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Energy savings — Definition of a methodological framework applicable to calculation and reporting on energy savings

Économies d’énergie — Définition d’un cadre méthodologique pour le calcul et la déclaration des économies d’énergies

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information.

The committee responsible for this document is ISO/TC 257, *Evaluation of energy savings*.

Introduction

This International Standard aims to provide standards used to determine the energy savings covering regions, cities, organizations and projects.

This International Standard provides a framework with definitions, types of information used to evaluate the energy savings in order to enable consistency for the standards developed by ISO/TC 257.

Figure 1 illustrates the relationship between the different working groups of ISO/TC 257, as well as ISO 50015, developed by ISO/TC 242 which is about energy management.

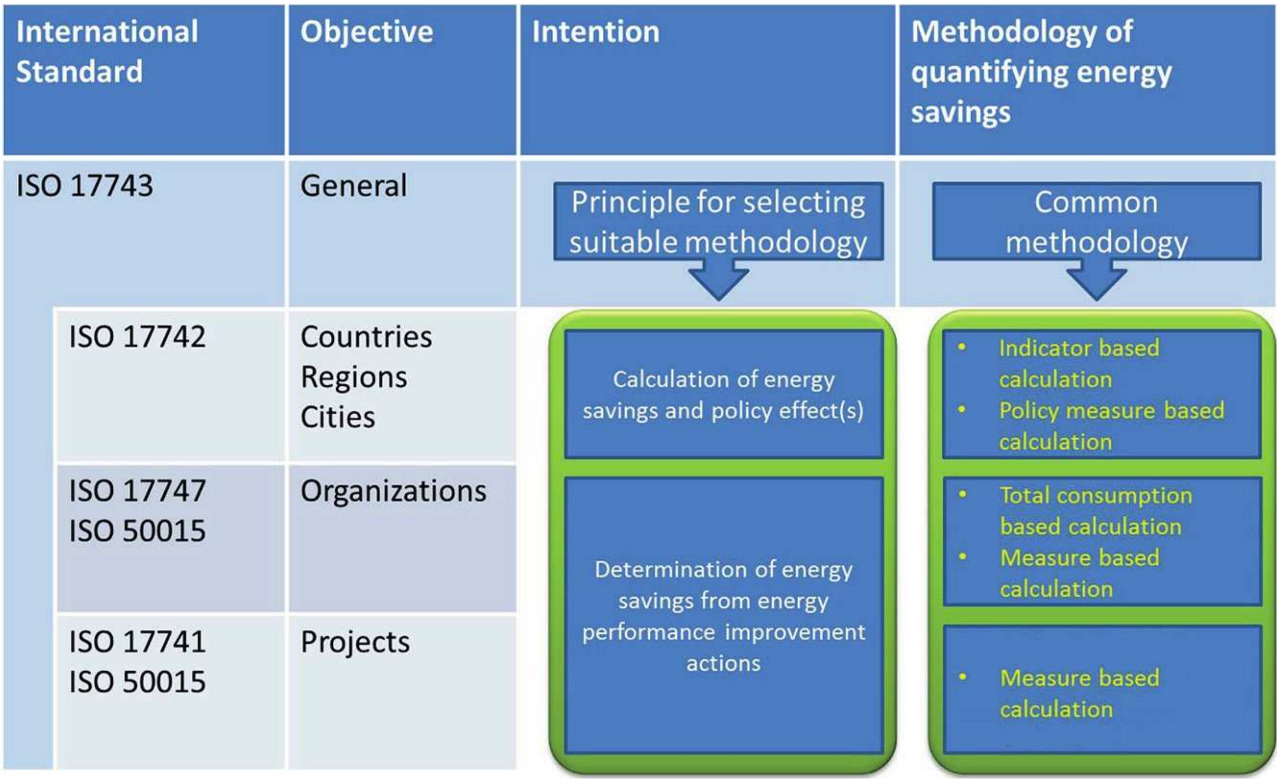


Figure 1 — Work programme of ISO TC 257

This International Standard may be used by any stakeholder (policy maker, decision maker, company, organization, NGOs, etc.) that aims to determine energy savings.

Energy savings — Definition of a methodological framework applicable to calculation and reporting on energy savings

1 Scope

This International Standard establishes a methodological framework that applies to the calculation and reporting of energy savings from existing (implemented) and prospective measures and actions which intend to save energy. This framework standard will be applicable to other standards in the field of energy saving determination.

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

— terminology;

— definition of the system boundaries;

— principles for the determination of a baseline;

— principles for statistical indicator-based methods;

— data used;

— principles for reporting.

The development of the methodology for measurement and verification of the energy savings is not in the scope of this International Standard.

