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Energy management systems — Requirements with guidance for use

Systèmes de management de l'énergie — Exigences et lignes directrices pour utilisation

ICS 27.010

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 50001 was prepared by Project Committee ISO/PC 242, *Energy management*.

Introduction

The purpose of this International Standard is to enable organizations to establish the systems and processes necessary to improve energy performance, including energy efficiency, use, consumption and intensity. Implementation of this standard should lead to reductions in energy cost, greenhouse gas emissions and other environmental impacts, through systematic management of energy. It is applicable to all types and sizes of organizations irrespective of geographical, cultural or social conditions. Successful implementation depends on commitment from all levels and functions of the organization, and especially from top management.

This International Standard specifies requirements of an energy management system (EnMS) for an organization to develop and implement an energy policy, establish objectives, targets, and action plans, which take into account legal requirements and information pertaining to significant energy use. An energy management system enables an organization to achieve its policy commitments, take action as needed to improve its energy performance and demonstrate the conformity of the system to the requirements of this International Standard. Application of this International Standard can be tailored to fit the requirements of an organization - including the complexity of the system, degree of documentation, and resources - and applies to the activities under the control of the organization.

This International Standard is based on the Plan-Do-Check-Act continual improvement framework and incorporates energy management into everyday organizational practices.

NOTE This approach can be briefly described as follows.

— Plan: establish the objectives and processes necessary to deliver results in accordance with opportunities to improve energy performance and the organization's policies.

— Do: implement the processes.

— Check: monitor and measure processes and product against policies, objectives and the key characteristics of its operations and report the results.

— Act: take actions to continually improve energy performance.

The basis of this approach is shown in Figure 1.

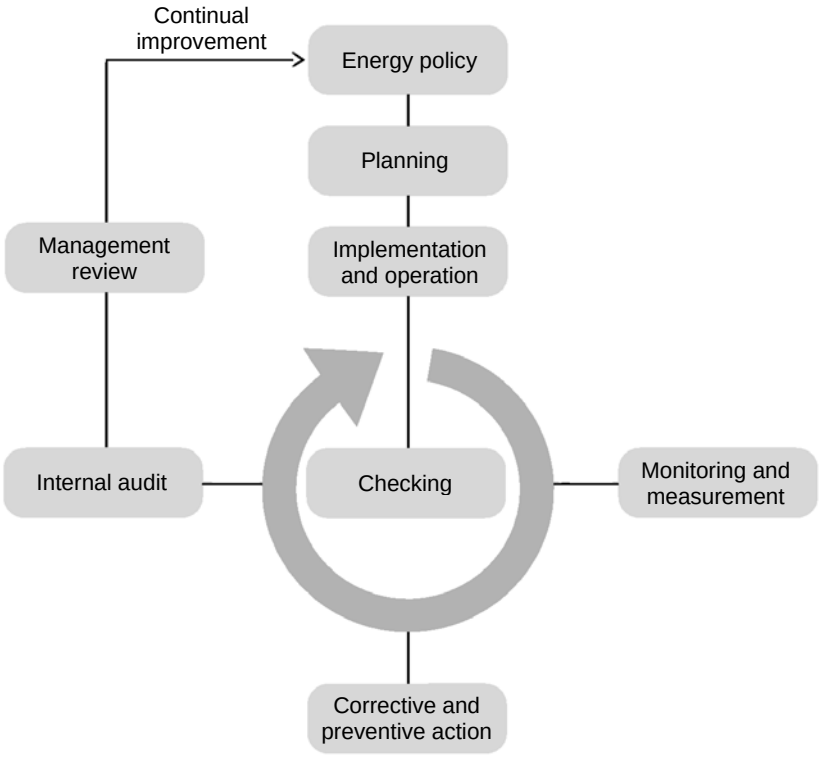

Figure 1 — Energy Management System Model for this International Standard

Global application of this International Standard contributes to more efficient use of available energy sources, enhanced competitiveness, and a positive impact on climate change. This International Standard considers all types of energy.

NOTE 1 Energy includes renewable, non-renewable and recovered energy.

This International Standard can be used for certification, registration and self-declaration of an organization's energy management system. It does not establish absolute requirements for energy performance beyond the commitments in the energy policy of the organization and its obligation to comply with applicable legal and other requirements. Thus, two organizations carrying out similar operations, but having different energy performance, can both conform to its requirements.

The organization can choose to integrate ISO 50001 with those of other management systems such as quality, environment, occupational health and safety or social responsibility, or other.

Energy management systems — Requirements with guidance for use

1 Scope

This International Standard specifies requirements for an organization to establish, implement, maintain and improve an energy management system, which enables that organization to take a systematic approach, in order to achieve continual improvement of energy performance, energy efficiency and energy conservation. This International Standard specifies requirements applicable to energy supply and energy uses and consumption, including measurement, documentation and reporting, design and procurement practices for energy using equipment, systems, processes, and personnel. This international Standard applies to all factors affecting energy use, which can be monitored and influenced by the organization. This international standard does not prescribe specific performance criteria with respect to energy.

This International Standard for energy management systems has been designed to be used independently, but it can be aligned or integrated with other management systems. It is applicable to all organizations.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

None at this time.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
boundaries
physical or site limits and/or organizational limits as defined by the organization

NOTE Examples include a process, a group of processes, a plant, an entire organization or multiple sites under the control of an organization.

