

Environmental Portfolio for Quality in University Education

2014-1-EL01-KA200-001373

Intellectual Output (O4)

The link between O4: EnMS Guidelines for Implementation and the ÉPOQUE Project

The document “*Energy Management Systems: Guidelines for Implementation*” is the result of O4 from the Epoque project. This document is intended to serve as a reference document for students and learners when developing an EnMS system for an organisation.

Link to Course IV

The O4 guidelines document is directly linked to Course IV from the Epoque portfolio entitled **Applied energy management systems in/for organizations (including schools)**¹ and can be found in the File Repository of this course where it is easily accessible to the learners. While Course IV goes into details and specifics of EnMS and also provides an overview of other EnMS supporting materials and background knowledge, the O4 Guidelines document serves as a quick and easy reference guide that will assist a person during the creation and implementation of an EnMS. The document is a step-by-step guide to EnMS implementation based on the ISO 50001 standard and also provides useful examples for the reports, checklists, action plans and many other documents required.

Link to students internship phase

During the blended mobility phase of the higher education students (activity C3) it was foreseen that the university students would use the O4 guidelines document as a quick reference guide for observing an existing EnMS system or for developing / assisting the running of an EnMS system in their assigned schools or SMEs.

Some examples of what the students have experienced in their internship phase with reference to EnMS are the following.

- Some students visited production factories where they could see the efforts being done for energy conservation, e.g. replacement of conventional exhaust pipes with heat recovery systems in a laundry industrial ambience.
- The students have monitored the energy and water consumption of a building over time.
- They were able to analyse the energy consumption reports provided by the university administration with a weekly status of 2 university buildings within the campus.
- The students assisted in calculation of carbon footprint for various equipment.
- They compiled lists of energy consuming devices within an area and projected the consumption of each device.

The Guidelines

The first draft of the O4: *Energy Management Systems: Guidelines for Implementation* document was presented during the ISP where it was evaluated and then finalized according to the feedback. It has also been translated into the partner languages for easy availability in all of the project countries.

¹ <http://www.epoque-platform.eu/>

ÉPOQUE: ENVIRONMENTAL PORTFOLIO FOR QUALITY IN UNIVERSITY EDUCATION

04

Energy Management Systems: Guidelines for Implementation

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1. Introduction

This document is the fourth Intellectual Output of the project **ÉPOQUE: Environmental Portfolio for Quality in University Education**. The objective of the ÉPOQUE project is to promote a smart specialisation of prospective teachers/trainers, scientists and engineers through an environmental portfolio which can be fully integrated to the University syllabuses, as well as the Adult Education courses provided and which aim at increasing the employability skills of the participants. It creates a new generation of green professionals in the context of higher education modernisation agenda connected to SMEs and enterprises. The ÉPOQUE project is funded by the European Commission, under the Erasmus+ programme, Key Action 2: Cooperation for Innovation and the Exchange of Good Practices.

Intellectual Output 04: Energy Management Systems Guidelines is a document that serves to provide the methodological reference for teachers and trainers to assist the students and learners respectively to develop an EnMS for the organisations selected. Within the document, important information will be provided in terms of the steps that need to be taken, the tools that can be used and the objective for each step. The document aims to provide a handbook without too many technical details, which will allow the target groups to be in a position to use during the validation phase of the project and guide the selected students/learners through the process of developing an EnMS.

The guidelines will describe all the tasks that need to be followed to successfully develop an EnMS for an organisation, be it an enterprise or a school. Within the ÉPOQUE project, all reference to and guidelines for the development of an EnMS are based on the ISO 50001:2011 - Energy management systems.

1.1 ISO 50001:2011 - Energy management systems

ISO 50001 is based on the management system model of continual improvement also used for other standards such as ISO 9001 or ISO 14001. This makes it easier for organisations to integrate energy management into their overall efforts to improve quality and environmental management.

The standard specifies the requirements for establishing, implementing, maintaining and improving an energy management system, whose purpose is to enable an organisation to follow a systematic approach in achieving continual improvement of energy performance, including energy efficiency, energy security, energy use and consumption. The standard aims to help organisations continually reduce their energy use, and therefore their energy costs and their greenhouse gas emissions.

Reducing the amount of energy consumed will also benefit the organisation by:

- reducing costs,
- reducing the impact of rising costs,
- meeting legislative or self-imposed carbon targets,
- reducing reliance on fossil fuels, and
- enhancing the entity's reputation as a socially responsible organisation.

ISO 50001 supports organisations in all sectors to use energy more efficiently, through the development of an EnMS.

Like other ISO management system standards, certification to ISO 50001 is possible but not obligatory. Some organisations decide to implement the standard solely for the benefits it provides.

Others decide to get certified to it, to show external parties they have implemented an energy management system. ISO itself does not perform certification that can be obtained through external evaluators and independent certification bodies.

1.2 Overview of the Plan-Do-Check-Act process

ISO 50001 is based on the management system model of continual improvement to achieve the objectives related to the environmental performance of an organisation / building. The process follows 4 phases of Plan-Do-Check-Act (PDCA) approach. PDCA is to be seen as a circular cycle. The phases overlap each other and thus ensure constant movement and renewal. Just as a circle has no end, the PDCA process should be repeated over and over again for continual improvement.

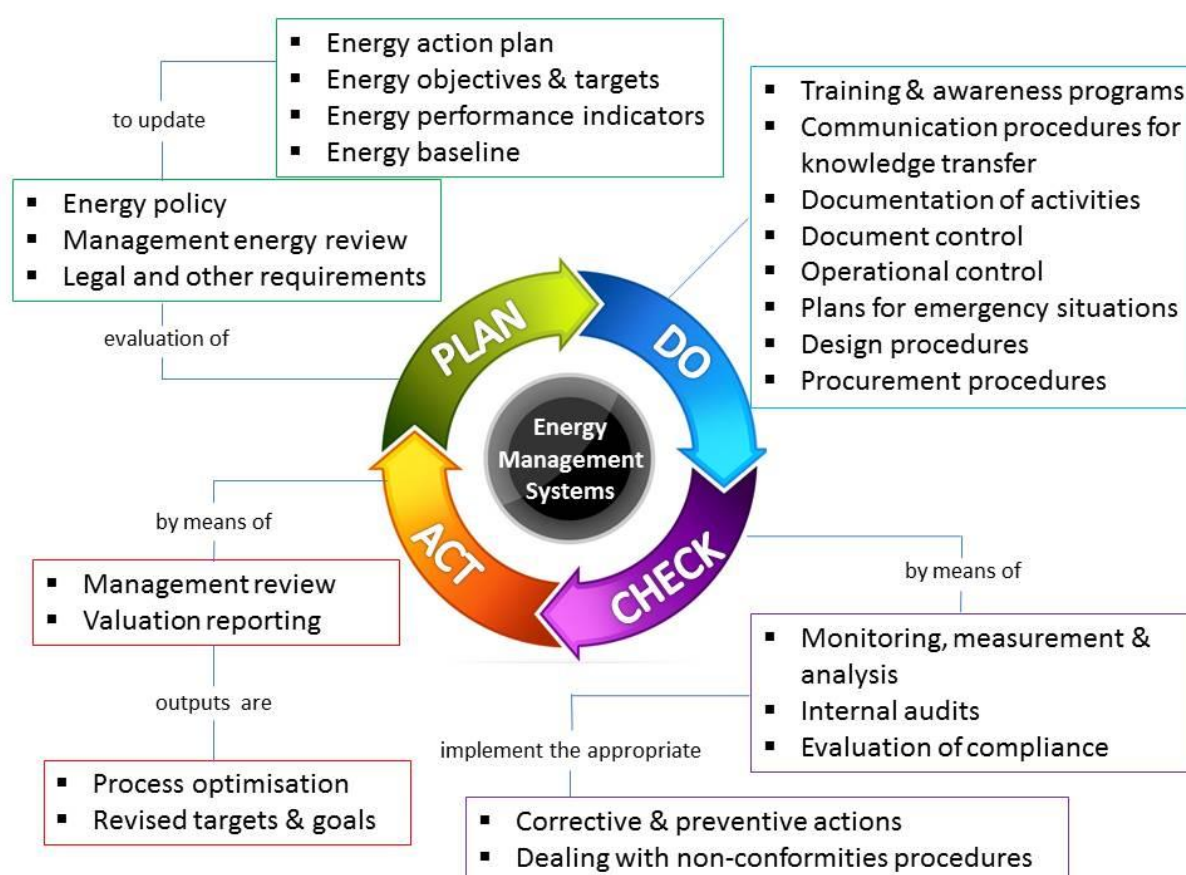


Figure 1 Overview of the PDCA process

The PDCA process in simplified form is:

- Plan - recognise an opportunity and plan a change
- Do - implement the change
- Check - review the change, analyse the results and identify problem areas or areas for further improvements
- Act - Take action based on what was learned in the check stage. If the implemented change did not perform well, repeat the PDCA cycle with a different plan. If it was successful, consider wider changes to improve further and begin the cycle again.

The various tasks, documentation, requirements and procedures that are needed for EnMS implementation that is compliant to the ISO 50001 standard based on the PDCA model are presented and discussed in the following chapters.

1.3 Benefits from EnMS implementation



Figure 2 Benefits to the organisation through EnMS implementation

More efficient energy management within an organisation / building will lead to:

- **Reduction of energy costs** - since less energy is consumed
- **Transparency of energy consumption** - better understanding of energy use
- **Compliance with regulations / guidelines** - reduced GHG emissions, less waste, etc.
- **Implementation of sustainable processes** - reduced maintenance, reduced resource utilisation leading to greater productivity. For example, maintenance costs may decline through better matching of equipment to demand needs resulting in less cycling of equipment operation, thus reducing wear. Optimisation of resource utilisation can be achieved through efficiency improvements for example coupling of systems where excess capacity is used for other applications. Implementation of sustainable processes also has the added benefit of a reduced risk on dependence on energy supply.
- **Achievement of tax benefits** - when available per country
- **Image cultivation** - Enhanced stakeholder reputation, enhanced staff morale and improved communications both internally and externally
- **Reduced import dependency** - by reducing energy consumption and thus depending less on imported energy into the organisation

- Enhanced energy security, economic competitiveness and environmental quality

The benefits to be achieved through implementation of an EnMS are not one-time benefits but will keep on increasing in effect as long as the EnMS is maintained and reviewed for continual improvement.

2. Energy Policy

Energy powers our modern world, fuelling innovation and improving living standards across the globe. However, delivering access to reliable and affordable energy, while limiting its social and environmental impacts, is one of society's greatest and most complex challenges.

Energy policies are one tool for countries and international players to plan and implement efficient, competitive, and cost-effective measures to ensure adaptable and flexible markets that safeguard energy security while remaining consistent with international commitments such as reducing GHG emissions.

For example, the European Union and its Member States have agreed on a comprehensive energy policy strategy called Europe 2020 containing five objectives on employment, innovation, education, social inclusion and climate/energy which are reinforced by various Directives and Regulations. The recently adopted Europe 2030 framework for climate change aims to make the EU's economy and energy system more competitive, secure and sustainable and also sets a target of at least 27% for renewable energy and energy savings by 2030.¹

2.1 Energy Policy Document

In a similar fashion, an organisation implementing an EnMS needs to have an energy policy document that shall state the organisation's commitment to achieving energy performance improvement in line with the ISO 50001 requirements, namely:

1. Policy must be appropriate to the nature and scale of the organisation's energy use

The policy should not require more management effort than is warranted by the value of the energy saved in relation to the scale of investment required and the risk involved in achieving the savings.

