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Energy efficiency benchmarking methodology

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee SEM/1/2, Energy Efficiency Saving Calculations and Benchmarking.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Energy efficiency benchmarking methodology

Méthodologie de benchmarking de l'efficacité énergétique

Energieeffizienz-Benchmarking-Methodik

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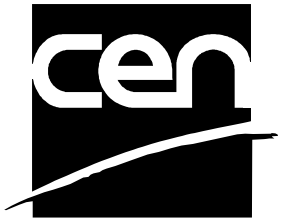

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Contents

Page

Foreword

This document (EN 16231:2012) has been prepared by Technical Committee CEN/CENELEC JWG 3 “Energy Management and related services — General requirements and qualification procedures”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2013, and conflicting national standards shall be withdrawn at the latest by March 2013.

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Introduction

The overall aim of this European standard is to provide organisations with a methodology for collecting and analysing energy data with the purpose of establishing and comparing energy efficiency between or within entities.

It may lead to reductions in total energy consumption by showing improvement opportunities and consequently possible reductions in costs and emissions of carbon dioxide. This standard addresses the general aspects of benchmarking. This does not include the definition and establishment of sector specific benchmarks.

Energy efficiency benchmarking may be motivated by different needs, among which are:

— awareness of energy performance levels of peers to trigger energy efficiency improvement actions;

— definition of energy performance objectives;

— knowledge and follow up of the energy performance of a group and the related (best) practices.

Energy efficiency benchmarking applies to specific energy consumption whereby other performance aspects like technologies and operating practices may be taken into account.

The benchmarked entity can be a facility, an activity, a process, a product, a service or an organisation.

Energy efficiency benchmarking is related to energy management, energy audits and energy efficiency calculation methods.

The benchmarking methodology model for this standard is shown with the main steps in Figure 1.

Figure 1 — Benchmarking methodology model

The basis of the approach can be briefly described as follows:

— purpose & planning (see 4.2.1): define the objectives for the benchmarking, including definition and select the approach and type of benchmarking, produce a project plan and assign resources;

— data collection & verification (see 4.2.2): agree on data collection method, collect and verify data and collate the findings to enable analysis;

— analysis & results (see 4.2.3): assess current performance levels, produce tables, charts and graphs to support analysis and seek explanations for the differences in performance;

— reporting (see 4.2.4): communicate results including lessons learned.

The following step is optional in accordance with management systems in the organisation (see Annex F):

— monitoring & actions: implement specific actions, monitor progress and implement specific actions including those from lessons learned.

1 Scope

This European Standard specifies requirements and provides recommendations for energy efficiency benchmarking methodology. The purpose of energy efficiency benchmarking is to establish the relevant data and indicators on energy consumption, both technical and behavioural, qualitative and quantitative in comparing performance between or within entities.

Energy efficiency benchmarking can be either internal (within a specific organisation) or external (between organisations including competitors). This standard describes how to establish the boundaries of what is being benchmarked, including for example facilities, activities, processes, products, services and organisations.

This European Standard provides guidance on the criteria to be used in order to choose the appropriate level of detail for the data collection, processing and reviewing which suits the objective of the benchmarking.

This European Standard does not itself state specific performance requirements with respect to energy use. For all activities related to the continual improvement cycle (such as the Plan-Do-Check-Act methodology) reference shall be made to management systems in the organisation.

2 Normative references

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

No normative references are cited.

3 Terms and definitions

For the purposes of this European Standard the following terms and definitions apply.

3.1
benchmark
reference or standard value for comparison derived from benchmarking

3.2
benchmarking
process of collecting, analysing and relating performance data of comparable activities with the purpose of evaluating and comparing performance between or within entities

Note 1 to entry: Different types of benchmarking exist, ranging from internal benchmarking to establishing the "best in industry/sector" performance. Internal benchmarking is looking for differences in energy efficiency within an organisation and highlighting best practices for dissemination to other parts of that organisation. External benchmarking may be used to establish a range of energy performance indicators for an installation/facility or a specific product/service in the same field or sector.

3.3
benchmarking boundary
limit to the process installation, facility, product, building or organisation being benchmarked

Note 1 to entry: The boundary may relate to a single process installation or facility, a finished product, a single building (including all the products or processes carried on inside that building), a division or operational unit of an organisation, or an entire organisation or group of organisations.

Note 2 to entry: The energy efficiency of an installation/facility or a specific product depends on the boundary of the process that is being benchmarked and how all energy flows, feedstock(s)/raw material(s) and (by)product(s) crossing the boundary of the process installation are to be taken into account.