3.2
continual improvement
recurring process which results in enhancement of energy performance and the energy management system

NOTE 1 The process of establishing objectives and finding opportunities for improvement is a continual process.

NOTE 2 Continual improvement can achieve improvements in overall energy performance, consistent with the organization's energy policy.

3.3
correction
action to eliminate a detected nonconformity (3.13)

NOTE Adapted from ISO 9000:2005.

3.4
corrective action
action to eliminate the cause of a detected nonconformity

NOTE 1 There can be more than one cause for a nonconformity.

NOTE 2 Corrective action is taken to prevent recurrence whereas preventive action is taken to prevent occurrence.

3.5
energy
electricity, fuels, steam, heat, compressed air, renewables and other like media

NOTE 1 For the purpose of this standard, energy refers to the various forms of primary or secondary energy which can be purchased, stored, treated or used in equipment or in a process, or recovered

NOTE 2 The capacity of a system to produce external activity or perform work.

3.6
energy baseline
quantitative reference providing a basis for comparison of energy performance

NOTE 1 An energy baseline can reflect a point in time or a period of time.

NOTE 2 An energy baseline can be normalized by adjustment factors [relevant variable affecting energy use and/or consumption] such as production level, degree days (outdoor temperature), etc.

3.7
energy consumption
quantity of energy applied

3.8
energy efficiency
ratio or other quantitative relationship between an output of performance, service, goods or energy, and an input of energy

NOTE 1 Examples are conversion efficiency, energy required/energy used, output/input, theoretical energy used to operate/energy used to operate.

NOTE 2 Both input and output have to be clearly specified in quantity and quality, and be measurable.

3.9
energy management system
EnMS
set of interrelated or interacting elements to establish an energy policy and energy objectives, and processes and procedures to achieve those objectives

3.10
energy objective
specified outcome or achievement set to meet the organization's energy policy related to improved energy performance

3.11
energy performance
measurable results related to energy use and energy consumption

NOTE 1 In the context of energy management systems, results can be measured against the organization’s energy policy, objectives, targets and other energy performance requirements

NOTE 2 Energy performance is one component of the performance of the energy management system

3.12
energy performance indicator
EnPI
quantitative value or measure of energy performance as defined by the organization

3.13
energy policy
overall intentions and direction of an organization related to its energy performance as formally expressed by top management

NOTE The energy policy provides a framework for action and for the setting of energy objectives and energy targets.

3.14
energy review
determination of the status of the organization's energy performance based on data and other information leading to identification of opportunities for improvement

3.15
energy services
activities and their results related to the provision and/or use of energy

NOTE In other regional or national standards, concepts such as identification and review of energy aspects or energy profile are included in the concept of energy review.

3.16
energy target
detailed energy performance requirement, quantifiable, applicable to the organization or parts thereof, that arises from the energy objective and that needs to be set and met in order to achieve this objective

3.17
energy use
manner or kind of application of energy

NOTE 1 Examples are ventilation, lighting, heating, cooling, transportation, processes, production lines.

3.18
interested parties
person or group concerned with or affected by the energy performance of the organization

3.19
management system audit
systematic, independent and documented process for obtaining evidence and evaluating it objectively to determine the extent to which requirements are fulfilled

3.20
nonconformity
non-fulfilment of a requirement

[ISO 9000:2005, definition 3.6.2]

3.21
organization
company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration and that has the authority to control its energy use and consumption.

NOTE An organization can be a person or group of people.

3.22
preventive action
action to eliminate the cause of a potential nonconformity

NOTE 1 There can be more than one cause for a potential nonconformity.

NOTE 2 Preventive action is taken to prevent occurrence whereas corrective action is taken to prevent recurrence.

3.23
procedure
specified way to carry out an activity or a process

NOTE 1 Procedures can be documented or not.

NOTE 2 When a procedure is documented, the term “written procedure” or “documented procedure" is frequently used. The document that contains a procedure can be called a "procedure document.”

[ISO 9000:2005, definition 3.4.5]

3.24
product
result of a process

3.25
record
document stating results achieved or providing evidence of activities performed

NOTE Records can be used, for example, to document traceability and to provide evidence of verification, preventive action and corrective action.

[ISO 9000:2005, definition 3.7.6]

3.26
scope
extent of activities, facilities and decisions which the organization addresses through an EnMS, which can include several boundaries

3.27
significant energy use
energy use accounting for substantial energy consumption and/or offering considerable potential for energy performance improvement

NOTE Significance criteria are determined by the organization.

3.28
team
person(s) responsible for effective implementation of the energy management system activities and for delivering energy performance improvements

NOTE The size and nature of the organization, and available resources, will determine the size of the team. The team may be one person, such as the management representative.

3.29
top management
person or group of people who directs and controls an organization at the highest level

NOTE Top management controls the organization defined within the scope of the management system for energy.

[ISO 9000:2005, definition 3.2.7]

4 Energy management system requirements

4.1 General requirements

The organization shall

a) establish, document, implement, and maintain an energy management system (EnMS) in accordance with the requirements of this International Standard;

b) define and document the scope and boundaries of its EnMS; and

c) determine and document how it will meet the requirements of this standard in order to achieve continual improvement of its energy performance and of its EnMS.

