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Gaining Value from ESOS Audits

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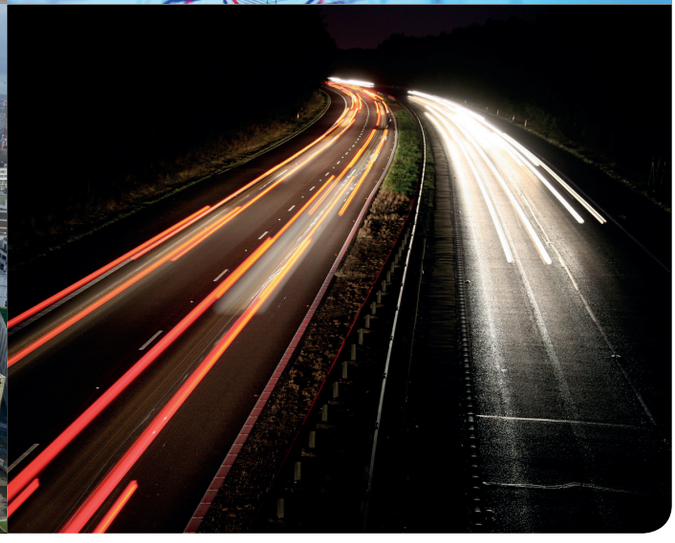

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Summary

This briefing paper describes ESOS (the Energy Savings Opportunity Scheme). The first part outlines the basic principles of compliance to ESOS. The second part discusses the value organisations can obtain from following the recommendations given in an ESOS energy audit, instead of viewing it merely as a 'tick box exercise' in order to meet compliance.

Compliance should not be seen as a cost or a burden to a business, but as an opportunity to reduce risks, and improve efficiency and profitability by implementing simple improvements at no or little cost.

The regulation aims to encourage energy efficiency in larger businesses; many organisations have already recognised the business and financial value of doing this. This briefing paper aims to help those who do not already have energy-saving measures in place to choose between the various ways of complying with ESOS in order to maximise the value for money they can achieve.

Introduction

The Energy Savings Opportunity Scheme is a mandatory regulation which is applicable to many large undertakings (businesses) in the UK. The regulation is taken from Article 8 (4) of the EU 2012 Energy Efficiency Directive [1], which states:

"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."

The Department of Energy and Climate Change, now part of the Department for Business, Energy and Industrial Strategy, has been responsible for the implementation of the directive, in conjunction with the Environment Agency.

Large undertakings qualify for ESOS [2] if they are:

– Large undertakings employing more than 250 staff; or

– Undertakings which have an annual turnover in excess of 50 million euro (£38,937,777), and an annual balance sheet total in excess of 43 million euro (£33,486,489) as of the first compliance period on the 31st December 2015

Using the above criteria, it was estimated that approximately 12,000 businesses across the UK are included in the ESOS.

Definition of an Energy Audit

The term 'energy audit' refers to reviewing energy data to identify savings opportunities [3]. In order to understand an organisation's energy usage, an energy audit needs to be carried out to identify where energy is used throughout the organisation. This will include buildings, transport and industrial processes. Once this information has been collated, organisations can then develop an end energy profile to enable them to have a better understanding of the end energy uses throughout the organisation. This will then help identify anomalies in energy consumption. For example, high energy consumption may be due to equipment wearing out and requiring replacement. Carrying out an energy audit helps identify the issues and the decisions to be made. The value of auditing can be summarised as:

- pulls together all the relevant data
- identifies data gaps
- maps the organisation
- identifies the organisation's needs
- is organisation specific
- provides a snapshot of where an organisation is in terms of energy management
- identifies opportunities for savings and barriers to implementation.

The effectiveness of audits is improved when they are part of a part of a larger structured energy management programme [4]: Figure 1 shows how energy audits feed in to energy review and planning processes, which in turn underpin the overall energy policy of an organisation

