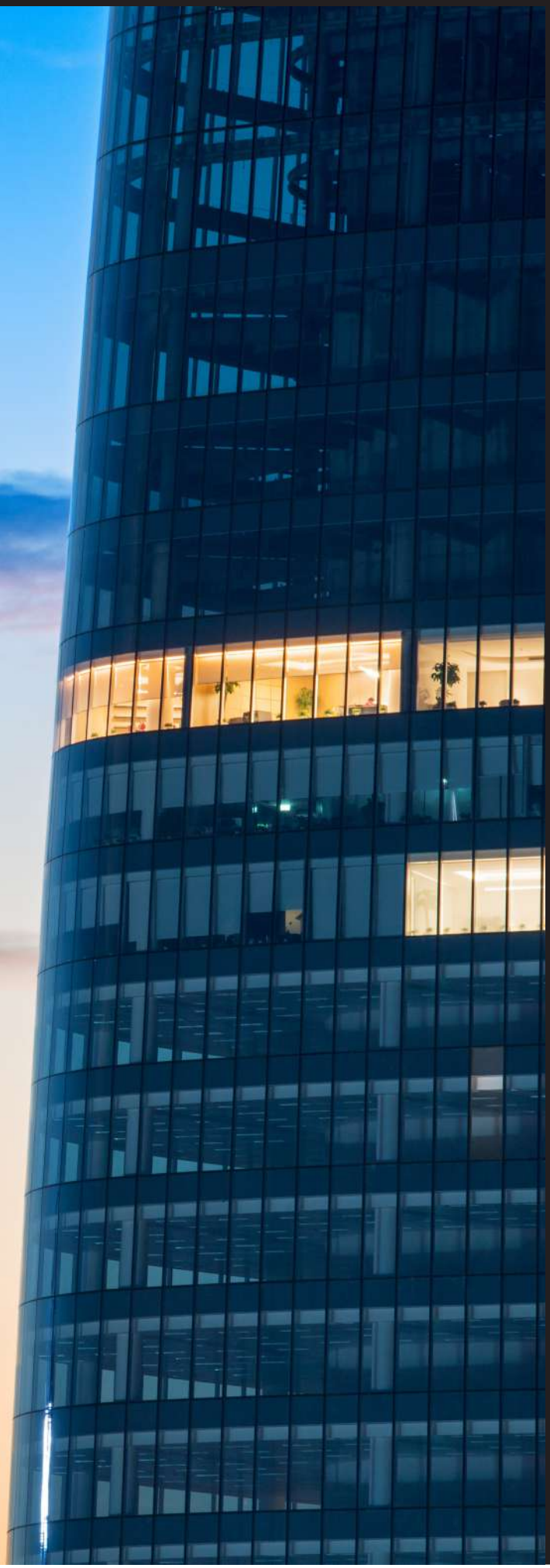
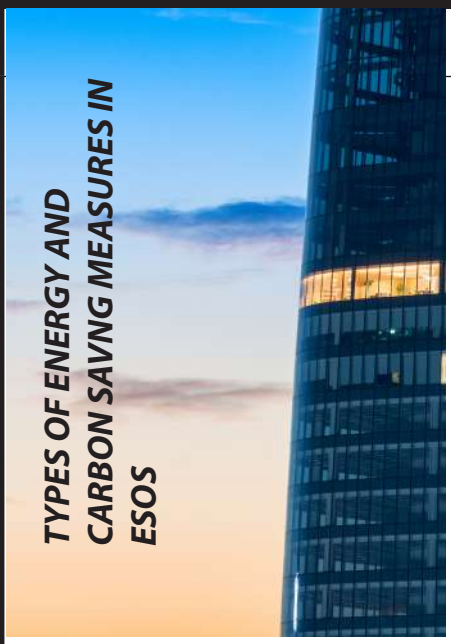
Types of Energy and Carbon Saving Measures in ESOS

The Energy Savings Opportunity Scheme (ESOS) Lead Assessors identify, advise on, review, and calculate financial costs and benefits, of energy savings opportunities based on the outcome of the energy audit. These recommendations play a key role in the ESOS and the aim to reduce organisational energy use.

ESOS Lead Assessors Dr Mary Pothitou and Sam Arje explain their approaches to carrying out this step of ESOS compliance.