4.2 Management responsibility

4.2.1 General

Top management shall demonstrate its commitment and support to the EnMS and to continually improve its effectiveness by:

a) establishing, implementing, and maintaining the energy policy;

b) appointing a management representative and approving the formation of an energy management team;

c) providing the resources needed to establish, implement, maintain and improve the energy management system,;

d) identifying the scope and boundaries to be addressed by the energy management system;

e) communicating to the organization the importance of energy management;

f) ensuring energy performance objectives and targets are established;

g) ensuring EnPIs are appropriate to the organization;

h) including energy considerations in long-term planning, if applicable;

i) ensuring that results are measured and reported; and

j) conducting management reviews.

4.2.2 Roles, responsibility and authority

Top management shall appoint a management representative with the appropriate skills and competence, who, irrespective of other responsibilities, has the responsibility and authority to:

a) ensure the energy management system is established, implemented, maintained, and continually improved in accordance with this International Standard;

b) report to top management on the performance of the energy management system;

c) report to top management on changes in energy performance;

d) identify person(s), authorized by an appropriate level of management, to work with him or her in support of energy management activities;

e) plan and direct energy management activities 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.

4.3 Energy policy

The energy policy shall state the organization's commitment for achieving energy performance improvement. Top management shall ensure that the energy policy:

a) is appropriate to the nature and scale of, and impact on, the organization's energy use;

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 and other requirements to which the organization subscribes which relate to its energy use;

e) provides the framework for setting and reviewing energy objectives and targets;

f) supports the purchase of energy efficient products and services;

g) is documented, communicated, and understood within the organization; and

h) is regularly reviewed, and updated as necessary.

4.4 Energy planning

4.4.1 General

The organization shall conduct and document energy planning that includes the following: legal and other requirements to which the organization subscribes, energy review, energy baseline, energy performance indicators, objectives, targets, and action plans. Energy planning shall lead to activities to improve energy performance.

Energy planning involves a review of the organization's activities which can affect energy use and consumption, or relate to them in a wider sense. Having brought this data and information together, a range of tools and techniques are available to develop the energy planning outputs.

NOTE 1 a diagram illustrating energy planning is included in Annex A.

NOTE 2 in other regional or national standards, concepts such as identification and review of energy aspects or the concept of energy profile, are included in the concept of energy review. See Annex B for a comparative table.

4.4.2 Legal and other requirements

The organization shall identify and have access to the applicable legal and other requirements to which the organization subscribes related to its energy uses.

The organization shall determine how these requirements apply to its energy uses and shall ensure that these legal and other requirements to which the organization subscribes are taken into account in establishing, implementing and maintaining the energy management system.

4.4.3 Energy review

The organization shall develop, record, and maintain an energy review. The methodology and criteria used to develop the energy review shall be documented. To develop the energy review, the organization shall:

a) Analyze energy use based on measurement and other data

- 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

- identify the facilities, equipment, systems, processes and personnel working for or on behalf of the organization that significantly affect energy use and consumption;
- identify other relevant variables affecting significant energy use and consumption;
- determine the current performance of facilities, equipment, systems, and processes related to identified significant energy uses

c) Identify, prioritize, and record opportunities for improving energy performance, including, where applicable, potential energy sources, use of renewables, or alternative energy sources,

The energy review shall be updated at defined intervals and in response to major changes in facilities, equipment, systems, or processes.

4.4.4 Energy baseline

The energy baseline shall be established using the information in the initial energy review considering a data period suitable to the organization's energy use. Changes in energy performance shall be measured against the energy baseline. Adjustments to the baseline shall be made when Energy Performance Indicators (EnPIs) no longer reflect organizational energy use; there have been major changes to the process, operational patterns, or energy systems; or according to a predetermined method.

The energy baseline shall be maintained and recorded.

4.4.5 Energy performance indicators

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.

4.4.6 Objectives, targets and action plans

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 it's financial, operational and business conditions, technological options, and the views of interested parties.

The organization shall establish, implement, and maintain energy management action plans for achieving its objectives and targets. 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.

4.5 Implementation and operation

4.5.1 General

The organization shall use the energy management action plans resulting from the planning process for implementation and operations

NOTE a diagram illustrating this connection is included in Annex A., A.4, Figure A-1.

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. 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.

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 Documentation

4.5.3.1 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.

The EnMS documentation shall include:

a) The scope and boundaries of the EnMS;

b) the energy policy;

c) energy objectives, targets, and action plans;

d) plans for achieving the energy objectives and targets; and

e) documents considered by the organisation to be necessary for ensuring planning, operation and control.

NOTE The degree of documentation can vary for different organizations for the following reasons:

a) Scale of the organization and type of activities;

b) complexity of the processes and their interactions; and

c) competence of personnel

4.5.3.2 Control of documents

Documents required by this International Standard and the EnMS shall be controlled. This includes technical documentation where appropriate.

The organization shall establish, implement and maintain procedures to:

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.

4.5.4 Operational control

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:

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;

b) operating and maintaining facilities, processes, systems and equipment, in accordance with operational criteria; and

c) appropriate communication of the operational controls to personnel working for and personnel working on behalf of the organization.

4.5.5 Communication

The organization shall communicate internally with regard to its energy performance and EnMS as appropriate to the size of the organization.