2. It must include a commitment to continual improvement in energy performance

This specifies that the energy policy should include a statement of intent to continually improve energy performance backed up by the appropriate EnMS processes and procedures. Management at all levels implements the commitment to continual improvement in energy performance by periodically monitoring, measuring and assessing energy system performance.

3. It must include a commitment to ensure the availability of information and of necessary resources to achieve objectives and targets

All information that is essential and relevant to attain environmental objectives and targets defined by its energy policy is fully identified. This commitment drives management at all levels to focus on continual improvements to the EnMS.

The commitment to ensure the availability of information and of necessary resources to achieve objectives and targets is represented by a statement in the energy policy.

4. It must include a commitment to comply with applicable legal requirements and other requirements to which the organisation subscribes

The organisation must fulfil its commitment to comply with applicable requirements governing its energy usage by providing an appropriate commitment statement in the energy policy. It must

¹ http://ec.europa.eu/clima/policies/2030/index_en.htm

ensure that applicable legal and other requirements to which the organisation subscribes and other stakeholder requirements as specified will be met through processes and procedures described in the policy.

5. The policy must provide the framework for setting and reviewing of the energy objectives and targets

The term framework means a well-managed planning process or processes for setting and reviewing energy objectives and targets. It enables top management to assert control over the performance of its EnMS in accordance with the energy policy. The processes and procedures that implement the framework must be well documented in the policy.

6. The policy must support the purchase of energy efficient products and services and design for energy performance improvement

This includes a well-documented and cost-effective purchasing program for energy operations that assures that the organisation only pays for services and items of demonstrable benefit to the EnMS and that meet quality requirements, such as those in contractual technical specifications.

7. It must ensure that all EnMS documentation is regularly reviewed and updated as necessary.

By continual review and updating, management is assured that the energy policy continues to reflect its commitment to energy performance improvement and a functional framework for moving forward. Records indicating that management has reviewed the energy policy and updated it as desired as well as records of successive revisions are needed.

8. The policy must include a commitment and methodology to ensure that the energy policy itself is communicated, documented and understood within the organisation.

All management and staff should be given a clear understanding of their roles in meeting management's performance expectations. All affected parties must receive and understand the energy policy. The result is effective teams that communicate horizontally and vertically to ensure continuous improvement of the EnMS.

An example of a sample Energy Policy document can be found here:

http://www.energyimprovement.org/tools/2_Plan/2.1/FacilityEnergyPolicy-Example.pdf

3. Identification and review of energy aspects

The identification and analysis of the energy performance for the organisation is an important input to the Energy Review. Tools and techniques that could be used for this purpose are various and include:

- Graphs, charts and tables
- Walk-through energy audit reports
- Interpretation of data from monitoring systems
- Detailed energy audits
- Feasibility studies for particular equipment or processes
- Financial & economic analysis
- Evaluation reports

An energy profile is a useful tool to allow management to have a closer look at the detailed energy consumption status of the organisation. An example of an energy profile presented in a pie chart format is shown below.

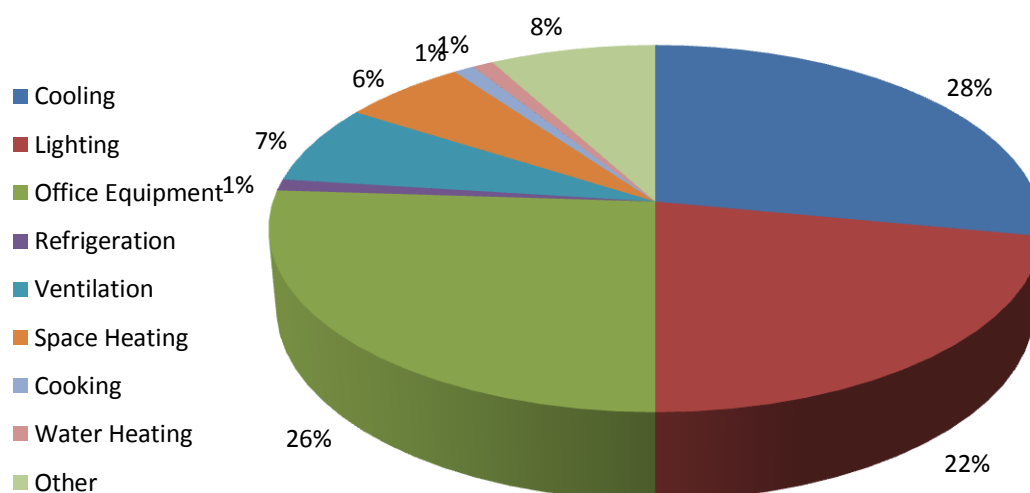


Figure 3 End-use electricity consumption for a typical office building ²

Further detailed analysis may also be made available by producing similar pie charts for each of the major end-uses presenting data by area, equipment or any other criteria. It is best to present an energy profile for each fuel source in as many ways as possible that are meaningful. Two examples are shown below:

² Source: Based on data from the Dept of Energy, EIA, Building End-Use Consumption Survey, 1999

Example A: Energy profile by end uses

| Uses | Machine Identifier(s) | Peak MW | Total | Variation +/- % | Energy Information |
|----------------|-----------------------|---------|-------|--------------------|--------------------|
| Fans | | | | | |
| Pumps | | | | | |
| Compressed Air | | | | | |
| Heating | | | | | |
| Lighting | | | | | |
| Other | | | | | |

Example B: Energy profile by unit process

| Unit Process | MWhr/yr | Operating Peak MW | % of total | Uncertainty +/- % | Source of Energy |
|--------------|---------|-------------------|------------|----------------------|------------------|
| Offices | | | | | |
| Air Handlers | | | | | |
| Ovens | | | | | |
| Other units | | | | | |

Determination of energy consumption can be collected by:

- Analysis of energy bills including electricity, diesel, gasoline, LPG, natural gas etc.
- Energy measurement by sub-meters to obtain energy consumption data of different types of equipment.
- Energy estimation when actual measurement of data is not available. This estimation is done by power rating and amount of operating hours.

4. Legal Obligations and Compliance

The organisation shall identify, implement, and have access to the applicable legal requirements and other requirements to which the organisation subscribes related to its energy use, consumption and efficiency. The organisation shall determine how these requirements apply to its energy use, consumption and efficiency and shall ensure that these legal requirements and other requirements to which it subscribes are considered in establishing, implementing and maintaining the EnMS.

4.1 Legal & Regulatory Compliance Status Document

The aim of this document is to highlight which legal and regulatory legislations relevant to energy use, are to be adhered to by the organisation. This document should be referred to when monitoring EnMS progress against planned milestones in order to avoid violations of laws and regulations, as well as lawsuits and legal proceedings.

This document should:

- Identify all applicable legal and other requirements to which the organisation subscribes. It must be ensured that all relevant documentation pertaining to these requirements are easily available to the staff.

Example C: List of legal and regulatory documents to which the organisation subscribes

| Internal Ref # | Document Title | Regulatory Body | Latest Revision | Publication Date | Depository (to access the document) |
|----------------|----------------|-----------------|-----------------|------------------|-------------------------------------|
| | | | | | |
| | | | | | |

- Legal requirements and other requirements shall be reviewed at defined intervals in order to update the above list, removing or adding documents as required, and ensuring that the latest versions are always available.
- Include records of compliance to all regulations that are to be checked at regular, planned intervals.

Example D: Record sheet of legal and regulatory compliance checks

| Doc Internal Ref # | Requirement | Doc section/pg | Compliance | | Verified by | Date of verification |
|--------------------|-------------|----------------|------------|----|-------------|----------------------|
| | | | Yes | No | | |
| | | | | | | |
| | | | | | | |

5. Energy Planning

The organisation shall conduct and document an energy planning process. Energy planning shall be consistent with the energy policy and shall lead to activities that continually improve energy performance.

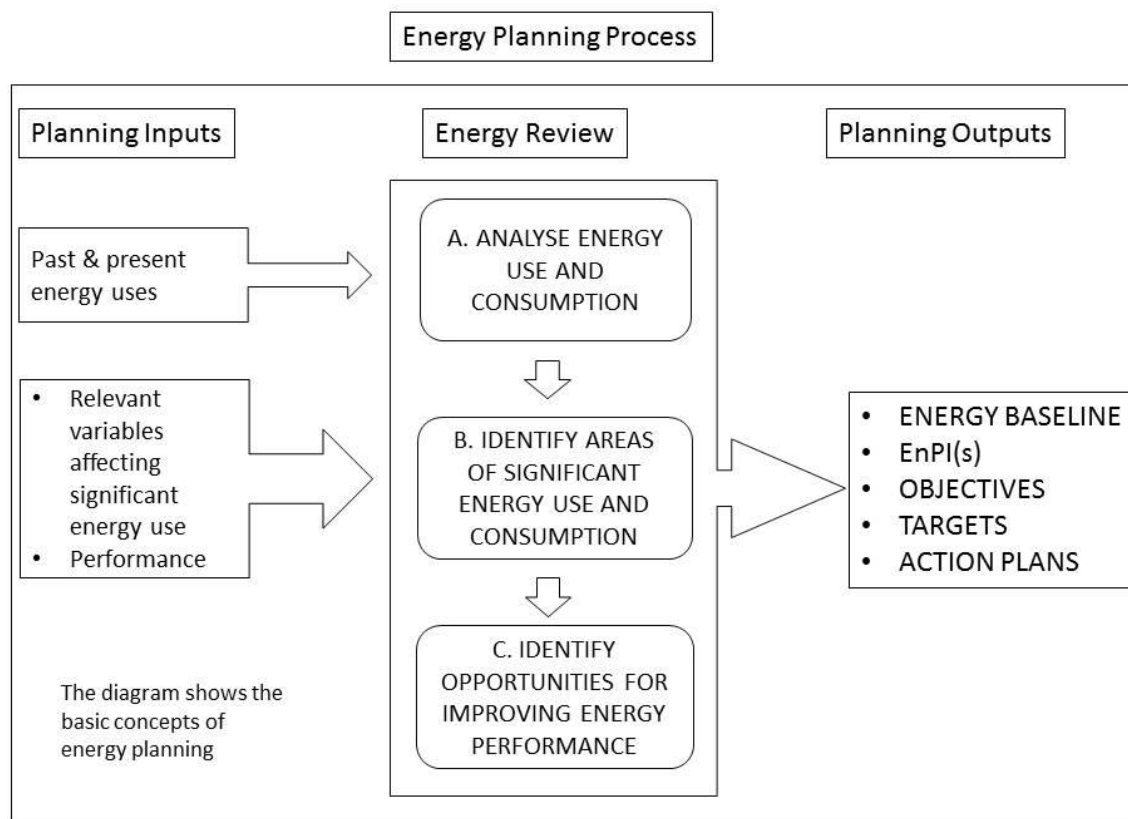


Figure 4 Energy planning process concept diagram³

The above diagram provides a conceptual diagram intended to improve understanding of the energy planning process with inputs to the energy review being used to analyse energy use and identify possibilities for improvement and producing the outputs from the planning process. This diagram is not intended to represent the details of a specific organisation and is not exhaustive as there may be other details specific to the organisation or to particular circumstances.