TYPES OF ENERGY AND CARBON SAVING MEASURES IN ESOS



By Dr Mary Pothitou, Certified ESOS Lead Assessor (EMA)

ESOS provides a structured framework for organisations to assess their energy consumption, identify opportunities for improvement, and drive sustainability and energy efficiency. This can be achieved by implementing efficiency measures, leading to significant cost savings over time and reducing the environmental impact of organisations. Adopting energy-efficient practices and implementing measures can also enhance brand reputation and create a more sustainable and resilient business model, reducing reliance on resources as well as mitigating the risks associated with energy price volatility and climate change.

During my involvement in the delivery of ESOS compliance for national and multinational organisations, I conducted numerous site energy audits and gained firsthand insight into key opportunities within different business sectors, including real estate, the IT sector, and manufacturing. Energy auditing primarily focused on real estate, encompassing office buildings and data centres, with fewer cases in manufacturing.

GETTING STARTED

To gain a comprehensive understanding of significant areas for improvement, it was critical to engage with Facilities Management teams and those operating onsite energy equipment in order to obtain details on equipment operational activities, people energy practices, and transportation. I developed a methodology for requesting information and data, providing clear instructions and templates to facilitate conversations with stakeholders and gather required details on building characteristics, energy systems used onsite and transportation data. Supplementary information was gathered during the onsite surveys, including reviewing equipment characteristics and maintenance records, verifying building plans against actual installed equipment at the time of the audit, and assessing Building Management System (BMS) utilisation and software sophistication. Beyond collating and verifying energy data and relevant information on energy systems and transportation, discussions on organisational intentions, goals, and investment plans were essential to identify tailored, practical and cost-effective opportunities.

Energy consumption and transportation data, information on energy systems operations, and people energy practices were key elements to consider and analyse when identifying energy efficiency measures. Profiling energy consumption was also key to breakdown how energy is used by specific assets or activities. The types of energy and carbon saving opportunities can vary depending on the specific circumstances of an organisation. Efficiency opportunities were dependent on factors such as the organisation's industry, operations, goals, building ownership or leasing, and investment constraints. Therefore, prioritisation of efficiency opportunities was necessary.

FACTORS TO CONSIDER

To prioritise identified efficiency measures, the aspect of the importance to implement the measure in order to facilitate future energy auditing was considered. This would involve improving asset inventory, metering and submetering installations to improve the quality of energy data for future analysis, and methods to enhance transport data, for monitoring energy consumption and identifying issues and potential energy savings. Furthermore, higher energy savings and carbon savings with a shorter return on investment and ease of implementation were criteria considered for the prioritisation of the efficiency measures. This included 'quick wins' such as implementing lighting upgrades, optimising building shading to reduce heating waste or excessive cooling demand, and BMS optimisation. Additionally, HVAC system optimisation, such as improving pipe insulation and implementing smart controls which can lead to substantial energy savings, were prioritised in most cases compared to those measures which would require higher capital investment, time and effort to be implemented, as for instance renewable energy adoption, HVAC equipment upgrade, waste

heat recovery or free cooling and behaviour change initiatives. These measures were primarily applied to office buildings, data centres and factories.

ESOS EXAMPLE

A practical example of an organisation with different types of buildings was a multinational company that provided information technology services and consulting, with over 100,000 employees worldwide, operating in 60 countries, including Europe and the UK. The IT company operated data centres and occupied office buildings in the UK and was in scope for ESOS due to the number of employees (exceeding 8,000 employees within the UK at the time of the audit). During the energy audit, the total energy consumption (TEC) of the UK portfolio (comprising 56 sites) was close to 280,000 MWh, including grey fleet transportation. The primary energy consumed was electricity for heating, ventilation, cooling, and small power use, with gas used solely for restaurant facilities and diesel fuel minimally used only for backup generators in the data centres. Due to the implementation of the ISO 50001 energy management system for the operation of data centres, a number of sites were out of scope for ESOS, covering 65% of the total energy consumption. The organisation required to conduct energy audits for ESOS for those sites not certified to ISO 50001 in order to cover the remaining 35% of energy usage (approximately 100,000 MWh). A sampling approach was undertaken, considering sites (above 20,000m²) with significant consumption, representative of the portfolio (combining office area, data centre, restaurant facilities and parking areas) and sites owned by the organisation to be included in the audit. These sites accounted for 10% of the total energy consumed by the UK portfolio. The remaining 25% of total energy consumption consisted of sites mainly comprising office facilities leased with limited control over implementing energy efficiency measures.