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.

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.

4.5.6 Design

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.

The results of the energy performance evaluation shall be incorporated into the specification, design and procurement activities of the relevant project.

The results of the design activity shall be recorded.

4.5.7 Procurement of energy services, products, equipment and energy

4.5.7.1 Procurement of energy services, products and equipment

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.

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.

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.

4.5.7.2 Procurement of energy supply

The organization shall define energy purchasing specifications as applicable for effective energy performance.

4.6 Checking performance

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. Key characteristics shall include at a minimum:

a) the outputs of the energy review;

b) significant energy uses;

c) the relationship between significant energy use and consumption, relevant variables;

d) EnPIs; and

e) effectiveness of the action plans in achieving objectives and targets.

The results from monitoring and measurement of the key characteristics shall be recorded.

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.

The organization shall investigate and respond to significant deviations in energy performance.

Results of these activities shall be maintained

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.

Records of the results of the evaluations of compliance shall be maintained.

4.6.3 Internal audit of the EnMS

The organization shall conduct internal audits at planned intervals to ensure that the EnMS:

— conforms to planned arrangements for energy management including the requirements of this International Standard.

— is effectively implemented and maintained.

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.

The selection of auditors and conduct of audits shall ensure objectivity and the impartiality of the audit process.

Records of the audit results shall be maintained and reported to top management.

4.6.4 Nonconformities, correction, corrective, and preventive action

The organization shall establish, implement and maintain a procedure(s) for dealing with actual and potential nonconformity(ies) and for making correction, and for taking corrective action and preventive action. The procedure(s) shall define requirements for:

a) reviewing nonconformities or potential nonconformities and determining the causes of nonconformities or potential nonconformities;

b) evaluating the need for action to ensure that nonconformities do not occur or reoccur;

c) determining and implementing the appropriate action needed;

d) maintaining records of corrective and preventive actions; and

e) 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 consequences encountered.

The organization shall ensure that any necessary changes are made to the energy management system documentation.

4.6.5 Control of records

The organization shall establish and maintain records as necessary to demonstrate conformity to the requirements of its energy management system and of this International Standard and the energy performance results achieved.

The organization shall define and implement controls for the identification, retrieval and retention of records

Records shall be and remain legible, identifiable and traceable to the relevant activity, product or service.

4.7 Management review

At planned intervals top management shall review the organization's energy management system to ensure its continuing suitability, adequacy and effectiveness.

Records of management review shall be maintained.

4.7.1 Input to management review

Inputs to the management review shall include:

a) follow-up actions from previous management reviews;

b) review of the energy policy;

c) review of energy performance and related EnPIs;

d) evaluation of legal compliance and changes in legal and other requirements to which the organization subscribes;

e) the extent to which the energy objectives and targets have been met;

f) energy management system audit results;

g) the status of corrective and preventive actions;

h) projected energy performance for the following period, as appropriate; and

i) recommendations for improvement.

4.7.2 Output from management review

Outputs from the management review shall include any decisions or actions related to:

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 energy management system, consistent with the organization's commitment to continual improvement; and

e) allocation of resources.

Annex A
(informative)

Guidance on the use of Clause 4 Energy management system requirements

A.1 General requirements

The additional text given in this annex is strictly informative and is intended to prevent misinterpretation of the requirements contained in Clause 4 of this International Standard. While this information addresses and is consistent with the requirements of Clause 4, it is not intended to add to, subtract from, or in any way modify these requirements. The concept of scope and boundary allows flexibility to the organization to define what is included within the EnMS.

The figure below is a conceptual representation of energy performance

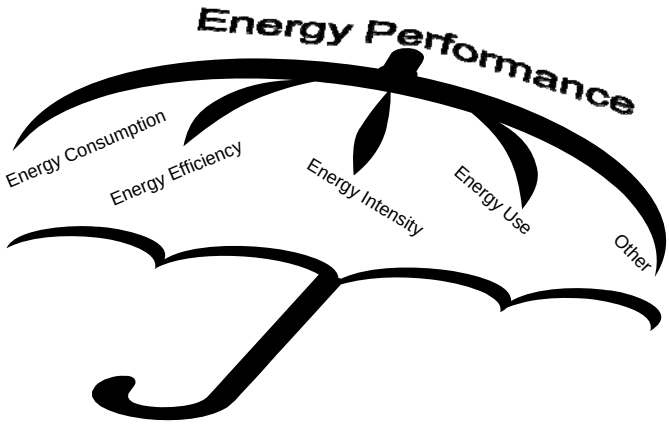

Figure A.1 — Conceptual representation of energy performance

A.2 Management responsibility

A.2.1 General

The management representative may be a current, new or contracted organization employee. The responsibilities of the management representative may represent all or part of the job function.

Top management approves the formation of an energy management team. The team ensures delivery of energy performance improvements. The size of the team is determined by the complexity of the organization and may be one person such as the management representative. The organization may use a multi-functional team.

For organizations that conduct long-term planning, they should include energy considerations such as: energy source, energy performance, and energy performance improvements in the planning activities.

A.2.2 Roles, responsibility and authority

Top management should promote energy organizational behavior through employee participation, employee empowerment, employee motivation, employee recognition, and employee rewards and participation.

The management representative may coordinate the activities of the team to achieve energy performance improvements.