3.4
benchmarking target group
organisations with comparable activities, products or services which are potential participants in a benchmarking

3.5
benchmarking participants
organisations taking part by providing data for a benchmarking

3.6
correction factor
factor agreed to be applied to make data in the benchmarking comparable

3.7
energy consumption
amount of energy used

[SOURCE: CEN/CLC/TR 16103]

Note 1 to entry: Although technically incorrect, energy consumption is a widely used term.

Note 2 to entry: The manner or kind of application of energy is expressed as energy use.

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

EXAMPLE Conversion efficiency; energy required/energy used; output/input; theoretical energy used to operate/energy used to operate.

Note 1 to entry: Both input and output need to be clearly specified in quantity and quality, and be measurable.

Note 2 to entry: Energy efficiency is commonly used with the meaning of "optimum energy efficiency" namely "to operate (an entity) with the minimum energy consumption".

Note 3 to entry: Commonly used sense of energy efficiency is doing at least the same with less energy.

Note 4 to entry: In energy efficiency benchmarking, energy efficiency is usually based on the specific energy consumption of the manufacture or supply of the product, activity or service being benchmarked and is expressed for example as GJ/tonne or GJ/standard activity.

3.9
energy performance
measurable results related to energy efficiency, energy use and energy consumption

[SOURCE: EN ISO 50001:2011]

Note 1 to entry: In the context of energy management systems, results can be measured against the organisation’s energy policy, objectives and targets.

3.10
entity
object of benchmarking

EXAMPLE Process installations, products, services, retail shops, buildings.

3.11
organisation
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

[SOURCE: EN ISO 50001:2011]

3.12
primary energy
energy that has not been subjected to any conversion process

[SOURCE: CEN/CLC/TR 16103]

Note 1 to entry: Primary energy includes energy from:

1) non-renewable sources such as natural gas, oil, coal;

2) renewable sources such as biomass, biogas, solar thermal energy;

3) electricity such as that produced from wind, hydro, solar or nuclear power.

3.13
secondary energy
energy resulting from energy conversion of primary energy

[SOURCE: CEN/CLC/TR 16103]

EXAMPLE Electricity, steam or hot water.

3.14
specific energy consumption
energy consumption per (physical) unit of output

[SOURCE: CEN/CLC/TR 16103]

Note 1 to entry: In energy efficiency benchmarking, the output can be a product, activity or service.

EXAMPLE Gigajoule (GJ) per tonne of steel, annual kWh per m^2, kWh per full time employee (fte).

3.15
validation
confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled

Note 1 to entry: Validation can be expressed by the query “Are you building the right thing?”.

Note 2 to entry: In benchmarking, checking that the methodology is suitable for intended use.

3.16
verification
confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

Note 1 to entry: Verification can be expressed by the query “Are you building it right?”.

Note 2 to entry: In case of benchmarking, testing of data for completeness and accuracy.

4 Energy efficiency benchmarking methodology

4.1 Minimum requirements for energy efficiency benchmarking

The energy efficiency benchmarking process shall, as a minimum, include the following:

— definition of deliverables for each step;

— definition of the energy efficiency benchmarking objective(s) and the entitie(s) and boundarie(s);

— definition of the target group of the benchmarking;

— definition of the characteristics for selecting the sample;

— selection of participants and designation of the coordinator and establishing their roles;

— definition of conditions for accurate, reliable and comparable data collection;

— definition of level of confidentiality of collected data and of database ownership and access conditions;

— verification of collected data;

— validation of the benchmarking results by coordinator and participants;

— definition of reporting content, depending on objective and participants.

4.2 Benchmarking steps

4.2.1 Purpose and planning

Energy efficiency benchmarking starts with the definition of specific objectives of that benchmarking.

The type of benchmarking (i.e. internal or external) shall be selected depending on:

— the need that has motivated the benchmarking;

— whether a particular benchmark shall be derived.

EXAMPLE 1 Example of need triggering and leading to internal benchmarking: comparison of energy performance on different locations within the same organisation in order to improve energy performance.

EXAMPLE 2 Example of need triggering and leading to external benchmarking: better understanding of the statistical energy performance (average, minimum, maximum, scattering, etc.) of a sector.

Management commitment for carrying out the benchmarking is important. Approval for resources shall be obtained.

The coverage of the energy efficiency benchmarking (i.e. geographical, sector specific and/or technical) shall be defined.

The participants and their main characteristics shall be determined in relation to the product(s), service(s) and associated technologies which are subject of the benchmarking.

