g. number of lights).              |
| Energy management plans in place. Energy management activities/energy teams/energy targets and progress.       | Assessing current levels of energy management.   |
| Policies which determine heating set points, light levels, etc.  | Helping to assess potential opportunities e.g. reduction of heating set point.   |
| Operation and maintenance manuals – if available   | Determining power use and operational characteristics of equipment.  |
| Type of building management systems (BMS) system on site and whether data is logged.                           | Understanding the programming to investigate all set points and to identify strategies for achieving savings from making any changes to the BMS. |
| Detail of equipment that requires special access (e.g. rooftop air-conditioning systems).                      | Helping to organise the site audit.  |
| Any equipment which is switched remotely (i.e. not on site), and information on who decides switching times.   | Determining opportunities to reduce energy use by switching off equipment when not required.   |
| Details of sub metering at site and metering data.   | Collecting data to analyse energy use on a site, area and equipment use level.   |
| List of people who control/maintain systems and their contact details and responsibilities.                    | Identifying equipment use to identify opportunities for savings.   |
| Details of previous audits/surveys; lists of identified opportunities/recent improvements.                     | Developing a comprehensive list of opportunities to be developed.  |

For a **transport audit**, data could include:

- Portfolio of transport used (freight, on-site, business travel, company cars) ideally including:
  - Engine size
  - Vehicle size
  - Vehicle age
- A breakdown of energy use and efficiency for each category.
- Information on the purpose of journeys (for business travel and company cars)
- Transport energy efficiency policy (including any reduction targets)
- The contact names of staff responsible for the organisation of transport activities
- Energy reduction measures carried out to date and any planned measures
- Any previous transport audit reports

Whilst the listed information is relevant it may not always be available or practicable to obtain, or it may only be available in part. If transport activities count for a significant proportion of your energy consumption, you may wish to consider how to obtain more detailed data for future phases of ESOS.

Where a team of auditors has been engaged to carry out site surveys, the whole audit should be coordinated by the Lead Assessor or an appointed lead auditor to ensure that relevant information is shared and that the audits cover the required scope.

To ensure that the outputs from each auditor are of the same quality, detail and focus, you might wish to use an audit or site survey checklist and ensure all auditors are briefed together on the task and that expectations explained. It may help to provide pre-arranged visit times and contact details to ensure that audits happen within an agreed timeline.

If using external auditors, you may need to agree basic rules for site visits, such as:

- If there are any safety and personal protective equipment requirements
- If access will be provided to all areas or if special permission is required
- If any photo identification such as a passport is required
- If the taking of photographs is permitted
- If any specific hazards or sensitive areas are going to limit auditing
- The level of detail expected of the audit and the time allowed for this
- Site personnel who will need to be present
- Whether any specific additional measurement of energy use can be carried out on site

It is likely to be helpful for each auditor to be accompanied by someone from the site who is knowledgeable about the area being surveyed. In addition, the auditor is likely to benefit from interviewing a cross section of staff including the energy manager (or equivalent) as many energy savings opportunities will already be known to the staff and it is important that these are captured during the audit. Employees to

engage with could include facilities and maintenance staff, those operating specific equipment or occupying areas. Each will have their own observations.

In doing so the auditor will gain an understanding of the current status of energy management and staff awareness. Typical questions could include finding out who is responsible for energy management, if there is an energy team, energy wardens, energy targets (both at site and area level), etc. The auditor can also enquire if the workforce knows the progress being made against energy saving targets and the effectiveness of any energy awareness campaigns, suggestion schemes, etc.

The auditor should keep detailed notes of the site visit and take photos (if permitted) of relevant areas and equipment. In addition they should ensure that measurements and observations are recorded in a clear and understandable format.

Where factors influencing performance such as extreme weather conditions or elevated production levels are observed they should be recorded. Under these circumstances it may be beneficial to make additional observations and measurements during normal working conditions. There may also be value in undertaking an audit outside normal working hours or during shut-down periods, especially where energy wastage by unused equipment being left on is suspected.