A.3 Energy policy

The energy policy is the driver for implementing and improving an organization's energy management system and its energy performance. The policy may be a brief statement that members of the organization can readily understand and apply to their work activities. The energy policy dissemination can be used as a driver to manage organizational behaviour.

A.4 Energy planning

A.4.1 General

Figure A.2 is a conceptual diagram intended to improve understanding of the energy planning process. This diagram is not intended to represent the details of a specific organization. The information in the energy planning diagram is not exhaustive and there may be other details specific to the organization or particular circumstances.

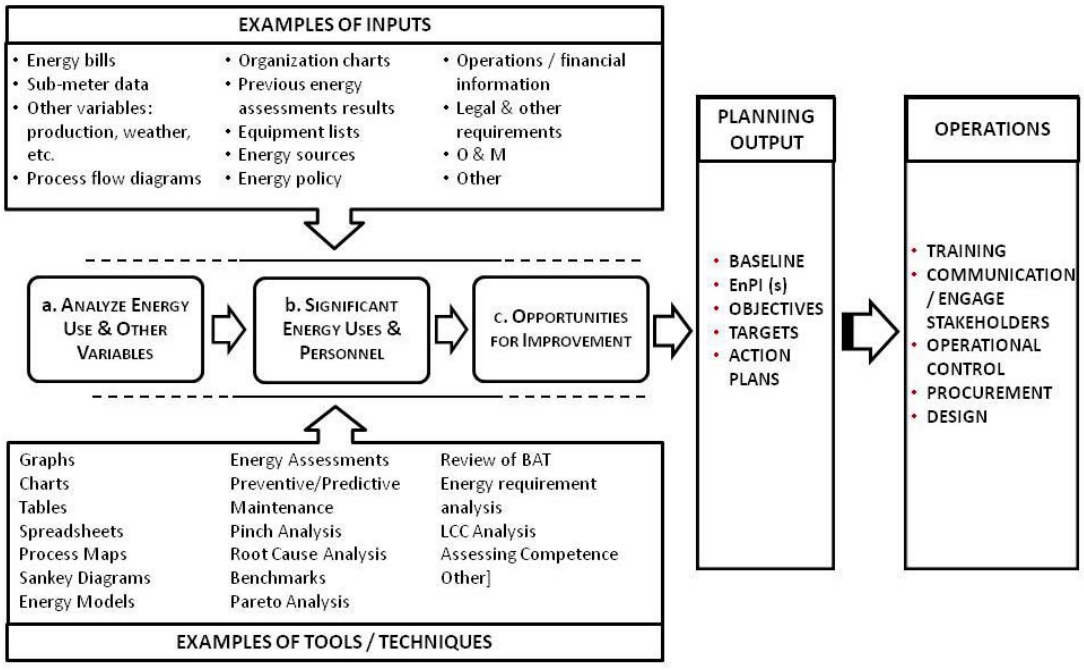

Figure A.2 — Energy Planning Process Concept Diagram

This section of the standard focuses on the energy performance of the organization and tools to maintain and continually improve energy performance.

A.4.2 Legal and other requirements

Applicable legal requirements are those international, national, regional, and local requirements that apply to the scope of the energy management system related to energy. Examples of other requirements may include agreements with customers, voluntary principles or codes of practice, voluntary programs and others.

A.4.3 Energy review

Significance is defined by the organization.

Examples of personnel working on behalf of the organization include service contractors, part time personnel, and temporary staff.

Updating the energy review means updating the information related to the analysis, determination of significance and determination of opportunities.

A.4.4 Energy baseline

Suitable period means the organization accounts for regulatory requirements, or variables that affect the energy use and consumption.

The energy baseline shall be maintained and recorded as a means for the organisation to determine the records maintenance period. The adjustments to the baseline are also considered maintenance and the requirements are defined in the text.

A.4.5 Energy performance indicators

EnPIs are designed to achieve energy performance improvement and meet other performance criteria. There is a range of EnPIs from a simple metric ratio to the complex model. The organization should choose EnPIs that inform the energy performance.

A.5 Implementation and operation

A.5.1 Competence, training and awareness

The organization defines competence and training for its organisational needs.

To ensure the person can retain or achieve competence, other actions may be taken such as coaching, cross-training, job modification, transfer, change of requirements for the job, or training by different techniques.

The organization may use tools such as posters, training, suggestions boxes, meetings, etc to maintain awareness.

Positive organizational behaviours should be the result of competence and awareness.

If a person working for or on behalf of the organization is unaware of the risks of not following an established procedure, they may negatively impact the energy performance. Therefore, they need to understand the consequences of not following the established procedures.

A.5.2 Documentation

A.5.2.1 Documentation requirements

The only procedures that have to be documented are ones that state that the procedure shall be a documented procedure. Otherwise the procedure does not have to be documented.

The organization can develop any documents they determine necessary to effectively demonstrate energy performance and EnMS.

Examples of documents necessary to ensure effective energy planning may include: process flow diagrams, energy flow diagram, energy assessment protocol.

Examples of documents necessary to ensure effective operational control may include: a work instruction for boiler maintenance, a checklist for maintenance of the steam system.

A.5.3 Operational control

Dissemination of motivational concepts (see roles, responsibility, and authority above) is essential to effective management of operational controls.