5.1 Inputs to the planning process

The inputs to the planning process include the information provided through the activities detailed in Chapter 3: *Identification and review of energy aspects* as well as other information relevant to the Energy Review. Examples of inputs to the Energy Review include:

- Annual energy reports
- Energy bills
- Energy action plans
- Production data

³ Source: ISO 50001 - Energy Management Systems

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- The Energy Policy and any reviews to it
- Equipment lists
- Equipment operating procedures
- Daily inspection records
- Diagrams (system, piping, wiring, etc.)
- Factory layouts
- Utility systems diagrams
- Follow-up actions from previous energy reviews
- Reviews of energy performance and related EnPIs
- Results of the evaluation of compliance with legal requirements and changes in legal requirements and other requirements to which the organisation subscribes
- The extent to which the energy objectives and targets have been met
- EnMS audit results
- The status of corrective actions and preventive actions
- Projected energy performance for the following period
- Recommendations for improvement
- Other documents relevant to the particular organisation

5.2 The Energy Review Process and Report

The energy management planning stage must have 8 essential components. These include:

1. Measurement of energy usage

Establish a baseline against which all future consumptions will be measured and compared. Once a baseline has been established, the organisation can track consumption on an ongoing basis and quantify the savings resulting from the efforts to reduce consumption. Measuring of energy consumption could also be done by sub-meters in order to identify specific areas that could lead to energy savings if addressed.

2. Establish an energy use profile

The development of an energy use profile will demonstrate where and how energy use is distributed within the building/organisation e.g. heating, water, lighting, refrigeration, etc. It will also identify the energy source for each system. Breaking down energy consumption data into discrete systems will help to further identify reduction opportunities and allow for a more strategic approach to targeting improvement efforts.

3. Creating a GHG emissions inventory

EnMS of large operations/facilities would also benefit from a GHG emissions inventory that links directly with energy consumption profile.

4. Establishing teams & leadership

Setting up of an energy team with representatives from all departments that share responsibility for energy planning, usage and management is essential for the EnMS success. Leadership roles should be made clear and resources administered where necessary.

5. Setting targets & goals

The energy management plan is to be made up of both short-term and long-term energy reduction goals that are integrated into a meaningful and achievable energy management plan. Goals are to be established after having considered baseline values and energy use profiles to make sure that they are consistent with the possible targets. These targets will be the driving force being the EnMS leading to the defined goals.

6. Implementation

The success of the proposed energy management action plans depends on effective implementation by all the energy management team. All personnel must deliver and report of the status of their responsibilities and report to the energy team.

7. Tracking, measurement and reporting

Tracking and measurement are important to verify whether goals are being met, to track savings, to monitor staff satisfaction and to design future actions within the EnMS. Regular reporting to the team is essential as well as dissemination to all persons residing in the organisation/building. All commitments and progresses are to be reported.

8. Training, education and celebration of accomplishments

Encouraging persons outside the energy team to support the energy saving initiatives is done through effectively communicating the need for energy management and also through providing training and guidance on how to implement specific strategies and initiatives. Success is easier to achieve when users are educated on the reasons for any changes (what are the goals), trained on work practice changes (how to engage), and regularly informed on how action plan progress is matching up to goals (progress reports). Training and education is both formal with specific learning objectives and informal with educational materials provided via posters, newsletters, etc. Recognising individual and collective efforts through awards or other recognition programs also provides opportunities to celebrate and communicate the valuable work being accomplished.

During the Energy Review, the management team will:

- A. Analyse the energy use and consumption together with a detailed analysis and identification of any variables that influence the overall energy system. This will be based on measurement and other data of current, past and future energy sources and their use and consumption.
- B. Identify areas of significant energy use and consumption in terms of particular areas, equipment, systems, processes, groups of personnel, etc. that have a major impact on the energy consumption. The current energy performance of these significant energy uses are to be determined and their future energy use and consumption estimated.
- C. Identify, prioritise and record opportunities for improving energy performance detailing in specific the areas concerned and the methods for energy reduction. Examples of opportunities may relate to potential sources of energy, use of renewable energy or other alternative energy sources, etc.

The methodology and criteria used to develop the Energy Review shall be documented and is a required document as per the ISO 50001 specifications. The energy review shall be updated at defined intervals, as well as in response to major changes in facilities, equipment, systems, or processes.

Example E: Extract of an energy review report

| Energy Review, Energy Baseline and EnPIs | | | |
|---|------------|----|-----|
| Requirements | Conformity | | |
| | Yes | No | N/A |
| 1. Has a procedure been established, implemented and maintained to identify the baseline and EnPIs? | | | |
| 2. Has energy baseline related to potential significant energy use been considered in establishing and implementing the EnMS? | | | |
| 3. Has the organisation identified the areas of significant energy use? | | | |

| | | | |
|--|--|--|--|
| 4. Has the organisation determined the current energy performance related to identified significant energy uses? | | | |
| 5. Are all significant energy uses controlled by objectives, targets and programmes, procedures or monitoring? | | | |
| 6. Has the organisation identified other relevant variables affecting significant energy uses? | | | |

This methodology is to be applied to cover all aspects dealt with in the Energy Review.

5.3 Outputs from the planning process

The outputs from the energy review can be split into 2 categories:

1. **Planning Aspects (quantitative / measureable)**
 - Energy baselines
 - EnPIs
 - Objectives
 - Targets
 - Action plans
 - Allocation of resources
 - Other planning outputs
2. **Operational Procedures (methodologies / policies)**
 - Training plans
 - Communication plans (internal & external)
 - Operational Control methods
 - Procurement procedures
 - Design guidelines and procedures
 - Updates to the Energy Policy
 - Updates to the Action Plan
 - Other necessary documentation updates

Example F: Presentation of the Energy Baselines for the organisation

| Fuel / Resource | Total Annual Consumption / Production | Total Annual Cost / Value | Percentage of Total Energy Cost / Production Units |
|---|---------------------------------------|---------------------------|--|
| Electricity | | | |
| Natural Gas | | | |
| Fuel Oil | | | |
| Other fuel | | | |
| Water | | | |
| Other units of consumption / production | | | |

Example G: 5 year energy management action plan

Source: Example Energy Management Plan, Energy Solutions Ltd⁴

| Category | Immediately | In next 12 months | In next 3 years | In next 5 years |
|------------------|--|---|--|--|
| Responsibilities | Document existing energy management responsibilities. Form an initial energy management team. | Assign energy management tasks into the job descriptions of staff on the energy management team. Appoint a senior energy manager to the team. Consider a full time energy manager position. | Continue regular productive meetings. Appoint a dedicated energy manager, if needed. Energy team to report to top level management in a brief and accessible manner. | Energy manager and energy team continue managing energy optimisation programme. Continue presenting good reports to top management and stakeholders. |
| Strategy | Circulate and communicate first 5 yr mgmt plan. Set initial targets. | Detailed, realistic 12 month+ energy management plan for each area. | Update the energy management plans to match actual experience. | Update the energy management plan to exploit new opportunities. |
| Savings Targets | Set targets - perhaps a 10% reduction of energy use within 5 years benchmarked per m2. It should also be broken down into year by year targets - eg: 4% saving after 1 year, 6% after 2 years etc. | Review the savings achieved and update targets. Adjust the action plans accordingly. | Review the savings achieved and update targets. Adjust the action plans accordingly. | Review the savings achieved and update targets. Adjust the action plans accordingly. |
| Budgets | Determine what the appropriate funding streams are, determine what procedures and timeframes are needed to access the funding. | Submit next year's budget to top level management early with a good plan - accurate costs estimated. | Consistently achieve budget deadlines for capital and operational funding. | Maintain effective budget management. |
| Staff Training | Send 2 staff members to an energy management course followed by a presentation to senior management. | Send 2 more staff to an energy management course or run in-house seminars. | Expand energy management training to include all staff in particular areas. | Expand energy management training to include all staff. |
| Other categories | | | | |

⁴ <http://energysolutions.co.nz/pdf/Energy-Management-Plan-Guidelines.pdf>

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6. Roles and Responsibilities

Successful EnMS implementation requires a strong top management involvement and leadership from the initial conceptual stages. Top management commitment is extremely vital when it comes to establishing a new EnMS as well as appointing and authorising projects for the EnMS champion. This EnMS Champion / Management Representative is responsible to direct activities down to the Energy Management Team and effectively to the whole organisation. Other activities of top management would include allocating resources, setting performance ownership, ensure fair evaluation, direct the management review and define the energy policy.

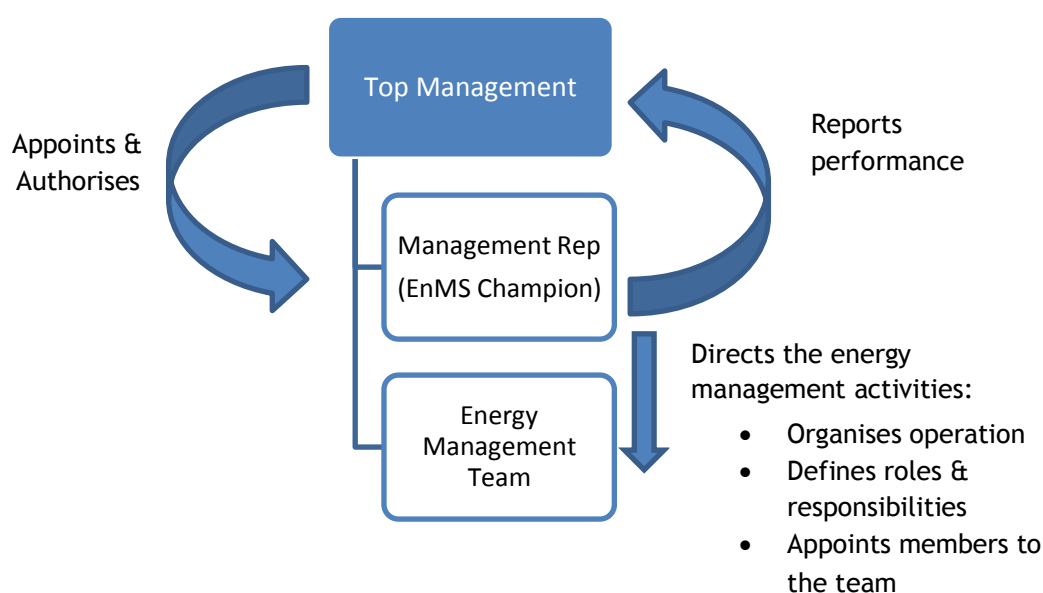


Figure 5 Roles of Top Management and Management Representative

6.1 The Energy Manager / Champion

Top management shall appoint a management representative(s) with appropriate skills and competence, who is responsible for overseeing the development and implementation of the EnMS and acting as the link between senior management and the rest of the organisation. Irrespective of other responsibilities, the Energy Manager / Champion has the responsibility and authority to:

- ensure the EnMS is established, implemented, maintained, and continually improved in **accordance with ISO 50001 standard**
- Identify **supporting person(s)**, authorized by an appropriate level of management, to work with the management representative in support of energy management activities as part of the energy team.
- **report** to top management on energy performance and on the performance of the EnMS
- ensure that the **planning of energy management activities** is designed to support the organisation's energy policy
- define and communicate **responsibilities and authorities** in order to facilitate effective energy management

- determine **criteria and methods** needed to ensure that both the operation and control of the EnMS are effective
- promote **awareness of the energy policy** and objectives at all levels of the organisation via various mediums such as newsletters, marketing efforts, etc.