The notes recorded during the site surveys should provide an understanding of each major energy use, including operating routines and user behaviour and their impact on energy consumption and efficiency. This should allow a preliminary list of energy savings opportunities to be identified and collated. It will also highlight any gaps in the data and anything that may be required in addition.

Notes, photos and calculations should be kept in the audit pack to provide supporting information for the audit reports.

#### **Example 12: Collaborative working in complex industrial processes**

Company 12 operates a complex chemical site. The Lead Assessor and auditor are experienced at auditing industrial processes. As with most complex sites the potential for savings are process specific and as a result Lead Assessor and auditor worked closely with the process engineers and operators to jointly develop specific process related energy savings opportunities in heat recovery, in addition to a number of more generic opportunities relating to steam distribution and compressed air generation. Without the Lead Assessor and auditor being thoroughly briefed by site staff on the actual processes and having access to the process engineers and local operations staff, this would not have been possible.

### **Analysis and Identification of Opportunities**

Based on the analysis of energy consumption data and site surveys, the auditor should compile a list of cost effective intervention measures for the organisation.

The impact of each of these savings opportunities should be evaluated against a set of pre-agreed criteria. These should reflect the processes and procedures of the company and should be agreed during the development of the audit plan and checklists.

The approach taken will need to be tailored to the participant organisation but could include:

- financial savings offered by the improvement measures;
- necessary investment required;
- return on investment (or other agreed economic criteria agreed);
- other possible non-energy gains (such as productivity or maintenance);
- The comparison in terms of both cost and energy consumption between alternative energy efficiency improvement measures;
- Technical interactions between multiple actions.

ESOS requires participants to use Life Cycle Cost Analysis (LCCA) where practicable. LCCA accounts for other benefits in addition to energy savings such as water and waste. The costs include capital cost, operating cost, maintenance and disposal. A discount factor is applied to future savings. If this is not practical for an organisation, then other discounted cash flow methods can be used, or failing that a simple payback can be calculated.

Simple payback calculations may also be used where these are more appropriate, for instance for low cost high payback measures such as pipe insulation. LCCA, on the other hand is likely to be more appropriate for more complex and higher capital expenditure projects.

Further details on how to undertake LCCA calculations is provided in the [ESOS compliance guidance](#) (section A.6).

## Documenting energy audits

With all the information gathered and surveys completed you will want to consider how to gather that information in an accessible report. The aim of this is to provide a clear comprehensive document which builds a business case for implementation. It should summarise the significant opportunities for energy savings and present these opportunities in a way that is readily understandable, and fits with the organisation's own methods for making decisions on capital and operational spend.

As well as listing the opportunities the site reports should include the following:

- The scope and boundaries of the audit
- The methodology adopted
- The sources of the data used
- Any significant gaps in data
- What methods were used to cover gaps in energy data through estimation

Similarly any on-site measurements of data should be described including method of measurement and accuracy. Data used in the identification of opportunities should

be detailed along with any assumptions. Calculations of energy use, energy savings and cost savings should be included in an appendix to the report.

As well as providing survey reports for each site visited there should be a summary report drawing together the findings of the site survey reports. Where appropriate it should extrapolate energy savings measures identified during the site visits across all sites and reflect upon their company-wide impact. It should highlight priority measures by means of a prioritised list of energy savings opportunities.

The summary report is crucial as it is likely to be the one read by senior management. Therefore it should be clear and concise. It should focus on presenting the identified opportunities in terms of potential for business efficiency, cost and energy savings, cost of implementation (capital and operating), and payback. It should reflect the language and normal investment protocols that the company applies.

Before the site reports and overall summary reports are handed over, the Lead Assessor should check that the scope of the audits has been met. The reports should be peer reviewed and quality checked.

**An example of the structure and content for site survey reports is given in the Annex II. It is based on BSI Standard BS EN 16247-1:2012:**

# Engaging senior management

There are two reasons why you must engage with the senior management in your organisation regarding your ESOS audits.

