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Energy management: the foremost challenge for facilities managers

With energy costs persistently rising, continuing concerns over resilient energy supplies, and increasing levels of statutory obligations connected to emissions and climate change policies, facilities managers and their colleagues will have to face many energy management challenges. Authors Cameron Steel and Andy Lewry discuss how facilities managers can prepare for these challenges.

How energy management is undertaken, with its associated responsibilities and roles, can vary depending on the type of organisation and on the lifecycle of the installation. Larger estates and corporations, for instance, will have a duty-holder with a clearly defined role for managing energy. However, within smaller companies it is typically the case that energy management will fall into the facility manager's or other professional's role as an additional responsibility.

For successful outcomes, coordination within the different parts of the business is crucial. To keep overhead costs down an energy manager may be tempted to turn the lights and equipment off wherever possible. However, for a business to operate successfully, it is essential to provide staff with conditions that promote efficient and effective working practices. Such dilemmas are not uncommon in most businesses but short-sighted cost cutting should not be allowed to prevail as this will affect productivity and profits.

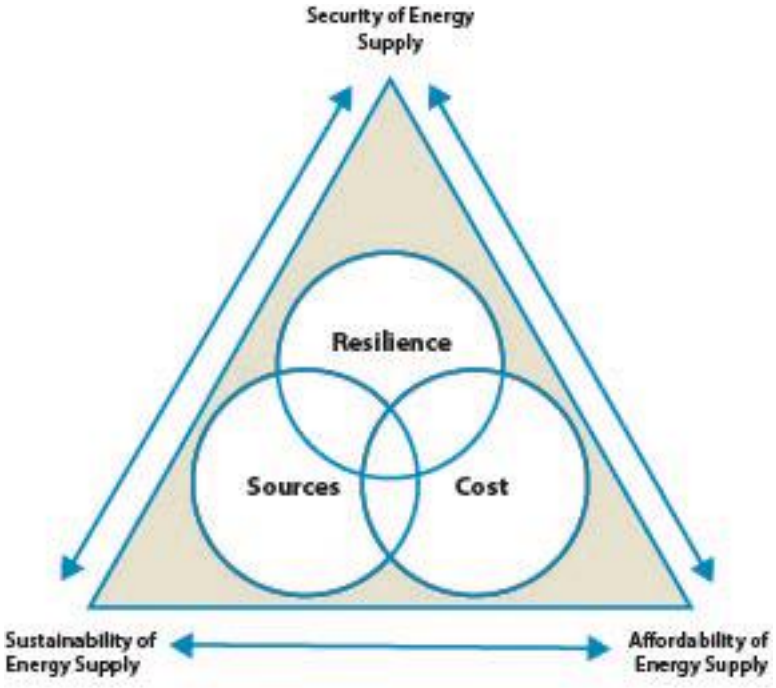


Figure 1 *Energy trilemma - reproduced from the IET's* Guide to Energy Management

Despite the complexity of some of the issues involved, doing nothing and carrying on as normal – typically classified as 'business as usual'– is not an option when considering energy

management. Rising energy prices and security of supply now pose major risks to business and need to be managed. So, what exactly are the challenges that need to be overcome?

Energy management: the challenges

Ownership

Who actually owns the problem of energy management? Who is driving the agenda and why do they need to?

An organisation must have a plan to effectively address any challenges that might be encountered. Sometimes these plans are driven by compliance – to meet statutory requirements and adhere to policies, for instance, health and safety, environmental management, and equal opportunities policies.

Like each of these issues, increasing levels of legislation governing energy consumption, reporting mechanisms and the need for business efficiency mean that facilities managers should acknowledge that energy management also needs similar levels of ownership and responsibility throughout the organisation – from board level to the shop floor. In addition, visitors also need to understand how to play their part in reducing unnecessary use of energy. The strategy and plan need active boardroom support or the initiative will stall at the technical level and not result in organisational culture change. The aim should be to ensure that the strategy is embedded in the management practices and becomes the 'new' 'business as usual'.