6.2 The Energy Team

Best practices in energy management require the involvement of staff from many different areas and roles across the organisation. This may include personnel with specific technical and operational knowledge, staff from financial, environmental and other departments, and senior managers with the authority to make significant business decisions. As discussed, the energy team is formed by the Energy Manager. Forming an energy team facilitates participation and commitment, provides the energy manager with a resource base to draw upon, and ensures all aspects of the business are taken into account for energy efficiency projects.

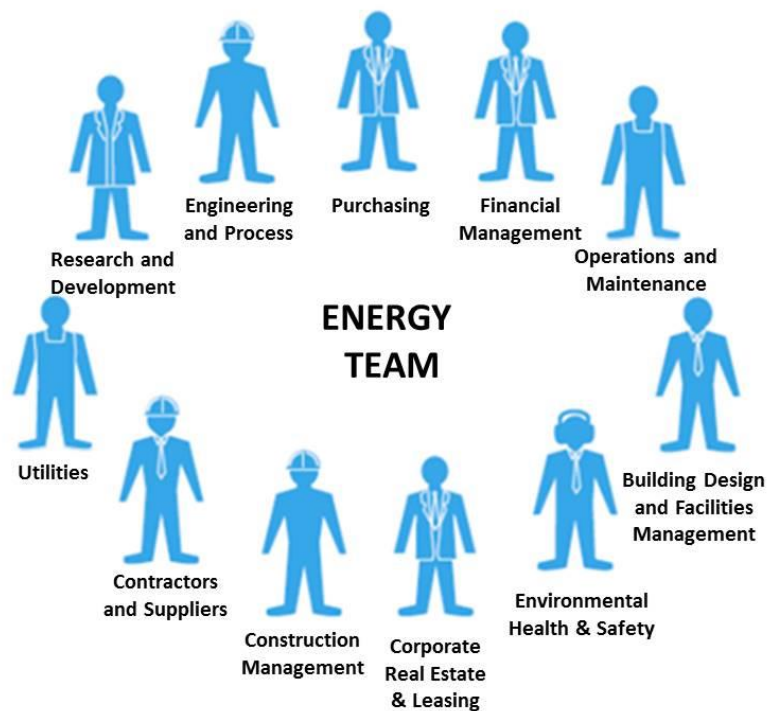


Figure 6 Formation of an example Energy Team with representatives from each department⁵

The individual roles and responsibilities of each person are to be detailed and documented as part of the EnMS Charter document.

⁵ Source: Energy savings master plan program: Partnering for sustainability
<http://members.questline.com/presentations/20120522DukeEnergyESMPWebinar.pdf>

7. Awareness Raising and Communication

The organisation is responsible for making sure that any person working for or on its behalf are competent on the basis of appropriate education, training, skills, or experience. A representative of the energy management team must ensure that appropriate training records are maintained and that all employees are aware of their roles and the benefits and impact of implementing the ISO 50001 standard.

7.1 Training Plan Document

The plan should identify appropriate education, training, skills or experience that provides the basis of competence for the operation of the EnMS. The employees' training should include a clear understanding of:

1. the importance of conformity with the energy policy, energy management procedures and the requirements of the EnMS
2. each individual's roles, responsibilities and authorities as assigned by the energy management team in achieving the requirements of the EnMS
3. the overall benefits of improved energy performance both to the organisation and to the employees in a holistic approach
4. the impact, actual or potential, with respect to energy use and consumption, of their activities. Also to be included is an understanding of how their activities and behaviour contribute to the achievement of the energy objectives and targets, and the potential consequences of departure from specified procedures.

The organisation shall identify the training needs associated with the control of its significant energy uses and the operation of its energy management system. It shall provide training or take other actions to meet these needs. Associated records shall be maintained.

Persons /groups of employees requiring training can be split into groups:

- Management level
- Energy management team
- All persons working in the boundaries
- All persons working for the organisation
- All persons working on the organisation's behalf
- Others

7.2 Training Records

Documentation, planning and recording of completed and future training requirements is a must for energy management systems as required by ISO 50001. An example of personal training records for each employee/individual is shown below.

Example H: Employee training records

| TRAINING RECORD | | | | |
|---------------------------------------|---------------------------|---------------------------|---|----------|
| Name: _____ | | | | |
| Job Title: _____ | | | | |
| Date of employment: _____ | | | | |
| Employee Number: _____ | | | | |
| Details of qualification / experience | | | Date obtained | Verified |
| | | | | |
| Recommended training | Planned date for training | Date of training received | Employee's signature to confirm training received | Comments |
| Induction | | | | |
| Safety awareness | | | | |
| Quality awareness | | | | |
| Environmental awareness | | | | |
| Etc. | | | | |

Figure 7 Example of training record sheet

7.3 Communication Plan

A communication matrix is a useful tool to communicate information to the project audiences. The matrix also includes the frequency of communication for the different types of information and the method of communication together with the key message of each.

Example I: Communication matrix

| Subject | Objective | Key Message | Audience | Delivery Method | Frequency | Responsible |
|--|--|--|---|--|-----------------------------------|---|
| <i>e.g. Reports, Presentations, EnMS Announcements, Reviews, Team Building, etc.</i> | <i>The aim of the communication exercise</i> | <i>Brief description of what is to be communicated</i> | <i>e.g. employees, particular department, stakeholders, suppliers, energy team, sponsor, etc.</i> | <i>e.g. email, seminar, meeting, staff newsletter, briefings, media articles, etc.</i> | <i>e.g. Weekly, monthly, etc.</i> | <i>e.g. Energy Manager, team member, etc.</i> |

8. System Documentation

The ISO 50001 standard requires solid documentation as a fundamental aspect for conforming to ISO 50001 requirements. All clauses and sections of the ISO 50001 document state that everything is to be recorded starting from the basic energy monitoring data to the guidelines for use and status reports.

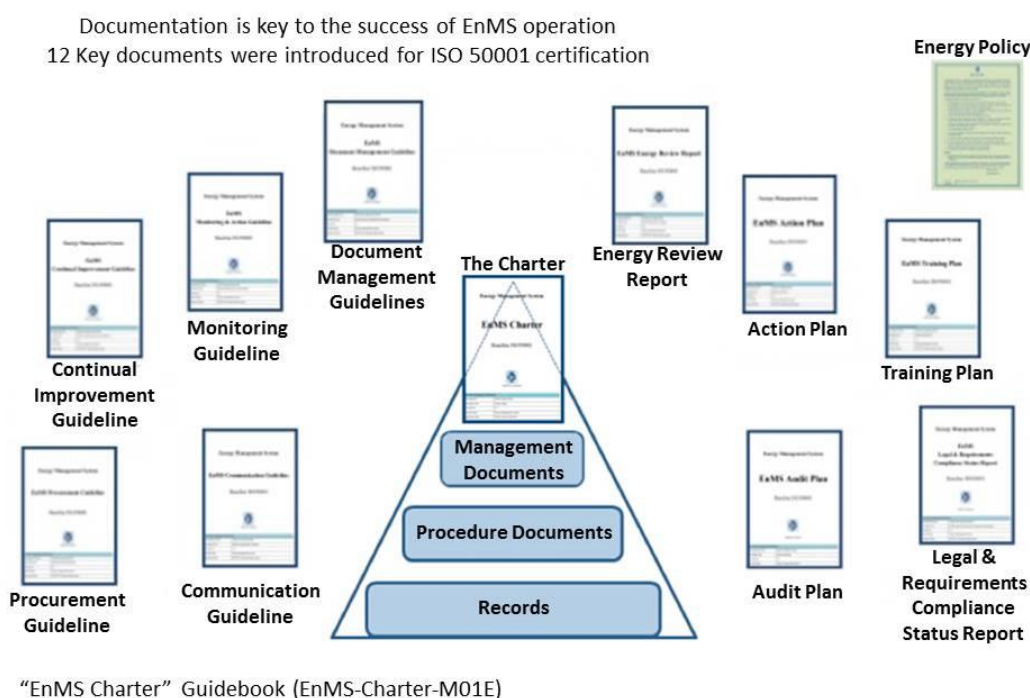


Figure 8 ISO 50001 documentation required

A number of the documents shown in the figure above are described in various chapters throughout this document. These are: the Energy Policy (Chapter 2.1), the Legal and Regulatory Compliance Status (Chapter 4.1), the Energy Review Report (Chapter 5.2), the Training Plan (Chapter 7.1), the Document Management Guideline (Chapter 9.1), the Monitoring Guideline (Chapter 11.1) and the Audit Plan (Chapter 13.1). The other documents required for certification are:

8.1 EnMS Charter

This document is the starting point of EnMS implementation and gives the guidelines and provisions that shall be followed throughout the entire operation of the EnMS. The document guides the persons within the organisation in order to pursue the optimum energy performance and to appreciate how the organisation can benefit from the implementation of the EnMS. Additionally, the Charter serves as a practical management tool to ensure achievement of the objectives. All other EnMS documents are to be coherent with the contents of this document that includes the following sections:

1. Introduction / Background

This section serves to give the basic overview of the EnMS system, what is plans to solve and a brief overview of the basic elements.

2. Scope and boundaries

Description of what is to be achieved and by when. It is crucial that all goals are specific and measureable. What results are expected to be achieved by the EnMS? What actions will the team take to undertake the project?

3. Structure and Organisation

Include an organigram or list of people involved in the EnMS project. Include all persons involved starting from the Energy Project Manager and the persons working within the organisation to the external persons involved. If the names of individuals are not known, list the title of the required position and department.

4. Guidelines and Provisions

4.1 General Requirements

The requirements and determination of the necessary actions that need to be taken to achieve the scope of the EnMS.

4.2 Management Commitments

Include a description of the responsibilities of each person detailing what each person is required to do. In particular it is required to extensively detail the roles of Top Management and of the Management Representative.

4.3 Energy Policy

This document is detailed in Chapter 2.1 and forms part of the EnMS Charter

4.4 EnMS Action Plan

The EnMS Action Plan is one of the documents required for ISO 50001 compliance and certification. For each of the actions required for EnMS implementation, it is important to establish significant dates and persons responsible for carrying out the defined actions. A sample table that could be used within the EnMS Action Plan is shown below.