Firstly, it is important to ensure that your directors or senior managers have a good understanding of the scope, purpose and needs of the ESOS audit process, given that board-level sign off is required by at least one director/senior manager to confirm that they have reviewed the recommendations of your organisation's ESOS audits and that they are satisfied that your organisation is compliant with the scheme requirements (or two directors if you use an in-house Lead Assessor).

Secondly any major energy saving opportunities you wish to implement will likely need to be subjected to an investment appraisal process. Senior management support throughout this process will generally increase the number of opportunities that may be delivered successfully, ensuring that your organisation makes the most of the opportunity to reduce costs and improve competitiveness.

To plan your engagement you need to understand from your senior managers how your organisation makes investment decisions and the format and content of the documents that they use in this process. This will allow you to commission audits that give you exactly the information that your senior managers need. For instance, a consultant might normally report the financial performance of a proposed energy efficiency intervention in terms of simple payback period (SPP). This is of little use if your organisation makes investment decisions based on internal rates of return (IRR). And you may need to explain to your board the value of Life Cycle Cost Analysis for longer-term energy efficiency investments.

## Pre-audit engagement

Directors will need to understand the scope of the scheme, the requirements it places upon your organisation and what your organisation needs to do to comply. Details of compliance requirements are clearly documented in the [Environment Agency's ESOS compliance guidance](#).

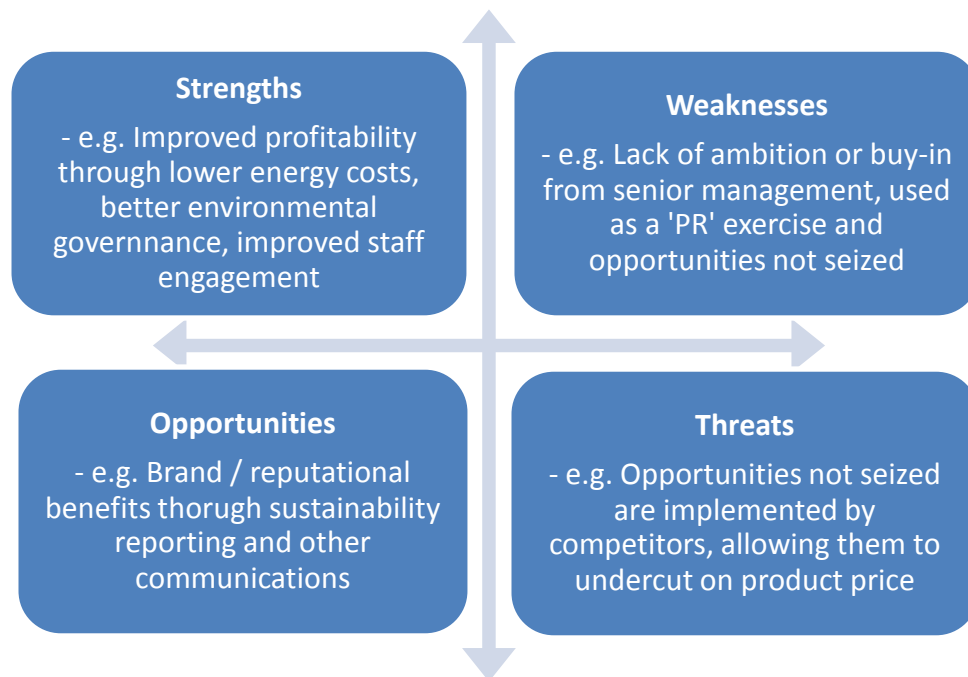
An important message to convey to senior managers is that when approached correctly, ESOS will deliver cost savings, reduce waste and increase competitiveness. To realise these energy savings they will need to include the identified saving opportunities within future investment plans.

You may wish to communicate an appropriate summary of what is required of ESOS participants to senior management through board presentations or reports. These could include both the mandatory aspects of compliance with the scheme rules and the benefits of involvement and the potential to reduce energy waste across the organisation.

