

Roadmap to energy efficiency:

Making British industry sustainable

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Introduction

Energy is currently a hot topic in the United Kingdom; be it in the boardroom or in parliament. Discussions about what generation method is most sustainable, how much energy should cost and how companies can reduce their usage make media headlines on a daily basis. According to the [Carbon Trust](#), offices, factories, schools and hospitals make up 18 per cent of the UK's CO₂ emissions and use 300TWh of energy every year. That amount is nearly the same as the primary energy supply of Switzerland.

Governments across the globe are considering alternative energy sources that would allow them to become self-sufficient, while some companies are engaging on a journey of their own to make operations more energy-efficient.

Putting aside a [recent price reduction](#), it's fair to say that energy costs have been steadily rising for the majority of the last two decades. As the supplies of natural resources become more and more limited, the market increasingly competitive and legislation stricter, manufacturers are starting to look for sustainable ways to reduce the amount of energy they use.

Here, industrial automation software expert COPA-DATA analyses how British industry is faring with the new generation of energy challenges and what manufacturers can do to reduce energy consumption in the long run.

Pressure and benefits of going green

Why do it?

There is an almost absurd discrepancy between how easy and rewarding it is for manufacturers to become more energy efficient and how slow most companies have been to take advantage of energy saving technology. In fact, in most cases, legal requirements and standards are the main reason companies adopt energy efficiency measures.

If you're wondering just how much your company can save by becoming more energy efficient, you might find the answer isn't always plain sailing. However, bear in mind the Carbon Trust estimates that any company could cut the energy bills of manufacturing operations by as much as 20 per cent just by implementing simple, inexpensive energy efficiency measures, such as using variable-speed drives, fixing leaks in your compressed air systems and cleaning your refrigeration condensers.

Remember, this is just the low hanging fruit. Companies that implement and maintain an energy management system can typically save another ten to 20 per cent on energy within the first five years.

Industrial automation

Automation and control are important aspects of modern manufacturing and it's fair to say that almost every business in operation today has implemented automation to some extent, even without being fully aware of it.

Industrial automation refers to the use of control systems and information technologies to handle processes and machinery in an industrial environment. The initial reason for implementing industrial automation was increasing productivity and implicitly reducing the cost associated with human operators.

As industrial automation evolved, additional advantages became obvious: the error rate in manufacturing dropped considerably, which resulted in higher quality products. Manufacturing lines also became more flexible, safer and able to provide higher information accuracy.

This final point is crucial in the energy debate. The first step of the energy efficiency journey is gathering relevant production data that will allow a company to identify where losses are happening and which processes are energy intensive. To collect and analyse the data manually would be a nightmare, but by using industrial automation systems and relevant software, the task is completed accurately in real time.

Compliance and efficiency

There are numerous ways of using energy in a more efficient manner. Legal requirements and standards are becoming increasingly strict, so companies of all sizes from across industry have started thinking about what they have to do to comply with the new generation of regulations.

Germany is one of Europe's energy efficiency pioneers and has pledged to reduce its CO₂ emissions by 40 per cent by 2020, compared to 1990. The rest of the European Union follows closely. In 2012, the Energy Efficiency Directive (EED) established a set of binding materials to help all its members secure a 20 per cent cut in energy usage by 2020. To achieve the target, each European country was meant to transpose the Directive's provisions in its own national laws and standards by June 2014.

In the UK, the Energy Efficiency Directive was implemented with the help of the Energy Savings Opportunities Scheme (ESOS). 2015 is a crucial year for the project because it marks the first official deadline.

Energy Savings Opportunities Scheme (ESOS)

What should you do?

ESOS was established by the Department of Energy and Climate Change (DECC) to implement Article 8 of the EED. The scheme is expected to result in £1.6bn net benefits to the UK, the majority of which will come from energy savings.

ESOS is all about introducing a programme of regular energy audits for 'large enterprises'.

Do I qualify?