Example J: EnMS Action Plan

| EnMS Action Plan | | | | | |
|------------------|--------------------|------------|-----------------|------------------------|-------------------|
| Action | Person responsible | Start Date | Completion Date | Method of Verification | Verification Date |
| | | | | | |
| | | | | | |

The action plans shall include:

- Designation of responsibilities
- Means and time frames by which individual targets are to be achieved
- A statement of the method by which an improvement in energy performance shall be verified

This procedure will ensure that:

- results are measured and reported at determined intervals
- EnMS performance is reported to top management regularly

- The criteria and methods needed to ensure operation and control of the EnMS are effective
- the energy planning process is consistent with the energy policy and shall lead to activities that continually improve energy performance
- energy objectives and targets are specific and measurable together with timeframes for their achievement.
- Operation and maintenance of facilities, processes, systems and equipment are performed in accordance with operational criteria
- design procedures for new or improved facilities, systems and equipment will include energy performance criteria
- design of new manufactured products will include energy performance evaluation.

4.5 Implementation and Operation

This section of the EnMS Charter includes the Training Plan (Chapter 7.1) as well as the:

4.5.1 Communication Guideline

ISO 50001 requires an organisation to communicate internally with regard to its energy performance and EnMS as appropriate to the size of the organisation and with the same manner and importance given to other important information. Personnel who are made aware of and understand top management's commitment to improved energy performance are more likely to be committed themselves and take action to improve energy performance.

The communication guidelines document serves to specify procedures for:

- energy performance and EnMS operation, including communication on operational controls and procedures to all personnel involved in the organisation
- awareness and motivation to adhere to the EnMS procedures for all levels of the organisation
- external communications about the EnMS

The final step of the communication process is to measure the effectiveness of the communication, report the results to top management, and adjust the communication plan and materials as needed. This aspect is to be included in the Action Plan (Section 4.4 of the EnMS Charter)

Examples of communication methods are:

- EnMS web portal
- Bulletin boards
- Suggestion boxes
- Meetings
- Training sessions
- Motivation and incentive programs, etc.

4.6 Checking Performance

This section of the EnMS Charter consists of the Monitoring Guideline document that is detailed in Chapter 11.1

4.7 Management Review procedures

The procedures to be followed in order to enable the Energy Planning Process detailed in Chapter 5. This should include all requirements and methods to ensure adequate, consistent and reliable inputs to the management review, the actual methodology to be followed during the management review including criteria for evaluation, as well as the required outputs from the planning process.

An overall aspects to be taken into consideration when developing a new EnMS Charter is to take into account any:

- Constraints - limiting factors that impact the project in a particular way
- Assumptions - factors that must be relied upon without guarantee in order to succeed with the EnMS
- Risks - anything that might get in the way of accomplishing the project goals
- Dependencies - the absolutely essential parts of the project.

8.2 Procurement Guideline

Aside from the standard terms and conditions of purchasing, such as price, payment, delivery, inspection, and acceptance, organisations should establish energy-related criteria that will be used to evaluate procurements. The organisation should decide how it will assess the energy use of the products, equipment, and services which it uses as inputs to its processes. This requirement is meant to apply only to those inputs that have a significant effect on the organisation's energy performance. It is up to the organisation to decide what is significant for them. In addition, organisations should inform prospective suppliers that these energy-related purchasing criteria are now part of the process used to select suppliers.

The organisation's purchasing department should develop relevant energy criteria based on achieving the organisation's energy objectives and targets. These criteria should be included in requests for quotations and proposals.

Example K: Criteria for energy purchasing specifications for lighting systems

Source: [http://www.hkeia.org/iso50001/eguidebook/ISO50001%20guide_ENG%2019Aug\(Final\).pdf](http://www.hkeia.org/iso50001/eguidebook/ISO50001%20guide_ENG%2019Aug(Final).pdf)

| |
|---|
| Unit cost and total cost |
| Number of lighting devices required |
| Power rating |
| Power factor |
| Energy saving percentage (i.e. compared with the traditional mercury lamp) and its payback period |
| Lifetime (i.e. frequency of replacement) |
| Lux level |
| Colour temperature |
| Luminous efficiency in terms of lm/w |
| Lumen depreciation |
| Surface temperature (i.e. impact on operating cost of air-conditioning system) |
| Any stroboscopic effect? |
| Any need for special disposal arrangement? |
| Any hazardous materials or heavy metals inside in the equipment? |
| After-sale maintenance service |

Contingency plans for issues related to equipment emergency situations are to be included in the guidelines. These are necessary to minimise the negative effects on the organisation in emergency disaster situations. Identify the key energy intensive processes and equipment, and analyse the impacts that would result from threats to them. Use this information to prepare for the worst, and take steps to improve the resilience to failure of the energy significant infrastructure supporting the key processes.

Example L: Checklists designed to be used when procuring goods or services.

Utilisation

| | Yes | No |
|---|-----|----|
| Is the product really necessary? | | |
| Have you checked surplus supplies to ensure that no comparable product is already at hand? | | |
| Have you investigated the feasibility of short-term rental, leasing or borrowing the product as an alternative to purchasing? | | |
| Is the quantity requested appropriate and sure to be used? | | |
| Will the product be used to the end of its useful life? | | |
| If not, can it be easily reused/recycled? | | |

Acquisition

| | Yes | No |
|---|-----|----|
| Is a complete list of the product's ingredients available on request? | | |
| Is the product free of hazardous materials/substances that would require special labelling, handling and/or waste disposal practices? | | |
| Will the product maintenance and upkeep be free of hazardous materials/substances/ products? | | |
| Is the product less polluting during its use than competing products (e.g., non-toxic, biodegradable)? | | |
| Can the manufacturer assure that the health of humans, other animals and plant life is not endangered in any way due to the manufacture, use and disposal of the product? | | |
| Is the product more energy-efficient or water-efficient during use and operation than competing products? | | |
| Is the product free from banned substances and resources that come from environmentally sensitive regions? | | |
| Has the product been certified under a recognized eco-labelling program? | | |
| Is the product designed to minimize waste? | | |

| | | |
|--|--|--|
| Does the product contain post-consumer recycled materials? | | |
| Is the product available from a local supplier? | | |

Packaging

| | Yes | No |
|---|-----|----|
| Can the product be purchased in bulk? | | |
| Has the supplier/manufacturer tried to reduce the amount of packaging for the product? | | |
| Does the product arrive from the supplier packaged in material(s) that are reused by either the end user or the supplier? | | |
| Does the product arrive from the supplier packaged in material(s) that are non-hazardous and can be recycled within available recycling programs, or does the supplier take back the packaging for recycling? | | |
| Does the packaging material(s) have post-consumer recycled content? | | |
| Operation, Utilization and Maintenance | | |
| Is the product easy to maintain? | | |
| Is it economical to repair? | | |
| Allowing for possible future needs, can the product be easily upgraded? | | |
| Are replacement parts recycled, recyclable or re-conditionable? | | |
| Have you ensured that components required for maintenance of the product are not environmentally damaging? | | |

Disposal

| | Yes | No |
|--|-----|----|
| Is the product recyclable in the local where it is to be used? | | |
| If the product is made of several components, can it be dismantled so as to recycle parts? | | |
| Can the product or its parts be reused, reallocated, sold or donated to others? | | |
| Can the product or its parts be returned to the supplier for reuse, recycling or recovery? | | |
| Can the product or its parts be contributed to a waste exchange program? | | |
| Have you ensured that there are no special costs involved in disposing safely of the product or its component parts? | | |

Verifying Suppliers' Environmental Commitment

| | Yes | No |
|--|-----|----|
| The organisation's practices respect all municipal, provincial/territorial and federal environmental legislation | | |
| The organisation or individual has never been convicted of an environmental offence | | |
| The organisation or individual makes all reasonable efforts to reduce waste | | |
| The organisation or individual uses certified recycled-content paper (preferably with a high post-consumer content, and preferably not chlorine-bleached) and all printing is double-sided | | |
| The organisation has ISO 14001 environmental management system certification | | |
| The organisation has ISO 50001 energy management system certification | | |
| The organisation or individual adheres to green printing principles/and or EcoLogo certification for printed materials. | | |
| Any hazardous materials used are properly handled, stored and disposed of. | | |

9. Document Control

The establishment and maintenance of documents requires competent persons who are trained in such skills of document control. The documents' availability is the only proof for demonstration of the EnMS within the organisation.

9.1 Document Management Guideline

This document is required for ISO 50001 certification and aims to ensure that all policies and action plans are documented, updated, communicated and understood within the organisation. Furthermore it should describe procedures to:

- **Approve documents for adequacy prior to issue** - define a group of reviewers who are to approve the document prior to initial release. Approvals and comments from the reviewers must be documented.
- **Periodically review and update documents as necessary** - define when, how often and in what circumstances documents are to be reviewed
- **Ensure that changes and current revision status of documents are identified** - the reader should be able to know what revisions have been done to the document and also be sure that the document version at hand is the latest version

Example M: Authorisation and amendment control sheet

Document Title: _____

| Date | Issue no. | Revision no. | Page no. | Modification | Authorised by |
|------|-----------|--------------|----------|--------------|---------------|
| | | | | | |
| | | | | | |

- **Ensure that relevant versions of applicable documents are available at points of use**
- **Ensure that documents remain legible, readily identifiable and traceable** - Examples of document identifiers include:
 - Name of the organisation
 - Document title
 - Document type: policy, process, procedure, work instruction, research report, etc.
 - Document date
 - Version number
 - Unique document identification number
 - Author

- **Procedures to control external documents** - Ensure documents of external origin determined by the organisation to be necessary for the planning and operation of the EnMS are identified and their distribution controlled.

External documents typically consist of public documents and proprietary documents. Examples of public documents which are widely available include the ISO 50001 standard, regulatory regulations, and published books. Examples of proprietary documents that are customer-or supplier-owned include drawings, specifications, purchase orders, and requirements documents.

- **Prevent the unintended use of obsolete documents** - Make sure that all obsolete documents that have been replaced by a newer version are clearly marked as obsolete.

10. Operational Control

The organisation needs to identify and plan operations and maintenance activities which are related to its significant energy uses in order to ensure that they are carried out under specified conditions by means of the following:

1. Establishing and setting criteria for the effective operation and maintenance of significant energy uses, where their absence could lead to a significant deviation from effective energy performance;
2. Operating and maintaining facilities, processes, systems and equipment, in accordance with operational criteria;
3. Appropriate communication of the operational controls to personnel working for, or on behalf of, the organisation.

In order to identify operational controls, the organisation should systematically review all of its significant energy uses to identify those which are not already controlled or where existing controls may be insufficient, and to subsequently ensure that control procedures are in place for all such areas.

A recommended best practice procedure for operational control is to put in place a series of checklists for every process / operation within the organisation. These checklists are to be accompanied with a schedule of regular review that also defines who is responsible for going through the checklist and who to report to. This should be done as part of the Audit Plan detailed in Chapter 13.

It is suggested that the following are considered in relation to the preparation of operational control:

- The level of detail of the control procedures required
- The target users of the procedures e.g. working level or management supervisory level
- Distribution to relevant staff and / or contractors, where applicable;
- developing a matrix to cross check significant energy uses against operational controls to ensure that relevant procedures are in place for controlling each of the significant energy uses.