In your report or presentation to directors / senior managers, it may be helpful to include details on the cost of inaction. This could include the lost opportunity for cost saving by not implementing the energy saving projects identified by the ESOS audits. You might like to consider using a SWOT (strengths, weaknesses,

opportunities and threats) analysis approach to present these issues in a concise format.

**Figure 5: Example of a SWOT analysis regarding going beyond minimum ESOS compliance**



Section 9 of the [ESOS Compliance Guidance](#) outlines the enforcement options available to regulators. These include financial penalties of up to £50,000 and publication of details of non-compliance. You may wish to make the risks of non-compliance clear to your board level directors/ senior management.

## Engagement in energy audits

When initiating your ESOS audits you will want to consider how to make sure that the outputs from the audits provide the information that your organisation needs to support implementation of energy saving opportunities. This would include the inputs to the financial business cases for the identified opportunities and also the technical and energy consumption data, so that you can engage with operations/maintenance/property staff, as appropriate, regarding implementation planning. You may find it helpful to gain senior management input to help define what information you will require to support appropriate implementation of your audit recommendations.

You may need to explain to your directors / senior managers about the methodology chosen for undertaking ESOS audits. For example, they may be interested in understanding the quality controls and safeguards outlined in the methodology, as these directly affect the quality, accuracy and level of detail in the outputs of each ESOS audit; outputs that may be used to underpin future energy saving investment decisions.

You could also consider discussing the scope of audits with your senior management. This could include the parameters for audit selection / sampling and which processes will be included. Your senior management can input to ensure the audits focus on the priority areas for your property and transport portfolio.

In all cases you will want to ensure that senior management understand the scope of the audit to be completed in order to set expectations of the audit report and focus attention on the benefits that will be derived.

## Post-audit engagement

There are two aspects to consider in your post-audit engagement with senior management. The first is that you will need at least one board level Director or equivalent to review the audit report prior to sign-off for compliance purposes (two if you use an internal Lead Assessor).

The second is you will want to consider how to make best use of the business management information generated by the ESOS process to capitalise on the cost effective energy saving opportunities identified. To do this you may want to focus on presenting the main opportunities identified during the audits and the energy savings that they could realise. You will want to consider how to gain support from your senior management for taking forward the ESOS opportunities within your business investment framework.

To support discussions with senior management, it may be helpful to review what energy savings activities are being undertaken within the market in which your organisation operates. This will help identify where competitors may be actively targeting energy savings or where there is an opportunity for your company to gain a competitive edge by doing so. Good sources of information could be trade publications, conference presentations given by company representatives or consultants in your sector, or discussions with counterparts at sector association meetings. This information can be presented to your management to gain support for implementing ESOS recommendations.



# Annexes

## Annex I: Audit plan

The template below provides an example format for recording the details of your audit plan. In this example, one template would be completed per site being audited. There is no requirement to use these templates.

Sharing this plan with your Lead Assessor before undertaking audits will allow them to provide their input to the audit process before it begins.

| Audit details   |   |                                     |  |
|---|---|-------------------------------------|--|
| <b>Site name</b>  | <i>Insert name of site</i>  |                                     |  |
| <b>Site location</b>                                      | <i>Insert site location address</i>   |                                     |  |
| <b>Name(s) of auditor(s)</b>                              | <i>Enter names of auditors here</i>   | <b>Auditor(s) qualifications</b>    | <i>Enter details of relevant auditor qualifications</i>  |
| <b>Name of Lead Assessor</b>                              | <i>Enter name of Lead Assessor here</i>   | <b>Lead Assessor qualifications</b> | <i>Enter details of relevant Lead Assessor qualifications here (including accrediting body for Lead Assessor role)</i> |
| <b>Name(s) of personnel assigned to accompany auditor</b> | <i>Enter details of personnel that will accompany the auditor(s) on the site visit. Include details of which elements of the audit they will cover if relevant.</i> | <b>Contact details</b>              | <i>Enter contact details here.</i>   |
| <b>Special access arrangements</b>                        | <i>Include details of any special requirements or access arrangements e.g. protective clothing required, identification needed to access site.</i>                  |                                     |  |

