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### **Determination of energy savings in organizations**

Détermination des économies d'énergie dans les organisations

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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 17747 was prepared by Technical Committee ISO/TC 257, Evaluation of energy savings, Joint Working Group 4 (JWG4), working with ISO/TC 242 (Energy Management Systems).

This second/third/... edition cancels and replaces the first/second/R edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

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### Introduction

This International Standard describes approaches for determining energy savings based on:

- a) a change in the amount of energy consumed by the organization as measured within the organizational boundary an organization-based approach, or
- b) aggregating energy savings from energy performance improvement actions measured within the organizational boundary an EPIA-based approach

Both approaches compare energy consumption for a defined period of time – the reporting period – relative to the energy consumption in a baseline period. Guidance is given on reconciliation between the two approaches.

This International Standard also considers, in the context of energy savings, the use of primary and delivered energy, approaches towards aggregating energy savings from different types of energy and use of normalization.

This International Standard is designed to be consistent with the overall framework for the determination and reporting of energy savings in projects, organizations and regions set out in ISO 17743 as well as the measurement and verification of energy performance of organizations in ISO 50015.



Figure 1: Relationship between ISO 17747 and related ISO standards

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### Determination of energy savings in organizations

#### 1 Scope

This International Standard provides approaches for the determination of energy savings from existing (implemented) or prospective energy performance improvement actions (EPIAs) in organizations. These methods may be applied to any organization, whether incorporated or not, public or private. It can be used by organizations already operating to an energy management system, such as ISO 50001, as well as by organizations with no formal energy management system.

This International Standard addresses the following topics in the context of energy savings:

- Establishing the purpose of the determination of energy savings
- **Determining boundaries**
- Energy accounting, including primary and delivered energy
- Selecting an approach for the determination of energy savings
- Establishing an energy baseline
- Normalization of energy consumption
- Determination of energy savings
- Reporting and other matters

Specific methods for measurement and verification (M&V) of energy performance which are used to calculate energy savings are not in the scope of this standard. Guidance related to M&V of organizational energy performance can be found in ISO 50015 [8].

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#### 2 Normative references

No normative references are cited. This clause is included to retain clause numbering identical with other ISO standards.

#### 3 Terms and Definitions

#### 3.1 energy

electricity, fuels, steam, heat, compressed air, and other like media

Note 1 to entry: Examples of other like media include hot water, and intermediate products or by-products such as biogas or coke oven gas.

Note 2 to entry: In other contexts energy can be defined as the capacity of a system to produce external activity or perform work

Note 3 to entry: For the purposes of this International Standard, in order to use the same terminology as most organizations do in managing their energy, energy refers to the various types of energy which can be purchased. stored, treated, used in equipment or in a process, or recovered.

[source: adapted from ISO 50001 with new note 1]

#### 3.2 energy accounting

system of rules, methods, techniques and conventions used to measure, analyze and report energy consumption

#### 3.3 energy consumption

quantity of energy applied

[source ISO 50001]

#### 3.4 energy baseline

quantitative reference(s) providing a basis for comparison of energy performance

Note 1 to entry: An energy baseline usually reflects a specified period of time. Note 2 to entry: An energy baseline can be normalized using variables affecting energy use and/or consumption e.g. production level, degree days (outdoor temperature).

[source: adapted from ISO 50001:2011, 3.6 - Note 3 suppressed.]

#### 3.5 energy performance

measurable results related to energy efficiency, energy use and energy consumption

[source: ISO 50001:2011, 3.12, modified -- Note 1 and Note 2 to entry have been deleted since the notes were specific to energy management and not transverse.]

### 3.6 energy performance improvement action EPIA

action or measure (or group of actions or measures) implemented or planned within an organization (3.15) intended to achieve energy performance improvement through technological, management, behavioural, economic, or other changes

[source: ISO FDIS 50015: 2013 3.3]

#### 3.7 boundaries

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

Note 1 to entry: The boundary of the organization could be different from the boundary(ies) used for the determination of energy savings

Note 2 to entry: The determination of energy savings can include one or more boundaries, for example of one or more EPIAs, or of parts of the organization, *since and and standards* standards, size 17747

Examples: Equipment; a system; a process; a group of processes; a room; a building; a site; an entire organization; multiple sites under the control of an organization.

[source: ISO 50001, with additional examples and Notes modified from ISO 50002]

#### 3.8 energy use

manner or kind of application of energy

Examples: ventilation; lighting; heating; cooling; transportation; processes; production lines

[source: ISO 50001:2011, 3.18]

#### 3.9 double counting

the error of attributing a single instance of energy savings from one or more energy performance improvement actions when they influence the energy consumption of other energy using systems within the organization

Note 1 to entry: In cases where there are interactive effects between the EPIAs, the savings due to the combined effect of these EPIAs may be different from the sum of the energy savings from the individual EPIAs Note 2 to entry: The principle of double counting can also apply to energy consumption (e.g. counting both the gas consumed by a CHP system and the electricity produced).

[source: Modified from EN 16212; new note 2]

#### 3.10 normalization

process of modifying energy data in order to account for changes in relevant variables to compare energy performance under equivalent conditions

[source: CD ISO 50006]

#### 3.11 baseline period

specific period of time selected as the reference period for the determination of energy savings.