A.5.4 Design

Design provides the organization with an opportunity to create a positive step change in energy performance. During the review of this opportunity the following may be considered:

— Why use the energy source?

— What is the right energy source?

— What are the technological options?

— "Who" will maintain this design later?

— How will the existing processes be modified?

— How will the baseline be affected?

— Will this lead to sustainable or renewable opportunities?

— When will these changes affect the EnMS?

A.5.5 Procurement of energy services, products and energy

A.5.5.1 Procurement of energy services and products

Procurement is an opportunity to improve energy performance through use of more efficient products and services. It is also an opportunity to work with the supply chain and influence their energy behaviors.

A.5.5.2 Procurement of energy supply

If the organization has a choice of energy supply, then the organization needs a specification for the procurement of the energy supply. If the organization does not have a choice this requirement does not apply to the organization.

A.5.5.3 Energy supply purchasing

In developing the purchasing specifications for energy supply the following items may be considered:
a) energy quality;
b) availability;
c) capacity;
d) variation over specified time;
e) billing parameters, cost;
f) environmental impact;

g) renewability; and
h) others as determined appropriate by the organization.

NOTE The applicability of this section may vary from market to market. It is recommended that the energy management personnel and energy purchasing personnel collaborate to maximize energy performance improvements.

A.6 Checking performance

A.6.1 Monitoring, measurement and analysis

EnPIs are designed to achieve energy performance improvement and meet other performance criteria. This section addresses the monitoring, measurement and analysis of energy performance; it does not address the monitoring and measurement of the EnMSMsn. This section addresses the investigation and response of energy performance. EnPIs can be used to encourage organizational behaviour.

Examples of relevant variables could include production level, weather, product mix, occupancy rate, etc.

A.6.2 Evaluation of legal/other compliance

The organization should appoint a competent person, internal or external to perform this evaluation.

Annex B
(informative)

Comparison Table for National and Regional Standards on Energy Management to the Energy Review Criteria of ISO 50001

ISO 50001 (London Draft) Energy Review	ANSI/MSE 2000-2008	DS 2403: 2001	EN 16001	KATS KSA 4000:2007	NSAI IS 393	SAC GB/T —200 March 2009	SIS SS 627750 Reference	TISI ENERGY MANAGEMENT SYSTEM: SPECIFICATIO N 9/2004
Analyze energy use based on measurement and other data	The organization shall identify, collect, record and analyze the data necessary for energy management planning and organizational strategic planning. Utility data shall be collected, analyzed and tracked. Utility data shall include, as appropriate: a) utility bills, tariffs, and contracts, b) submetered energy data, c) utility interval data, and d) other relevant	a) past and present energy consumption based on measurement and other data. When revision the review, the significant energy consumption shall to an increasing extent be based on measurement.	a) past and present energy consumption and energy factors based on measurement and other data	The energy aspects analysis shall be implemented at least once a year through systematic continual data collection and records with determination of the priority among energy aspects and identification significant energy aspects.	a) past and present energy usage based on measurement and other data,	The organization shall establish, implement and maintain one or more documented procedures to establish energy management baseline	-Past and present energy use, based on measurements and other data. When updating the assessment the significant energy use should, to an increasing extent, be based on measurement.	Planning for the control of energy consumption into the acceptable range

ISO 50001 (London Draft) Energy Review	ANSI/MSE 2000-2008	DS 2403: 2001	EN 16001	KATS KSA 4000:2007	NSAI IS 393	SAC GB/T —200 March 2009	SIS SS 627750 Reference	TISI ENERGY MANAGEMENT SYSTEM: SPECIFICATIO N 9/2004
	energy or water data. External information to be included in the energy profile shall include, as appropriate, energy performance benchmark, climate data, tariffs, tax incentives, rebates, loan programs, alternate suppliers, new technology and forecasts of energy availability and cost.							
identify current energy sources								
evaluate past and present energy use and consumption	Utility data shall include, as appropriate: a) utility bills, tariffs, and contracts, b) submetered energy data, c) utility interval data, and d) other relevant energy or water data.	a) past and present energy consumption based on measurement and other data. When revision the review, the significant energy consumption shall to an increasing extent be based on measurement.	a) past and present energy consumption and energy factors based on measurement and other data	a) energy consumption in the past and present based on measurements and other data, Note: The measurements and other data shall include all bills of utility expenditures, customs, contract,	a) past and present energy usage based on measurement and other data,		-Past and present energy use, based on measurements and other data. When updating the assessment the significant energy use should, to an increasing extent, be based on measurement.	Record energy consumption and present energy consumption

ISO 50001 (London Draft) Energy Review	ANSI/MSE 2000-2008	DS 2403: 2001	EN 16001	KATS KSA 4000:2007	NSAI IS 393	SAC GB/T XXXX—200X March 2009	SIS SS 627750 Reference	TISI ENERGY MANAGEMENT SYSTEM: SPECIFICATION 9/2004
				detailed energy data, utility data, and other energy related data.				
estimate future energy use and consumption		c) the planned efforts to achieve greater energy efficiency	c) an estimate of the expected energy consumption during the following period;		c) the planned efforts to achieve greater efficiency for the coming period,			Review and estimate new activities or potential activities for energy consumption