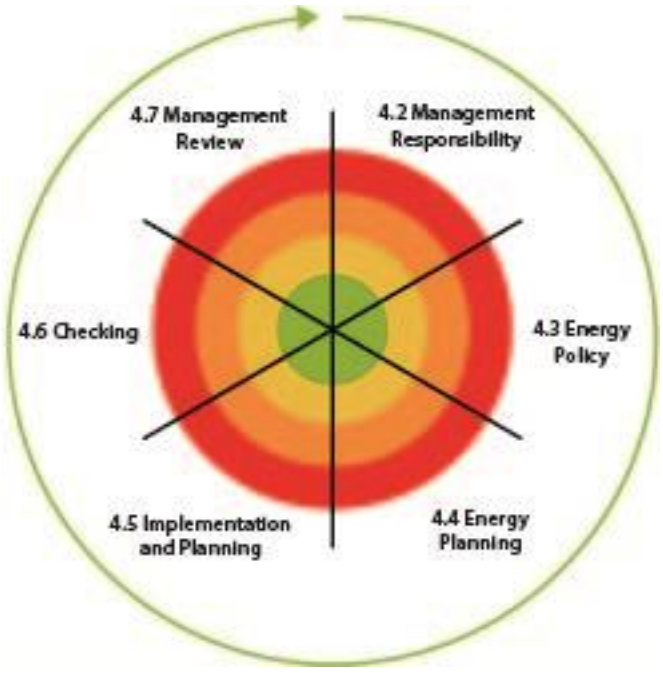


Figure 2 – The components of the continuous process of ISO 50001 that are an integral part of a much wider picture – reproduced from the IET's Guide to Energy Management

System

For energy management to succeed there must be a process-driven system to facilitate change supported by technology that closely assesses what, where, why and how the energy is used. Careful monitoring and analysis will identify areas and opportunities for improvement.

The international standard ISO 50001 – *Energy Management* provides a framework for an energy management system using the universal model of 'plan, do, check, act' that is often adapted to manage improvements in the engineering world.

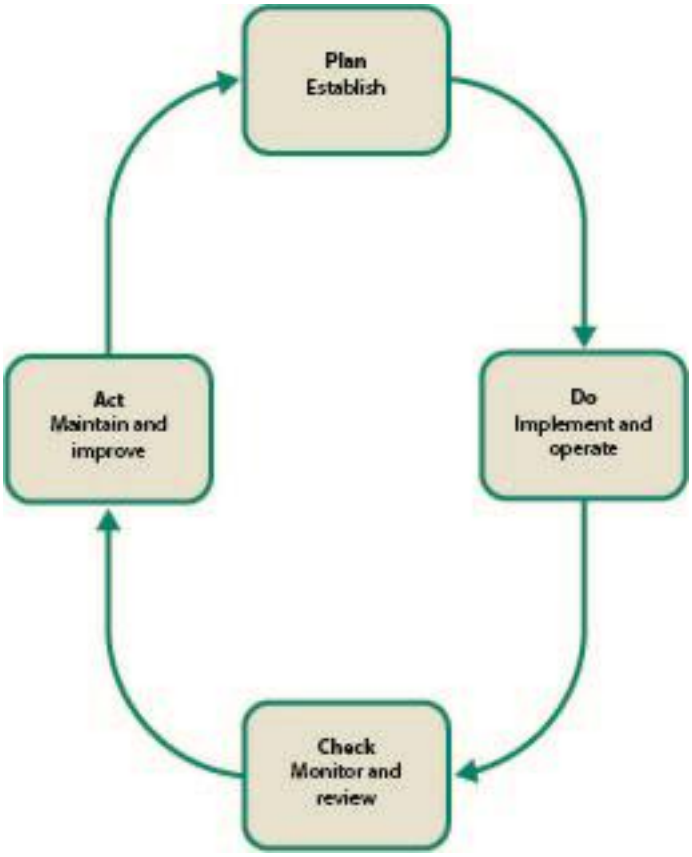


Figure 3 – Plan, Do, Check, Act cycle – reproduced from the IET's Guide to Energy Management

However, facilities managers need to be aware that there is no single solution. A robust energy management system should:

(a) have appropriate policies in place and include processes that employ a wide variety of tools, all of which have been adapted for the local needs of the business;
(b) reflect strategic direction;
(c) include procedures that make the best use of resources;
(d) have clear aims and objectives that are quantifiable and are 'SMART' in nature; and
(e) be flexible enough so that it is adaptable in response to changes in use, changes to the overall size of the estate, or changes to occupancy.