The methodology of construction of the scenarios for future energy saving measures and actions is not in the scope of this International Standard.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

3.1
baseline period
specific period of time before the implementation of *energy performance improvement action* (3.7) selected for the comparison with the *reporting period* (3.11) and the calculation of *energy savings* (3.9)

[SOURCE: ISO/IEC 13273-1:2015, 3.3.8.1, modified — “energy performance” replaced by “energy savings” and deleted “and of energy performance improvement action”]

3.2
energy
capacity of a system to produce external activity or to perform work

Note 1 to entry: Commonly, the term energy is used for electricity, fuel, steam, heat, compressed air and other like media.

Note 2 to entry: Energy is commonly expressed as a scalar quantity.

Note 3 to entry: Work, as used in this definition, means external supplied or extracted energy to a system. In mechanical systems, forces in or against direction of movement; in thermal systems, heat supply or heat removal.

Note 4 to entry: In the International Systems of Units, the reference unit for energy is Joule (J).

[SOURCE: ISO 13273-1:2015, 3.1.1, modified — added Note 4 to entry]

3.3
energy baseline
quantitative reference(s) providing a basis for comparison of *energy performance* (3.6)

Note 1 to entry: An energy baseline usually reflects a specified period of time.

Note 2 to entry: An energy baseline can be adjusted using variables which affect energy use and/or consumption, e.g. production level, degree days (outdoor temperature), occupancy period, etc.

Note 3 to entry: The energy baseline is also used for calculation of energy savings, as a reference before and after implementation of energy performance improvement actions.

[SOURCE: ISO 50001:2011, 3.6]

3.4
energy consumption
quantity of *energy* (3.2) applied

Note 1 to entry: Energy consumption can be determined with and without or before and after any energy performance improvement action.

[SOURCE: ISO 50001:2011, 3.7, modified — added Note 1 to entry]

3.5
energy end-user
individual or a group of individuals or organization with responsibility for operating an energy using system

Note 1 to entry: The energy end-user may differ from the customer who might purchase the energy but does not necessarily use it.

[SOURCE: ISO 13273-1:2015, 3.1.10, modified — added Note 1 to entry]

3.6
energy performance
measurable results related to energy efficiency, energy use, and *energy consumption* (3.4)

[SOURCE: ISO 13273-1:2015, 3.3.1]

3.7
energy performance improvement action
EPIA
action or measure (or group of actions or measures) implemented or planned within an organization intended to achieve energy performance improvement through technological, management, behavioural, economic or other changes

Note 1 to entry: EPIAs are also applicable at project level or country, regions and city level.

Note 2 to entry: In the context of energy savings calculation, EPIAs are generally concerned with energy efficiency.

Note 3 to entry: In some International Standards, “elementary unit of action” is used instead of EPIA.

[SOURCE: ISO 13273-1:2015, 3.3.7, modified — added Note 1 to entry, Note 2 to entry and Note 3 to entry]

3.8
energy savings
reduction of *energy consumption* (3.4) compared to an energy baseline

Note 1 to entry: Energy savings can be actual (realized) or expected (predicted).

Note 2 to entry: Energy savings may be the result of implementation of an EPIA (energy performance improvement action) or autonomous progress.

3.9
energy using system
physical items with defined system boundaries, using *energy* (3.2)

EXAMPLE Facility, building, part of a building, machine, equipment, product, etc.

[SOURCE: ISO 13273-1:2015, 3.1.9]

3.10
adjusted energy savings
energy savings with use of adjustment(s)

Note 1 to entry: The difference in energy consumption with and without or before and after the energy performance improvement action(s) with the use of adjustment(s).

3.11
reporting period
defined period of time selected for determination and reporting of energy savings

[SOURCE: ISO 50006:2014, 3.15, modified, “calculation” replaced by “determination” and “energy performance” replaced by “energy savings”]

3.12
routine adjustment
determinable adjustment made to energy consumption to account for changes in relevant variables according to a predetermined method

Note 1 to entry: In some International Standards, the term “normalization” is used in preference to “routine adjustement”, in order to enable different methods of adjustment (commonly based on reference conditions, baseline period conditions or reporting period conditions) to be distinguished.

[SOURCE: ISO 50015:2014, 3.20, modified — “determinable” and Note 1 to entry added and “energy baseline” replaced by “energy consumption”]

3.13
unadjusted energy savings
energy savings (3.8) without any adjustment

4 Energy savings and methods for determination

4.1 General

The choice for the method for calculating and reporting energy savings should be suitable for the intended use of the results. There are three main methods:

— statistical indicator-based method[2][8];

— measure-based method, including EPIA based methods[1][3][8];

— total consumption-based method[3].

The statistical indicator-based method starts from indicators that relate energy consumption to a relevant variable (driver). The change in this efficiency indicator is used to calculate savings, by multiplying it with the value of the relevant variable (driver).

The measure-based method, including EPIA-based methods, aggregates energy savings calculated for each EPIA or other measure implemented.

Total consumption-based method starts from the change in measured energy consumption between the baseline period and the reporting period.

4.2 Principles

This framework standard introduces the key concepts for calculating energy savings. Energy savings will be determined as a difference in energy consumption with and without or before and after the energy performance improvement action(s).