ISO 50001 (London Draft) Energy Review	ANSI/MSE 2000-2008	DS 2403: 2001	EN 16001	KATS KSA 4000:2007	NSAI IS 393	SAC GB/T XXXX—200X March 2009	SIS SS 627750 Reference	TISI ENERGY MANAGEMENT SYSTEM: SPECIFICATION 9/2004
Based on energy use analysis, identify the areas of significant energy use and consumption	The organization shall identify the facilities, equipment, processes and personnel working for or on behalf of the organization that significantly affect energy consumption, cost, or energy-related or water related environmental impact. The method(s) for identifying these significant energy uses shall be recorded. The significant energy uses shall be controlled to optimize and maintain efficient operation (see	b) an identification of equipment having a significant energy consumption	b) identification of areas of significant energy consumption, in particular of significant changes in energy use during the last period;	significant energy aspects,	b) an identification of equipment having significant energy usage,	Identifying the energy aspects of the activities, products and services covered by the management system for energy that it can control or have influence over, including to consider the factors of planned, newly developed or changed activities, products and services;	-An identification of equipment or systems with significant energy use; In order to determine which energy aspects might cause significant impact on the use of use of energy, the organization shall establish and maintain procedures for the identification and assessment of such energy aspects as are caused by the organization's activities/operations, products or services and can be governed and influenced by the organisation.	Estimation of Significant Energy

ISO 50001 (London Draft) Energy Review	ANSI/MSE 2000-2008	DS 2403: 2001	EN 16001	KATS KSA 4000:2007	NSAI IS 393	SAC GB/T XXXX—200X March 2009	SIS SS 627750 Reference	TISI ENERGY MANAGEMENT SYSTEM: SPECIFICATION 9/2004
	7.3). The identified significant energy uses shall be reviewed on a regular basis and the list of significant energy uses modified as operational and facility changes occur.							
identify the facilities, equipment, systems, processes and personnel working for or on behalf of the organization that significantly affect energy use and consumption	Information on the current state of equipment, systems, and processes related to energy purchase, use, reliability, storage and disposal shall be collected at defined intervals. This information shall be analyzed and used in identifying significant energy uses and	e) an identification of the employee whose work may affect the significant energy consumption	d) identification of all persons working for and on behalf of the organization whose actions may lead to significant changes in energy consumption		e) an identification of all persons working for and on behalf of the organisation whose work may affect the significant energy usage.		-An identification of staff whose work can influence the use of energy to a considerable extent	Listings of high proportional energy consuming equipment

ISO 50001 (London Draft) Energy Review	ANSI/MSE 2000-2008	DS 2403: 2001	EN 16001	KATS KSA 4000:2007	NSAI IS 393	SAC GB/T XXXX—200X March 2009	SIS SS 627750 Reference	TISI ENERGY MANAGEMENT SYSTEM: SPECIFICATION 9/2004
	opportunities for energy management projects.							
identify other relevant variables affecting significant energy use and consumption				identification of improvements factors for the efficient use of energy by reviewing performance indicator and establishment of improvement plan				Energy conservation plan
determine the current performance of facilities, equipment, systems, and processes related to identified significant energy uses	Information on the current state of equipment, systems, and processes related to energy purchase, use, reliability, storage and disposal shall be collected at defined intervals. This information shall be analyzed and used in identifying significant							

ISO 50001 (London Draft) Energy Review	ANSI/MSE 2000-2008	DS 2403: 2001	EN 16001	KATS KSA 4000:2007	NSAI IS 393	SAC GB/T XXXX—200X March 2009	SIS SS 627750 Reference	TISI ENERGY MANAGEMENT SYSTEM: SPECIFICATIO N 9/2004
	energy uses and opportunities for energy management projects.							

ISO 50001 (London Draft) Energy Review	ANSI/MSE 2000-2008	DS 2403: 2001	EN 16001	KATS KSA 4000:2007	NSAI IS 393	SAC GB/T XXXX—200X March 2009	SIS SS 627750 Reference	TISI ENERGY MANAGEMENT SYSTEM: SPECIFICATION 9/2004
Identify, prioritize, and record opportunities for improving energy performance, including, where applicable, potential energy sources, use of renewables, or alternative energy sources,		d) an identification of opportunities for improvement	e) identification and prioritisation of opportunities for improving energy efficiency. The organization shall maintain a register of opportunities for saving energy.	identification of improvements factors for the efficient use of energy by reviewing performance indicator and establishment of improvement plan	d) an identification of opportunities for improvement in the future,	Establish energy management benchmark as a primary basis if feasible, for determining energy objective and target, evaluating energy management performance. The organization shall review these baseline and benchmark and update them as necessary.	-Identification of opportunities for improvement	Energy conservation potential by benchmarking with other organizations

Annex C
(informative)