However, it is important to recognise that any changes need careful recording so that data can be compared and realistically analysed.

Energy sources

What sources of energy is the installation actually connected to? Is the capacity large enough? Is the business about to grow with demands that are greater than the local infrastructure can provide?

The sources of energy that an organisation uses will depend very much on where they are located, the availability of grid connections and what the particular needs of the organisation are. Costs will vary too depending on the size of supply required, both in terms of average and peak loads. Legislation changes mean that there are increasing challenges in understanding what the commodity prices are, what the legislative costs are and what scope there is for influencing any of it through careful energy management, and therefore reducing energy costs as an overhead to the organisation's activities.

Local renewable energy sources are increasingly being deployed. These can assist with reducing the costs of importing energy to a site but they do bring their own strategic issues, such as storage, consistency and resilience, in addition to ensuring there is adequate cover during essential maintenance periods.

An energy management strategy needs to be carefully linked to the overall business strategy so that it does not become a constraint; after all "process is king" and this activity should support good business practice.

User behaviour

Spending a fortune on energy saving equipment and associated controls technology may well save energy, but are there quicker wins to be had? Could the technological investment be undermined by the activities of the occupants? People are energy management's biggest and best resource, but if badly managed can also be the biggest obstacle. Technology is only an enabler and for energy management to really work the management and staff need to be on-board.

Within any space, environment or building, modifying the behaviour of occupants with respect to the use, and potential wastage, of energy is generally recognised as the quickest way to reduce energy consumption. It does not really matter if the technology in your estate is old and tired or brand new and state of the art. Where the working culture is to override controls and leave the lights on even when they are not required, then energy will be wasted. It must be recognised that this is not the staff's fault; all they want is a comfortable working environment and this has been shown to lead to staff productivity being maximised. The aim is to provide that environment and not just turn off systems to cut energy usage.

Site induction, education, training, feedback and updates will all assist. Directors should champion energy management and the associated initiatives; managers should own the procedures; and users should be incentivised. The challenge in reducing energy demand is keeping people engaged in the drive to keep reducing energy consumption while maintaining an environment that allows the business to prosper.

Measures for achieving good energy management

So, what technologies should be applied and where? Are your buildings the energy equivalent of a sieve trying to hold water?

Passive measures – design and building fabric

Modern building designs are governed by regulatory parameters (for example, UK Building Regulations and similar design criteria); these have back stop values for the thermal performance of building elements (u-values) and the efficiency of HVAC and lighting. However, the building needs to reach an overall building energy performance that can be achieved by passive design, and the use of low carbon technologies and renewables.

On older structures this is not always as straightforward. To reduce energy demand, one of the main challenges then becomes dealing with the building fabric and its constituent elements. Although building science dictates that the fabric should be dealt with first, the economics don't usually add up unless you have already planned an upgrade and all you're doing is upping the specification – this is normally a comfort decision (i.e. maintaining the working environment) or protecting the asset. Both are a legitimate part of the business case as they ensure the value of the asset and, if rented out, maintain rental values and reduce void times. If the project is standalone often the only cost effective measures are controls and pipe insulation. Plant comes into the picture only if it is at the end of its service life or an upgrade is planned.

A holistic approach to refurbishment is always advisable where all measures that will contribute to successful energy reduction are considered together, but be wary of creating other problems through ill-conceived initiatives.