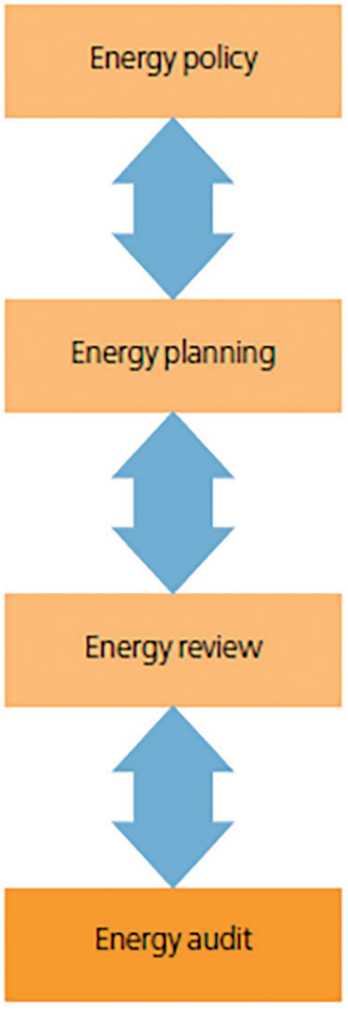


Figure 1: How energy auditing fits into the management framework

Compliance to ESOS

There are four main routes to comply with ESOS:

ISO 50001 – Energy Management [5]

ESOS energy audits [2]

Non Domestic Green Deal Assessments [6]

Display Energy Certificates (DECs) [7]

Other detailed energy audits could also be used for compliance, as long as they are recognised European or International standards, for example, BS EN 16247-1 Energy Audits [8].

ISO 50001 – Energy Management

The ISO 50001 standard is no different from any other standard used for an organisation's processes, such as ISO 9001 or ISO 140001. The ISO 50001 Energy Management standard is based on four key principles, Plan, Do, Check, Act (see fig 1). The key benefit of adopting the ISO standard is the implementation of an energy management programme throughout the business in order to identify energy wastage, save energy, reduce the environmental impact and increase profitability long term [4]. For organisations to adopt and implement IS0 50001, there must be buy-in throughout the organisation, and this requires commitment and drive from senior board members. Targets are set to save energy and running costs across the business throughout the year. The savings should then be reinvested to fund further improvements. A key part of the requirement is monitoring all energy uses, so it is vital to have the right control package [9] and Monitoring and Targeting system in place. The process is repeated each year with an on-going review on what measures worked well and what did not.

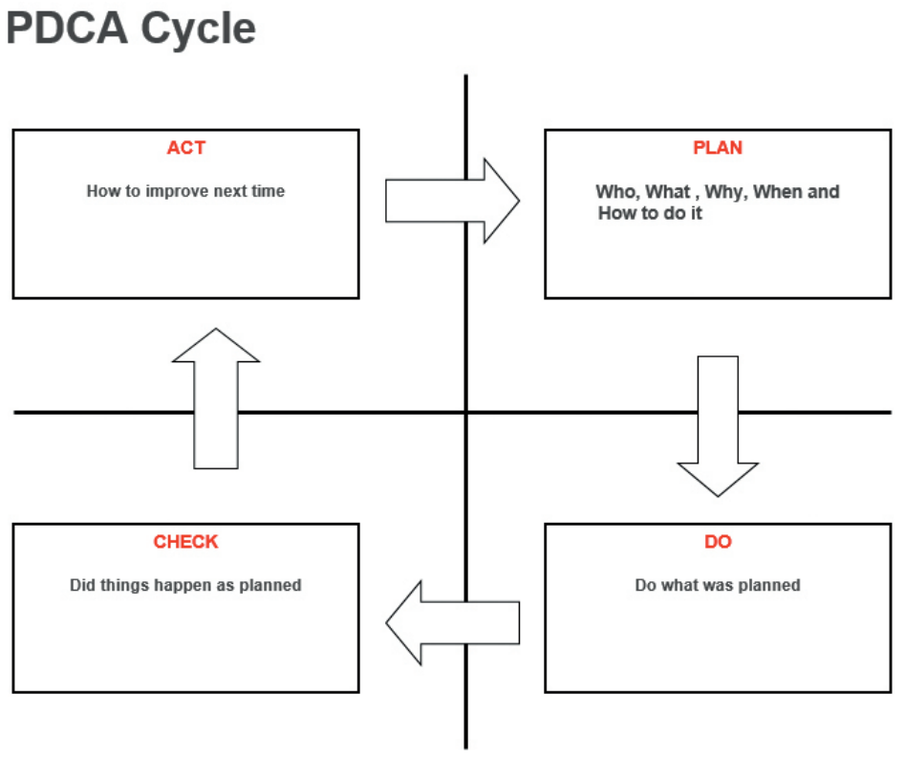


Fig 1

In the long term, large undertakings should be looking to implement the ISO 50001 standard where feasible. Organisations need to be aware of what they are committing themselves to and what is required from them to achieve this standard. The success of the ISO 50001 implementation can vary across the different types and sizes of organisation, with some businesses seeing success (in terms of energy and cost savings) within the first few years of implementation, whilst others need a longer period.