Short and mid-term opportunities

Most of the energy efficiency opportunities identified were short-term (defined as <5 years) and mid-term (defined as <10 years) capital improvements. These were related to energy management practices, control enhancements, HVAC systems upgrades, application of renewable energy sources and behaviour change interventions for energy usage and transportation.

One of the energy management practices that was recommended included 'Energy Monitoring and Metering' involving the implementation of enhanced metering and submetering systems, along with an energy management programme to monitor energy usage. This enables data analysis and identification of areas for improvement in energy systems and equipment used onsite (e.g., HVAC, lighting, small power use). The metering and sub-metering system facilitates the disaggregation of energy consumption per end-use (heating, cooling, lighting, small power use) and enables monitoring of energy consumption, capturing unusual or excessive consumption. Due to the importance of good quality data to be accessed for understanding site performance, this efficiency measure is also applicable to organisations in various sectors (e.g., hospitality, IT sector, manufacturing, logistics/

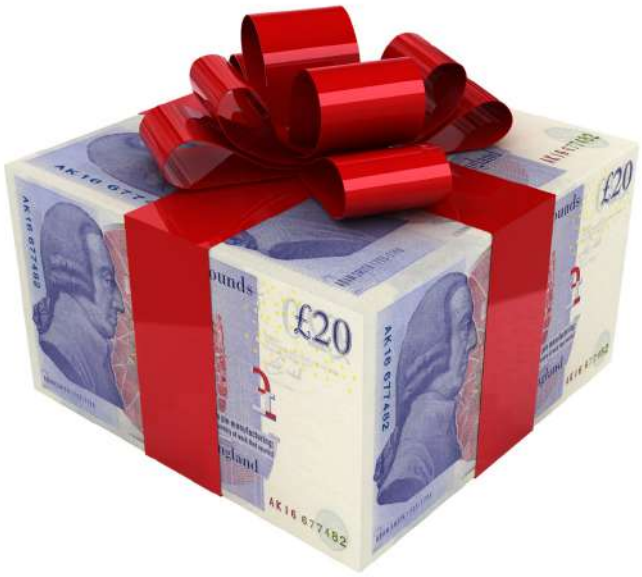
warehouses). The anticipated financial investment in metering/sub-metering systems was up to £30,000, considering the different sizes of the buildings and required equipment installations. The potential annual energy savings ranged between 420,000 kWh and 1,600,000 kWh, with annual cost savings of up to £120,000, and the estimated payback period was less than a year.

Control improvements

A recommended 'control improvement' measure included the demand-side management via BMS optimisation and control of Air Handling Unit (AHU) fan motors. BMS optimisation allows real-time monitoring of energy consumption and performance benchmarking by comparing historical data and industry benchmarking to identify areas for energy efficiency improvements. The anticipated financial investment for this measure was £750,000, with annual energy savings of up to 550,000 kWh, and annual cost savings of up to £80,000, while the estimated payback period was around 10 years.

Improving control of AHU fan motors would enable more efficient operation of ventilation system for the control of temperature, humidity and air cleanliness. The estimated investment for this measure was approximately £37,000, achieving annual energy savings of up to 135,000 kWh, and annual cost savings of up to £20,000, with payback period of two years. Generally speaking, optimising equipment operation and the scheduling of equipment maintenance ensure that energy systems operate at peak efficiency.

Examples of short-term capital investments included, the upgrading carpark lighting to LED with sensoring control and



the installation of solar PV panels. Lighting upgrades to LED with improved control can achieve significant energy and cost savings, reducing maintenance costs and equipment replacement due to LED's longer lifespan compared to traditional lighting fixtures, especially in areas like carparks that benefit from daylight and minimal human presence. The anticipated investment for this measure was around £130,000, with annual energy savings of up to 450,000 kWh, annual cost savings of up to £65,000, and a payback period of two years.

