UK Government

UK-ASEAN
ENERGY EFFICIENCY ACCELERATOR

Energy efficiency guidance for the food & beverage sector

Setting up an Energy Management System: best practice from ISO 50001

CARBON TRUST

EY Building a better working world

iMC worldwide

Energy efficiency guidance for the food & beverage sector

Implementing an energy management system (EnMS) in line with ISO 50001 can help organisations to better control their energy usage and consumption. Following a systematic approach towards energy management can help to achieve the continual improvement of energy performance.

What is ISO 50001?

ISO 50001 (full title: ISO 50001 : 2018 – Energy management systems – Requirements with guidance for use) is an international standard published by ISO (the International Organization for Standardization). Initially published in 2011 it is now in its second edition.

The standard provides requirements for how to implement an energy management system, designed to facilitate the continual improvement of energy performance. It can be used by any organisation of any size and in any sector.

It is designed so that its use can be integrated with other management system standards (e.g. ISO 9001 the international standard for quality management systems or ISO 14001 the international standard for environmental management systems).

What is a Management System?

A management system is a set of policies, processes, procedures, etc. that an organisation needs to follow in order to meet its objectives.

In some small organisations the management system might not need to be formally documented, just "our way of doing things" as known and practiced by staff. However, the larger the organisation is the more likely that processes need to be documented to ensure clarity on how they are conducted and by whom.

Organisations can operate a single "integrated management system" (IMS) that can meet the requirements of two or more management system standards.

The Plan-Do-Check-Act cycle

All management systems follow the Plan-Do-Check-Act (PDCA) continual improvement framework:

Plan

Establish what needs to be achieved and organise resources

Do

Implement the processes

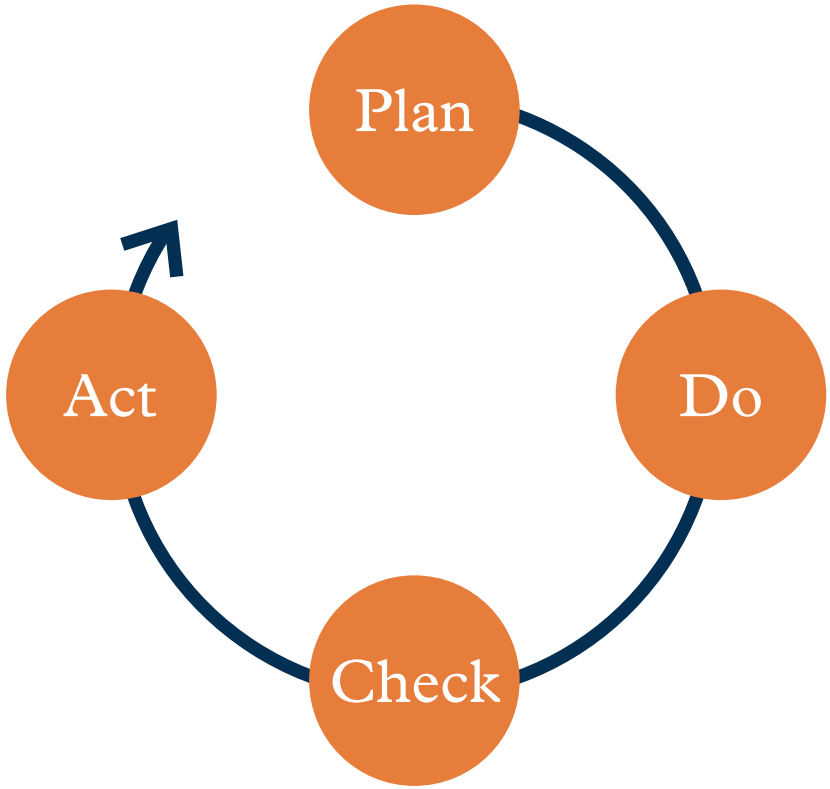
Check

Monitor and measure the processes and their outputs

Act

Respond to findings from the checking activities in order to improve

By following the PDCA framework, and ensuring that the various elements link into each other in a cyclical manner, an organisation can ensure that they continually improve the effectiveness of their management system.



ISO 50001 – requirements overview

SO 50001 is structured into ten clauses, as follows:

1. **Scope**
2. **Normative References**
3. **Terms and definitions**
4. **Context of the organization**
5. **Leadership**
6. **Planning**
7. **Support**
8. **Operation**
9. **Performance evaluation**
10. **Improvement**

Clauses 1 to 3 provide supporting information to the users of the standard, whilst clauses 4 to 10 detail the specific requirements that an organisation needs to follow in order to conform to the standard and implement an EnMS.

Initial steps

Before starting the implementation of your EnMS, follow the below steps in order to ensure that the implementation process goes smoothly.

Obtain a copy of the standard

In order to ensure that you have fully understood and met the requirements of the ISO 50001 standard it is a vital, but sometimes surprisingly overlooked step, to obtain a copy of the standard itself. The standard can be purchased directly from ISO themselves, or from the relevant national standards body in your country. A list of national standards bodies is available via the ISO website.

Identify your aims for energy management

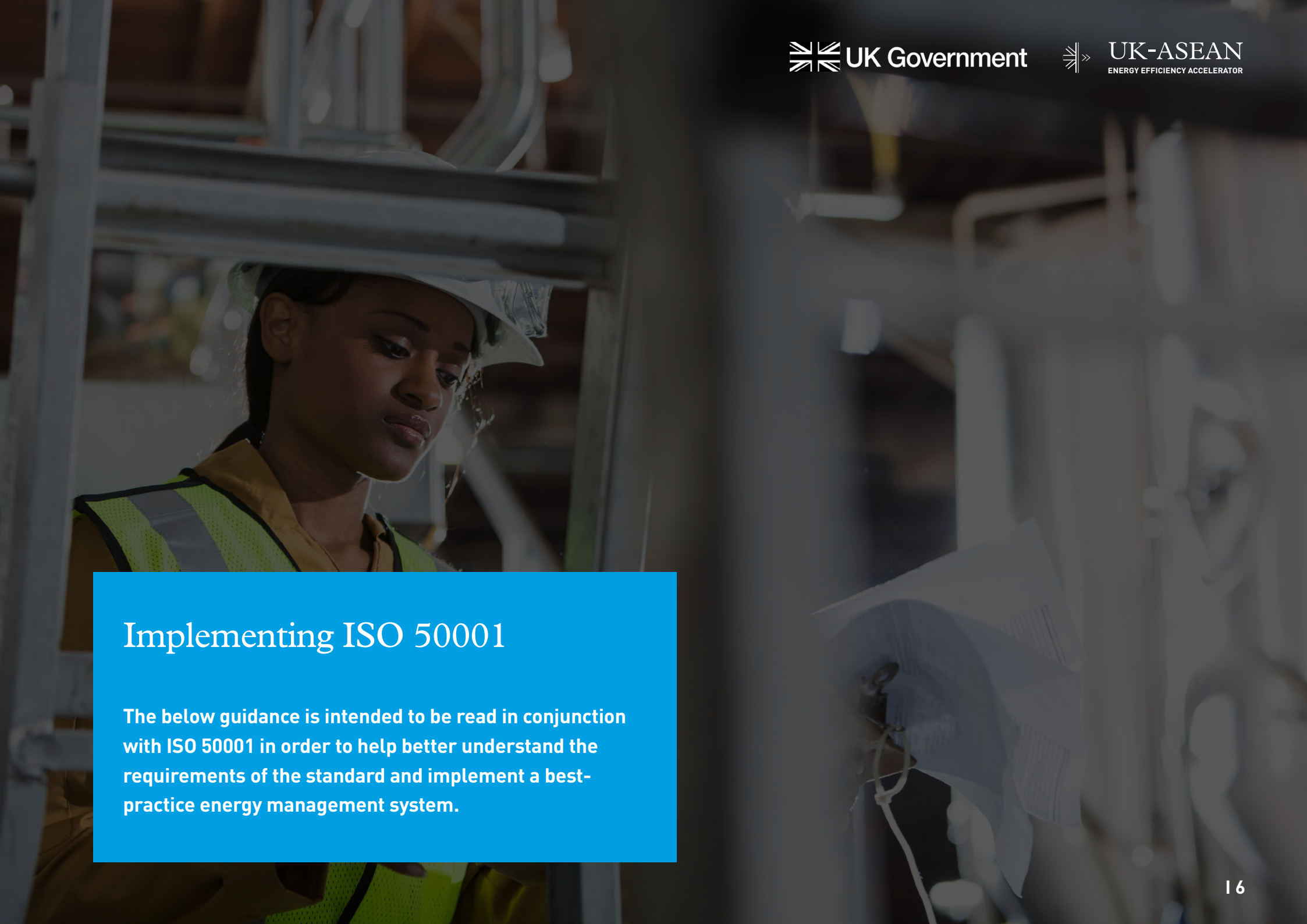
Before setting out to implement an EnMS it is important to identify what the organisation intends to achieve by doing so, including how ambitious it wants to be with regards to improving its energy performance.