Key benefits of ISO 50001 include:

- Recognised European standard
- Identifies energy wastage
- Identifies energy savings
- Reduces operational running costs
- Reduces the environmental impact for a business.

Managing energy, like any other good management practice, relies on the ability to:

- Measure;
- Investigate; and then
- Control.

This is enforced by an energy management procedure based on the four principles:

- Plan;
- Monitor;
- Implement; and
- Improvement.

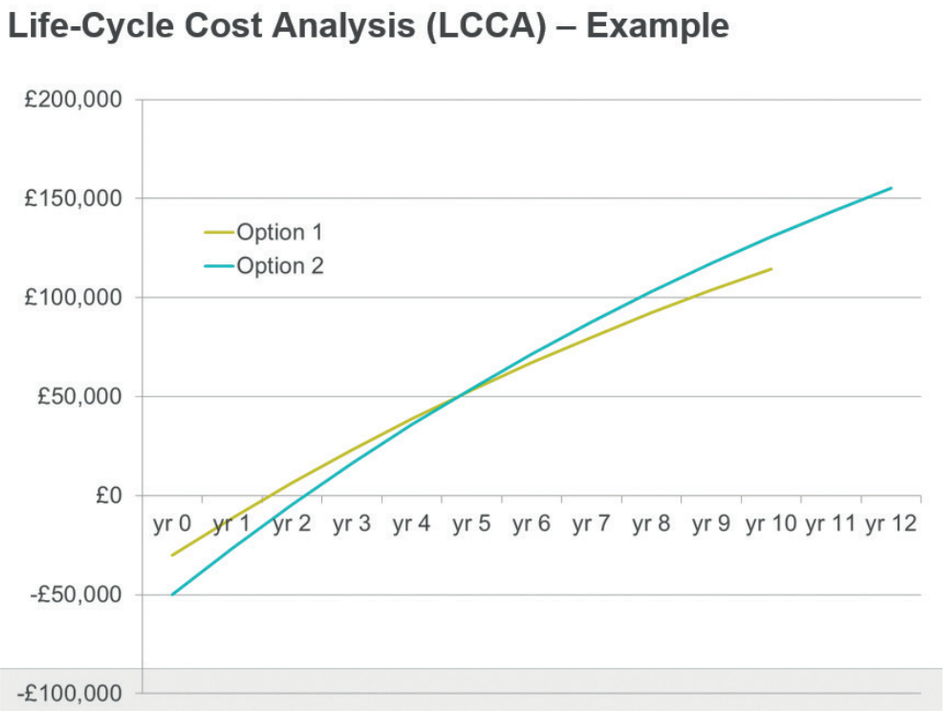
ESOS Energy Audits

Article 8(4) of the European Union Energy Efficiency Directive (2012/27/EU) [1] requires all Member States to introduce a programme requiring large enterprises to conduct regular energy audits by appropriately qualified and/or accredited individuals. Such individuals may be either in-house experts or external consultants and energy service providers.

The ESOS energy assessments covers buildings or groups of buildings, industrial processes and transportation. Within ESOS, the lead energy assessor is the one who is responsible for either: carrying out the energy audits, leading an assessment team, or reviewing the energy assessment for an organisation. PAS 51215 [10] covers the requirements and competences necessary to become the “lead energy assessor”.

The ESOS energy audits are a means of identifying the energy usage across the whole organisation and highlighting areas which have a significant energy usage. In order for the energy audits to have any real value, energy consumption should be recorded for buildings, industrial processes and transportation. If the ESOS lead assessor is an external consultant they can either use this information to carry out an energy audit by themselves or to review an internal audit carried out by staff within the organisation. The final ESOS report must be signed off by a senior director within the company to confirm that it accepts the recommendations highlighted for saving energy.

Undertakings which have a large portfolio that includes buildings, transport and industrial processes should have already considered the ESOS audit option. The lead assessor working closely with the client can identify the various buildings, transport and industrial processes for the energy audit and where any recommendations could be replicated across the organisation. The key to delivering a successful ESOS audit is identifying the high energy uses when selecting which areas to audit. The reports should include life cycle analysis; if not, then simple paybacks to show the likelihood of achievable savings. Below (Fig 2) is an example of the same measure; although option 1 is cheaper by £15,000, the overall life efficiency of option 1 is less.