Energy savings are dependent on the system boundary being considered.

If an energy performance improvement action results in an increase in the energy consumption, then the energy savings are negative.

This Clause describes the different characteristics of methods as to the following:

— energy savings (4.3);

— system boundary(s) (4.4);

— energy baseline and adjustment of energy savings (4.5 to 4.6).

4.3 Energy savings

Energy savings may result from the following:

— facilitating measures intended to encourage an end-user action;

— EPIAs independently taken by energy end-users;

— autonomous progress, other market changes or policies that arise without end-user actions intended to save energy (these are described in more detail in 4.6.3.3).

Facilitating measures, such as regulation, subsidy schemes or voluntary agreements, may encourage energy end-users to implement energy performance improvement actions. Facilitating measures do not by themselves result directly in energy savings.

EXAMPLES Minimum energy efficiency performance standards for refrigerators, power transformers and appliance in general, tax reduction for efficient car, subsidized loans for higher efficiency industrial electric motors and voluntary agreements with manufacturers to reduce standby energy consumption of televisions.

Energy end-users may take actions that lead to energy savings. These actions are known as energy performance improvement actions (EPIAs). The EPIAs may be physical, organizational, or behavioural.

EXAMPLES A physical action may be to replace old refrigerators or power transformers by more efficient ones; an organizational action may be to identify oversized and underloaded electric motors and redistribute the load; a behavioural action may be to apply eco-driving principles.

Statistical indicator-based methods relate energy consumption at an aggregated level (sector, targeted energy use, such as all refrigerators or all electric motors in a country) to one relevant variable (driver) that is (statistically) defining the change in energy consumption. The change in the indicator value is used to calculate the savings. Part of these savings is considered as the result of EPIAs that focus on the energy use covered by the indicator.

EXAMPLE Average floor area of dwellings, energy consumption per m^2 in buildings, average fuel consumption per car.

End-user actions can be the result of facilitating measures but can also be caused by other factors like high energy prices, autonomous progress, market forces or non-energy government policy. The indicator values incorporate the effect of all relevant facilitating measures. However, the indicators can only show their combined effect.

In cases of facilitating measures, the energy savings will be derived from the effect of the end-user actions stimulated (e.g. for energy audits, the end-user actions to implement the energy saving measures mentioned in the audit report). These energy savings can be directly calculated and may or may not be linked to one or more facilitating measures.

For organizations or projects, the change in statistical indicators can be used to calculate energy savings, as well as direct measurements in the considered system.

4.4 System boundary(s)

The system boundary(s) should be established for the entity to which the energy savings apply, such as country, region, city, multi-site company, a project, an organization, a system or a specific appliance.

EXAMPLE System boundary could be limited to all buildings operated by an organization or to a single building.

Allocation rules should be established to avoid double counting of energy savings between different EPIAs that apply within the same boundary. These allocation rules should, when possible, be aligned with the logical order of energy using systems and processes. These allocation rules should be recorded.

EXAMPLE In a building (physical boundary), two actions are implemented, insulation of the building envelope and change of the central heating boiler. Double counting occurs when their interaction is not taken into account. The building's manager will determine the energy savings by firstly considering the energy savings due to improvement of the building envelope and then the savings due to the higher efficiency boiler for the reduced heating load.

4.5 Energy baseline determination

The energy baseline represents the reference situation appropriate to the energy savings determination and should be documented. The choice of this baseline and the baseline period affects the resulting energy savings[4][5].

The energy baseline may be time related (for comparing energy consumption before and after EPIA, see Keys 1 and 2 in Figure 2 below) or case related (for comparing energy consumption with and without EPIA, see Keys 4 and 2 in Figure 2 below).

NOTE 1 Using a representative sample (participating / non-participating) is an illustration of a case-dependant energy baseline.

The relevant variables (e.g. production volume, temperature, building area) affecting energy use or consumption in the baseline period should be documented. If this is different from the service level in the reporting period, then the energy consumption of the baseline period or the reporting period or both should be adjusted to enable a fair comparison to be made. It will be for the person determining the energy savings to decide and report on whether or not adjustement is required, taking into account factors, such as the purpose for which the energy savings are being determined, type of available data and data quality.

There can be multiple types of baseline.

— If the equipment having the average energy performance in the market at reporting period is applied.

— If the equipment having the average energy performance in the market at baseline period was applied.