The data collection method shall be determined depending on the objectives, participants and allocated resources.

Annex A provides an example of a checklist for an energy efficiency benchmarking.

A coordinator shall be nominated and their role shall be established.

In case of external benchmarking, participants shall approve the nominated coordinator, in order to ensure confidentiality of collected data and information. The coordinator of the energy efficiency benchmarking should

have appropriate knowledge in energy management. Preferably, the coordinator should have a good knowledge of the products or services and related technologies which are to be benchmarked.

It shall be defined whether correction factors such as weather conditions, product or service and associated technology, production level, quality of feedstock used, will be taken into account.

A documented project plan shall be developed.

Participants should take part in the definition of the project plan.

The project plan shall include the method for:

— data collection template (e.g. questionnaire, self-declaration, walkthrough audit, energy audit/diagnosis);

— data processing;

— data storage (database);

— data control, verification and validation.

The project plan shall also include:

— confidentiality requirements;

— database ownership and accessibility;

— result distribution criteria;

— reporting rules, such as presentation formats and level of detail (e.g. units, tables and graphs).

4.2.2 Data collection and verification

In order to perform energy efficiency benchmarking the coordinator (or designated investigators) shall draw up a data collection template in which the type, format and accuracy of the required input data is described in a clear and unambiguous way. To make sure that the questionnaire ensuing from this template is adequate and complete, its content could be presented to the benchmarking participants in order to ensure consensus.

The coordinator shall further take care of following actions:

— compile a request for information and data on energy performance to the target group participants using the agreed template;

— review and control the use of and agreement on correction factor(s);

— perform a first plausibility check of the received input data. (Annex D provides examples of tools to perform this check);

— in case of external benchmarking the processed data shall be made anonymous by decoupling them from the identification of the participant;

— calculate the energy efficiency based on the received input data points and rank these output data according to the agreed reporting order (mostly ascending, but other orders are possible e.g. historical);

— verify the data collected from the participants on correctness and comparability;

— review the output results in order to check the calculation method and reject unrealistic inputs, since unrealistic outputs are commonly caused by unrealistic inputs;

— if this check involves some questions on input data, request clarifications or corrections from the data suppliers. After receipt of the clarifications and/or new input data, recalculate the results.

Annex B provides examples of templates for questionnaires and Annex C includes some examples of correction factors.

4.2.3 Analysis and results

To ensure that the study and the results are relevant, the findings shall be analysed in respect of the homogeneity of the characteristics of the entities and in particular on the combinations product/technology or service/equipment.

For analysis of the findings of the benchmarking the output data should be represented in tables, charts or graphs, as agreed in the objective.

If stipulated in the objective, a suitable benchmark should be identified. The participants shall validate the results and the analysis.

This analysis should provide sufficient information to explain the differences in performance between data points, eventually after normalisation to get a common measurement base. The pertinence of the choice and definition of correction factors shall be validated through the analysis.

The coordinator should ensure that comparisons are meaningful and credible and should identify further input data points that might not be representative. In this case, the coordinator may make additional corrections to take account of abnormal activity levels or other identified correction factors. The coordinator shall indicate which data points have been normalised in this manner, why and how.

When the objective of the benchmarking is assessment or improvement of energy efficiency, the results shall include information to identify the energy efficiency related to current best practice. The result of the energy efficiency benchmarking shall be assessed against organisations with similar operating conditions.

4.2.4 Reporting

A report shall be provided. It shall contain the objective(s), boundaries, subject, type, elements of context (product or service definition, timeframe, participants, limitations etc.), the results of the benchmarking, the collected data in anonymous format if appropriate, the analysis, as well as encountered difficulties during the realisation of the study.

The correction factors shall be explained and their pertinence in the evaluation of the differences shall be discussed.

The findings of the benchmarking could be presented to the participants during a meeting in order to facilitate exchanges and discussions.

The reporting can be done in various ways, e.g. tables, graphs, benchmarking curves or charts. In Annex E two examples are given.

The conditions of reporting shall be respected as defined in 4.2.1, in particular confidentiality, distribution of the data and the results.

"Lessons learned" shall be documented so that they can be used to improve the energy efficiency benchmarking process.

Annex A
(informative)

Example of a checklist for an energy efficiency benchmarking

1 Is the purpose and scope of the energy efficiency benchmarking clearly defined?

2 Is confidentiality of the input guaranteed?

3 Is a system available to check the correctness of the supplied data input?

4 Has data accuracy been defined: physical measurement, evaluation of bills and records, estimation etc.?

5 How big is the group of potential participants?

6 Is the group of participants representative of the entire industry or sector and sufficiently large to provide a statistically valid result?