| Audit programme – buildings and industrial processes |  |   |                             |   |                        |                                     |
|--|--|---|-----------------------------|---|------------------------|-------------------------------------|
| Relevant standards                                   |  | <i>Details of relevant standards to be used in undertaking the building audits</i>  |                             |   |                        |                                     |
| Building name  | Building type                          | Building age  | Building size               | Selected for audit?                     | Date and time of audit | Audit type                          |
| <i>Name of building</i>                              | <i>Building use and fabric</i>         | <i>Age in years</i>   | <i>Internal floor space</i> | <i>Included in audit sample? Yes/no</i> | <i>Date and time</i>   | <i>Full audit/high level review</i> |
| <i>Add more rows as needed</i>                       |  |   |                             |   |                        |                                     |
| Audit programme - transport                          |  |   |                             |   |                        |                                     |
| Relevant standards                                   |  | <i>Details of relevant standards to be used in undertaking the transport audits</i> |                             |   |                        |                                     |
| Vehicle/other mode of transport name                 | Type                                   | Number and fuel type used   | Age                         | Selected for audit?                     | Date and time of audit | Audit type                          |
| <i>Name e.g. vans, cars</i>                          | <i>Type e.g. 'cars' or 'van model'</i> | <i>Number of vehicles e.g. 10 vans and fuel type e.g. diesel</i>                    | <i>Age in years</i>         | <i>Included in audit sample? Yes/no</i> | <i>Date and time</i>   | <i>Full audit/high level review</i> |
| <i>Add more rows as needed</i>                       |  |   |                             |   |                        |                                     |

## Annex II: Site survey report

### Site details

|               |  |
|---------------|--|
| Site name     |  |
| Site address  |  |
| Site contact  | <i>Contact details for the site contact.</i> |
| Date of audit | <i>DD/MM/YYYY</i>                            |

### Auditor details

|   |  |
|---|--|
| Auditor name  |  |
| Lead Assessor name<br>(if different to the auditor) |  |
| Lead Assessor sign-off:                             |  |

### Background information

*Include general information regarding the participant/site, e.g. site operations, location, age, operating hours, number of employees. Make a record of a unit of scale which can be used to calculate benchmarks (floor area, number of buildings, production units). Outline information on the current monitoring methods in place.*

### Energy audit description

*Include information on scope, aim and thoroughness, timeframe and boundaries.*

### Energy audit methodology

*A brief description of the methodology used, including a statement about which data was used and whether it was measured or estimated. Comment on the consistency and quality of data; the rationale for the measurements and how they contribute to analysis and the difficulties encountered in data collection and field work. Include a copy of key data used and calibration certificates where appropriate. Include details of staff you met and interviewed.*

### Analysis of energy consumption

*Describe energy use at the site including, an energy use profile and record of total and significant energy use. Add details of any profiling or benchmarking that has been carried out.  
Provide details of the overall energy management maturity of the site and recommendations on how the data and energy management could be improved.*

## **Energy saving opportunities**

*Rank the proposed recommendations by cost-effectiveness.*

*Explain about the opportunities and their application.*

*Record if they are specific to the site or could be applied company wide.*

*Add in details on the type of measure if they are physical or through better management.*

*Explain the criteria used for ranking the energy saving opportunities identified. Explain all assumptions used in calculating savings and provide a statement on the limits to the accuracy of estimated costs and savings.*

## **Implementation of energy saving opportunities**

*Provide details of the proposed recommendations with an estimated timeline for implementation. Make available any information concerning relevant grants and subsidies, as well as potential interactions with other proposed recommendations.*

*Suggest any measurement and verification methods which could be used to track the effectiveness of the proposed recommendations.*

## Annex III: Audit checklist

The following is intended to serve as a checklist for ensuring that all relevant aspects of ESOS audit planning and delivery are completed.