A large enterprise is defined by ESOS as an organisation that employs at least 250 people or has an annual turnover in excess of €50 million. Companies that met these requirements before the cut-off date, December 31, 2014, are obligated to comply with the regulation. Businesses that haven't yet reached these thresholds are also encouraged to undertake energy audits and perform proactive energy management.

If you've decided that you qualify as an ESOS participant, the next step is to complete an ESOS assessment of your organisation. Before doing so, it's important to check whether your company has an ISO 50001 Energy Management System confirmed by an approved certification body.

If your company does have ISO 50001, you'll probably be aware of it, but it's worth checking again. The great news is that ISO 50001-certified companies don't need to perform any additional energy audits, although they do still need to notify the Environmental Agency of their ESOS compliance.

Measuring energy consumption

For companies who are not ISO 50001-certified, the procedure is fairly straightforward and only involves five simple steps.

First of all, the company needs to measure its total energy consumption across a twelve month period, known as 'the reference period'. It's important that the reference period overlap with the qualification date.

When deciding how to measure energy consumption, bear in mind any existing meters or monitoring systems you have in place. To provide a complete picture, energy consumption needs to include buildings, transport and industrial processes.

Energy consumption can be calculated in energy units, kilowatt hours for example, or in expenditure terms, as long as the unit of measurement is consistent.

At this point, you might be asking yourself what exactly is covered by the term 'energy'. According to ESOS, energy consumption includes all energy products, electricity, combustible fuels, heat, renewable energy and any other form of energy.

It is during this initial evaluation stage that every company also has to appoint a Lead Assessor and make him known to the Environment Agency when reporting compliance. The Lead Assessor can be either an in-house expert or external individual who coordinates the project.

When selecting a Lead Assessor, companies should consider any sector-specific experience, familiarity with the industry and technology and experience in auditing against prescribed standards like ISO. The Lead Assessor will have several responsibilities including agreeing on audit methodology, time table and sampling, identifying or calculating energy saving opportunities, presenting recommendations and maintaining an ESOS Evidence Pack to substantiate the audit(s) and its findings.

Areas of significant consumption

The second step is to determine the areas and processes that correspond to significant energy consumption. Just as a guideline, these areas should account for at least 90 per cent of your total energy consumption.

A company can exclude up to ten per cent of energy consumption from the ESOS audit by allocating it to de minimis. This rule ensures more flexibility and fewer costs for companies who want to exclude areas that consume less energy from their audits.

Routes to compliance

The third stage is to decide what routes to compliance you can use to cover your areas of significant energy consumption. At the moment, there are four types of energy management accepted by ESOS.

ESOS energy audits can include any energy audit undertaken during the compliance period under other schemes like the Carbon Trust Standard or Green Fleet reviews, as long as it meets the minimum standards required by ESOS. The other three options are ISO 50001 certified Energy Management Systems (EnMS), Display Energy Certificates (DECs) and Green Deal Assessments.

ESOS is relatively flexible when it comes to compliance. It is compatible with a variety of different standards and assessments – the aim isn't to get large enterprises to perform a new generation of costly energy audits, but to get companies that currently don't have energy management in place to do the bare minimum to become more energy efficient.

To cover all areas of significant energy consumption, companies will sometimes need to use a combination of compliance routes. For example, although your buildings and industrial processes might be covered by ISO 50001, your transport may not, in which case you could use an ESOS energy audit to address it.

It's important for Lead Assessors to be involved in this stage and ensure the routes chosen meet the minimum ESOS standards. The bottom requirements are to provide twelve months of energy consumption data for the initial audit, generating new data for each compliance period. It is also essential to produce cost-effective recommendations for audited areas, overseen or reviewed by an ESOS Lead Assessor.

Auditing and reporting

The fourth step is to actually carry out the audits for all areas of significant energy consumption, as agreed with your Lead Assessor. Examples of cost-effective energy efficiency improvements that ESOS Energy Audits often identify include installing smart meters and more advanced energy monitoring tools, maintenance improvements, replacing travelling with videoconferencing, capital investment projects and organisational culture changes.