7 Are the participating installations comparable?

8 Is distinction in technology excluded?

9 Do the generally well-known ‘best performers’ participate?

10 Are the boundaries of the benchmark clearly and correctly defined?

11 Is all energy consumption included?

- fossil fuels (gas, coal, oil);
- heat (steam, hot water, hot oil, etc.);
- electricity;
- utilities (for example cooling water, compressed air, etc.);
- exothermic energy arising from processes;
- energy from renewables (biomass, biogas, photovoltaic, solar thermal, etc.);
- energy from raw materials, by-products or waste gasses.

12 Is the conversion from primary to secondary energy well defined?

13 If energy output from CHP is involved: is it clear how the energy consumption must be treated?

14 Is a questionnaire available with clear questions on which data are required and in which format?

- units used for energy input;
- primary or secondary energy;
- units for output.

15 Is the number of potential corrections low?

16 Are potential corrections well defined?

17 Is the impact of corrections on the energy consumption of the participants low?

18 Is the benchmarking curve (see Annex E) smooth without breaking points?

Annex B
(informative)

Two examples of energy efficiency benchmarking data collection questionnaires

In this annex two examples of questionnaires for the collection of energy efficiency data are given.

The level of detail of the questions will be determined by the scope of the benchmarking and complexity of the entities to be benchmarked. The first example refers to an energy intensive process industry benchmarking and the second example deals with a non-industrial application namely benchmarking of energy consumption of a retail chain of stores.

EXAMPLE 1 Industrial energy use

The questionnaire outline below gives an overview of the questionnaire data and further information which is typically used in an energy-intensive industry benchmarking:

a) plant location;

b) plant capacity;

c) a drawing with a flow chart of the (processing) steps of the product(s) to be benchmarked with the benchmarking boundaries marked on it. An example of such drawing for a process industry benchmarking is shown in figure below;

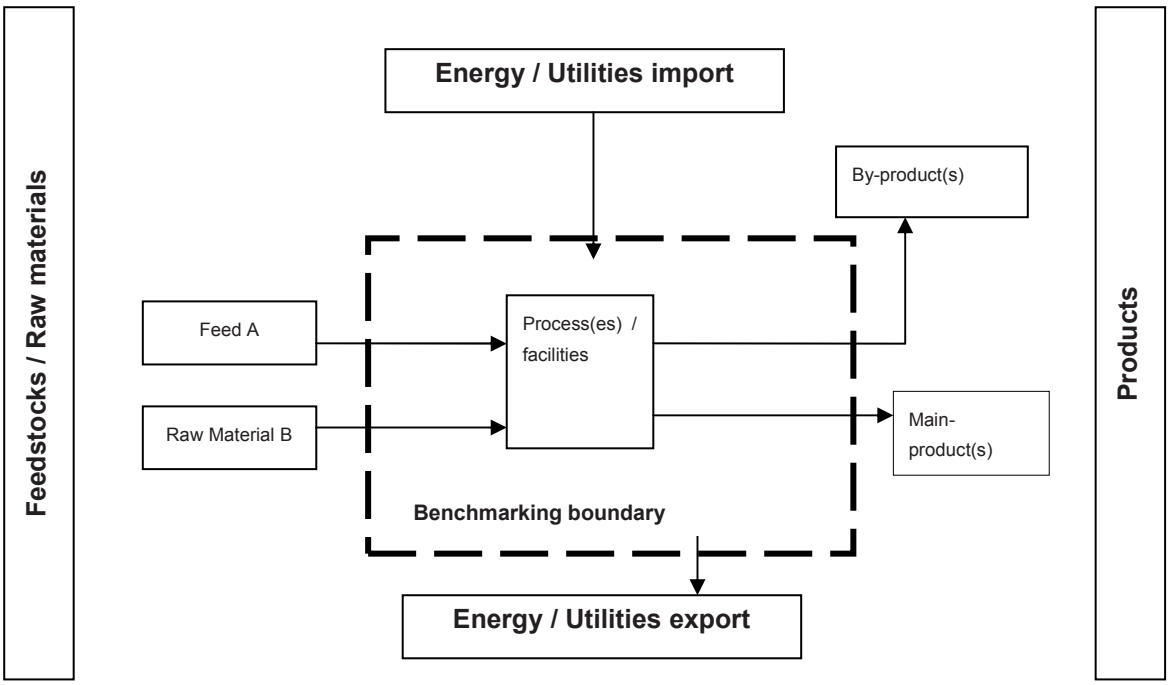

Figure B.1 — Example of a flow chart with the benchmarking boundary for a process industry benchmarking

d) time period (e.g. calendar year) for which the (representative) input data will be gathered;

e) inputs of feedstock / raw materials (tonnes/y), together with their heat content (GJ/tonne) if the energy consumption will be calculated from an enthalpy balance;

f) inputs of chemicals (tonnes/y) if this information is required to calculate correction factors;

g) energy / utilities import;