11. Energy Monitoring

The key characteristics of the organisation's operation that determine the overall energy performance and affect EnMS success, are to be monitored, measured and analysed at planned intervals. These key characteristics include:

- **The outputs of the energy review** - those outputs defined in the energy review as important for characterisation of past, present and future energy consumption patterns
- **Significant energy uses** - the data of the preceding energy review is analysed to determine the significant energy uses that need to be monitored
- **Relationship between significant energy use and consumption** - one must characterise the variables that affect the consumption and cost of each energy use, i.e. electricity, gas, diesel, etc.
- **Energy performance indicators (EnPIs)** - all of the EnPIs defined in the energy review are to be monitored
- **Effectiveness of the action plans in achieving objectives and targets** - the organisation must set metrics that are suitable to measure the effectiveness of each objective, target, and action plan.
- **Evaluation of actual versus expected energy consumption** - to keep on track with the set objectives and targets.

11.1 Monitoring Guideline Document

The goal of monitoring techniques and methods is to help the energy managers be in a position to evaluate energy performance and improve it. The availability of monitoring data will show the effectiveness of the action plans in achieving objectives and targets and also allow for an evaluation of actual versus expected energy consumption.

This guideline document is used to:

- Define methods of treating records
- Define how to review measurement needs
- Define methods to maintain the quality of monitoring equipment and records
- Define procedures to identify and act against deviations in energy performance
- Define procedures for consistent monitoring and action operation
- Define methods of measuring changes in energy performance against the energy baseline.
- Define methods for adjusting the baseline when the EnPIs no longer reflect the organisation's energy use.
- Define methodologies for determining and updating the EnPIs.
- Establish the monitoring frequency and updating of records for all EnPIs compared to the energy baseline
- Define methods to evaluate the actual versus expected energy consumption

Energy data collection should be reviewed for quality and the results monitored on an ongoing basis by the Energy Manager/ Management representative. Taking a proactive approach and monitoring consumption in real time, and consolidating energy data into one platform can save up to 30% of energy costs.

11.2 Monitoring Procedures

Procedures that are to be included in the Monitoring Guideline include:

- Procedures for **recording of data** that is vital to the energy review and might also be used at later stages when there is the need to refer back to the effectiveness of certain actions that were taken in the past. All results from monitoring and measurement of the key characteristics shall be recorded.
- An **energy measurement plan**, appropriate to the size and complexity of the organisation and its monitoring and measurement equipment, shall be defined and implemented. Examples of variables which require measurement include all EnPIs defined in the planning process as well as any other variables deemed important by the energy management team.
- The organisation shall define and periodically **review** its measurement needs. Any changes are to be documented as a new energy measurement plan revision.
- The organisation shall ensure that the equipment used in monitoring and measurement of key characteristics provides **accurate and repeatable data**.
- **Calibration records** and other means of establishing accuracy and repeatability shall be maintained including date of last maintenance and calibration, hours of operation, etc.
- The organisation shall investigate and respond to **significant deviations** in energy performance. Procedures to be followed in the case of detection of deviations is to be established and documented. Results of these activities shall also be maintained.

Measuring equipment can range from simple utility meters for small organisations up to complete monitoring and measurement systems connected to a software application capable of consolidating data and delivering automatic analysis. It is up to the organisation to determine the means and methods of measurement.

12. Non-Conformities, Corrective and Preventive Actions

All non-conformities must be controlled according to a procedure designed to prevent, or respond to, unintended deviations from the EnMS objectives and targets. It is the primary responsibility of the Energy Manager to ensure reporting and control of all non-conformities as soon as they are detected and take the necessary corrective and preventive actions to eliminate the non-conformity and prevent it from re-occurring.

12.1 Continual Improvement Guideline Document

An organisation that already has documented corrective action and preventive action procedures as part of its quality, environmental, or safety management systems, need not establish redundant procedures for the scope of the EnMS but simply to indicate that the existing procedures apply to the EnMS.

The Continual Improvement Guideline document consists of a set of procedures to be followed to investigate and respond to significant deviations in energy performance including procedures for:

- taking corrective actions and preventive actions
- periodical review of the non-conformities or other identified potential non-conformities by collect the non-conformity information and prioritising them on the basis of importance and consequence
- determining the causes of non-conformities or potential non-conformities via a root-cause analysis (formal or informal as appropriate) to determine the cause of the nonconformity. Failure Mode and Effects Analysis (FMEA) is a well-known method for determining root causes
- evaluating the need for action to ensure that non-conformities do not occur or reoccur
- determining and implementing the appropriate action needed
- maintaining records of corrective and preventive actions
- reviewing the effectiveness of the corrective or preventive action taken

Example N: EnMS Non-Conformance Incident Report

| | | |
|--|-------|------------|
| Incident reported by: | Date: | Report no: |
| Department/site: | | |
| Description of incident/non-conformance: | | |
| Short-term action taken: | | |
| Action taken by: | | Date: |

| | |
|---------------------------------------|------------------------|
| Proposed long-term preventive action: | |
| Proposed by: | Date: |
| Action to be taken: | Action to be taken by: |
| | Date by: |
| | Action taken: |
| | Date: |

Form to be sent to the Energy Manager when completed

Verified as effective: _____ Date: _____

Example O: Corrective / Preventive Action Request Form

| | |
|-------------------------------------|---------------------|
| Audited Area / Department | |
| Audit Date: | Audit Ref No: |
| Audited by: | |
| Description of the non-conformance: | Root cause analysis |
| Corrective Action Requested: | |
| Date of Implementation: | |
| Preventive Action Requested: | |
| Date of Implementation: | |
| Verification: | Signature: |
| | Date: |

Example P: Corrective and Preventive Action Tracking Log

| Ref # | Issue Date | Area / Department | Problem Description | Corrective Action Completion Date | Preventive Action Completion Date | Closure Date |
|-------|------------|----------------------|------------------------|--|--|-----------------|
| | | | | | | |
| | | | | | | |
| | | | | | | |

13. Internal Audits

According to the ISO 50001 standard, organisations should establish a programme to evaluate periodically on its EnMS implementation and check the effectiveness of the system in fulfilling their energy policy. The programme should include the scope and frequency of the audits.

An internal audit of the EnMS is different from an energy audit or assessment. The internal audit evaluates the processes, procedures and implementation of the EnMS to determine if they are appropriate to the organisation, implementation status and conforming to requirements of the ISO 50001 standard. It helps identify nonconformities and opportunities for improvement of the EnMS to ensure that the organisation is actively seeking to implement all cost-effective measures for reducing energy use. In practice, it can be performed by either internal or external persons, as long as they are competent, impartial and objective in conducting the EnMS audit.

13.1 Audit Plan Document

The Audit Plan Document contains procedures for the internal audits that are to be conducted at planned intervals to check conformity with ISO requirements as well as the energy objectives and targets established. An audit plan and schedule shall be developed taking into consideration the status and importance of the processes and areas to be audited as well as the results of previous audits. Audits contribute to the improvement of the EnMS by identifying nonconformities and opportunities for improvement which management should act upon. The entire EnMS can be audited at the same time in a single comprehensive audit, or it can be broken into subsystems that are audited separately.

Example Q: Schedule of EnMS System Related Audits for the Year 20..

| Topic | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Energy management system | | | | | | | | | | | | |
| Energy Policy | | | | | | | | | | | | |
| Environmental aspects | | | | | | | | | | | | |
| Legal requirements | | | | | | | | | | | | |
| Objectives, targets, management programme | | | | | | | | | | | | |
| Structure and responsibility | | | | | | | | | | | | |
| Training, awareness and competence | | | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|--|--|--|--|--|--|--|--|--|--|--|--|
| Communication | | | | | | | | | | | | |
| Documentation, document control | | | | | | | | | | | | |
| Operational control | | | | | | | | | | | | |
| Emergencies | | | | | | | | | | | | |
| Monitoring and measurement | | | | | | | | | | | | |
| Non-conformance, corrective & preventive action | | | | | | | | | | | | |
| Records | | | | | | | | | | | | |
| Internal audits | | | | | | | | | | | | |
| Management review | | | | | | | | | | | | |

- ☐ Audit planned
☒ Audit taken place (no action required)
☒ Action required
☒ Short-term action taken, long-term action notified

Signed: _____

Date: _____

Example R: Audit Findings Report Sheet

| Scope/subject: | | Contact: | Auditors: | Date: | Audit no: | Page: of |
|----------------|-----------------------|---------------------|-----------|--------|-------------------------|---------------------------|
| Ref | Evidence and findings | Recommended actions | | Status | Short term action taken | Long term action notified |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Short-term action taken, long-term action notified: Environmental Manager Date: _____

Example S: Internal Audit Checklist - Example #1

Audit Reference No. _____

Audit conducted by: _____

Date: _____ to _____

| Energy Management System Requirements | Observations/Comments | Results |
|--|-----------------------|---------|
| Has the organisation established, documented, implemented, maintained and improved an EnMS as required by ISO 50001:2011? | | |
| Has the organisation defined and documented the scope and boundaries of the EnMS? | | |
| Has the organisation determined how it will meet the requirements of the standard in order to achieve continual improvement of its energy performance and of its EnMS? | | |
| Additional questions... | | |

Example T: Internal Audit Checklist - Example #2

Audit Reference No. _____

Audit conducted by: _____

Date: _____ to _____

| Management Responsibility | Observations/Comments | Results |
|---|-----------------------|---------|
| Has top management defined, established, implemented and maintained an energy policy? | | |
| Has a management representative been appointed and an energy management team formed? | | |
| Are the resources needed to establish, implement, maintain and improve the EnMS and the resulting energy performance available? | | |
| Are the scope and boundaries to be addressed by the EnMS clearly defined? | | |
| Is the importance of energy management being communicated to all those in the organisation? | | |
| Are the energy objectives and targets established? | | |
| Are the energy performance indicators (EnPIs) appropriate to the organisation? | | |
| Is energy performance being considered in long-term Planning at management level? | | |
| Are results are measured and reported at determined intervals? | | |
| Are management reviews being conducted regularly? | | |
| Additional questions... | | |

Example U: Internal Audit Checklist - Example #3

Audit Reference No. _____

Audit conducted by: _____

Date: _____ to _____

| Non-Conformance, Corrective & Preventive Actions | Observations/Comments | Results |
|--|-----------------------|---------|
| Are the guidelines for corrective and preventive action in place? If yes, do they need to be revised? In what way? | | |
| Who needs to be involved in this process within our organisation? | | |
| How are non-conformities and other potential system deficiencies identified? (List methods such as audits, employee suggestions, ongoing monitoring, etc.) | | |
| How do we determine the causes of non-conformities and other system deficiencies? How is this information used? | | |
| Is the status of corrective and preventive actions adequately tracked and recorded? | | |
| Is the information on non-conformities and corrective actions reported to the EnMS Energy Manager? | | |
| Additional questions... | | |

ANNEX 1 – Documents subject to ISO 50001 certification

Source: http://www.enms-doc.com/downloads/DocSubject_to_ISO50001Requirements_1.0.pdf