Prepare the business case

Implementing an EnMS requires resources, including human and financial, however these are typically offset many times over by the cost savings and increases in efficiencies that improved energy performance brings. The organisation should look to research the potential savings it could achieve and make a business case for securing the resources necessary to implement ISO 50001.

Gain Top Management commitment

Once a business case has been prepared, approval and commitment from top management should be obtained. An ISO 50001-conforming EnMS cannot be implemented without the involvement of top management so it's important to obtain their buy-in at the start of the implementation process.



UK Government

UK-ASEAN
ENERGY EFFICIENCY ACCELERATOR

Implementing ISO 50001

The below guidance is intended to be read in conjunction with ISO 50001 in order to help better understand the requirements of the standard and implement a best-practice energy management system.

4. Context of the organisation

4.1 Understanding the organisation and its context

In order to implement an EnMS an organisation needs to understand both itself and the internal and external issues that affect it (its context). This understanding then needs to be used in the implementation of the system (see clause 6 Planning).

Below are illustrative examples of how an organisation could look to identify the types of issues (non-exhaustive) that may need to be considered:

Issue	Issue type	Issue type detail	Considerations for implementation
Staff demographics	Internal	Staff employed come from a variety of backgrounds and speak a number of different languages.	Copies of key EnMS documentation (policies, procedures, communications, etc.) may need to be provided in multiple languages.
Capacity and capability	Internal	There is limited internal capabilities with regards to energy management and management system operation.	Additional resource (either a new internal hire or an external consultant) may need to be obtained.
Market demands	External	Target export markets have strong demands for goods manufactured by organisations with strong environmental credentials.	Improve environmental performance through energy-management in order to gain entry to new target export markets.
Competition	External	Major competitors are attracting new investors through improving financial position via improved energy management.	Aims for energy management to include securing financial position to better compete with competitors.

Other potential internal and external issues can relate to:

Internal issues:

- Governance and structure
- Policies
- Strategic direction
- Capacity and capability
- Contractual relationships
- Culture
- Energy management maturity
- Sustainability considerations

External issues

- Political
- Economic
- Financial
- Competition
- Social
- Cultural
- Market and public demand
- Natural (e.g. weather, effects of climate change)
- Restrictions or limitations on energy supply, security and reliability

4.2 Understanding the needs and expectations of interested parties

ISO 50001 requires you to identify the persons, both internal and external, who have an interest in your energy management, determine what their needs and expectations are, and determine which of these you need to take action within the EnMS to address (see clause 6 Planning).

Examples of interested parties can include:

- **Employees**
- **Customers**
- **Investors**
- **Regulatory bodies**
- **Neighbours**
- **Trade / industry bodies**

Needs and expectations should include matters that are formally communicated (e.g. a written request from a parent organisation for the provision of energy data) and also those that are generally implied (e.g. an investor expecting an organisation to improve their financial position via improved energy management).

Included amongst the relevant needs and expectations is the need to comply with relevant legal requirements (e.g. requirements arising from legislation, regulation, etc.) and other requirements (e.g. contractual requirements, customer agreements, mandates from parent companies, etc.) related to energy use and consumption.

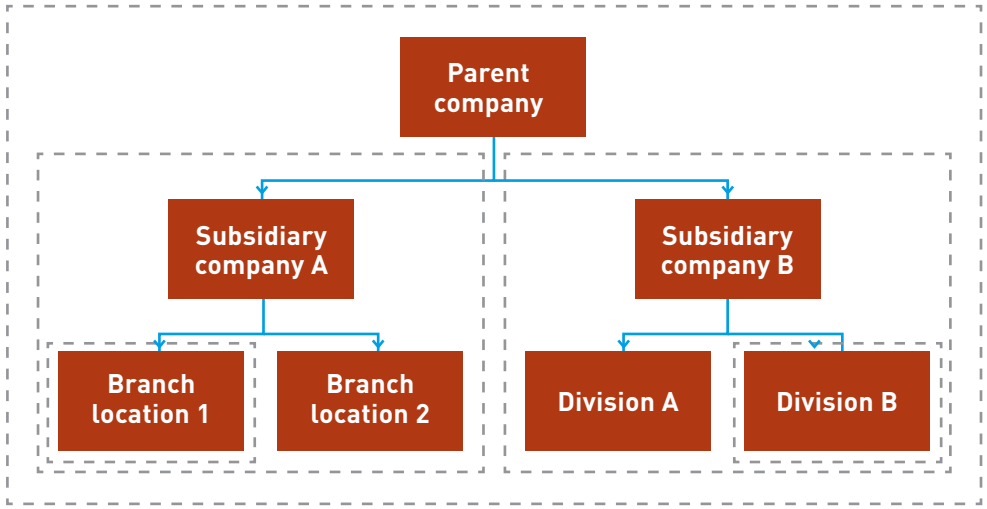
Organisations need to identify these requirements and ensure they establish processes within their EnMS to ensure compliance.

4.3 Determining the scope of the energy management system

Each organisation needs to define the scope (activities) and boundaries (physical locations) that their EnMS will cover. It is entirely up to you to decide what your EnMS covers, but once decided you must include all energy consumed by the relevant activities at the relevant locations – you can't exclude specific types of energy from the EnMS.

If you have multiple sites or activities then the EnMS doesn't need to cover all of them. This can be advantageous if some sites or divisions are more energy-intensive than others, or if it would be beneficial to roll the system out in stages.

The below figure illustrates possible different ways of establishing the scope and boundaries of an EnMS around a complex organisation:



Scope and boundary possibilities (not exhaustive)

4.4 Energy management system

This clause requires organisations to ensure that they implement, work to and continually improve their EnMS, and also continually improve their energy performance.

It is important to note that what energy performance means is for the organisation to determine the intended outcomes of the EnMS (i.e. what the organisation wants to achieve with the management system), and is linked to clause 9.1 Monitoring, measurement, analysis and evaluation of energy performance and the EnMS.

As such improvement in energy performance could be achieved via measures such as:

- Reducing total energy consumption over time;
- Reducing energy consumption over time relative to productivity (e.g. per tonne of product or by turnover);
- Improvement in performance determined via a statistical model (e.g. a model considering the expected decrease in performance over time owing to aging equipment); etc.

5. Leadership

5.1. Leadership and commitment

To ensure that the energy management system is provided with the support and resources that it needs to achieve its aims, it is vital that leadership and commitment from top management is secured.

Top management is the person or people within the organisation (relative to the scope and boundaries established in clause 4.3) who control and direct it at the highest level. This could be the person at the very top of the organisation (e.g. the President, Chief Executive Officer or Managing Director) or the Board of Directors as a whole.

The ways in which top management can demonstrate leadership and commitment, in line with the requirements of the standard, can include (amongst others):

- Decision making regarding energy-related matters;
- Providing resources (people, finances, etc.) required for the EnMS to be effective;
- Making direct communications within the organisation (verbally and written) relating to the EnMS and energy performance;
- Helping to develop a culture whereby all people are encouraged to participate in effective energy management.