Comparison Table for ISO 50001, ISO 9001, ISO 14001 and ISO 22000

ISO 50001 (London Draft) Reference	Criteria	ISO 9001:2008 Reference	Criteria	ISO 14001 Reference	Criteria	ISO 22000 Reference	Criteria
	Foreword		Foreword		Foreword		Foreword
	Introduction		Introduction		Introduction		Introduction
1	Scope	1	Scope	1	Scope	1	Scope
2	Normative references	2	Normative references	2	Normative references	2	Normative references
3	Terms and definitions	3	Terms and definitions	3	Terms and definitions	3	Terms and definitions
4	Energy management system requirements	4	Quality management system	4	Environmental management system requirements	4	Food safety management system
4.1	General Requirements	4.1	General requirements	4.1	General requirements	4.1	General requirements
4.2	Management Responsibility	5	Management responsibility (only sub clause title)			5	Management responsibility
4.2.1	General	5.1	Management commitment	4.4.1	Resources, roles, responsibility and authority	5.1	Management commitment
4.2.2	Roles, responsibility and authority	5.5.1 5.5.2	Responsibility and authority Management representative	4.4.1	Resources, roles, responsibility, and authority	5.4 5.5	Responsibility and authority Food Safety team leader
4.3	Energy policy	5.3	Quality Policy	4.2	Environmental Policy	5.2	Food safety policy
4.4	Energy Planning	5.4	Planning	4.3	Planning	5.3 7	Food safety management system planning Planning and realization of safe

ISO 50001 (London Draft) Reference	Criteria	ISO 9001:2008 Reference	Criteria	ISO 14001 Reference	Criteria	ISO 22000 Reference	Criteria
							products
4.4.1	General	5.4.1 7.2.1	Quality objectives Determination of requirements related to the product	4.3	Planning	5.3 7.1	Food safety management system planning General
4.4.2	Legal and other requirements	7.2.1 7.3.2	Determination of requirements related to the product Design and development inputs	4.3.2	Legal and other requirements	7.2.2 7.3.3	(no title) Product characteristics
4.4.3	Energy review	5.4.1 7.2.1	Quality objectives Determination of requirements related to the project	4.3.1	Environmental aspects	7	Planning and realization of safe products
4.4.4	Energy baseline	5.4.1 7.2.1	Quality objectives Determination of requirements related to the project			7.4	Hazard analysis
4.4.5	Energy performance indicators	7.2.1	Determination of requirements related to the project	4.3.1	Environmental aspects	7.4.2	Hazard identification and determination of acceptable levels
4.4.6	Objectives, targets and action plans	5.4.1 7.1	Quality objectives Planning of product realization	4.3.3	Objectives, target and programme(s)	7.2	Prerequisite programmes
4.5	Implementation and operation	7	Product realization	4.4	Implementation and operation	7	Planning and realization of safe products
4.5.1	General	7.5.1	Control of production and service provision	4.4.6	Operational control	7.2.2	(no title)

ISO 50001 (London Draft) Reference	Criteria	ISO 9001:2008 Reference	Criteria	ISO 14001 Reference	Criteria	ISO 22000 Reference	Criteria
4.5.2	Competence, training and awareness	6.2.2	Competence, training and awareness	4.4.2	Competence, training and awareness	6.2.2	Competence, awareness and training
4.5.3	Documentation	4.2	Documentation requirements (only sub clause title)			4.2	Documentation requirements
4.5.3.1	Documentation requirements	4.2.1	General	4.4.4	Documentation	4.2.1	General
4.5.3.2	Control of documents	4.2.3	Control of documents	4.4.5	Control of documents	4.2.2	Control of documents
4.5.4	Operational control	7.5.1	Control of production and service provision	4.4.6	Operational control	7.6.1	HACCP plan
4.5.5	Communication	5.5.3	Internal communication	4.4.3	Communication	5.6.2	Internal communication
4.5.6	Design	7.3	Design and development			7.3	Preliminary steps to enable hazard analysis
4.5.7	Procurement of energy services, products, equipment and energy	7.4	Purchasing				
4.5.7.1	Procurement of energy services, products, and equipment	7.4.1	Purchasing process	4.4.6 c)	Operational control	7.3.3.1	Raw Materials, ingredients and product-contact materials
4.5.7.2	Procurement of energy supply	7.4.2	Purchasing information			7.3.3.1	Raw Materials, ingredients and product-contact materials
4.6	Checking performance	8	Measurement, analysis and improvement	4.5	Checking	8	Validation, verification and improvement of the

ISO 50001 (London Draft) Reference	Criteria	ISO 9001:2008 Reference	Criteria	ISO 14001 Reference	Criteria	ISO 22000 Reference	Criteria
4.6.1	Monitoring, measurement and analysis	8.2.3 8.2.4 8.4	Monitoring and measurement of process Monitoring and measurement of product Analysis of data	4.5.1	Monitoring and measurement	7.6.4	food safety management system System for monitoring of critical control points
4.6.2	Evaluation of legal/other compliance	7.3.4	Design and development review	4.5.2	Evaluation of compliance		
4.6.3	Internal audit of the Energy Management System	8.2.2	Internal audit	4.5.5	Internal audit	8.4.1	Internal audit
4.6.4	Nonconformities, correction, corrective, and preventive action	8.3 8.5.2 8.5.3	Control of nonconforming product Corrective action Preventive action	4.5.3	Nonconformity, corrective action and preventive action	7.10	Control of nonconformity
4.6.5	Control of records	4.2.4	Control of records	4.5.4	Control of records	4.2.3	Control of records
4.7	Management review	5.6	Management review	4.6	Management review	5.8	Management review
4.7.1	Input to management review	5.6.2	Review input	4.6	Management review	5.8.2	Review input
4.7.2	Output from management review	5.6.3	Review output	4.6	Management review	5.8.3	Review output