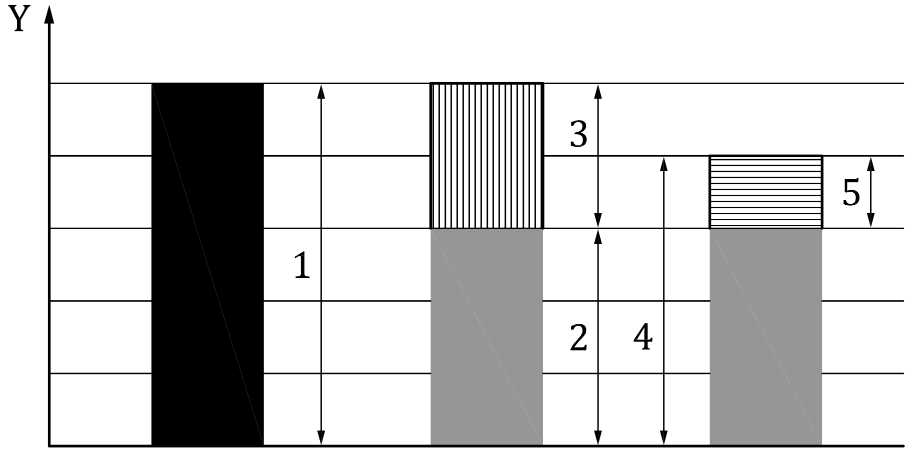
— The equipment used in the baseline period is still in use.

When determining energy savings at a regional level due to changes in energy using systems (e.g. building, appliance, car, etc.), the baseline may be determined by Figure 2, reference to the stock in use, as one possible option for Figure 2, Key 1.

NOTE 2 The energy savings can be determined using the difference in the values for a statistical indicator such as specific energy consumption (SEC) of the new energy using system compared to the average energy performance of energy using system for an equivalent service level which is already in use.

Reference to the market, as one possible option for Figure 2, Key 4.

NOTE 3 The energy savings can be determined using the difference in the values for a statistical indicator such as specific energy consumption (SEC) of the new energy using system and the average of solutions available on the market in the baseline period.



Key

Y energy consumption, in Joules

1 energy baseline based on the situation before the EPIA (can be determined based on specific conditions or on average conditions such as stock average for buildings or equipment)

2 energy consumption of the reporting period [after (or with) the EPIA]

3 energy savings based on a before/after comparison (1–2)

4 energy baseline based on the situation without the EPIA (can be determined based on market average or minimum energy performance standards for example)

5 energy savings based on a without/with comparison (4–2)

NOTE All quantities are expressed in energy units.

Figure 2 — Qualification of unadjusted energy savings depending on the reference situation

Criteria for the choice of one of these options could be linked to the lifespan of the EPIA or the speed of stock turnover.

— With equipment with a short lifetime, the reference to the market-share weighted performance of the products available on the market is relevant (e.g. changing domestic appliances, such as refrigerators, television, light bulbs).

— For an investment planned with the intention to save energy for a long period of time, reference to the stock in use is more relevant (e.g. improvement of the thermal performance of the building shell).

Depending on the availability of data (such as with large scale programmes of EPIAs), a representative sample may be used for defining the baseline. The energy savings are accounted as the difference between the reference representative sample not participating in the energy performance improvement action and a sample participating in the said action.

The energy baseline should be reviewed periodically to ensure it is still appropriate for the purpose of the determination of energy savings.

NOTE 4 In organizations undertaking continuous improvement as part of an energy management system, a moving baseline calculated with reference to the immediately preceding year or years' energy consumption may be appropriate.

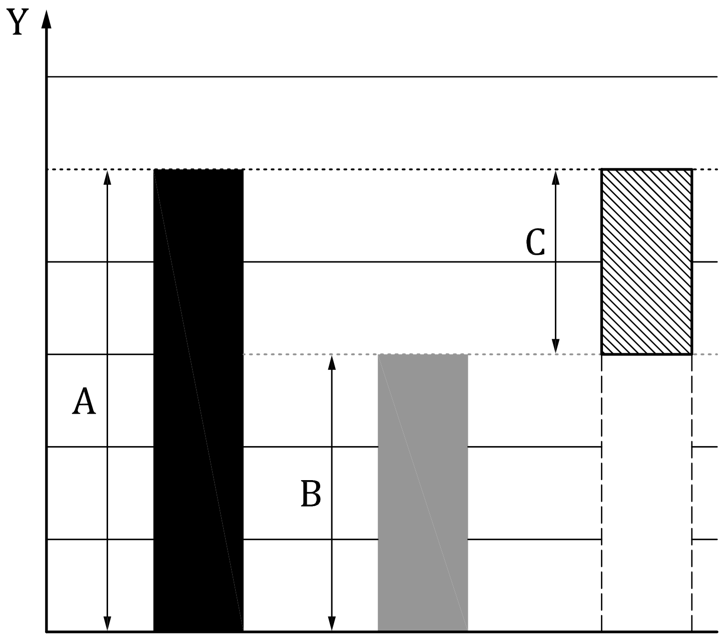
4.6 Unadjusted energy savings and adjusted energy savings

4.6.1 General

Unadjusted energy savings are the change in energy consumption expressed as the difference between the energy baseline and the energy consumption for the reporting period. The unadjusted energy savings are presented in Figure 3 as Key C.