This is where companies that are just beginning to improve energy efficiency can benefit most. Common energy saving opportunities include areas like heating, ventilation, lighting, building control, refrigeration, motors and drives, fuel consumption, routeing and scheduling and awareness campaigns.

The fifth and final step is to report your ESOS compliance to the Environment Agency before December 5, 2015. After this date, regular audits need to be performed and submitted to the EA every four years.

Additional compliance activities

During the first ESOS audit, every company has to compile an ESOS Evidence Pack, which should be updated during every new evaluation. The pack should include the details of the Lead Assessor, responsible board-level director that will sign-off ESOS compliance, the company's total energy consumption, identified areas of significant energy consumption, routes to compliance, details of audit methodology and any justifications, when available.

The ESOS Evidence Pack is meant to be constantly updated and used for continuous improvement of energy consumption. Benchmarking can be used to compare sites or activities during different timelines, route optimisation, energy use per employee and much more.

ESOS penalties

The ESOS scheme compliance bodies can apply civil penalties to companies that are meant to comply with the scheme, but don't. Non-compliance can be made public, while failure to notify the Scheme Administrator of compliance by the required date results in a fixed penalty of up to £5,000 and an additional £500 for each day of delays, subject to a maximum of 80 days.

Similar fines will be issued for failure to maintain adequate records, while a monetary penalty of up to £50,000 will be applied to companies that make false or misleading statements.

ESOS will clearly change the way large enterprises look at energy consumption. The scheme's flexibility is meant to help companies use any accreditations or processes they might already have in place to prove ESOS compliance, while the fines are meant to reinforce the programme. The ultimate aim is to make large enterprises in the UK more eco-friendly and sustainable.

One particular voluntary certification that is perfectly compatible with ESOS is ISO 50001, which certifies the Energy Management System of a

company and confirms the organisation's commitment to continuous improvement of energy use.

ISO 50001

The ESOS scheme is now mandatory for large UK enterprises. However, smaller companies that want to reap the benefits of energy efficiency or large firms that want to go beyond compliance can implement ISO 50001. The standard is applicable regardless of the size and industry of the company.

As opposed to the ESOS scheme, which is only applicable and relevant within the EU, ISO 50001 is recognised internationally. COPA-DATA used Google search statistics to see which countries showed the most interest in energy management and ISO 50001.

The International Standard Organisation (ISO) estimated ISO 50001 could influence up to 60 per cent of the world's energy use. The novelty of the scheme comes from its specific purpose – enabling organisations to establish the systems and processes necessary to improve energy performance, efficiency, use and consumption. The ultimate aim is reducing the greenhouse gas emissions, environmental impact and energy costs of organisations.

When a company embarks on an ISO 50001 journey, its success depends on the commitment of all levels and functions within the organisation, especially top management.

The core principle of ISO 50001 is its 'Plan-Do-Check-Act' (PDCA) continual improvement framework.

Planning refers to conducting an energy review or audit, similar to the ESOS audits. A company must establish the baseline, energy performance indicators (EnPIs), energy objectives and targets, as well as its action plans.

The 'Do' step refers to implementing the energy management action plans, while the 'Check' stage includes monitoring and measuring processes that determine energy performance and checking the data against the energy policy and objectives. The final step, 'Act', involves taking actions to continually improve energy performance and the EnMS.

Even more so than ESOS, ISO 50001's PDCA mentality means the improvement process is continuous. Every change in processes must be

monitored and evaluated. If the results show a long-term reduction in energy, the change becomes the norm until the next evaluation. This corporate culture makes companies more flexible and more energy-focussed.

Energy Management Systems (EnMS)

So what exactly is an EnMS and how can it make companies more energy efficient? In a nutshell, it's a set of related elements contributing to an energy policy or leading to energy objectives. Processes and procedures that help a company set and achieve its energy objectives are also part of the EnMS.

To truly reduce energy consumption, companies should implement an energy management system that allows them to analyse the energy use across activities and sites, using relevant measurement data. This is where an Energy Data Management System (EDMS) comes in.