Non Domestic Green Deal Assessments

The Non Domestic Green Deal Assessments are designed for commercial and industrial buildings. A Green Deal module is part of the current version of the iSBEM [6] software, which allows competent users to model a building (its form of construction and HVAC strategy) and compare the results to the actual operation and management of the building [11]. Once the building profile has been created, users can model the impact of various changes. For example, changing the boiler and heating system controls to see how much impact this will have in terms of cost, energy and CO2 savings. The software also calculates savings based upon the current management of the building. So where there is no operational management plan currently in place, there are likely to be significant savings achievable, which can be made at no cost or low cost. It is important to highlight that the savings shown, based upon simple paybacks, are estimated by the software, so may differ from actual savings realised.

Under current ESOS rules, if organisations take the Green Deal approach, they have to apply it to all their buildings, which can be a very expensive and time-consuming exercise. If they also have transport and industrial processes to audit, then they are required to have separate audits for each.

Ideally, using Green Deal assessments should only be considered if undertakings have 5 buildings or less, and they are looking to refurbish the building(s) within the next two years. This is where the assessment methodology can support important decisions for the building owner, such as looking at which building components can save energy and what is the likelihood of cost savings.

Display Energy Certificates (DEC)

DECs, as they are commonly known, are required in all buildings that are visited by the public [7]. DECs are based on operational data, i.e. fuels that are used in the building, which are then benchmarked against best practice to provide the actual rating of a building. A recommendations report accompanies the DEC, giving Low, Medium and Long payback energy efficiency measures suitable for the building. The payback calculations are based on simple paybacks. DECs are only valid for a year, so the exercise is repeated every year to show the building owner whether the overall energy consumption of the building has increased or decreased, see Fig 3.

Any undertaking which meets the DEC requirements and only occupies one or two buildings should have explored this as a possible option for compliance with ESOS. However, the only real benefit for organisations is that it enables them to monitor their energy performance over time.