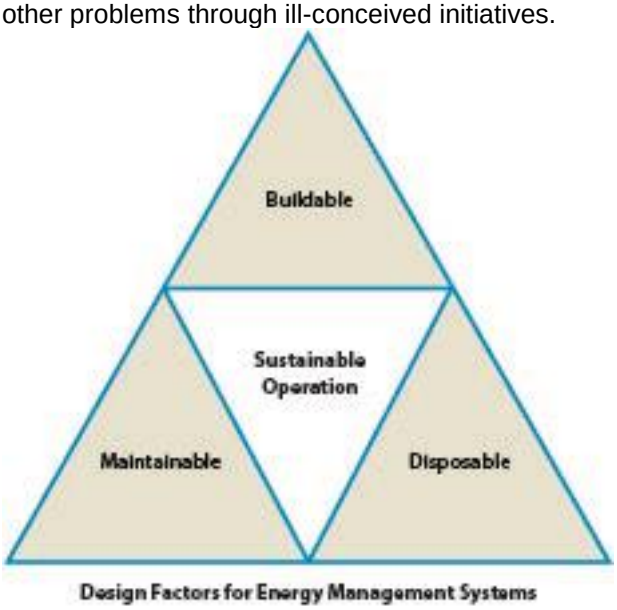


Figure 4 – Design factors for energy management systems – reproduced from the IET's Guide to Energy Management

Active measures

If the occupants are continually demonstrating poor user behaviour – for example, opening windows and using portable heaters – this is usually a sign of a poorly controlled building. The environment required is not being provided so what measures can be applied? Controls are normally the answer – but is the deployment of automated controls actually appropriate? The choice depends on the functionality required and whether there is requirement to provide manual overrides.

Again, regulatory parameters and national and international standards drive modern building designs towards the use of energy-saving technology and controls. The complexity of this approach will vary according to needs and budgets. Sustainability design tools such as the Building Research Establishment Environmental Assessment Method (BREEAM) will help shape new installations and refurbishment projects, but care needs to be taken that 'green' boxes are not simply ticked off. Consideration also needs to be made on user requirements, installation operation, potential maintenance issues, user interfaces and whole-life performance. Get any of these wrong and the expensive technology, designed to save energy, will simply not work in the manner envisaged on the design table – this is part of the so-called 'performance gap'. Another possible downfall might arise if the operation, maintenance and commissioning issues are not considered. A proper assessment of the anticipated use of the installation and the holistic approach is vital; this can be completed using assessment methodologies such as BREEAM-In-Use

Challenges will also exist on retrospectively installing new technology within older buildings and on older infrastructures. It is important to ensure that the implementation of technology in a particular installation, often as a replacement for legacy, is an appropriate use of resources. The impact of new technology, such as variable speed drives, may reduce energy consumption at the point of use, but it could lead to other problems on a 40-50 year old electrical switchboard or cabling infrastructure.

When undertaking this assessment, looking at the whole installation is vital. Another consideration may be to ask whether all the required passive measures are in place before the active measures are taken. Although replacing the building's ancient cast iron central heating boiler if there is a double height single-glazed atrium losing heat from the building is not logical in engineering terms; economics and/or the practicalities of the fabric solution may favour the installation of new plant and controls.

Checks and balances

How can you ensure that the measures already taken are actually working to justify the initial investment? What else should be done? Where are the priorities?

Without monitoring and analysing both the existing situation and the feedback that informs any subsequent improvements, a management plan will fail. Energy management, though, needs to be seen as more than just checking the meters and correlating the bills; although this may be essential to initially sell the philosophy and to generate subsequent savings.

Proactive processes to check meter readings and to observe the general patterns of use and operational energy consumption trends will help to highlight problem areas and any unusual energy activity or specific events. Ideally this should be done in real time if possible or very soon afterwards. If it is available, analysis of half-hourly readings, that document electrical energy consumption in more detail, can highlight wasted overnight energy or controls that

bring on heating too early in the working day. Spikes in the daily usage are also indicative of poor control and/or a failing plant.

Regular energy audit processes, using recognised methods, can highlight particular areas for improvement. These should be used to influence user behaviour and to implement passive measures, active measures or better working processes. The consumption of energy should not simply be accepted as it is – it needs to be challenged and improved where possible in a successful and robust energy management system.