A prerequisite of energy efficiency is the automated collection, compression and analysis of valid, relevant data from various sources, using an EDMS. The system should also be able to automatically generate valid reports that become the basis for remedial action in the energy system.

Industrial automation systems help companies extract data from production lines in real-time, which means it's easier for energy managers to identify where the company uses most energy and where the potential savings are.

An EDMS is usually integrated into the control system of the production line. To gather energy consumption data for different processes, the control system is usually able to communicate with drives and interfaces. This means that on a production level, the relevant drives need to be able to communicate with the programmable logic controllers (PLCs).

One of the main characteristics of industrial automation is the variety of products used within just one system. Any one production facility usually integrates numerous generations of sensors, drives and meters produced by different original equipment manufacturers (OEMs). Because of this diversity it's often difficult to collect, archive and analyse sets of data.

Fortunately, open systems that connect all kinds of drives and meters are already available for companies that want to implement a reliable EDMS.

Choosing the right EDMS

Identifying the most appropriate EDMS solution for a company can be difficult, but luckily, there are a few characteristics that are crucial, regardless of the company size or its field of activity.

Before anything else, an EDMS must be easy to implement in a functioning system without causing any costly downtime or production disruptions.

A good EDMS should also be open, meaning able to collect and process data from the entire equipment infrastructure in a seamless way. COPA-DATA's zenon, for example, has more than 300 communication protocols, covering all the important standards, right up to individual drivers. This means users can request targeted queries from any sensor, meter, measuring device or machinery.

An integrated EDMS needs to be able to connect to a wide range of data sources, software, integrated automation and IT architectures including process control, utilities and building automation systems. For example, technology built into machines - like pumps, motors or heating systems - directly influences the amount of energy consumed. An EDMS can run a diagnosis during non-productive time.

Secondly, an EDMS must be scalable. As the company grows, the system should allow the seamless integration of new devices or machines. It should also allow the simple creation of new reports and straightforward addition of new users.

Because zenon can be integrated with Industry 4.0 and big data or cloud technologies, it is even more future-proof than other systems. To achieve ISO 50001, an EDMS also has to consider the entire company, from office buildings to transport as well as the production line.

Another important feature is flexibility when it comes to the reporting function of an EDMS. The ability to generate immediate reports according to the user's needs is crucial. Displaying information in a clear way carries a lot of weight. zenon Supervisor and zenon Analyzer for example can display data in the form of key performance indicators, energy analyses, trend curves, events, alarms, or complex graphical reports.

The ability to access historical data easily is also crucial because it helps managers make energy-saving decisions. In addition, easy access to performance indicators and reports should be available directly at the HMI, on a PC, tablet or mobile.

Finally, the system has to be secure and allow several user verifications without becoming tedious.

Regardless of whether it is used for mandatory compliance schemes like ESOS or more advanced energy efficiency standards like ISO 50001, a reliable EDMS is crucial for companies that want to reduce their energy usage. An EDMS can help the entire team, from machine operators up to the CEO to better understand a company's energy consumption, maintain records and make decisions concerning energy usage.

This brings us to a final point about embarking on an energy-saving journey – the people. Energy management initiatives will only succeed if all the relevant team members are on board and understand what the company wants to achieve. Without ownership and vision, even the most advanced EDMS can only have limited impact on energy consumption.

Conclusion

Looking at the current international climate, it's clear that mandatory environmental requirements and industry standards are becoming more and more rigorous and the pressure to conform is always increasing. Now is the best time for companies to make a move and turn energy efficiency into a competitive advantage while they still can.

Easy wins are important, but they won't get you very far. Long term energy efficiency can't be achieved without an energy management system. Regardless of whether a company is just trying to comply with schemes like ESOS or gain an ISO 50001 certification, COPA-DATA predicts it won't be long before EMDS becomes a requirement in European countries. The good news is that in our experience, the original investment can often be recovered in the first year. The other good news is that help is never too far away.

To find out more about how to start your journey in energy efficiency, contact COPA-DATA UK experts on sales@copadata.co.uk or by phone on +44 (0) 1925 207 007.



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