Energy management and performance should be seen by top management as a top priority for the organisation, and key decisions regarding the organisation and its strategic direction should include consideration of energy wherever relevant.

5.2. Energy policy

The energy policy is what defines the strategic direction of the organisation with regards to energy, and should be seen as an element of the overall business strategy of the organisation. As such it is important that top management are involved in the creation of policy (with additional technical input as necessary) – it is not sufficient for them to just sign off on the policy after being written entirely by someone else.

The energy policy should be reviewed for suitability and adequacy by top management on a regular basis (preferably at least annually), and changes made where appropriate. This can be done as part of the management review process (see clause 9.3 Management review).

The standard prescribes the necessary details and commitments that an energy policy needs to contain in order to be effective.

Where the standard specifies that the policy should provide a 'framework for setting and reviewing objectives and energy targets' it is important to note that this doesn't necessarily require including the specific objectives and energy targets within the energy policy itself (as these may change more frequently than it is intended for the energy policy to be reissued). However, the policy should include details on how these are set, such as how frequently are these to be set / reviewed, at what level (e.g. organisational level, site level, plant level, etc.), by whom, regarding which elements of the organisation's energy use and consumption, etc.

Once established the energy policy should be communicated so that all relevant persons (employees, contractors, etc.) are aware of it, such as being held on the company website and/or intranet, being displayed on noticeboards, etc. You should decide how you plan on communicating the policy and ensure that you do this every time the policy needs to be updated.

5.3. Organisation roles, responsibilities and authorities

In order for the necessary tasks and actions required for implementing and operating the EnMS to be carried out, relevant responsibilities and authorities need to be established and assigned to relevant roles within the organisation and the system. Linked to clause 5.2, these responsibilities and authorities are to be assigned by top management.

The standard prescribes certain general responsibilities and authorities that are necessary for an EnMS to operate and are to be assigned to an energy management team. The energy management team is tasked with implementing the EnMS and achieving energy performance improvement, and can be a group of people or just one person depending on the size and complexity of the organisation and availability of relevant resources.

In addition to the energy management team there will be other specific responsibilities and authorities that need to be assigned to ensure that the organisation's EnMS functions effectively.

The roles within an EnMS could be dedicated roles in line with a person's job description (e.g. an energy manager) or they could be specific to the management system and in addition to a person's regular job (e.g. an internal auditor).

Examples of responsibilities and authorities (not exhaustive) are as follows:

Responsibility	Typical person / role
Establish strategic direction with regards to energy	President, CEO, MD, Board of Directors
Develop the energy policy	President, CEO, MD, Board of Directors
Monitor overall EnMS performance	Energy manager
Promote continual improvement	Management team
Ensure planned preventative maintenance actions are complete on time	Facilities manager
Conform to EnMS requirements	All persons working under the organisation's control

Once determined, these roles and responsibilities need to be communicated within the organisation. This can be done via making a list of relevant persons available on an intranet or noticeboard, via emails, presentations, workshops, etc.

6. Planning

6.1. Actions to address risks and opportunities

Requirements relating to risk in ISO 50001 are primarily focused on the effects that can be caused by uncertainty. These effects can be positive or negative.

Examples of risk leading to negative outcomes can include:

- Non-fulfilment of a previously unidentified legal requirement resulting in fines (legal and other requirements);
- Deviation from established procedures caused by language barriers among staff that had not been previously been identified (internal context);
- Lack of resources for the EnMS caused by unpredicted economic downturn, e.g. recession (external context);
- Fuel delivery not completed due to supplier going out of business unforeseen (procurement);
- Urgent customer requirement resulting in longer working hours resulting in higher energy consumption (needs and expectations of interested parties).

Examples of risk leading to positive outcomes can include:

- New technology, such as control equipment, that had not been previously considered in planning;
- Optimising existing processes beyond anticipated levels;
- Collaborating with persons not previously identified as interested parties to ensure better control.

Once relevant risks and opportunities have been identified, the organisation needs to plan to take action to address them, such as by establishing:

- Objectives and energy targets;
- Operational controls;
- Other business processes, e.g. communication, supplier evaluation, etc.

Once these actions have been established their effectiveness needs to be determined. Methods and techniques to evaluate effectiveness of actions can include:

- Comparing monitoring and measuring results with expected performance levels;
- Statistical analysis;
- Evaluation of compliance, etc.

6.2. Objectives, energy targets and planning to achieve them

Setting objectives and energy targets is how the organisation turns its energy policy and overall aims and intended outcomes for the EnMS into actions.

An objective is an overall result to be achieved, whereas an energy target is a quantifiable measure of energy performance improvement. Energy targets may be linked to objectives, however not all objectives would require energy targets.

Once objectives and energy targets have been set, plans need to be established to ensure they are achieved. These action plans should be SMART:

Specific

Measurable

Achievable

Relevant

Time-based

Examples of objectives and targets are as follows:

Objectives	Energy targets	Verification Method	Actions	Responsible Person(s)
Reduce the site's total electricity consumption.	Reduce electricity consumption by 75% by 2030 based on a 2018 baseline. Reduce electricity consumption by 50% by 2025 based on a 2018 baseline. Reduce electricity consumption by 20% by 2020 based on a 2018 baseline.	kWh per annum, measured via half-hourly meter	Implement energy reduction strategy by Sept 2019. Install new efficient boilers by end 2020. Complete LED lighting replacement programme by 2021.	Energy team
Increase frequency of energy-related toolbox talks to four per annum.	N/A	N/A	Identify suitable toolbox talk topics and create relevant materials. Add details to toolbox talk schedule.	Energy Manager Site Manager

6.3. Energy review

The energy review is a critical planning element of ISO 50001. Failure to correctly conduct the energy review can lead to knock-on effects for the effectiveness of the entire system; as such it is vital to ensure the correct interpretation of clause, and the different terms used such as energy use, types of energy, energy consumption and energy performance.

When evaluating past and present energy use and consumption:

- Data period and frequency both need to be sufficient to identify trends and be reflective of variation.
- A data period of typically at least 12 months should be evaluated, however this can be less if the data are sufficient.
- The more frequent (e.g. monthly, daily, half-hourly, etc.) the data the better quality (typically at least monthly for understanding trends / variations).
- Data quality is best when based on actual measurements, but can be based on calculated estimates.

Once an organisation has conducted the evaluation, it needs to determine its significant energy uses (SEUs). These are the key elements of the organisation's operations that the management system will be built around.

When determining the SEUs, the 'significance' of energy uses should be determined based on set criteria. This can include, for example consideration of whether:

- The energy use is associated with a substantial energy consumption;
- The energy use has poor energy performance;
- There is considerable opportunity for energy performance improvement for the energy use.

The variables that affect the SEUs need to be identified. These can include:

- Weather, humidity and other climatic conditions;
- Productivity;
- Building occupancy levels;
- Daylight availability;
- Operating hours; etc.

These variables are important to understand so that they can be taken into account when reviewing energy performance. For example, demand on HVAC systems may be influenced by seasonal changes in humidity, daylight hours, temperature, etc. These changes will need to be considered when trying to understand the impact of new technologies or energy-saving initiatives when this requires comparing consumption data from different seasons.

Confirmation of whether a factor either is or isn't a relevant variable may need to be obtained, for example through regression analysis.

The energy review requires an estimation of future energy use and consumption. These estimates should take into account:

- The specific SEUs;
- The relevant variables;
- Anticipated changes to facilities, equipment, systems and processes

The estimate can be determined after objectives, targets and action plans have been set in order to predict the potential resultant improvements in energy performance.

As part of the energy review, the organisation also needs to identify and prioritise Opportunities for improving energy performance. This Identification of opportunities could be done based on:

- Energy audit outcomes;
- Team meetings;
- Employee suggestions;
- Review of case studies;
- Review of new and emerging technologies, etc.

Prioritisation of opportunities could be done based on:

- Total energy saved (kWh);
- Total money saved (unit currency);
- Total greenhouse gas emissions saved (tonnes CO2e)
- Payback period;
- Feasibility;
- Business strategy, etc.