The adjusted energy savings (Figure 4, Key F or Key I or Figure 5, Key N) are derived for the observed situation using adjustment on the energy baseline (Figure 4, Key E) or on energy consumption of the reporting period (Figure 4, Key H), or on both the baseline (Figure 5, Key K) and the energy consumption of the reporting period (Figure 5, Key M).

The influence of adjustment can be positive or negative as their influence can result in a reduction or an increase of the adjusted energy savings as compared to the unadjusted energy savings.



Keys

Y energy consumption, in Joules

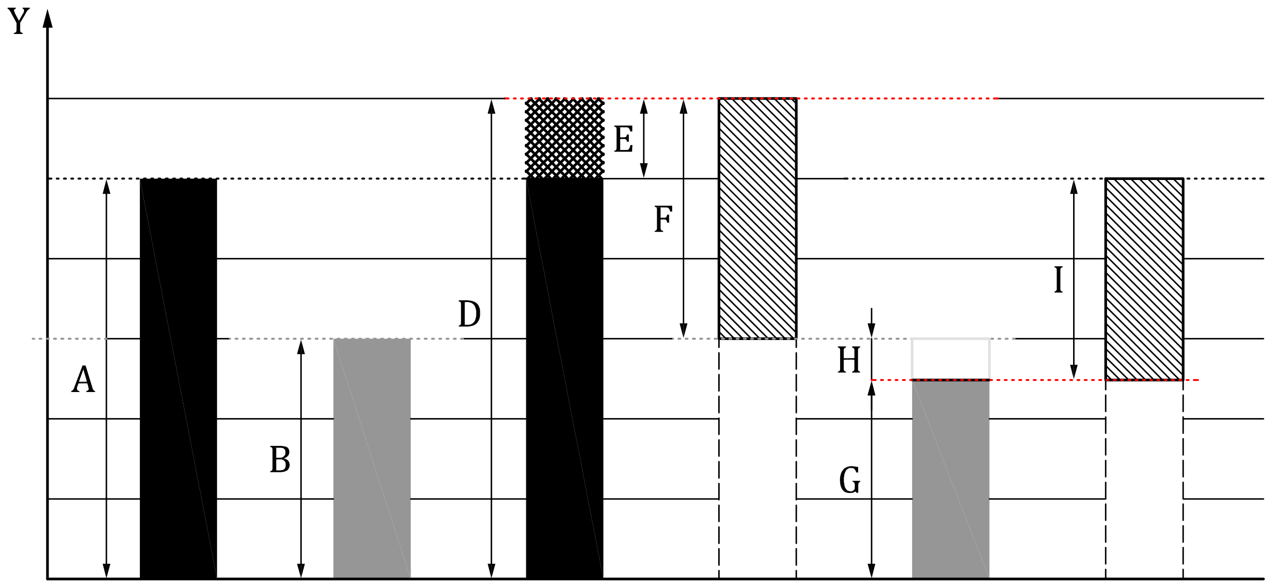
A energy baseline

B energy consumption of the reporting period [after (or with) the EPIA]

C unadjusted energy savings ([A]-[B])

NOTE All quantities are expressed in energy units.

Figure 3 — Determination of unadjusted energy savings



Keys

Y energy consumption, in Joules

A energy baseline

B energy consumption of the reporting period [after (or with) the EPIA]

D adjusted energy baseline ([A]+[E])

E adjustments (difference in the value for the energy consumption) on energy baseline (can be a positive or negative value)

F adjusted energy savings (adjustment on the energy baseline) ([D]-[B])

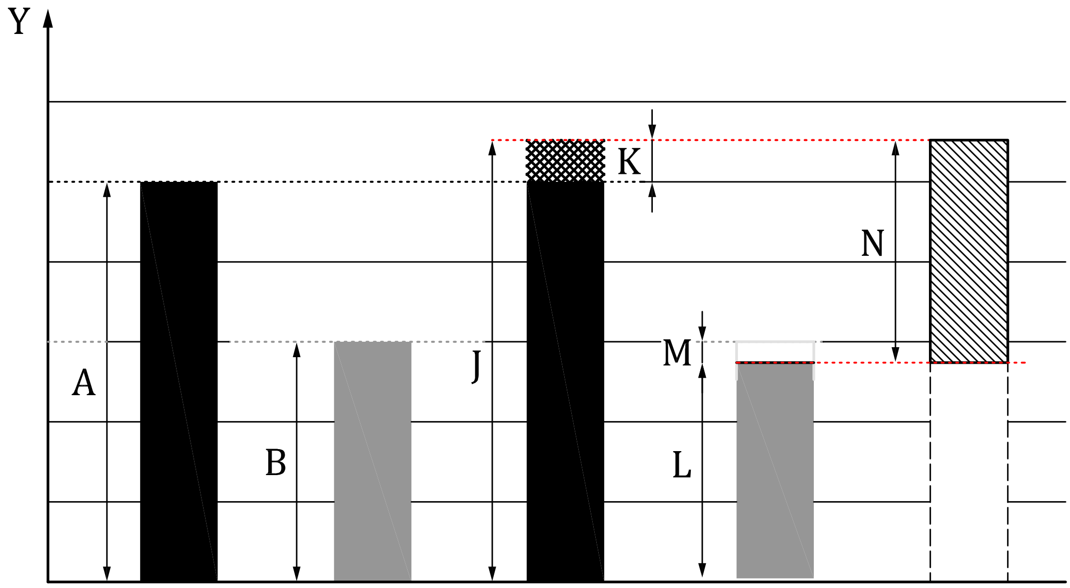
G adjusted energy consumption of the reporting period ([B]+[H])