- fuels (primary energy) such as natural gas, gasoline, etc. in clear units together with their heat content, e.g. GJ_{lhv}/Nm^3, GJ/litre, etc. The fuels to be taken into account in the energy efficiency benchmarking should include also the internally produced and consumed fuel or process gas;
- electricity in MWh/y;
- steam in tonnes/y together with the steam temperature (°C) and the pressure (barg), hot water in tonnes/y with the temperature (°C), other heat flows (e.g. hot gases) with the heat content in GJ/y;
- the 'energy flow' in GJ/y of other utilities e.g. cooling water and compressed air, when relevant.

h) energy / utilities export;

- steam generated and not consumed in the processing of the benchmarked product(s) in tonnes/y, together with the steam temperature (°C) and pressure (barg);
- electricity exported in MWh/y;
- condensate/hot water, produced and not consumed in the processing of the bench-marked product(s) (tonnes/y) with the water temperature (°C);
- exothermic heat generated during manufacturing of the product (GJ/y).

i) output of product(s) (tonnes/y). In case of products where the energy consumption will be calculated from an enthalpy balance, also together with their heat content (GJ/tonnes). Also further details on the (by-) products in case these are required to calculate correction factors;

j) to facilitate the filling out of the questionnaire the flows in the flow chart should have a reference number. The flow chart can further serve to delineate any correction factors.

EXAMPLE 2 Non-industrial energy use

The questionnaire below is an example of how data can be collected which might typically be used by a small retail chain of newsagents or convenience stores, but could apply to most retail trades.