It should be noted that some improvements can have an indirect energy effect that may warrant consideration when prioritising opportunities. For example, installing more efficient processing equipment not only reduces energy consumed by the processing activities themselves, but as the more-efficient equipment may generate less waste heat, there may also be a reduction in demand in cooling as well.

It is important to note that the quality of the energy review is influenced by the availability and quality of data used in it and how it is analysed. Sources of data can include:

- Energy audits, such those in line with the international standard ISO 50002:2014 Energy audits — Requirements with guidance for use;
- Engineering studies;
- Utility bills, fuel delivery receipts, procurement records;
- Meter readings from both main utility meters and sub-meters (where applicable);
- Building management system data;
- Maintenance / service logs;
- Equipment data, e.g. name plate energy rating, manufacturers stated efficiencies, asset inventory lists;
- Existing management system (e.g. EnMS) data.

6.4. Energy performance indicators

Energy performance indicators (EnPIs) formalise how energy performance is to be determined and expressed. The EnPIs chosen should correspond to how energy performance has been defined for the organisation, based on the organisation's overall aims and intended outcomes of the EnMS.

Examples of EnPIs can include:

- energy consumption (in total or broken down by energy use) (e.g. kWh, GJ);
- simple ratio such as energy consumption per unit of productivity (e.g. kWh per product, kWh per FTE employee, kWh per £ turnover);
- more complex EnPIs can include statistical models (e.g. linear and nonlinear regression) or engineering based models (e.g. simulation).

Where it has been determined during the energy review (clause 6.3) that there are relevant variables that significantly affect performance, then EnPIs should consider this. For example, if the monthly hours of daylight had a significant impact on lighting demand then an EnPI of kWh / hours daylight could be used to provide meaningful comparison in energy performance between different months.

It is through comparing the EnPIs to the energy baseline (see clause 6.5 Energy baseline) that an organisation can determine whether the continual improvement of energy performance has been achieved or not.

6.5. Energy baseline

An energy baseline is the point of comparison against which an organisation can determine changes in their energy performance.

The organisation can have one or multiple baselines. As well as an overall baseline(s) for the organisation's energy performance, separate baselines can also be established at the facility, system, process or equipment level.

The time period chosen for the baseline should be representative of the variations in organisational operations (e.g. seasonal production, occupancy, etc.) and would ideally represent at least one year.

The baseline(s) established should relate to the EnPIs, and be normalised to mitigate the effect of relevant variables where appropriate.

6.6. Planning for collection of energy data

This clause links heavily to clause 9.1. Monitoring, measurement, analysis and evaluation and provides the planning for those activities. The result of this planning forms the energy data collection plan.

The energy data collection plan should provide details on the organisation's energy data collection requirements and could look to describe:

- what is measured and monitored;
- why it is measured;
- how it is measured (e.g. device, method, frequency, accuracy and repeatability, calibration);
- the values to be expected;
- a significant deviation for that measurement;
- the action to be taken for a significant deviation;
- personnel responsible for data collection and measurement;
- what and where the record is;
- whether any measurements or parameters are especially process or safety critical;
- future measurement needs.

The organisation needs to plan to obtain relevant energy consumption data for both the organisation as a whole and for the individual SEUs. Installation of sub-metering would be good practice for collecting data on SEUs where these relate to metered supplies (electricity, gas, etc.).

The quality of monitoring and measurement is influenced by the availability and quality of data and its analysis. Sources of data can include:

- Observation of processes and comparison with expectations;
- Meter readings from utility meters and sub-meters (where applicable);
- Utility bills, fuel delivery receipts, procurement records;
- Building management system data;
- Maintenance / service logs; etc.

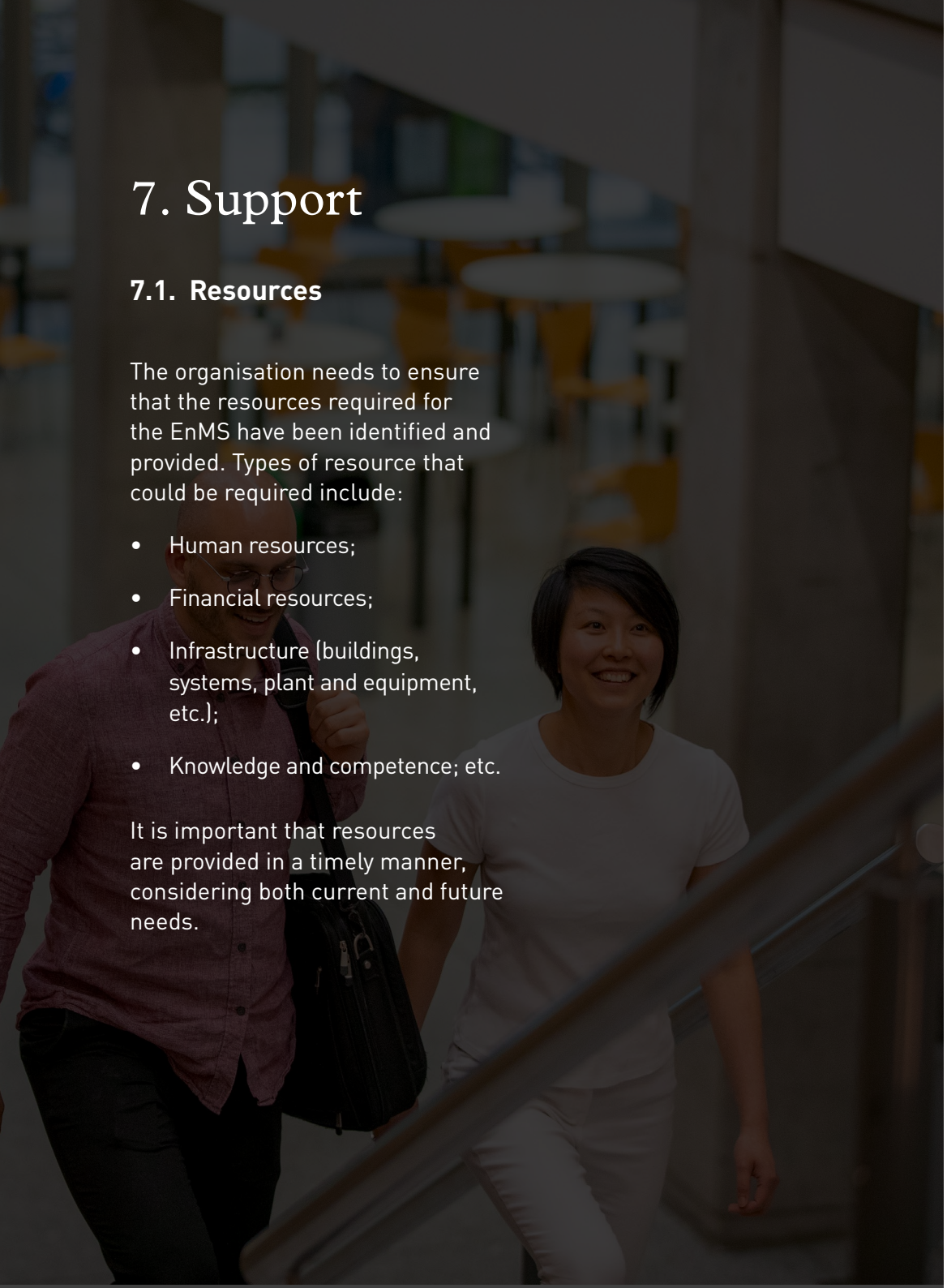
The quality of any analysis done on the data collected are typically better when the frequencies of data relating to SEUs and their variables align, e.g. where electricity consumption used by a facility and number of products produced are both collated daily.

Data / information collection frequency should be sufficient to identify trends and be reflective of variation. The more frequent (e.g. monthly, daily, half-hourly, etc.) the data the better quality (typically at least monthly for understanding trends / variations).

Data are best quality when based on actual measurements, but can be based on calculated estimates.

It is best practice that periodically (preferably annually) all meters, etc. are checked and calibrated (traceable to national standards) to ensure they are operating correctly.