H adjustments (difference in the value for the energy consumption) on the energy consumption of the reporting period (can be a positive or negative value)

I adjusted energy savings (adjustment on the energy consumption of the reporting period) ([A]-[G])

NOTE All quantities are expressed in energy units.

Figure 4 — Determination of adjusted energy savings with adjustement on the energy baseline or on the energy consumption of the reporting period



Keys

Y energy consumption, in Joules

A energy baseline

B energy consumption of the reporting period

J adjusted energy baseline ([A]+[K])

K adjustments (difference in the value for the energy consumption) on the energy baseline (can be a positive or negative value)

L adjusted energy consumption of the reporting period ([B]+[M])

M adjustments (difference in the value for the energy consumption) on the energy consumption of the reporting period (can be a positive or negative value)

N adjusted energy savings (adjustment on both the energy baseline and the energy consumption of the reporting period) ([J]-[L])

NOTE All quantities are expressed in energy units.

Figure 5 — Determination of adjusted energy savings with adjustment on both the energy baseline and the energy consumption during the reporting period

Annexes A and B present the application of Figures 3, 4 and 5 to different cases applicable at the country level or at the organization level.

4.6.2 Use of adjustment(s)

Unadjusted energy savings include all effects due to EPIAs, policy-induced actions (from external authorities or inside an organization), autonomous progress. Where energy savings need to be allocated between different energy performance improvement actions, the assumptions and decisions should be explained and recorded for traceability.

Adjusted energy savings (Figure 4, Key F or I, or Figure 5, Key N) are derived from the unadjusted energy savings (Figure 4, Key C) after adjustment of the energy baseline (Figure 4, Key E), or of the energy consumption of the reporting period (Figure 4, Key H), or both of the energy baseline (Figure 5, Key K), and of the energy consumption of the reporting period (Figure 5, Key M).

These adjustments may impact the determination of the structure effects and the value of energy consumption in the reporting period.

EXAMPLE Adjustment(s) may be done by considering weather conditions (temperature), occupancy patterns for hours of operation, production amount or quantity of products manufactured, compared to identical situation as presented in the baseline.

NOTE In practice, impacts on energy savings due to autonomous progress can often be included in the (adjusted) energy baseline when using statistical indicator-based method.

4.6.3 Types of adjustments

4.6.3.1 General

The adjustments can be grouped into two main types:

— routine adjustments;

— non-routine adjustments.

The use of these adjustments may be applied to the energy baseline or the unadjusted energy savings or both.

4.6.3.2 Routine adjustments

In order to understand calculated energy savings, energy consumption before and after (or with and without) end-user actions may need to be adjusted to provide an estimate of energy consumption under comparable conditions.

Routine adjustments are based on an energy consumption model which is used to take into account changes in relevant variables under conditions where the model is considered to be valid.

Example of relevant variable 1: adaptation for weather conditions (e.g. degree days for heating).

Example of relevant variable 2: changes in production volume.

Routine adjustments should be applied consistently, even if they may appear to be quite small in magnitude. Otherwise, there is a risk that when comparing resultant energy savings between different periods or between similar systems, one set of savings will have been adjusted but another may not have been, which could lead to an incorrect assessment of the effectiveness of the end-user actions.

EXAMPLE Energy savings are being compared between two stores in a retail chain that both had improvements made to their air-conditioning systems. One store is in an area where there is a large difference between summer and winter climate conditions, in the other external temperatures do not vary so much. However, both stores have to make routine adjustments for local climate, in order to provide a fair comparison between the two EPIA interventions.

4.6.3.3 Non-routine adjustments

Non-routine adjustment(s) may be required where there are effects that significantly influence energy consumption, but which occur relatively infrequently and are not as a result of any intentional EPIAs or policy-induced measures.

4.6.3.3.1 Structural effects

Structural effects arise as a result of change in activities or services:

Example 1: longer opening hours of shops and/or public buildings.

Example 2: change from hand washing of clothes to washing machines.

Example 3: changes in the floor area of dwellings.

Example 4: modal shift from road transportation to rail transportation.

Example 5: shift from energy intensive industry (steel, paper, cement) to light industry (equipment industry, electronics, software) and services.