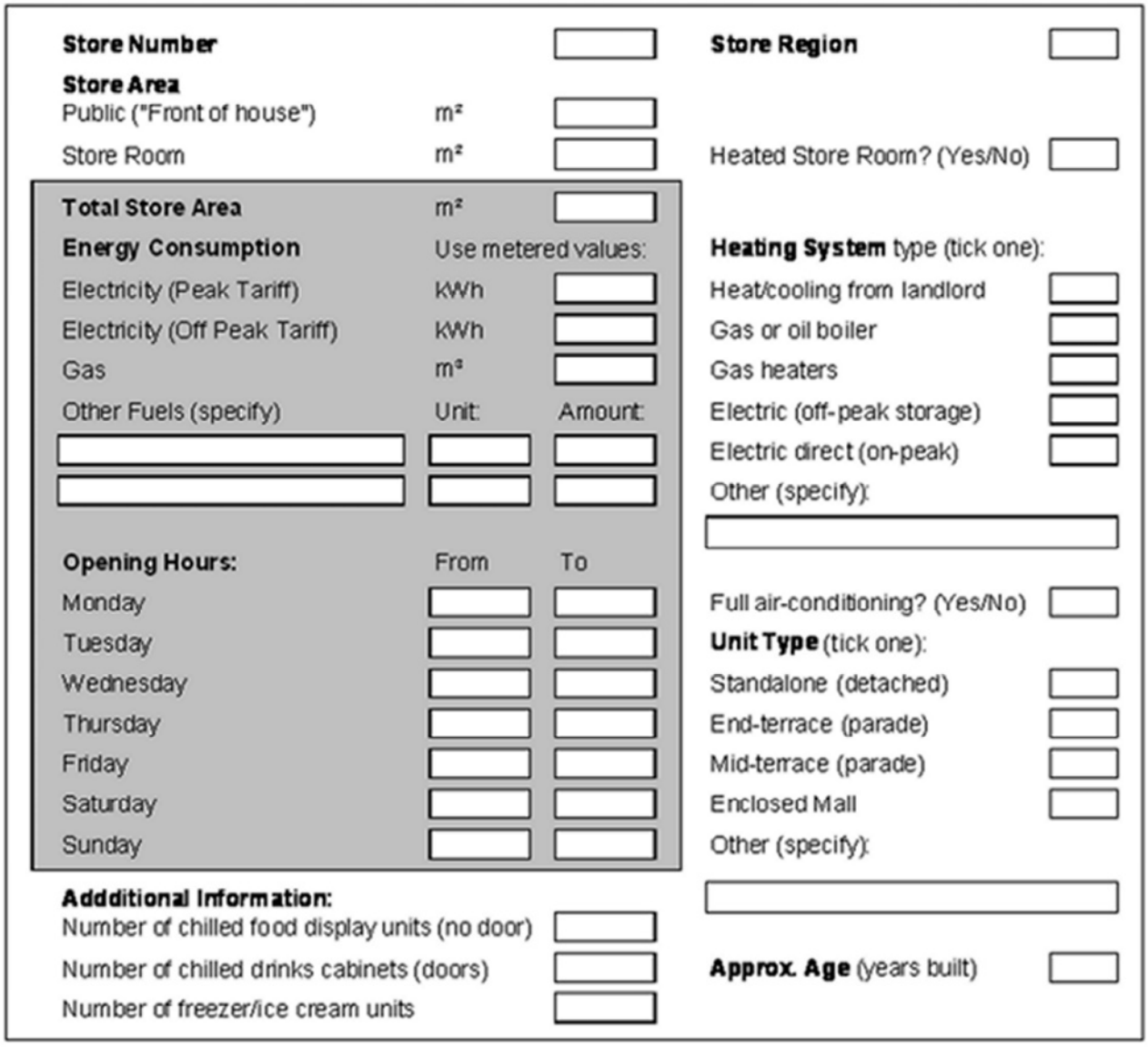

Figure B.2 — Questionnaire non industrial energy use

Data in the grey shaded box is used for normalisation. The key parameters are floor area, the total energy consumption and the operating period each week in hours.

Store managers are expected to collect energy consumption data from their meters; for example in the UK electricity is sold by the kilowatt-hour (kWh), but gas is sold by the cubic metre. They may also report other energy sources such as heating oil or heat billed as part of the service contract in a shopping mall. Gas and other fuels will need to be converted into a kWh figure at head office.

Data will also need to be normalised for store opening hours. Managers simply record standard hours; these will be converted to a number of hours per week at head office – this approach is used as an extra hour (or so) may be added to the heating day to allow for shops to reach the required temperature at opening time, or to allow for partial heating in the evening during shelf-filling and cleaning operations.

In most applications benchmarked data will be based on total store area (Gross Sales Area), but occasionally it may give more meaningful results if based on the public area, especially if store rooms are not normally heated or vary a great deal in size relative to the public area (Net Sales Area).

The rest of the data is informative to help the energy management team interpret the benchmarking data. Store region may be used with reference to degree days, but in most retail businesses the energy used for heating is insufficiently important to justify making an adjustment. Heating system data may help the energy manager understand unusual figures, especially if the only data available is from a shopping mall landlord ("heat with rent") where any weaknesses in the system may be landlord not tenant responsibilities. It may also be helpful to plot two benchmarking curves for those stores with or without full air-conditioning systems. The retail unit type and age should help identify how much heat may be lost through external walls.

Finally, some information may be collected on chilled cabinets and freezers, although in most cases the energy used by these should be approximately in proportion to the floor area. Other chains might add more specific questions to find out if, for example, there are hot drinks machines or a hot food counter. However, the overall form of the questionnaire is likely to be usable by most retail chains, irrespective of the products being sold.

Although the questionnaire is presented as a paper form here, in practice it is likely to be completed electronically over the web. Larger chains would almost certainly capture the energy consumption data through an automated monitoring and targeting system, requiring the store manager only to check that the other information has not changed since the previous reporting period.

Annex C
(informative)

Checklist correction factors

In general, corrections should be applied as little as possible. Note that corrections can often be avoided when the boundary of the benchmarking study is smartly chosen. As in energy efficiency benchmarking the energy consumption of processes with the same output is assessed, comparability of these processes is an important issue, but 'comparable' does not mean 'identical'.

In exceptional cases, comparability of processes can merely be reached by use of corrections, i.e. well defined adjustments of the specific energy consumption.

Corrections should be definable in an unambiguous, quantifiable, objective and clear way and should be applied to all data points of processes included in the benchmarking. By nature, they are small relative to the specific energy consumption of the benchmarked subject.

If too many corrections are made, it may lead to important real variances becoming hidden, as the benchmarking curve moves closer to a flat curve.