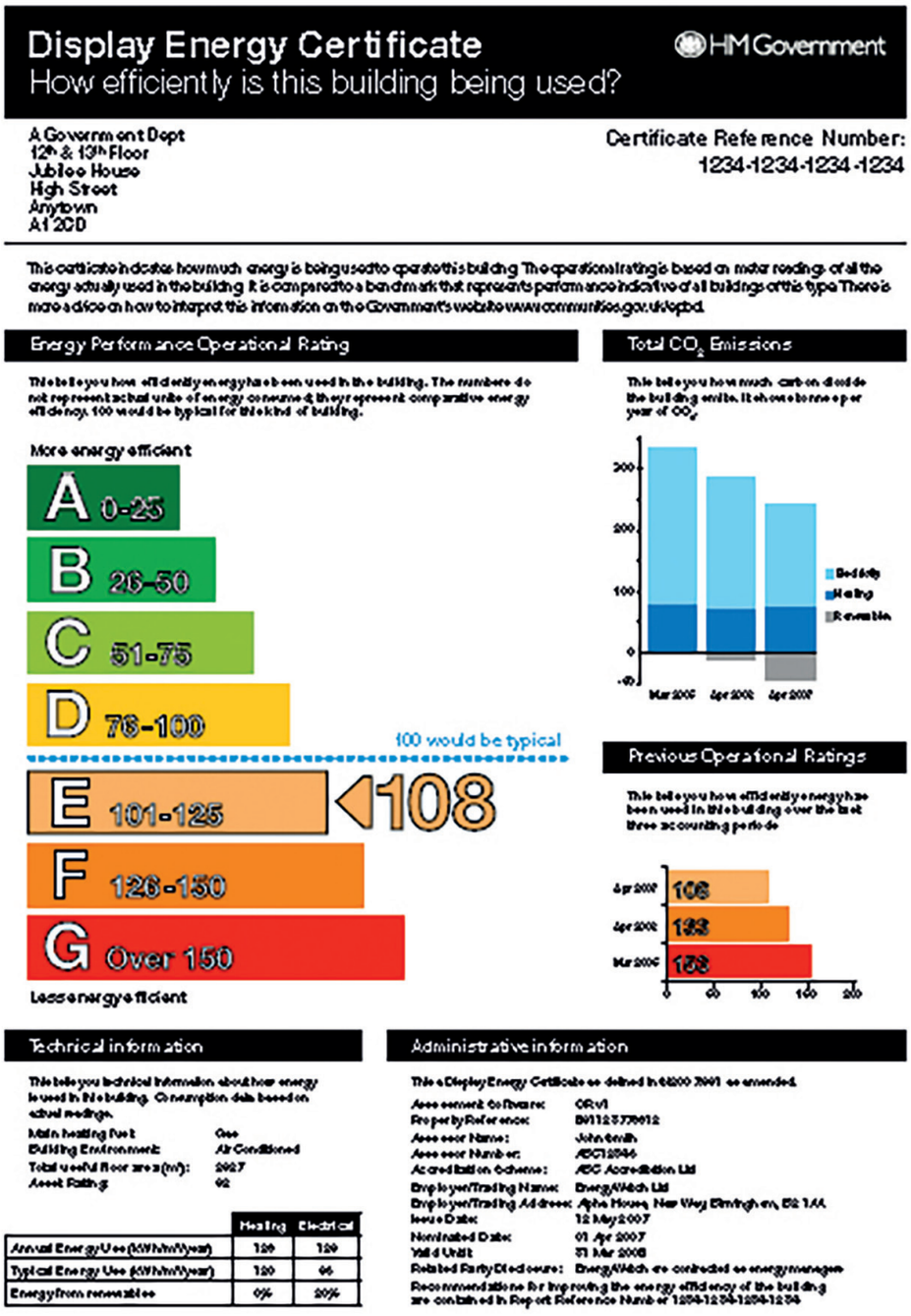


Fig 3

Gaining value from ESOS audits

The key question many organisations might ask is "why should we implement any of the recommendations from the ESOS reports?"

The answer is, there are a number of key reasons to reduce energy use [12]:

- to save costs;
- to comply with legislation;
- to manage risk.

A recent milestone was set in December 2015 at the Paris Climate Conference [13], when 195 countries adopted the first universal legal binding global climate change deal.

The agreement aimed to limit average global warming temperature below 2°C, with the further objective of limiting the average temperature rise to 1.5°C. Other key outcomes from the agreement included:

- On the need for global emissions to peak as soon as possible, recognising that this will take longer for developing countries;
- To undertake rapid reductions thereafter in accordance with the best available science.
- Come together every 5 years to set more ambitious targets as required by science;
- Report to each other and the public on how well they are doing to implement their targets;
- Track progress towards the long-term goal through a robust transparency and accountability system.

The agreement is set to come into force in 2020 which will require all the 195 countries signed up to the agreement to make progress in reducing their carbon emissions. It not only sets national targets but also global targets to minimise the effect of climate change. The EU has already pledged to reduce emissions by at least 40% by 2030.

Looking at the key energy statistics for the UK and the current position of the UK in terms of energy usage and generation -

The Digest of UK Energy Statistics [14] shows that in 2015 the UK imported 65% Coal, 53% Oil, 52% Gas. Over half of our energy use was imported in order to meet the demand.

The electricity generation in the UK consisted of 22% from Coal, 30% from Gas, then the remaining 48% from a combination of renewables, nuclear, biofuels and oil.

The overall demand for energy has decreased in the past 25 years, though the closure of power stations and not building new ones could potentially have an impact in the future, especially during the autumn and winter months when energy use is at its peak. Furthermore, the UK still needs to import energy and the price of energy is likely to increase in the future as resources are depleted globally. There is also the key issue of security of supply, considering where we import our energy from and the need for good relationships with countries along the supply routes. In order for the UK to be sustainable in the long term, it is important to manage our energy usage and our resources more efficiently and effectively. We need to minimise our dependency and importing of fuels in order to sustain our demand.

For most individuals in this country, 95% of their life will be spent in a building of one form or another, which requires lighting, heating and cooling. Our dependence on energy is already at a peak; in order to reduce the peak, we need to understand when the demand is required and not required.

Furthermore, the ESOS audits can cost organisations thousands of pounds over the years. The investment is not a one-off cost, as the process is repeated every four years until at least 2022. So the organisation should try to get as much benefit as possible from this process.

A recent publication from the UK Green Building Council [15] contains case studies from various businesses that have already benefited from ESOS energy audits across their organisations.