One way to reduce the impact of the structure effects is by the disaggregation of activities. This can be done for organizations, cities, regions, or countries. The level of disaggregation may have a strong influence on the results of structure effects. Due to restricted data availability, it is not always possible to correct for all structure effects. For example, at national level, instead of analysing the relationship between energy consumption and variables at overall industry level, it can be done at sectoral levels, chemicals versus equipment or sub-sectoral levels (basic chemicals, pharmaceutical).

4.6.3.3.2 Autonomous progress

Savings due to autonomous progress occur without being a direct consequence of the EPIA(s) considered. Autonomous savings are driven by competitive pressure to save costs (including energy costs) and/or normal technological progress to provide new products or services. They are included in Figure 4 in Key H.

Example 1: electronic control systems instead of electromechanical control systems for energy using systems

Example 2: development of catalysts operating at lower temperature leads to reduced energy consumption

Example 3: use of plastics for car bodies reduces the weight and as a consequence reduces the energy consumption

Autonomous progress can also lead to negative savings.

Example Use of membrane technologies (reverse osmosis, ultra-filtration) replacing resins for water treatment as this technology requires higher pressure and consequently uses more electrical energy.

4.6.3.3.3 Other non-routine adjustments

Other non-routine adjustments arise from price effects, multiplier effects and the rebound effect.

Methods for applying these non-routine adjustments are presented in References [1], [2] and [3].

5 Reporting energy savings

5.1 General information on reporting energy savings

The basis of reporting is the transparency and traceability of information used for the different options and choices of the energy saving determination during the entire process.

This requires that information is presented in sufficient detail to allow the user to assess the quality of the information.

Reporting of energy savings may include the following information and/or assumptions regarding the following:

— purpose of the energy saving determination (intended use and scope);

— identification of the EPIA(s) or measure(s);

— who ordered;

— who undertook the determination of energy savings;

- period of time for which the energy savings are accounted for;
- date of report and period for which the results are valid, if relevant;
- method used for the energy savings determination
  - system boundary(s);
  - energy baseline;
  - assumptions for adjustment of the energy savings measured/observed/estimated;
- allocation of energy savings when different EPIAs apply within the same system boundary(s) to avoid double counting;
- type of data (metered, monitored, estimated, calculated, including methods used for routine and non-routine adjustments)
  - data sources (official statistics, energy bills, etc.);
  - additional characteristics may be presented if relevant and useful;
  - data collection methods (e.g. frequency, sampling characteristics);

  If applicable, reasons for exclusion of data should be reported
- preservation of data;
- accuracy of results (uncertainty);
- statement regarding verification of the results, if relevant.

5.2 Communication of energy saving results

The communication from the report may be simplified according to the following rules.

- The expression of results in final energy for the different category of energy carriers or primary energy should be documented.

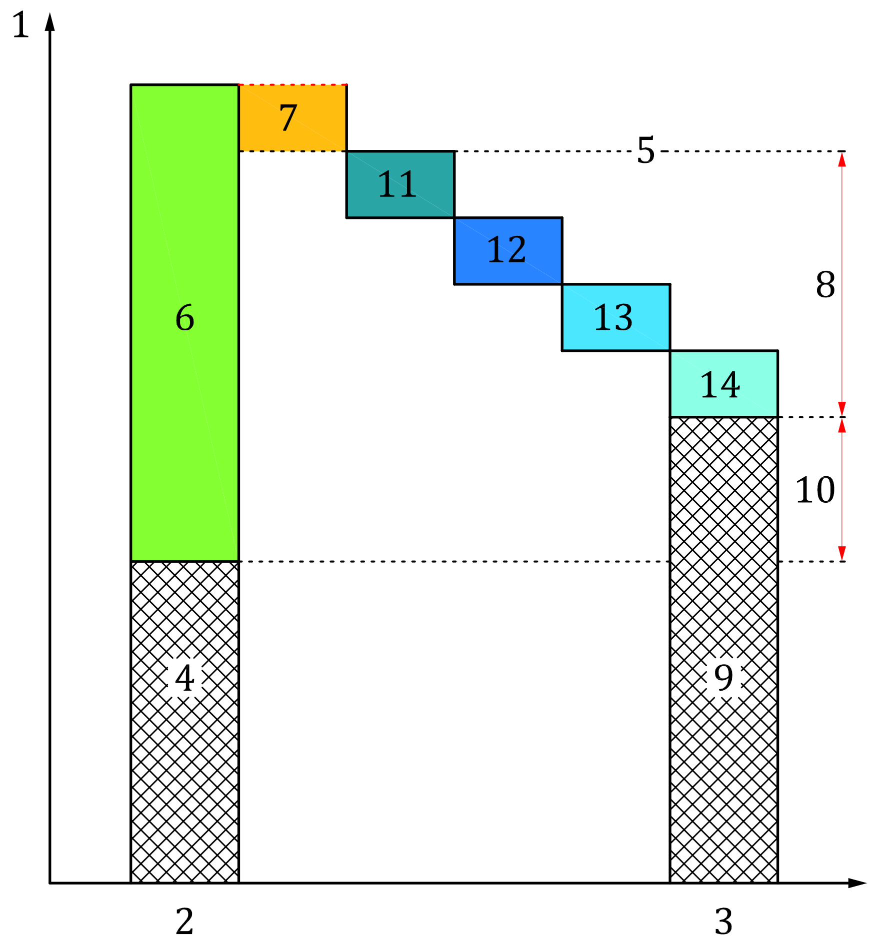
NOTE Energy savings may be expressed in terms of energy delivered to the boundaries or as equivalent primary energy, but it is outside the scope of this International Standard to explain how these are related.