As part of the energy data collection processes data on relevant variables and static factors should be collated. A variable is a quantifiable factor that significantly impacts energy performance and routinely changes (for example weather conditions, light levels, production levels, etc.) whilst a static factor is a factor that significantly impacts energy performance and does not routinely change (for example facility size, installed equipment, range of product, etc.). It should be noted that the same factors might be a relevant variable in one organisation and a static factor in another.



7. Support

7.1. Resources

The organisation needs to ensure that the resources required for the EnMS have been identified and provided. Types of resource that could be required include:

- Human resources;
- Financial resources;
- Infrastructure (buildings, systems, plant and equipment, etc.);
- Knowledge and competence; etc.

It is important that resources are provided in a timely manner, considering both current and future needs.

7.2. Competence

To ensure that relevant EnMS and general energy management related processes are conducted correctly, the organisation needs to ensure that people (staff, contractors, etc.) working in these areas are competent to do so.

Activities that may require persons to be competent can include:

- Implementing the EnMS;
- Conducting internal audits;
- Operating the SEUs;
- Conducting servicing and maintenance activities;
- Conducting design activities;
- Conducting monitoring and measurement activities.

Ensuring competence requires two elements:

1. Determining what "competent" is, e.g. setting competence criteria; and

2. Evaluating current competence levels against the competence criteria.

The competence criteria should relate to the knowledge and skills that a person has that enable them to fulfil their role correctly. This knowledge and skills can be obtained by means such as training, education or experience.

One common pitfall of a competence process is to assume that just because a person has attended a training course that they are competent. Training is not the same as competence, and attendance of a training course does not always ensure the competence of the attendee. Conversely, persons can be competent without attending any training courses at all.

As such evaluating people against set competence criteria to ensure that individuals possess the necessary knowledge and skills required by their roles.

Existing processes to assess suitability of persons to undertake various roles such as through candidate interviews for a job as part of a recruitment process could be used when evaluating competence. Alternatively, it could require a separate activity specifically for the EnMS.

It is also important to note that competence is a status which can change, and that a person once approved as competent may not always remain competent e.g. due to changing requirements or loss of skills and knowledge over time. As such ongoing competence must be reviewed on a continual basis at appropriate timescales.

Ongoing competence can be reviewed as part of general annual review processes (e.g. an annual staff performance appraisal), a separate EnMS competence review process, monitoring processes, internal audit, etc.

7.3. Awareness

The organisation needs to ensure that all relevant persons (staff, contractors, etc.) are aware of key matters to the EnMS, such as the energy policy and how they can contribute to the effectiveness of the EnMs.

Awareness raising activities can include:

- Briefings, meetings, presentations, etc.
- Internal training sessions, including site orientation / induction training, etc.
- Emails, bulletins, newsletters, etc.
- Posters, signs, notice boards, intranet posts, etc.

It is important to ensure that awareness raising activities cover all relevant persons. This may require different activities to be undertaken for different roles, for example a general induction training can raise awareness with new employees, but existing employees and contractors may not be included in this so would require separate activities for them.

Awareness is also a status that can be lost over time, as people forget the content of a training course. To counteract this awareness raising activities should be conducted on a regular basis, to ensure that the required level of awareness is maintained.

7.4. Communication

The organisation needs to establish processes for communicating information relevant to the EnMS, both internally and externally, that they determine to be necessary.

Relevant information that an organisation could look to communicate can include:

- Information about the EnMS itself;
- Current, historical and forecast energy performance;
- Information relating to objectives and energy targets, including progress on their achievement; etc.

Various methods of communications can include:

- Briefings, meetings, presentations, etc.
- Emails, bulletins, newsletters, etc.
- Posters, signs, notice boards, intranet posts, etc.

External communications may be required by legislation or agreements with customers, investors, parent companies, or other key stakeholders (see section 4.2 Understanding the needs and expectations of interested parties).

In addition to outgoing communications, the organisation needs to establish a process for enabling key persons (staff, contractors, etc.) to make comments or suggest improvements to the EnMS and energy performance. These processes can include:

- Central email for feedback;
- Consultation workshops;
- Suggestions boxes;
- Reviews and feedback sessions.

7.5. Documented information

7.5.1. General

The organisation's EnMS needs to consist of both documents that are required by the standard, and those that are necessary for the system to be effective and to demonstrate energy performance improvement.

When determining the level of documentation that is required it should be remembered that under-documenting processes can result in the processes not being fully effective, whilst over-documenting processes can be burdensome. As such a balance needs to be obtained, and documentation made where it adds value to the process.

7.5.2. Creating and updating

Processes need to be established for controlling the creation of new documentation, and reviewing and updating existing documentation.

These can include:

- Identification measures – ensuring all documents have a unique title and/or reference number (e.g. ENMS07 – Planned preventative maintenance procedure);
- Stating the name of the author;
- Ensuring documents are available in the necessary format (e.g. electronic master version with printed versions available to operatives at point of use);
- Ensuring documents are available in the required languages (see clause 4.1 Understanding the organization and its context);
- Ensuring that all documents are approved for suitability and adequacy prior to being issued.

It would be beneficial to assign roles and responsibilities related to reviewing and updating relevant documentation to ensure that people are aware of who is responsible for which documents.

7.5.3. Control of documented information

Once issued documentation needs to be controlled. This can include:

- Ensuring documents are available where required.
- Ensuring documents are suitably protected, for example via levels of read / write authorisation for electronic documents, or displaying hardcopy documents in a locked display board to prevent tampering.
- Keeping a record of all printed versions of documents so it can be ensured they are replaced when updating, and ensuring that uncontrolled printed versions are not used.
- Ensuring documents are regularly reviewed to ensure they remain suitable, and updating them (see clause 7.5.2) where changes are required.
- Retaining achieved versions of documents where necessary (suitably identified to prevent unintended use) and disposing of documents that are no longer required after a suitable period.

The organisation may need to use documents of external origin to operate their EnMS, such as standards (including ISO 50001 itself), external guidance, manufacturer's information on SEUs, etc. These documents need to be identified and access controlled as required.

8. Operation

8.1. Operational planning and control

Processes related to the organisation's SEUs need to be suitably planned and controlled in order to ensure that the organisation meets its objectives and energy targets, and achieves the continual improvement in energy performance.

Operational controls can include (amongst others):

- processes, procedures and operating instructions;
- physical devices, e.g. flow control valves, automation systems, etc.;
- set points, e.g. heating and cooling setpoints, start-up and shut-down timings, target lighting levels, etc.;
- maintenance programmes, e.g. planned preventative maintenance (PPM) and reactive maintenance processes;
- designing processes and equipment to ensure adequate control of energy (see section 8.2 Design).

The UK-ASEAN Energy Efficiency Accelerator has produced guidance documents on Opportunities for Energy Savings from common processes in the food and beverage sector. The details of criteria and controls in these guidance documents can be of relevance to this clause of ISO 50001.