#### 3.12 reporting period

specific period of time selected as the evaluation period for the determination of energy savings

#### 3.13 scope

extent of activities, facilities and decisions, which can encompass several boundaries

[source: ISO 50001 with the words "that the organization addresses through an EnMS" removed]

#### 3.14 static factors

conditions or variables that impacts energy performance and do not routinely change

Examples: facility size, design of installed equipment, the number of weekly production shifts, or the number or type of occupants (e.g. office workers), range of products

[source: CD ISO 50006]

#### 3.15 organization

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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

**ISO/DIS 17747** Note 1 to entry: An organization can be a person or a group of people st/211ee1b7-c564-4c7e-924e-

[source: ISO 50001:2011 3.2.2]

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#### 3.16 delivered energy

energy arriving at the boundary(ies) of an organization

Note 1 to entry: Primary energy produced or renewable energy generated onsite (such as electricity from photovoltaic panels, or oil from an oil well) is regarded as arriving from outside the boundary(ies) of the organization

#### 3.17 primary energy

energy that has not been subjected to any conversion or transformation process

Note 1 to entry: Primary energy can be either a non-renewable or renewable energy or a combination of both. Organizations will need to be aware of legal or other requirements when considering which types of energy are primary. [source: ISO 16818:2008. 3.177, modified - The Note 1 to entry was added]

#### 3.18 relevant variable

quantifiable factor that impacts energy performance and routinely changes

Examples: weather conditions, operating conditions (indoor temperature, light level), working hours, production throughput

[source: ISO 50015]

#### 4 Scope and Boundaries

#### 4.1 Preliminary considerations before determining the energy savings

Before commencing the determination of energy savings, the organization should establish:

- the purpose of the determination of the energy savings, such as:
  - compliance with applicable legal or other requirements,
  - use in annual reporting,
  - part of an Energy Management System such as ISO 50001,
  - calculation of the financial return of energy performance improvement actions;
- the organization for which energy savings are being determined;
- parties responsible for the determination of energy savings, their roles, and relationship to the organization;
- parties who will receive the results;
- a summary of the type of data its periodicity and intervals within which it is to be collected and analysed.

Energy savings should be based on energy consumed by the organization. Depending on the scope of the energy savings calculation, the boundary(ies) of the organization may or may not include, for example, transportation of goods or people by or on behalf of the organization, or activities of sub-contractors manufacturing components.

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### 4.2 Determining the boundaries ISO/DIS 17747

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#### Boundaries for the organization or its parts should be defined 17

Examples: a single building, a university campus or shopping centre, all the operations within a single manufacturing plant or process, all buildings owned by a public authority within an administrative district, all the buses operated by a transit authority.

However, the boundary(ies) of the energy saving calculation can be different from that of the organization. The following cases are illustrative but not exhaustive of where the boundaries may differ:

- Where energy is stored within the organization boundary
- Where energy is exported across the organization boundary
- Where primary energy is generated on site

The boundaries may include transportation energy used in delivering goods or services to customers, or by employees in undertaking work for the organization (e.g. salesmen or consultants travelling to customers' premises).

It may be necessary to define multiple boundaries, for example where an organization wishes to calculate energy savings from operations in several locations, each of which manufactures components of a single final product or service and the components are transported between the plants.

Example: company level energy used by a car manufacturer where the cars are assembled in one country but the engines and transmission units are manufactured in another country. In this case the total company energy consumption will exceed the sum of the energy consumed by the factories in the two countries due to the energy consumed in transportation.

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Organizations often seek to determine total energy savings across the organization by aggregating savings from a number of energy performance improvement actions (EPIAs). When this approach is taken, it may be useful to define a boundary which is specific for each EPIA. The boundary of the EPIA might cross over the organizational boundary (see Figure 2(B)); it might also overlap that of another EPIA (see Figure 2(C)). The total area within the EPIA boundaries may not encompass the whole organization.



Example: The physical location of an organization is shown in Fig. 2 (A). There are three factory buildings, one office building, and a utility building. This organization is composed by three production division, a head office and an energy division. (see Fig .2(C).) EPIAs currently carried out in this organization are shown in Fig. 2 (B). EPIA1 is the efficiency operation of the boiler. EPIA 2 is improvement of steam system. EPIA 3 is improvement of heating furnace. The boundary of EPIA 1 and EPIA 2 overlaps. Moreover, the total area of EPIA boundaries is smaller than the whole organization. The sub-organizations are divided from the organization without the space.

The boundary(ies) of the organization should be comparable in the baseline and reporting periods. Nonroutine adjustments should be made to reflect changes to the boundary(ies), such as the sale or purchase of subsidiary companies, the opening or closure of factories, plants or other premises by the organization, or outsourcing or in-sourcing of activities. (standards.iteh.ai)

Example: In the baseline period a company owns its own fleet of delivery vehicles. In the reporting period it has outsourced this activity to an external delivery company. To be consistent, either the fuel used for transportation by the company in the baseline period should be eliminated, or the delivery company's energy consumption should be accounted for.

When aggregating the results of energy savings across different functions of an organization (such as multiple manufacturing processes and transportation) variations in the measurement and methods uncertainty can result in uncertainty associated with the determination of the energy savings. To ensure accuracy in the results of combining energy savings, care should be taken when defining the boundary(ies).

The organization should document and report on the boundary(ies) selected as appropriate.

#### 5 Energy accounting

#### 5.1 General principles of energy accounting

#### 5.1.1 Introduction

The determination of energy savings should extend to all types of energy consumed within the organizational boundary(ies). This includes electricity supplied or generated onsite (e.g. from co-generation, combined heat & power (CHP), renewable energy, internal combustion engines or gas turbines).

Energy accounting should be appropriate to the organization's circumstances, and the purpose of the determination of the energy savings. The approach to energy accounting should be documented and reported and used consistently.

An example of energy accounting in the cement industry is given at Annex B.