- Care should be taken that they do not give a misleading impression of the overall energy savings, for example, by focusing on successful EPIAs but omitting ones that have shown poor results. Reporting should, as far as possible, be fair and give a complete picture of the overall savings.
- Results may be presented separately for all EPIAs or measures (if relevant).

Annex A
(informative)

Energy savings for different levels of analyses

Figure A.1 shows how the change in energy consumption over a period (Key 10) can be split into different contributions. The base year energy consumption (Key 2) changes due to volume effect (Key 6), structural effect (Key 7), and total savings (Key 8), resulting in the actual energy consumption (Key 9) for the calculation year (Key 3).



Key

1	energy consumption (unit)	8	total savings
2	base year	9	energy consumption in calculation year
3	calculation year	10	observed change in energy consumption
4	energy consumption in base year	11	autonomous savings
5	energy trend (due to socio-economic activities)	12	deliberate action savings
6	volume effect	13	policy direct savings
7	structural effect	14	policy indirect savings

Figure A.1 — Split of change in energy consumption including policy/deliberate savings

The total savings can be divided further into autonomous savings (Key 11), deliberate savings (Key 12), and direct or indirect policy savings (Keys 13 and 14).

Autonomous savings occur without a deliberate intervention to save energy, either from the users, themselves, or the policy makers. Technology might progress, even without any policy, for example by the introduction of hybrid vehicles, or production of base chemicals at lower temperature by using catalysts.

Savings due to policy measures are called policy-induced savings. These are important from the viewpoint of policy effectiveness. Policy can have a direct result (Key 13), e.g. national standards about maximum energy consumption of appliances. Or it can have an indirect result (Key 14), for example, requirements placed on other organizations (e.g. lowering of the speed limit implemented for safety reasons results in energy savings).

Other savings can be realized by stakeholders, such as socially responsible companies, non-governmental organizations (NGO), or cities on their own accord. These deliberate savings (Key 12) are neither autonomous nor policy induced. The deliberate and policy savings can overlap, e.g. because behavioural changes as to use of appliances have a smaller effect when appliances consume less electricity due to minimum efficiency standards. Therefore, the three saving effects do not add up to the overall effect.

When policy measures to stimulate savings are already in place for a long time, the demarcation between autonomous savings (Key 11) and policy/deliberate savings (Keys 12 to 14) can be difficult to determine.

Annex B
(informative)

Example of adjustment used in different energy saving calculation methods

Table B.1 presents some adjustments that can be used depending on the selection of the method used for the determination of the energy savings.

Table B.1 — Example of adjustment according to the general types of methods

Adjustments	Statistical Indicator-based methods	Measure-based methods	Total-energy-consumption-based method
Weather conditions	Applicable	Applicable	Applicable
Structural effects	Applicable	Not applicable	Depending on the system boundaries
Activity effects	Applicable	Applicable	Applicable
Autonomous trends	Applicable	May be partly addressed through the free-rider effect	May be partly addressed through the free-rider effect
Rebound effect	Not applicable	Applicable	Applicable
Free-rider and multiplier effect	Not applicable	Applicable	Applicable
Double counting	Not applicable	Applicable	Not Applicable

NOTE The free rider effect can be estimated through, for example, a comparison with energy savings realized in similar circumstances but without the subsidy scheme.

multiplier effect

effect of a facilitating measure after the measure has ended or in fields outside the focus

EXAMPLE Temporarily promotion of efficient appliances changes the market for these appliances in such a way that further penetration occurs after ending the promotion activity.

Note 1 to entry: In this International Standard, the multiplier effect is used for calculations at high aggregation level (e.g. all dwellings), while the term consequential effects can be used at lower aggregation level (e.g. individual company) in other standards.

rebound effect

change in energy using behaviour that yields an increased level of service and that occurs as a result of taking an end-use action

EXAMPLE Some households can take some of the benefits of energy efficiency improvements to their home in the form of higher internal temperatures, and so use more energy than might be calculated from the end-user action.

Note 1 to entry: The rebound effect can take many forms. Apart from the case in the example (higher internal temperature setting), the effect is often difficult to determine.

Bibliography

[1] ISO 17741, *General technical rules for measurement, calculation and verification of energy savings of projects*

[2] ISO 17742, *Energy efficiency and savings calculation for countries, regions and cities*

[3] ISO 17747, *Determination of energy savings in organizations*[1)]

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