Document subject to ISO 50001 Requirements

4.1 General requirements

| ISO 50001 Requirements | | Specific Document covering the requirement |
|--|--|--|
| The organization shall: | | |
| a) establish, document, implement, maintain and improve an EnMS in accordance with the requirements of this International Standard; | | EnMS Charter |
| b) define and document the scope and boundaries of its EnMS; | | EnMS Charter : Scope and boundary |
| d) determine how it will meet the requirements of this International Standard in order to achieve continual improvement of its energy performance and of its EnMS. | | EnMS Charter |
| | | EnMS Document Management Guideline |
| | | Energy Policy |
| | | EnMS Energy Review Report |
| | | EnMS Action Plan |
| | | EnMS Monitoring & Action Guideline |
| | | EnMS Audit Plan |
| | | EnMS Training Plan |
| | | EnMS Continual Improvement Guideline |
| | | EnMS Communication Guideline |
| | | EnMS Lean Energy Procurement Guideline |
| | | EnMS Legal & Requirements Compliance Status Report |

4.1-1

Document subject to ISO 50001 Requirements

4.2 Management responsibility

| ISO 50001 Requirements | | Specific Document covering the requirement |
|---|--|---|
| 4.2.1 Management responsibility | | |
| Top management shall demonstrate its commitment to support the EnMS and to continually improve its effectiveness by: | | |
| a) defining, establishing, implementing and maintaining an energy policy; | | Energy Policy |
| b) appointing a management representative and approving the formation of an | | EnMS Charter : Role and responsibility |
| c) providing the resources needed to establish, implement, maintain and improve the EnMS and the resulting energy performance; NOTE Resources include human resources, specialized skills, technology and financial resources. | | EnMS Charter |
| d) identifying the scope and boundaries to be addressed by the EnMS; | | EnMS Charter : Scope and boundary |
| e) communicating the importance of energy management to those in the | | EnMS Communication Guideline |
| f) ensuring that energy objectives and targets are established; | | EnMS Energy Review Report and EnMS Action Plan |
| g) ensuring that EnPIs are appropriate to the organization; | | EnMS Energy Review Report : Identification of EnPI |
| h) including energy considerations in long-term planning, if applicable; | | EnMS Charter and Action Plan |
| i) ensuring that results are measured and reported at determined intervals; | | EnMS Action Plan |
| j) conducting management reviews. | | Management review records, such as minutes of meeting |

4.2-2

Document subject to ISO 50001 Requirements

4.2 Management responsibility

| ISO 50001 Requirements | | Specific Document covering the requirement |
|--|---|--|
| 4.2.2 Management representative | | |
| Top management shall appoint a management representative(s) with appropriate skills and competence, who, irrespective of other responsibilities, has the responsibility and authority | | EnMS Charter: EnMS organisation / Role and responsibility |
| a) ensure the EnMS is established, implemented, maintained, and continually improved in accordance with b) identify person(s), authorized by an appropriate level of management, to work with the management representative in support of energy c) report to top management on energy performance; (report to top management on changes in energy performance.) d) report to top management on the performance of the EnMS; (identify person(s), authorized by an appropriate level of management, to work with him or her in support of energy management activities.) e) ensure that the planning of energy management activities is designed to support the organization's energy policy; f) define and communicate responsibilities and authorities in order to facilitate effective energy management; and g) determine criteria and methods needed to ensure that both the operation and control of the energy management system are effective h) promote awareness of the energy policy and objectives at all levels of the organization. | a) ensure the EnMS is established, implemented, maintained, and continually improved in accordance with | EnMS Charter EnMS Continual Improvement Guideline |
| | b) identify person(s), authorized by an appropriate level of management, to work with the management representative in support of energy | EnMS Charter: EnMS organisation / Role and responsibility |
| | c) report to top management on energy performance; (report to top management on changes in energy performance.) | EnMS Charter: Top management responsibility Management review records, such as minutes of meeting |
| | d) report to top management on the performance of the EnMS; (identify person(s), authorized by an appropriate level of management, to work with him or her in support of energy management activities.) | EnMS Action Plan |
| | e) ensure that the planning of energy management activities is designed to support the organization's energy policy; | EnMS Action Plan Energy Policy |
| | f) define and communicate responsibilities and authorities in order to facilitate effective energy management; and | EnMS Charter: EnMS organisation / Role and responsibility |
| | g) determine criteria and methods needed to ensure that both the operation and control of the energy management system are effective | EnMS Charter: Operation Control EnMS Action Plan |
| | h) promote awareness of the energy policy and objectives at all levels of the organization. | EnMS Communication Guideline |

4.2-3

Documents subject to the ISO 50001 Requirements

4.3 Energy Policy

| ISO 50001 Requirements | | Specific Document covering the requirement | |
|--|---|--|--|
| 4.3 Energy Policy The energy policy shall state the organization's commitment to achieving energy performance improvement. Top management shall define the energy policy and ensure that it: | | | |
| a) is appropriate to the nature and scale of the organization's energy use and b) includes a commitment to continual improvement in energy performance; c) includes a commitment to ensure the availability of information and of necessary resources to achieve objectives and targets; d) includes a commitment to comply with applicable legal requirements and other requirements to which the organization subscribes related to its energy use, consumption and efficiency; e) provides the framework for setting and reviewing energy objectives and targets; f) supports the purchase of energy-efficient products and services, and design for energy performance improvement; | Energy Policy | | |
| | | | |
| | | | |
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| | | | |
| | | | |
| g) is documented, communicated, and understood within the organization; and | EnMS Document Management Guideline | | |
| | EnMS Communication Guideline | | |
| h) is regularly reviewed, and updated as necessary. | EnMS Charter: Energy Policy | | |
| | EnMS Charter: Top management responsibility on energy policy | | |

4.3-4

Documents subject to the ISO 50001 Requirements

4.4 Energy Planning

| ISO 50001 Requirements | | Specific Document covering the requirement |
|--|--|--|
| 4.4.1 General | | |
| The organization shall conduct and document an energy planning process. Energy planning shall be consistent with the energy policy and shall lead to activities that continually improve energy performance. | | EnMS Action Plan |
| | Energy planning shall involve a review of the organization's activities that can affect energy performance. | EnMS Energy Review Report |
| 4.4.2 Legal and other requirements | | |
| Identify applicable legal and other requirements to which organization subscribes | | EnMS Legal & Requirements Compliance Status Report |
| | | EnMS Charter |
| | | EnMS Audit Guideline |
| 4.4.3 Energy Review | | |
| Development of energy review | a) Analyze energy use based on measurement and other data | EnMS Energy Review Report |
| | – identify current energy sources | |
| | – evaluate past and present energy use and consumption | |
| | – estimate future energy use and consumption | |
| | b) Based on energy use analysis, identify the areas of significant energy use and consumption | EnMS Energy Review Report: Significant energy use items |
| | – identify the facilities, equipment, systems, processes and personnel working for or on behalf of the organization that significantly affect energy use and consumption; | EnMS Scoped Facility-Equipment List |
| | c) Identify, prioritize, and record opportunities for improving energy performance, including, where applicable, potential energy sources, use of renewables, or alternative energy sources, | EnMS Energy Review Report: Summary of ECO |
| 4.4.4 Energy baseline | | |
| – The energy baseline shall be established using the information in the initial energy review | | EnMS Energy Review Report: EnPI and baseline |
| | – a data period suitable to the organization's energy use. | |
| | – Changes in energy performance shall be measured against the energy baseline. | EnMS Monitoring & Action Guideline |
| | – Adjustments to the baseline shall be made when Energy Performance Indicators (EnPIs) no longer reflect organizational energy use | |

Documents subject to the ISO 50001 Requirements

4.4 Energy Planning

| ISO 50001 Requirements | | Specific Document covering the requirement |
|---|--|--|
| 4.4.5 Energy performance indicators | | |
| <ul style="list-style-type: none"> – The organization shall identify EnPIs appropriate for monitoring and measuring energy performance. – The methodology for determining and updating the EnPIs shall be recorded and regularly reviewed. – EnPIs shall be reviewed and compared to the energy baseline on a regular basis. | | EnMS Energy Review Report: EnPI and baseline |
| | | EnMS Monitoring & Action Guideline |
| | | |
| 4.4.6 Energy objectives, energy targets and energy management action plans (1) | | |
| <ul style="list-style-type: none"> – The organization shall establish, implement and maintain documented energy objectives and targets at the relevant functions, levels, processes or facilities within the organization. – The energy objectives and targets shall be specific measurable. Time frames shall be established for achievement of the objectives and targets. – The objectives and targets shall be consistent with the energy policy. Targets shall be consistent with the objectives. – When establishing and reviewing objectives and targets, an organization shall take into account legal and other requirements, significant energy uses, and opportunities to improve energy performance as identified in the energy review. – It shall also consider its financial, operational and business conditions, technological options, and the views of interested parties. | | EnMS Action Plan |
| | | Energy Policy |
| | | EnMS Legal & Requirements Compliance Status Report |
| | | EnMS Charter |
| | | EnMS Energy Review Report: Significant energy use items |
| | | EnMS Energy Review Report: Summary of ECO |
| subtotal | | 0 |

Documents subject to the ISO 50001 Requirements

4.4 Energy Planning

| ISO 50001 Requirements | Specific Document covering the requirement |
|--|---|
| 4.4.6 Action plans | |
| (2) | |
| – The organization shall establish, implement, and maintain energy management action plans for achieving its objectives and targets. | EnMS Action Plan |
| – The energy management action plans shall include: | |
| a) designation of responsibility; | |
| b) the means and time frame by which individual targets are to be achieved; | |
| c) a statement of the method by which an improvement in energy performance shall be verified; and | |
| d) a statement of the method of verifying the results of the action plan. | |
| – The energy management action plans shall be documented, and updated at defined intervals. | EnMS Document Management Guideline |
| – Action Plan shall include: | |
| a) Competence, training and awareness | EnMS Training Plan |
| b) Communication (Two way communication) | EnMS Communication Guideline |
| c) Documentation | EnMS Document Management Guideline |
| d) Operational control | EnMS Charter: Operation control |
| e) design | EnMS Action Plan: Design |
| f) Procurement of energy services, products, equipment and energy | EnMS Lean Energy Procurement Guideline |

Documents subject to the ISO 50001 Requirements

4.5 Implementation and operation

| ISO 50001 Requirements | | Specific Document covering the requirement |
|---|--|--|
| 4.5.1 General | | |
| The organization shall use the energy management action plans resulting from the planning process for implementation and operations | EnMS Action Plan | |
| | Management Review minutes or EnMS Action Progress Report | |
| 4.5.2 Competence, training and awareness | | |
| The organization shall ensure any person or persons working for, or on its behalf related to significant energy uses are competent on the basis of appropriate education, training, skills or experience. | EnMS Training Plan | |
| | EnMS Charter: Role & responsibility / Competence, training and awareness | |
| – Identify members subject to "Competence, training and awareness" | EnMS Training Plan | |
| a) Management level | | |
| b) Energy management team | | |
| c) Energy SEP team | | |
| d) all member working in the boundaries | | |
| e) all member working for the | | |
| f) all member working on its behalf related to significant energy users | | |
| g) etc. | | |
| – Identify appropriate education, training, skills or experience that provide the basis of competence | | |
| – The organization shall identify training needs associated with the control of its significant energy uses and the operation of its energy management system. It shall provide training or take other actions to meet these needs. Associated records shall be maintained. | | |