These case studies illustrate a range of measures ranging from low cost to high cost, identified during the energy audits. These include:

- Installation of more efficient lighting and lighting controls
- Replacement of boilers and chillers to air source systems
- Installation of BMS (Building Management System) or reviewing the settings of an existing BMS
- Staff energy awareness training
- Building fabric improvements
- Insulating pipework
- Boiler and air conditioning controls
- Implementation of ISO 50001
- Minimum standards for grey fleet and car hire
- Smarter driver training
- Use of hybrid vehicles
- Installation of speed limiters

As an example, a recent ESOS audit of the RSA Insurance Group identified estimated annual savings of 802,070 KWh (£81,277, 356tCO_2 e) for the buildings. This included measures such as lighting replacement, improved BMS controls, employee engagement and the installation of renewable energy.

The transport review identified a further £191,108 of cost savings, delivered through initiatives including the introduction of minimum vehicle standards for grey fleet and hire cars and an investment in 'Smarter Driving' training.

All this is part of addressing risks to the business. The 'do-nothing' scenario is not a realistic option due to increasing energy prices and security of supply issues. To mitigate these risks, organisations now need to understand how they use their energy, manage it and then invest in its reduction

Buildings [16]

Many of the recommendations from building audits are based upon making more efficient the current energy systems used for providing heating, cooling, ventilation and artificial lighting within a building. As for industrial buildings, the recommendations would include identifying the efficiency of manufacturing systems and the operation of the equipment.

It is vital organisations have a good understanding of the energy use in their organisation before implementing any measures. Installing sub-metering on equipment and a monitoring and targeting system is the first basic investment to be implemented. Otherwise organisations are unable to monitor whether a particular measure is working or not as it should.

Before looking at the implementation of any energy saving measure inside buildings, the building fabric should be investigated. Replacing an inefficient boiler with a new more efficient boiler may make some savings, but the payback time will be longer if there is little or no thermal insulation in the building. Heat losses through buildings account for a high percentage of energy loss and should be addressed first. Carrying out an inspection of the building fabric should be the first priority to identify and minimise losses.

A high proportion of the recommendations in building energy audits highlight the energy savings from replacement of lighting systems. Lighting is one of the three major key energy uses in buildings, along with cooling and heating. It is important to consult a lighting expert to carry out a complete lighting audit to provide actual costs and paybacks. Using energy modelling software such as the iSBEM Green Deal software for non-domestic buildings is also recommended, as this software will calculate the energy savings for one measure and will also look at the overall energy impact across the building. For example, changing from a 58 watt T8 tube to a 24 watt LED equivalent would save 34 watts, with a 59% reduction in electricity use. However, as the heat output from the LED will be non-existent compared to that from the 58 watt T8 lamp, the knock-on effect is that there will be an increase of energy required from the heating system, including the auxiliary energy (fans and pumps), to replace the heat loss from the LEDs. Although the payback is calculated at 3 years, in reality it will be more than 5 years, when the additional heating requirements are taken into account. It is important to understand the whole building approach rather than looking at a single measure without understanding all the implications for the building's systems.

Easy quick wins from the ESOS reports can identify no cost or low cost measures to save energy. These can include simple good practice housekeeping, such as switching off equipment when not in use, turning off lights during daylight hours, adjusting heating and cooling set-points and having better controls, i.e. weather compensations, boiler optimisers in order to have better control and efficiency during the start time of the heating system and when it shuts down during course of the day, once the optimum temperature has been reached.

The EPC aspect of the Green Deal tool produces energy efficiency recommendations. Utilising the assessor's expert knowledge of the building, scenarios can be tested to assess the potential savings from these measures, eg installing better lighting. This means that the tool can produce data to support the business case by demonstrating the possible savings generated by different options [12].

Industrial

Industrial processes can be very intensive in terms of energy consumption and potentially offer a good opportunity to save energy and reduce running costs. The BS EN 16247-3 [17] Energy audits standard advises an energy management procedure based on the four principles: plan, monitor, implement and improvement. In order to have a good understanding of energy use across the various processes, having metering in place is vital.

Installing clamp-on meters to measure the actual energy use for large energy-intensive equipment should be the first step. Once users have collated a baseload profile over a week, they can calculate the amount of energy used by the equipment over the year. Reviewing the entire process from start to finish is critical. When fans and pumps are required, look at timings of equipment use during peak hours and off peak hours, throughout the day including weekends, to develop an energy profile.