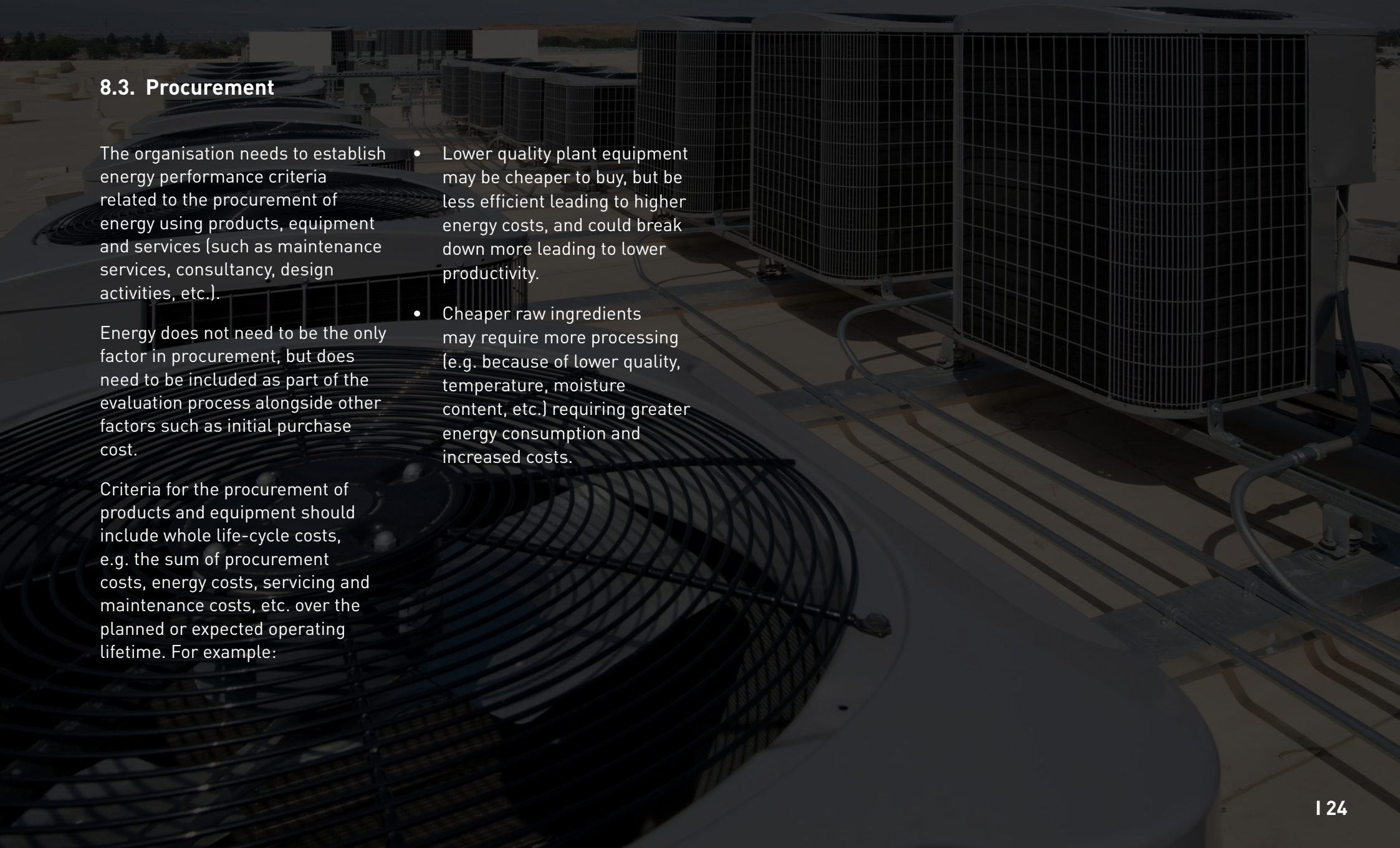
8.2. Design

The design clause of ISO 50001 is focused on the design of the energy-using buildings, plant and equipment, systems and processes to be used by the organisation. It is not concerned with energy consumed in the downstream use of the organisation's products (e.g. cooking, processing, etc.).

Considering energy requirements at the earliest stages of the design process and throughout typically achieves the best results.

Considerations during a design process can include:

- Specifying performance criteria for facilities;
- Eco-design / energy label requirements for equipment;
- Monitoring and measurement needs (meters / sub-meters);
- Internal movement planning;
- Ensuring correctly sized equipment, systems, etc.



8.3. Procurement

The organisation needs to establish energy performance criteria related to the procurement of energy using products, equipment and services (such as maintenance services, consultancy, design activities, etc.).

Energy does not need to be the only factor in procurement, but does need to be included as part of the evaluation process alongside other factors such as initial purchase cost.

Criteria for the procurement of products and equipment should include whole life-cycle costs, e.g. the sum of procurement costs, energy costs, servicing and maintenance costs, etc. over the planned or expected operating lifetime. For example:

- Lower quality plant equipment may be cheaper to buy, but be less efficient leading to higher energy costs, and could break down more leading to lower productivity.
- Cheaper raw ingredients may require more processing (e.g. because of lower quality, temperature, moisture content, etc.) requiring greater energy consumption and increased costs.

9. Performance evaluation

9.1. Monitoring, measurement, analysis and evaluation of energy performance and the EnMS

General

When conducting processes for monitoring, measurement, analysis and evaluation it is important to understand what these terms mean:

Monitoring

A process that determines the status of a system, process or activity. It generally refers to processes where observations are made over time without necessarily using monitoring equipment.

Measurement

A process that determines a value. It generally refers to processes where equipment is typically used to determine quantitative or qualitative properties.

Analysis

An activity to understand monitoring and measurement data, e.g. what do the data tell us? What trends exist?

Evaluation

An activity to understand the analysed data, e.g. what do the data and trends mean? How good is the organisation's energy performance? How effective is the EnMS?

These activities should be carried out on a regular basis, in line with the planning for collection of energy data (see clause 6.6) and the wider needs and requirements for the EnMS.

The organisation needs to determine their actual versus expected energy consumption. This activity links the monitoring and measurement data to the estimate of future energy use and energy consumption included in the energy review (see clause 6.3).

The organisation's energy performance should be determined by comparing monitoring and measurement data (processed to obtain the relevant values related to the chosen EnPIs) to the relevant energy performance baseline.

Where performance is not in line with expectations the organisation should classify these as being significant deviations in energy performance and investigate and respond to them. It is up to the organisation to determine what level of deviation counts as being significant, such as a particular percentage difference from an expected value, or any value below a static or variable target threshold.

Significant deviations can be positive or negative – both should be investigated in order to understand what has caused them. The organisation's corrective action process (see clause 10.1 Nonconformity and corrective action) can be used to address and correct negative significant deviations. Positive significant deviations (where performance is substantially better that expected) should be investigated to understand what caused the unexpected improvement in performance in case there are opportunities for further performance improvement.

As part of this clause the organisation needs to determine the effectiveness of the EnMS – this should include understanding of how well the EnMS is achieving its intended outcomes, including:

- Continual improvement in energy performance:
- Adherence to the energy policy:
- Meeting objectives and energy targets:
- Meeting other requirements for the EnMS, etc.

The results of monitoring and measurement can be used to identify:

- Performance trends;
- Areas of nonconformity;
- Adherence to legal and other requirements;
- Opportunities for improvement.

Evaluation of compliance with legal requirements and other requirements

Once an organisation has determined the legal requirements and other requirements with which it needs to comply (see clause 4.2 Understanding the needs and expectations of interested parties) it then needs to evaluate whether it is actually compliant with these requirements or not.

This evaluation of compliance can be conducted via one activity looking at all requirements, or several activities taking place separately and at different frequencies, or ongoing monitoring and measurement.

The outputs from the evaluation of compliance process should be able to be used by the organisation to confirm their compliance status at any time. The records from the evaluation should be sufficient to clearly state compliance status (e.g. compliant or non-compliance) and demonstrate how the compliance status was determined (e.g. what records, activities, etc. were evaluated in order to determine compliance status).

9.2. Internal audit

Planning and conducting internal audits is a vital step in ensuring that the EnMS has been implemented correctly, is being worked to, is effective and is being continually improved (see clause 4.4 Energy management system).

An internal audit programme should be established which details the necessary considerations for conducting internal audits, such as:

- When the audits will take place:
  - Typically consisting of an audit schedule covering a defined period of time (usually at least one year).
- What the audits will cover, including:
  - The audit scope and objectives;
  - The processes (not just clauses of the standard) that will be audited.
- Who will conduct the audits, including:
  - Ensuring auditors are competent to conduct the internal audits (see clause 7.2 Competence);
  - Ensuring auditors are independent from the area being audited and can conduct the audits objectively.
- Necessary tools and documents, including audit forms, checklists, etc, required for planning and conducting the audits;
- Requirements and instructions for how to compile and communicate the results of the audits to relevant persons, including top management.

When planning the audit programme, internal audits can be prioritised and conducted more frequently for:

- processes and activities that can have a greater impact on energy performance such as those relating to significant energy uses, objectives and energy targets, operational controls, etc.;
- processes and activities where weaknesses may be present, such as where nonconformities have been identified in previous audits;
- processes and activities that have changed since the last EnMS audit or where changes are planned.