4.5-8

Documents subject to the ISO 50001 Requirements

4.5 Implementation and operation

| ISO 50001 Requirements | | Specific Document covering the requirement |
|--|--|---|
| | – The organization shall ensure that persons working for or on its behalf are and remain aware of: | |
| | a) the importance of conformity with the energy policy, procedures and with the requirements of the EnMS; | |
| | b) their roles, responsibilities and authorities in achieving the requirements of the EnMS; | |
| | c) the benefits of improved energy performance; and | |
| | d) the impact, actual or potential, with respect to energy consumption, of their activities and how their activities and behaviour contribute to the achievement of energy objectives and targets, and the potential consequences of departure from specified procedures. | |
| 4.5.3 Communication (Two way communication) | | |
| | The organization shall communicate internally with regard to its energy performance and EnMS as appropriate to the size of the organization. | EnMS Communication Guideline |
| | The organization shall ensure commitment, awareness and understanding of personnel, as appropriate to their level and role. This shall include a process by which any person working in or on behalf of the organization can make comments or suggest improvements to the EnMS. | EnMS Charter: Scope and boundary |
| | The organization shall decide whether to communicate externally about its energy management system and energy performance, and shall record its decision. If the decision is to communicate externally, the organization shall establish and implement a plan for this external communication. | EnMS Communication Guideline: External Communication |

4.5-9

Documents subject to the ISO 50001 Requirements

4.5 Implementation and operation

| ISO 50001 Requirements | | Specific Document covering the requirement | |
|--|--|--|------------------------------------|
| 4.5.4 Documentation | | | |
| 4.5.4. Documentation requirements | | | |
| The organization shall establish, implement and maintain information, in paper or electronic form, to describe the core elements of the EnMS and their interaction. | | EnMS Charter: Document Management | |
| The EnMS documentation shall include: | | | EnMS Document Management Guideline |
| a) The scope and boundaries of the EnMS; | | | |
| b) the energy policy; | | | |
| c) energy objectives, targets, and action | | | |
| d) the documents, including records, required by this International Standard; | | | |
| e) other documents determined by the organization to be necessary. | | | |
| 4.5.4. Control of documents | | | |
| Documents required by ISO50001 and the EnMS shall be controlled. This includes technical documentation where appropriate. | | EnMS Document Management Guideline | |
| The organization shall establish, implement and maintain procedures to: | | EnMS Document Management Procedure | |
| a) approve documents for adequacy prior to issue; | | | |
| b) periodically review and update as necessary; | | | |
| c) ensure that changes and current revision status of documents are identified; | | | |
| d) ensure that relevant versions of applicable documents are available at points of use; | | | |
| e) ensure that documents remain legible and readily identifiable; | | | |
| f) ensure documents of external origin determined by the organization to be necessary for the planning and operation of the EnMS are identified and their distribution controlled; and | | | |
| g) prevent the unintended use of obsolete documents, and suitably identify those to be retained for any purpose. | | | |

4.5-10

Documents subject to the ISO 50001 Requirements

4.5 Implementation and operation

| ISO 50001 Requirements | | Specific Document covering the requirement |
|--|--|--|
| 4.5.5 Operational control | | |
| <p>The organization shall identify and plan those operations which are associated with its significant energy uses and that are consistent with its energy policy, objectives, targets and action plans in order to ensure that they are resourced and carried out under specified conditions, by:</p> <p>a) establishing and setting criteria for the effective operation and maintenance of significant energy uses or where the absence could lead to a significant deviation from effective energy performance;</p> <p>b) operating and maintaining facilities, processes, systems and equipment, in accordance with operational criteria; and</p> <p>c) appropriate communication of the operational controls to personnel working for and personnel working on behalf of the organization.</p> | | Corporate Business Objectives |
| | | EnMS Action Plan |
| | | Available procedural documents |
| | | Maintenance procedural documents |
| | | EnMS Action Plan |
| | | EnMS Monitoring & Action Guideline |
| | | EnMS Communication Guideline |
| 4.5.6 Design | | |
| <p>The organization shall consider energy performance improvement opportunities in the design of new, modified and renovated facilities, equipment, systems and processes that can have a significant impact on energy performance.</p> <p>The results of the energy performance evaluation shall be incorporated into the specification, design and procurement activities of the relevant project.</p> <p>The results of the design activity shall be recorded.</p> | | EnMS Energy Review Report |
| | | EnMS Action Plan |
| | | EnMS Action Plan: Design of Facilities/systems/equipments |
| | | EnMS Action Plan: Design of Manufactured product |
| | | Relative records |

4.5-11

Documents subject to the ISO 50001 Requirements

4.5 Implementation and operation

| ISO 50001 Requirements | | Specific Document covering the requirement |
|------------------------|--|--|
| 4.5.7 | Procurement of energy services, products, equipment and energy | |
| | When procuring energy services, products and equipment that have or may have an impact on significant energy use, the organization shall inform suppliers that procurement is partly evaluated on the basis of energy performance. | EnMS Lean Energy Procurement Guideline |
| | The organization shall define the criteria for assessing energy use over the planned or expected operating lifetime of energy using products, equipment and services which are expected to have a significant effect on the organization's energy performance. | EnMS Action Plan |
| | NOTE The organization should include contingency and emergency situations and potential disasters relating to equipment with significant energy use and determine how the organization will react to these situations. | EnMS Lean Energy Procurement Guideline: at the time contingency |
| | | EnMS Charter: Operation Control |
| | For procurement of energy supply | |
| | The organization shall define energy purchasing specifications as applicable for effective energy performance. | EnMS Charter: Operation Control |
| | | Relative Procedural Documents |

4.5-12

Document subject to ISO 50001 Requirements

4.6 Checking performance

| ISO 50001 Requirements | Specific Document covering the requirement |
|---|---|
| 4.6.1 Monitoring, measurement and analysis | |
| The organization shall ensure that the key characteristics of its operations that determine energy performance are monitored, measured and analysed at planned intervals. | EnMS Monitoring & Action Guideline |
| Key characteristics shall include at a | |
| a) significant energy uses and other outputs of the energy review; | EnMS Energy Review Report |
| b) the relevant variables related to significant energy uses; | |
| c) EnPIs; | EnMS Action Plan |
| d) the effectiveness of the action plans in achieving objectives and targets; | |
| e) evaluation of actual versus expected energy consumption. An energy measurement plan, appropriate to the size and complexity of the organization and its monitoring and measurement equipment, shall be defined and implemented. NOTE Measurement can range from only utility meters for small organizations up to complete monitoring and measurement systems connected to a software application capable of consolidating data and delivering automatic analysis. It is up to the organization to determine the means and methods of measurement. | EnMS Monitoring & Action Guideline |
| The results from monitoring and measurement of the key characteristics shall be recorded. | EnMS Document Management Guideline |
| The organization shall define and periodically review its measurement needs. The organization shall ensure that the equipment used in monitoring and measuring of key characteristics provides data which is accurate and repeatable. Records of calibration shall be maintained. | EnMS Charter: Operation Control |
| The organization shall investigate and respond to significant deviations in energy performance. | EnMS Continual Improvement Guideline |
| Results of these activities shall be maintained. | EnMS Document Management Guideline |

4.6-13

Document subject to ISO 50001 Requirements

4.6 Checking performance

| ISO 50001 Requirements | | Specific Document covering the requirement |
|---|---|---|
| 4.6.2 Evaluation of legal/other compliance | At planned intervals, the organization shall evaluate compliance with legal and other requirements to which it subscribes that are relevant to its energy uses. | EnMS Legal & Requirements Compliance Status Report |
| | Records of the results of the evaluations of compliance shall be maintained. | Related records |
| 4.6.3 Internal audit of the EnMS | | |
| | The organization shall conduct internal audits at planned intervals to ensure that the EnMS: | EnMS Audit Guideline |
| | – conforms to planned arrangements for energy management including the requirements of this International Standard. | EnMS Audit Plan |
| | – conforms with the energy objectives and targets established; | |
| | – is effectively implemented and maintained, and improves energy performance. | EnMS Audit Report related documents |
| | | EnMS Audit Plan |
| | An audit plan and schedule shall be developed taking into consideration the status and importance of the processes and areas to be audited as well as the results of previous audits. | EnMS Audit Plan |
| | The selection of auditors and conduct of audits shall ensure objectivity and the impartiality of the audit process. | EnMS Audit Guideline |
| | Records of the audit results shall be maintained and reported to top management. | Related records |

4.6-14

Document subject to ISO 50001 Requirements

4.6 Checking performance

| ISO 50001 Requirements | | Specific Document covering the requirement |
|------------------------|---|--|
| 4.6.4 | Nonconformities, correction, corrective, and preventive action | |
| | The organization shall address actual and potential nonconformities by making corrections, and by taking corrective action and preventive action, including the following: | EnMS Continual Improvement Guideline |
| | a) reviewing nonconformities or potential nonconformities; | Related improvement procedure records |
| | b) determining the causes of nonconformities or potential nonconformities; | |
| | c) evaluating the need for action to ensure that nonconformities do not occur or reoccur ; | |
| | d) determining and implementing the appropriate action needed; | |
| | e) maintaining records of corrective and preventive actions; and | |
| | f) reviewing the effectiveness of the corrective or preventive action taken. | |
| | Corrective actions and preventive actions shall be appropriate to the magnitude of the actual or potential problems and the energy performance consequences encountered. | EnMS Continual Improvement Guideline |
| | The organization shall ensure that any necessary changes are made to the energy management system documentation. | EnMS Document Management Guideline |
| 4.6.5 | Control of records (of conformity and achievements) | |
| | The organization shall establish and maintain records, as necessary, to demonstrate conformity to the requirements of its EnMS and of this International Standard, and the energy performance <u>results achieved</u> . | EnMS Document Management Guideline |
| | The organization shall define and implement controls for the identification, retrieval and retention of records. | |
| | Records shall be and shall remain legible, identifiable and traceable to the relevant activity | |

4.6-15

Document subject to ISO 50001 Requirements

4.7 Management review

| ISO 50001 Requirements | | Specific Document covering the requirement |
|---|---|--|
| 4.7.1 General | | |
| At planned intervals, top management shall review the organization's EnMS to ensure its continuing suitability, adequacy and effectiveness. | EnMS Charter: Management review/Operation Control | |
| Records of management review shall be maintained. | | |
| | | EnMS Document Management Guideline |
| 4.7.2 Inputs to management review | | |
| Inputs to the management review shall include: | Records related to calling for Management Review session | |
| a) follow-up actions from previous management reviews; | | |
| b) review of the energy policy; | | |
| c) review of energy performance and related EnPIs; | | |
| d) results of the evaluation of compliance with legal requirements and changes in legal requirements and other requirements to which the organization subscribes; | | |
| e) the extent to which the energy objectives and targets have been met; | | |
| f) EnMS audit results; | | |
| g) the status of corrective actions and preventive actions; | | |
| h) projected energy performance for the following period; and | | |
| i) recommendations for improvement. | | |
| 4.7.3 Output from management review | | |
| Outputs from the management review shall include any decisions or actions related to: | Records related to Management Review minutes | |
| a) changes in the energy performance of the organization; | | |
| b) changes to the energy policy; | | |
| c) changes to the EnPIs; | | |
| d) changes to objectives, targets or other elements of the EnMS, consistent with the organization's commitment to continual improvement; | | |
| e) changes to allocation of resources. | | |

4.7-16