Some of the key recommendations identified from ESOS reports could include installing higher efficient motors or variable speed drives (VSDs), voltage optimisers, and looking at automation for processes. Further recommendations may highlight building improvements, which could include the use of heat recovery, more efficient lighting and lighting controls, installation of a building management systems and building controls.

In order to address energy saving opportunities for industry processes, organisations need to have a clear understanding of the whole process taking place from start to finish. Without metering of the various stages they cannot develop a complete picture. Before investing in improvements they will require a monitoring and targeting system to help identify where energy use is high, when and why. Installing more efficient equipment on its own may not cut energy consumption as much as expected, so having a good monitoring and targeting system will help identify where any problems exist.

Organisations should look to implement the no cost and low cost improvements as identified in the reports, whether they are related to the building or the process itself. Where equipment needs to be replaced, a specialist should be consulted to carry out a feasibility study, as the cheapest option is not necessarily the best if the life span of the cheaper equipment is shorter.

Furthermore, Industrial based organisations should look at implementing the BS EN 16247-3 standard, which concentrates on processes. Industrial processes are unique to the sector to which they belong, e.g. chemicals, but a common range of operations may be carried out within different processes.

The UK government best practice guide, GPG316 [18], deals with most of these subjects. It should also be remembered that there will be some overlap with the building envelope that houses the processes and its associated services.

Transport

Transport audits are no different from energy audits for building or industrial processes. In order to be able to understand the need of business travel or the use of a grey fleet, it is important to map out and benchmark the transportation use in the business.

The first step for businesses is a company policy for business travel. Before making any business journey, individuals should run through a process to check whether they actually need to travel on business, can they arrange a remote meeting using technology such as a conference call, video conferencing, etc. There are many options available for us to communicate with each other globally. Making use of technology should be the first step. This will help reduce the carbon and environment impact by cutting out all unnecessary travel.

If individuals are required to make the business trip, then they should look at public transport as the next option. Public transport has improved over time as the population has grown. Planning the journey and the meeting time is vital as you want to try and avoid peak rush hour when the cost of the journey will be at its highest. Managing the cost of business travel helps to contribute to the business profits. Using public transport instead of a personal vehicle, a company car or hiring a car helps reduce the environmental impact considerably.

Businesses should look at alternative grey fleet options, such as electric vehicles or hybrid vehicles, which are not only more environmentally friendly but offer better tax break incentives for businesses. The technology for electric vehicles in the past few years has come a long way with some of the newest generation of electric cars achieving nearly 300 miles on a single charge. The other option is hybrid vehicles, which are a safer option for most businesses and are in the lower tax band.

For a better understanding of transport audits, BS EN 16247-4 [19] concentrates on transport and requires a breakdown by mode of transport:

- road
- rail
- aviation
- marine

It is now a widespread legal practice in the UK to keep a log of all travel by all staff members, whether in company cars, taxis, by rail or air. This is in order to ensure that organisations are reporting accurately their carbon footprint under the growing requirements of environmental reporting as exemplified by the Greenhouse Gas Protocol (www.ghgprotocol.org).

The Energy Saving Trust (www.energysavingtrust.org.uk) has produced a range of Good Practice Guides on road transport and car fleets, such as A fleet manager's guide to ecodriving: advising ecodriving techniques for your fleet [20] and A guide to managing and reducing grey fleet mileage [21]. These can be used to support any recommendations that arise as a result of the audit.

Conclusion

Businesses should take maximum advantage of the ESOS reports to help reduce their overall organisational energy consumption and manage risks to the business.

After making the initial investment to comply with ESOS, organisations can only really benefit from the energy audits by implementing the simple no cost or low cost solutions identified in the reports. Taking that first step may seem enormous, though in the long term business will see the difference and improvement this will make.

This applies, not only in terms of energy savings for the organisation, but in the social and environmental responsibility it can demonstrate to the outside world. Issues such as climate change will become more and more important and taking an initial step now will help in reducing all the carbon emissions that are produced through energy consumption every day.

Having better control and management of the energy used - this is when businesses can then see the real benefits, not only in profitability but also in environmental and social benefit, including globally. There are many solutions available to help reduce our energy use, though most of them are based on better more efficient systems. If we can make building systems and components more energy efficient, then why can't we be more efficient in how we use all our energy? All we need is an understanding of the day to day energy use, have a good management process in place and then make a start by tackling the quick and easy wins.

'Any investment made should be beneficial to the business, not just financially but environmentally'.

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