Conversely, audits may be conducted less frequently for:

- processes and activities that are not likely to significantly impact energy performance, e.g. document control;
- processes that have fewer nonconformities from previous audits; or
- areas which have not changed since the last EnMS audit.

There are multiple methods of collecting audit information available to an internal auditor. These can include:

- Review of documents such as policies, objectives, procedures, specifications, audit records, meeting minutes, audit reports, monitoring records, data summaries, analyses, etc.
- Observations of live activities and surrounding work environment and conditions, or demonstrations, tests and simulations of activities that are unable to be observed live.
- Interviews with relevant persons such as top management, general employees, contractors, etc.

To aid in compiling audit results organisations should look to define specific categories for classifying formal audit findings. Common categories can include:

Major Nonconformity

Absence or total breakdown of a process / system.

Minor Nonconformity

Temporary or isolated breakdown of a process / system.

Opportunity for Improvement (OFI)

Area where a process / system does conform to requirements, but where improvement could be made or future nonconformity could develop.

When recording audit findings it is preferable for these to be stated in relation to the effectiveness of process(es) being audited, for example:

Observation:

The Energy Review did not identify production mix as a relevant variable for the SEU of process plant.

Audit Finding Statement:

The process for ensuring relevant variables are identified for all SEUs within the Energy Review is not fully effective.

This is preferred as typically an internal audit only samples evidence related to a process, and where evidence has only been sampled further instances of the same nonconformity may exist. Should the audit finding be related to the particular example of the nonconformity identified in the sample then the corrective action taken may not fully address the potential for additional or future instances of the same nonconformity to exist.

9.3. Management review

The organisation's top management (see clause 5.1 Leadership and commitment) are required to review the EnMS on a regular basis.

The frequency of the management review is to be determined by the organisation, and the organisation can cover the required inputs and outputs for the management review process either at all management reviews, or spread out over several reviews. It is preferable for all of the required inputs and outputs for management review to be covered at least once per annum.

The Format for management review can be determined by the organisation and can include:

- Meetings in person or teleconference / videoconference
- Individual review of a prepared report with collation of comments / feedback

Where management reviews take the format of a meeting a standing agenda is often used to ensure all inputs and outputs are included.

Records of the management review should be maintained, such as meeting minutes and decisions made. A clear recorded statement on the EnMS's suitability, adequacy, effectiveness and alignment with strategic direction would be beneficial.

10. Improvement

10.1. Nonconformity and corrective action

Where nonconformities are identified, such as during internal and external audits, as a result of general monitoring and measurement or evaluation of compliance activities, or simply following general observations, these need to be managed and suitable corrective action taken.

Possible reasons for identifying nonconformities can include:

- The management system does not conform to the standard;
- Observed practice does not conform with the EnMS requirements;
- Legal and other requirements are not being complied with;
- The certification body requirements are not being met (e.g. use of logo);
- Objectives have not been reached;
- Continual improvement has not been achieved (indicating that the system is not effective).

The organisation should look to recording relevant information in relation to the identified nonconformities. This can include:

- Administration details (e.g., dates, names, finding reference number, etc.)
- Reference of requirement (e.g. ISO 50001 clause number)
- Grading (e.g. Major / Minor)
- Statement of nonconformity (relatable to the requirement and process)
- Objective evidence to support the statement of nonconformity

When nonconformities have been identified the organisation should look to determine how it will address them. This may include:

- details from the nonconformity report;
- the area concerned and persons responsible;
- the person responsible for completing the corrective and/or preventive action;
- correction, root-cause analysis, corrective action;
- agreed closure date;
- actual date the action was completed;
- results of the review of the effectiveness;
- date when the nonconformity was closed.

In order to prevent reoccurrence action is needed to eliminate the cause of a nonconformity, not just correct the immediate issue. At the time that the nonconformity is initially identified the cause of the nonconformity may not be fully identified or understood – root cause analysis is necessary to be conducted in order to identify the true cause.

Various tools can be utilised for determining root-cause, for example:

- ➔ brainstorming;
- ➔ 5 Whys' technique;
- ➔ fishbone diagrams.

To illustrate the importance or root-cause analysis a worked example is provided (to the right) showing how a non-conforming situation could have multiple different root-causes, which would require distinctly different corrective action to address.

Root Cause Analysis – worked example

Nonconforming situation:

The Energy Review did not identify production mix as a relevant variable for the SEU of process plant.

Why did the nonconforming situation occur?

Scenario A

i. The person responsible did not know that production mix would affect energy performance of process plant

ii. The person did not complete the scheduled ISO 50001 training

iii. The person was ill when due to attend and was not asked to attend further training

iv. Full records of training attendance were not kept

v. The procedure for delivering training was not adequately defined.

Scenario B

i. The methodology and criteria for updating the Energy Review identified production mix as a static factor, not a relative variable.

ii. Production mix was not variable at the time the Energy Review was initially conducted but subsequently changed.

iii. The Energy Review was not updated as a result of the change in production mix.

iv. The circumstances under which the Energy Review should be updated were not adequately defined in the associated methodology and criteria.

After action is taken to address nonconformities, the organisation needs to review the effectiveness of the actions in order to confirm that nonconformities can be closed. This review of effectiveness can be conducted:

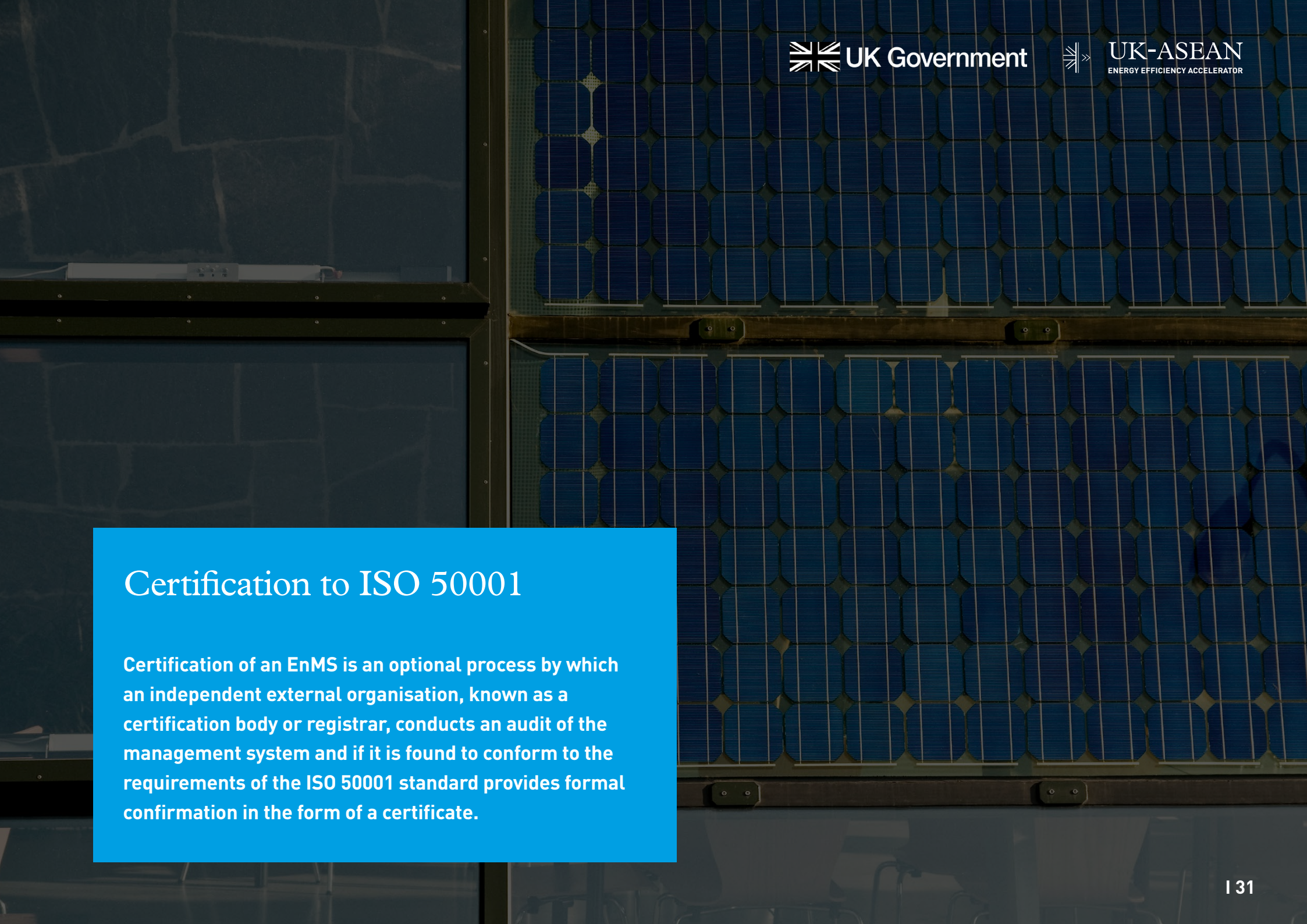
- At the next routine internal audit (internal findings) or external audit (external findings);
- At a supplementary internal / external audit;
- As a separate (non-audit) activity;
- Immediately upon completion of correction (where root cause analysis indicates something was a one-off, e.g. something overlooked during system implementation).