### Before undertaking the audits

- Have significant energy sources and total energy consumption been correctly determined?
- Have all energy sources within the scope of ESOS been correctly identified?
- Have de minimis energy sources been selected (where relevant)?
- Has a review of existing information, such as data and previous audit reports, been undertaken?
- Is the sample of sites selected for audit suitably representative of the participant's operations?
- Has an audit plan been generated and agreed with the Lead Assessor? Has the audit methodology been chosen and agreed?
- Who are the auditors? Do they have appropriate experience and qualifications?
- Is the Lead Assessor suitably experienced and accredited under a relevant professional body?
- Has site access been arranged? Are suitable people available to accompany the auditor(s)?
- Have appropriate members of Senior Management been engaged? Does your audit plan take account of your business strategy?
- Has Director sign-off been arranged?

### During the audits

- Is relevant data available for all operations being audited?
- Have all operations been audited? Were there any areas to which access was not possible?
- Has data from audit sample been scaled up across all operations using an appropriate methodology?
- Have costed recommendations been developed using life cycle cost analysis where practicable?

### After undertaking the audits

- Have audit reports been prepared in the agreed format for all operations covered by the audit plan?
- Has the Lead Assessor reviewed the audit reports?
- Has Director sign-off been received?
- Has the Environment Agency been notified of compliance?

- Is the evidence pack up to date?

## Annex IV: Audit report

The following is an example template for an ESOS summary report

This report has been prepared by <Enter Lead Assessor name> under contract to <Enter participant name>. The report forms the output of an ESOS Audit designed to assess the energy performance of <Enter participant name>, and to recommend cost-efficient energy efficiency savings for the participant.

|  |     |     |
|--|-----|-----|
| <b>Participant organisation:</b>                                     |     |     |
| <b>ESOS compliance deadline:</b>                                     |     |     |
| <b>Participant's total energy consumption:</b>                       | kWh |     |
| <b>Participant's assessed energy consumption (i.e. minimum 90%):</b> | kWh |     |
| <b>Total cost-effective energy saving potential identified:</b>      | £   | kWh |

*The following / No* cost-effective actions can be recommended by the Lead Assessor following the ESOS audits.

| Action          | Identification Method  | Applicability         | Estimated annual savings |                          |           | Estimated cost (£) | Payback period (years) | May be eligible for ECA/loan | Section of Report |
|-----------------|------------------------|-----------------------|--------------------------|--------------------------|-----------|--------------------|------------------------|------------------------------|-------------------|
|                 |                        |                       | (£)                      | CO <sub>2</sub> (tonnes) | (kWh)     |                    |                        |                              |                   |
| <i>e.g. LED</i> | <i>e.g. ESOS Audit</i> | <i>e.g. All sites</i> | <i>XX</i>                | <i>XX</i>                | <i>XX</i> | <i>XX</i>          | <i>XX</i>              | <i>Y/N</i>                   | <i>e.g. 1</i>     |

|                 |  |  |  |  |  |  |  |  |  |
|-----------------|--|--|--|--|--|--|--|--|--|
| <i>lighting</i> |  |  |  |  |  |  |  |  |  |
|                 |  |  |  |  |  |  |  |  |  |

### Lead Assessor Sign-off

|  |   |
|--|---|
| <b>Lead Assessor name (organisation)</b> | <i>John Smith (Independent Contractors)</i> |
| <b>Signature</b>                         |   |
| <b>Date</b>                              |   |

### Participant Sign-off

If the participant does not have any directors (as per Section 250 of the Companies Act) then a senior manager can sign this off. If the Lead Assessor is in-house, two signatures are required from directors / senior managers.

|                                  |                           |                                  |   |
|----------------------------------|---------------------------|----------------------------------|---|
| <b>Director / senior manager</b> | <i>Name of director 1</i> | <b>Director / senior manager</b> | <i>Name of director 2 (if required)</i> |
| <b>Signature</b>                 |                           | <b>Signature</b>                 |   |
| <b>Date</b>                      |                           | <b>Date</b>                      |   |





## Annex V: ESOS evidence pack structure

Your ESOS evidence pack should be readily available in the event that the Environment Agency requests to see it. The evidence pack could be comprised of a collection of documents stored in one place, or a list of different documents and where to find them.