Renewable energy opportunities

The application of renewable energy sources was recommended to the organisation because renewables can provide partial energy independence and resilience against rising energy costs, fuel shortages and power outages, while reducing environmental impact of using energy from fossil fuels as green energy is generated onsite. The installation of roof-mounted solar PV panels covered areas ranging from 800m^2 to 8,000m^2, with anticipated investment between £100,000 and £1,000,000, annual energy savings from 100,000 kWh to 1,000,000 kWh, and payback periods of up to seven years.

CONCLUSION

The above sample of measures detailed as part of the energy audit for the IT company were also applicable to other types of organisations, professional and bank services using office buildings, manufacturing facilities, and logistics/warehouses. These efficiency measures are amongst the most common ones which can be identified in most energy audits, alongside the measure of replacing conventional lighting with LED and sensoring control in buildings.

Author's profile:

Mary spent over a decade in academia, earning an Engineering Doctorate (University of Reading) and completing the Business Sustainability Management training course (University of Cambridge). In late 2019, she transitioned to the industry in the UK, conducting energy audits mainly in offices, data centres and manufacturing for national and international organisations.

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14th	Net Zero Fundamentals and Strategies
20th	On-site Electricity Generation
21st	Energy Monitoring, Targeting and Validation

JULY

4th	Energy Auditing Techniques
5th	Reaching Net Zero
11-12th	Fundamentals of Energy Management
18th	Energy Procurement

SEPTEMBER

13th	Energy Management in Building Services
20th	Essential HVAC Control and Optimisation
27th	Lighting – Basic Understanding

OCTOBER

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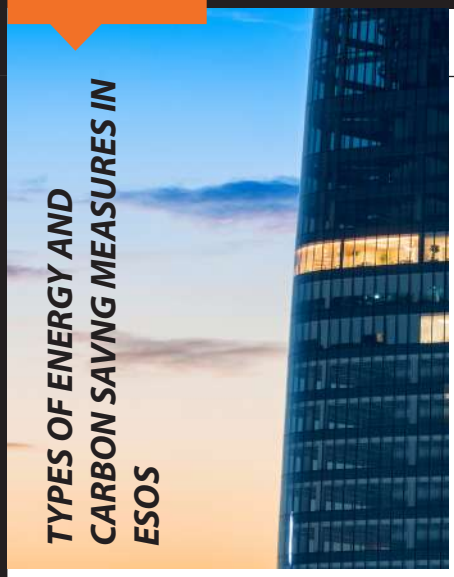

TYPES OF ENERGY AND CARBON SAVING MEASURES IN ESOS

By Sam Arje, Senior Energy Consultant at TEAM Energy

As an ESOS Lead Assessor, the "by the book" description of my role is to ensure compliance during the ESOS process for my clients. I prefer to think of my role as working to understand the client's business, and use my experience and knowledge to advise on how their business operation can run in a more energy efficient way with very little or no impact on either staff satisfaction, client satisfaction or business success. Ultimately at the end of the ESOS process, I want the participating organisation to be ESOS compliant as a by-product of the journey we have been on together. Getting them ESOS compliant is never my sole aim in the process, although it is of course necessary.

GETTING STARTED

I start every interaction with a client that meets the criteria to comply with ESOS with a kick off call, that typically lasts around an hour. This has two purposes.

1) to ensure my client fully understands the ESOS requirements and processes, and what I will require to assist in the process.

2) to get an introduction to their business operations and the way it runs, with little or no focus on energy, to ensure that my recommendations can be targeted and aligned as much as possible to their business operations.

This initial call helps me create an Audit Plan, which is where we document the ESOS process we hope to undertake; which buildings are to be audited, the reference period to be used, the energy data sources we will use and the elements of the organisation that are in or out of scope for ESOS.

FACTORS TO CONSIDER

Before any site audits are conducted, I like, where possible, to have the data for that site well in advance, so I can see what their energy usage looks like for the building(s) to be audited. Where half hourly data is available I like to create an expected profile of the energy use for the day I am due to carry out the site audit. I always give the client the choice as to whether they would prefer to have a chaperone to assist me on the audit or whether I should carry out the audit alone. Both methods have their advantages and disadvantages. Working with a chaperone allows questions to be asked as we walk around, but could restrict what is shown to me. Working alone allows me free reign of the building and allows perhaps a more "real" image of what really occurs there, but means questions are restricted to after the audit.