Reoccurrence of nonconformities may indicate root cause analysis was not effective.

10.2. Continual improvement

The organisation is required to continually improve the EnMS. This can be determined as a result of:

- Monitoring, measurement, analysis and evaluation activities;
- Internal audits;
- Management review;
- General regular review of the suitability, adequacy and effectiveness of the system.



UK Government

UK-ASEAN
ENERGY EFFICIENCY ACCELERATOR

Certification to ISO 50001

Certification of an EnMS is an optional process by which an independent external organisation, known as a certification body or registrar, conducts an audit of the management system and if it is found to conform to the requirements of the ISO 50001 standard provides formal confirmation in the form of a certificate.

Why certify?

Certification by an external organisation is not a mandatory requirement of the ISO 50001 standard – you could make an evaluation and self-declaration in relation to your conformity to the standard, or seek confirmation of your conformance by interested parties, such as customers.

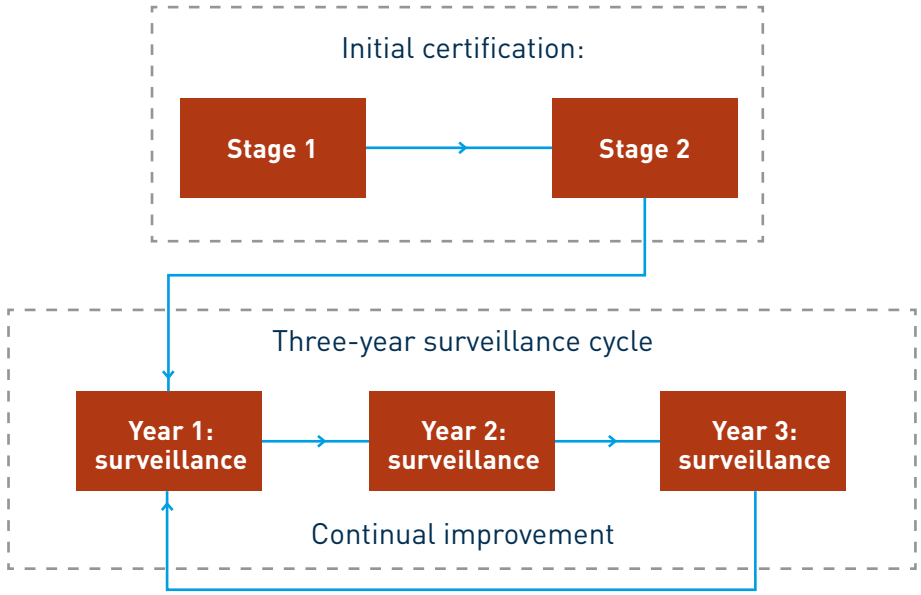
External certification does provide additional benefits, however, such as:

- Providing you with independent reassurance of the EnMS's effectiveness and confidence in the processes that you have established;
- Identify additional means for improving the effectiveness of the EnMS and improving energy performance;
- Providing proven business credentials, confirming that you work to international best practice in energy management;
- Enabling you to win more business with organisations looking to procure from organisations taking steps to improve their environmental performance.
- Convincing potential investors that you have a strong financial position as energy costs are efficiently controlled.

The certification process

The certification process consists of a series of audits and decisions related to an initial certification and ongoing certification. Once a certificate is issued it should last for three years before it will need reissuing.

This certification process is illustrated below:



Initial certification

Stage 1 audit

The Stage 1 audit is primarily a document review and planning exercise.

During the audit the EnMS is typically reviewed in order to:

- Confirm that the required policies, procedures, documents, etc. are all in place, covering all requirements of the standard;
- Confirm that the energy review has been conducted appropriately, an energy baseline established, and opportunities for improving energy performance recorded;
- Confirm that the internal audit and management review processes are underway;
- Identify any areas of concern that the organisation should look to address prior to the Stage 2 audit;
- Plan for conducting the Stage 2 audit, including the processes to be audited and the areas of the site to be visited, etc.

Stage 2 audit

The Stage 2 audit is conducted after the Stage 1 audit and is primarily designed to evaluate the implementation of the EnMS, including confirming how effective it is. This includes review and consideration of:

- Evidence of conformity to all requirements of the standard;
- Operational controls confirmed as being effective and adhered to;
- Monitoring and measurement activities confirmed as taking place;
- Confirmation that the organisation is adhering to its own policies, objectives and procedures;
- Confirmation that the system is designed to achieve and is achieving continual improvement of energy performance.

In order for the system to be adequately tested the EnMS typically needs to have been fully operational for at least three months prior to a Stage 2 audit taking place. This should give sufficient time for necessary system activities to take place and records to be available for review.

Where Major Nonconformities are identified these must be addressed prior to certification being granted. If Minor Nonconformities are identified the organisation typically needs to provide the certification body / registrar with a plan of corrective action.

[1]https://www.uncclearn.org/sites/default/files/inventory/undp44.pdf

Certification approval

Recommendation for certification made at Stage 2 audit is then reviewed by independent decision maker at the certification body / registrar who was not part of the audit team. If the independent decision maker agrees with the auditor's recommendation they will approve the issuance of an ISO 50001 certificate.

The certificate is typically issued for three years and begins a three-year cycle of surveillance auditing, culminating in the conduct of a recertification audit in the third year. This surveillance auditing helps to ensure continual improvement of the certified EnMS.

Surveillance audit

Surveillance audits typically take place at least once per annum. They are conducted so that the certification body / registrar can maintain confidence that the management system continues to fulfil requirements. Surveillance audits are not necessarily full system audits and may not review all processes or clauses of the standard.

Recertification audit

Recertification audits take place in the third year of each three-year cycle, prior to certificate expiry. They are conducted to confirm the continued conformity and effectiveness of the management system as a whole and include a review of previous surveillance audit reports and consideration of the performance of the management system over the cycle.

Following the recertification audit the ISO 50001 certificate is reissued (following review by decision maker) for further three years and the next three-year certification cycle begins.

[1]https://www.uncclearn.org/sites/default/files/inventory/undp44.pdf

The Carbon Trust is an independent company with a mission to accelerate the move to a sustainable, low-carbon economy. The Carbon Trust:

- advises businesses, governments and the public sector on opportunities in a sustainable, low-carbon world;
- measures and certifies the environmental footprint of organisations, products and services;
- helps develop and deploy low-carbon technologies and solutions, from energy efficiency to renewable power.

www.carbontrust.com

The Carbon Trust is a company limited by guarantee and registered in England and Wales under Company number 4190230 with its Registered Office at: 4th Floor, Dorset House, 27-45 Stamford Street, London SE1 9NT.