It may be easiest for future access to retain the evidence pack in an electronic format. More than one member of your team should be aware of its location and should understand how it has been structured.

A suggested content structure for the evidence pack is shown below. This assumes that the participant has undertaken ESOS audits. Participants undertaking alternative compliance routes may have different requirements.

It may be helpful to produce an index for your evidence pack. For example, this could be structured as an Excel template, showing what is included within the pack, and where it can be located.

**Table 2: Suggested evidence pack structure**

| Evidence pack section                                   | Details   |
|---|---|
| ESOS qualification                                      | Evidence to support your qualification for ESOS e.g. details of employee numbers or financial records to support your turnover figure at the scheme qualification date.   |
| Scope of participation                                  | Details to support the scope of your operations included in ESOS. For example, if you have undertaken a mapping exercise as described in earlier in this document, this should be retained in your evidence pack.<br><br>If any of your operations have not been included in ESOS this should be clearly stated in your evidence pack, together with supporting evidence.   |
| Corporate groupings and responsibilities for compliance | Written agreements between parties where parts of the group are participating separately. Written agreement between parties where an undertaking other than the highest UK parent is taking responsibility for compliance on behalf of the corporate group. Written agreement between parties where more than one highest UK parent in the same corporate group has decided to comply together. Written agreement between parties, where an undertaking which belonged to a qualifying organisation on the qualification date has changed ownership between the qualification and compliance date, to confirm which party is taking responsibility for the undertaking's ESOS compliance. |

|  |  |
|--|--|
| Calculation of total energy consumption  | Evidence of the determination of your total ESOS energy consumption should be retained. This should be auditable i.e. details of the primary source of the data contributing to these calculations should be made available. Details of the primary source of the data contributing to these calculations, methodologies used for estimation of any data and clear identification of estimated figures in data records.            |
| Use of de minimis  | If you have chosen to opt out some of your energy consumption under de minimis, you must retain evidence to show how you have determined which consumption you have not audited.   |
| Selection of site auditors   | Details of site auditors and their relevant experience should be recorded in your audit plan, which must be retained within your evidence pack. This should clearly show that your auditors have relevant experience in undertaking audits.  |
| Lead Assessor  | Evidence of your Lead Assessor's key qualifications, including the professional body under which they are accredited, must be retained.  |
| Audit plan   | Your audit plan must be retained. Any further information to support decisions taken in selecting an audit sample should also be kept in your evidence pack.   |
| Audit reports<br>(including reports from previous audit activity being used towards ESOS compliance) | All reports generated following ESOS audits must be retained. All data used for the audits needs to be retained and clearly identifiable as either verifiable data or estimates and methodologies for any estimates made need to be recorded. Any associated calculations such as benchmarking and calculation of savings should also be kept in the evidence pack. Clear records of the savings identified need to be maintained. |
| Audit methodology  | Details of the audit methodology used, including any relevant standards that have been followed, should be recorded in your evidence pack. Justification for where energy consumption profiling has not been undertaken needs to be recorded.  |
| Evidence of sign off   | Evidence (as described in section 7 of the <a href="#">ESOS compliance guidance</a> ) of Lead Assessor review and Company Director sign off for your audits must be included in your evidence pack.  |
| Responses to voluntary disclosure questions  | If you choose to respond to the voluntary questions asked by the Environment Agency as part of ESOS you should retain a record of your responses.  |

|                                |  |
|--------------------------------|--|
| Record of compliance           | You should retain a record of your notification of compliance to the Environment Agency.   |
| Records of communication       | If you have copies of correspondence with the Environment Agency regarding your participation in ESOS, you must retain a record of these in your evidence pack.  |
| Further supporting information | Copies of all previous audits and data used to support your ESOS compliance must be retained. In addition, if you have used additional alternative compliance routes such as Display Energy Certificates, these and the accompanying advisory reports must also be retained. |

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Department of Energy & Climate Change

3 Whitehall Place

London SW1A 2AW

[www.gov.uk/decc](http://www.gov.uk/decc)