Procurement

Procurement, as part of an energy management system, is often a challenge to get right and finance departments will always be looking to achieve best value for money. There are also many facets to getting procurement activities correct and high peak loads are expensive and need to be considered to be as important as the average usage. There are also penalty charges to be considered, which are imposed when you exceed these limits. Estimation of usage need to take into account usage patterns and the growth of the business while still minimising risk over the period of the contract.

The most immediate challenge might be choosing an energy supplier and getting the correct tariff. Trying to compare different energy suppliers and their respective tariffs to ensure the best deal can be bewildering. Matching the tariff to the business load profile can be difficult and estimating future needs may require outside expert help.

As energy management systems develop, and projects that will save energy are identified, further procurement challenges are likely to relate to ensuring that the best solution is purchased, whether that be user focused (such as training) or a technology offering. Enthusiastic sales representatives may focus only on their particular product or service, whilst not necessarily looking holistically at the overall installation and how it is used. Taking a short-term view or cut-price approach, i.e. value engineering, is normally a false economy.

Low-cost projects may save proportionately more energy than more expensive projects and may be easier to justify in terms of payback times to keep the finance department happy. However, sometimes an organisation may need to bite the bullet and invest heavily in energy management projects. Also, no-cost or low-cost solutions such as behaviour changes are not silver bullets or single-shot solutions; they need to be continuously reinforced or the working culture will slip back to its previous state and savings will eventually be lost.

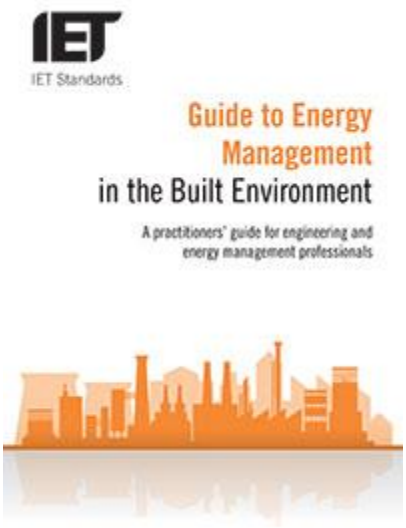
Conclusion

The reality is that the business may not always prioritise investment in energy saving measures. Such projects do cost money and may not provide obvious returns on the money invested. The business case needs to be robust and take into account reduced maintenance and increased productivity. Such factors will minimise risk to the owners by protecting the asset and, if the building is rented out, ensuring high rental values and low void times. From a commercial perspective, if the building is owner occupied, it may be tempting to invest the same amount of money in direct business, ignoring the subsequent waste of more energy, but in turn potentially generating more profit for the business.

However, proper planning and implementation of energy management systems provides real benefits to the wellbeing of staff and visitors, to an organisation’s profitability, and to the organisation’s environmental credentials.

The duties and responsibilities related to energy management are constantly evolving. Keeping the challenges in perspective requires professional advice and guidance. The principal aspects of standards such as ISO 50001 will apply to all installations, but other publications can provide more detail on specific areas, such as the built environment. These publications should assist the reader to understand the context of their own estates and adapt best practice processes to reduce the consumption of energy in a meaningful way.

Further reading



The IET *Guide to Energy Management* has been developed for those with specific or delegated responsibility for managing the procurement, consumption and control of energy. The Guide provides tools to assist energy managers and engineering staff to understand their own particular processes and responsibilities and the correlation between their respective duties. The Guide provides more detail about the framework required for successful energy management processes, the importance of better coordination with engineering design and also the interface activities with engineering maintenance throughout the life cycle of the installation or estate.

The aim of the Building Research Establishment Environmental Assessment Method (BREEAM) is to inspire developers and creators to excel, innovate and make effective use of resources at the design, refurbishment and operational stages.

ISO 50001 - *Energy management* is the international standard that supports organisations in all sectors to use energy more efficiently through the development of an energy management system (EnMS).