During site audits, my most useful tool is a camera. I always check with the client if they are ok with me taking photos during the audit (obviously not capturing any people or confidential information in any pictures). However, backing up recommendations and opportunities in building audit reports with a photo of the offending behaviour, infrastructure, technology or fabric is often more meaningful than paragraphs of written text. I would recommend that all ESOS auditors include photographs in reports where they are permitted to.

I try to write up at least the framework of the site audit within a week of completion. As ESOS Lead Assessors get more and more work, the closer to the deadline we get, sometimes this is not possible. But I have learned that writing up the report, while the actual site audit is still fresh in your head, can add more emotion and a personal touch to the findings. Rather than waiting longer and just going off the notes you made at the time as the site audit took place too long ago or several others have taken place since to remember some of the intricacies of the findings during the audit.

When writing up the audit, I always use the information gained during the kick off call and subsequent conversations to make the findings meaningful and appropriate to the organisation in question. For example, if I have audited a facility that is public facing, such as a retail unit or hospitality venue, I acknowledge that certain extravagant energy usage is expected in that environment to stand up to customer expectations. For example, for lighting displays that may be more decorative than operational in these environments, rather than suggesting removing them altogether, I would encourage (of course) replacing them with LED if not already done so, but focus more on controls such as timer settings that ensure they are off when no guests are present.

Conversely in non public facing environments such as offices, I would always stress that lighting should be on only if necessary and focus heavily on behaviour change, concentrating more on ensuring blinds are open before resorting to putting lighting on at all.

I also like to consider the reality of implementation of recommendations before writing the report to ensure detail is placed on the opportunities the client is likely to take up. Into this algorithm comes variables such as whether the building is owned or leased, whether the company is expanding or cutting back on capital expenditure, and how much focus the organisation plays in energy saving and sustainability already. I also tailor the report so that the level of technical descriptions is appropriate to the reader. Again, information picked up from prior conversations.

SAVING OPPORTUNITIES

Ideally, I prefer to give a range of recommendations too if possible; these could be immediate/short term priorities (normally no cost to implement), low cost Capex (mid priority) and higher cost Capex (long term considerations). Alternatively, this could be a mix of behavioural change and infrastructure/technology upgrades. Another example would be a combination of recommendations across different parts of the building, if the building has multiple uses. However, these "ranges" could be restricted based on some of the variables mentioned previously.

CHANGES TO PHASE 3

A new aspect of Phase 3 is that you must suggest an implementation programme for the recommendations. The guidance tells us this must include both a timescale for implementing the opportunities and the combined costs, benefits and a payback period for carrying out the opportunities identified in the programme. In previous phases, we were always required to provide payback, which also indirectly would lead to a sort of timescale for implementation (i.e., those recommendations with no cost should take place as soon as possible, with all others coming as and when money was available to pay for them). However, now we are required to consider other elements in the suggested timescale for implementation. This could be things such as government legislation when funding becomes available or when current equipment is likely to reach end of life naturally.

The latest ESOS legislation requires Lead Assessors to discuss available funding to businesses for their energy saving projects. However, this new requirement I think would be more appropriate for the new ESOS Action Plan and Annual Progress updates that have a 12-month turnaround period, rather than a document that is issued once every 4 years. As such, unless I am aware of specific funding available at that time for a particular project, most of my recommendations around funding have been to check what is available currently via a link to a generic site listing current available grants.

CONCLUSION

I have always seen ESOS as the piece of legislation and mandatory compliance giving the most benefit to the organisation involved. Nearly all updated mandatory requirements in Phase 3, for the most part, add further value to the reports issued to the client. I have also definitely noticed that clients are far more engaged in Phase 3 than in any of the previous two phases. This is pleasing, and possibly partly down to the increase in energy costs over the past 4 years, but I genuinely think more and more companies are now wanting to reduce energy consumption, simply to be doing the right thing, with cost savings being a benefit of doing this.

Author's profile:

Sam is an ESOS Lead Assessor and approved EnCO Practitioner. He is an experienced energy project manager with a passion for sustainability, driving down energy consumption and reducing carbon emissions. He has solid experience in establishing successful sustainability strategies, managing a large utility spend, and implementing energy projects.