Examples of potential corrections:

— product quality or type: if the produced products differ from the standard ones used in the benchmarking and consume basically more or less energy than the standard ones;

EXAMPLE 1 The gram weight of paper produced in a paper mill.

EXAMPLE 2 High viscous copolymers produced versus homopolymers in the benchmarking.

— product grade mix;

EXAMPLE 3 The product mix differs drastically from the one used in the benchmarking and has basically different energy consumption.

— quality and composition of raw materials used as input;

EXAMPLE 4 The raw material is not at 'polymerisation grade' purity while the benchmarking assumes it is.

EXAMPLE 5 The sugar concentration in sugar beets differs significantly from the one used in the benchmarking.

— energy used for specific local environmental requirements: local authorities require an organisation to implement extra treatment of waste or by-products not generally included in the benchmarking boundary;

— energy used for storage of input and output materials;

— energy used to convert end products from a liquid into a gaseous state or vice versa;

— advantages or disadvantages due to climate;

EXAMPLE 6 A production plant in Southern Spain compared to one in Finland.

Annex D
(informative)

Plausibility check of input data

The received input data for benchmarking have to be checked on plausibility and reliability. To that purpose, the following tools could be used:

— plausibility check by use of mathematical, thermodynamic and physical limits in order to eliminate typos and wrong inputs;

— if production processes are involved, energy and material balances could be helpful;

— in case of doubt, the reputation of the data provider (producing company) can necessitate more investigation of the input data;

— knowledge of and experience with manufacturing the benchmarked product or supplying the benchmarked service should enable the coordinator to assess that the input data are not outside the possible range.

Next is to check the preliminary results of the energy efficiency benchmarking. In case they were ranked in ascending order, a curve is obtained with a minimum and a maximum value. The following checks are suggested:

— check ratio between maximum and minimum value: a rule of thumb is that this ratio should not exceed three without explanation;

— check shape of the curve: a normal benchmark curve is smooth without jumps or interruptions. If not, the coordinator must investigate or be able to explain the reason for this non-standard shape: possibly the questionnaire was not consistently filled out by all data providers, e.g. in some data inputs CHP is included, in others it is not;

— check best point of the curve: check that the first points of the curve follow each other with normal intervals: in case there are a few points far ahead of the others, the coordinator should establish the reason for this phenomenon;

— check worst point of the curve: check whether the energy efficiency figures of the last points of the curve are realistic ones or whether they seem impossible;

— check numerical value of potential correction factors: in general corrections should be small and reasonable. If they are too big, either the input for correction factors is wrongly applied or the calculation method is unsuitable.

Annex E
(informative)

Two examples of presentation of benchmarking output

In this annex two examples of presentation of benchmarking output are given.

EXAMPLE 1 Benchmarking curve and benchmark

The benchmarking results can be presented in various ways. An often used form presenting results of a process installation benchmarking is a curve which gives the graphical representation of the specific energy consumptions of all participating process installations versus the number of these installations.

The energy efficiency benchmark is the specific energy consumption for the agreed 'reference result' of the benchmarking, for example best 10 % point, first quartile point or the median point, etc.:

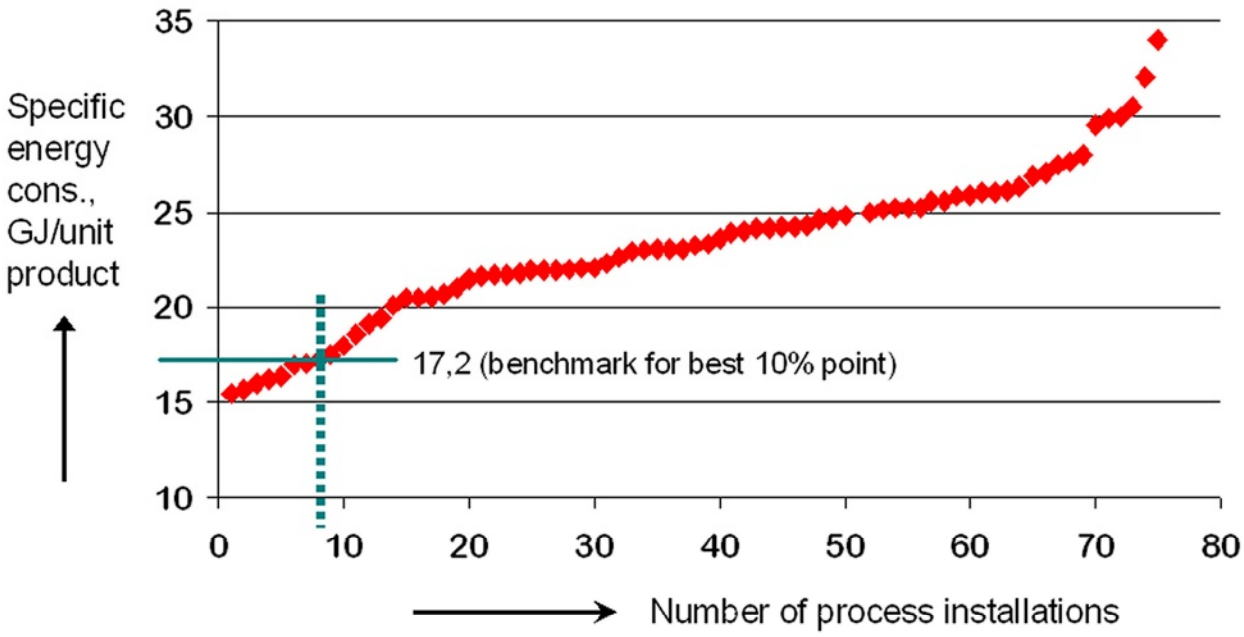

Figure E.1 — Benchmarking curve

EXAMPLE 2 Benchmarking results in industrial laundries

Specific consumption benchmarking in industrial laundries carried out in France.

The benchmark is the total specific consumption average. The specific consumption data are established during an energy diagnosis on industrial sites (close to 70 sites).

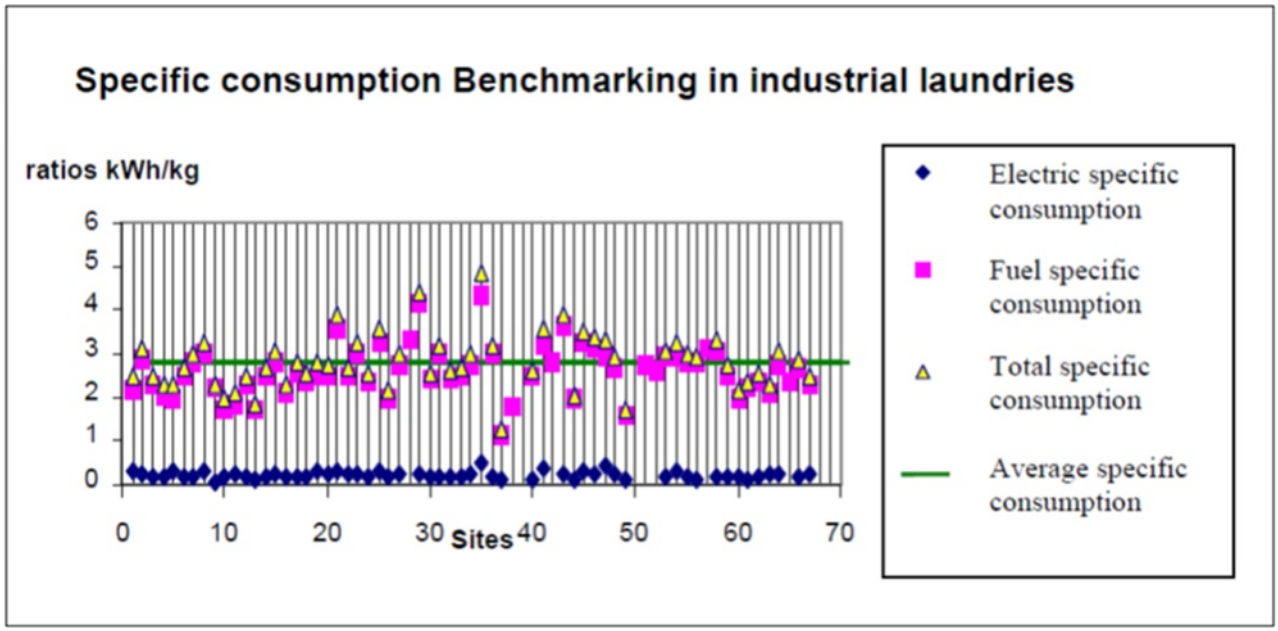

Figure E.2 — Benchmarking results in industrial laundries

Annex F
(informative)

Benchmarking as a management tool

The application of energy efficiency benchmarking as a management tool is shown in Figure F.1 and comprises the following elements:

1) identifying differences in performance and opportunities for improvement (gap);

2) improving performance by learning and applying “Best Practices”;

3) measuring success whilst closing the gap;

4) maintaining stimulus for continual improvement.

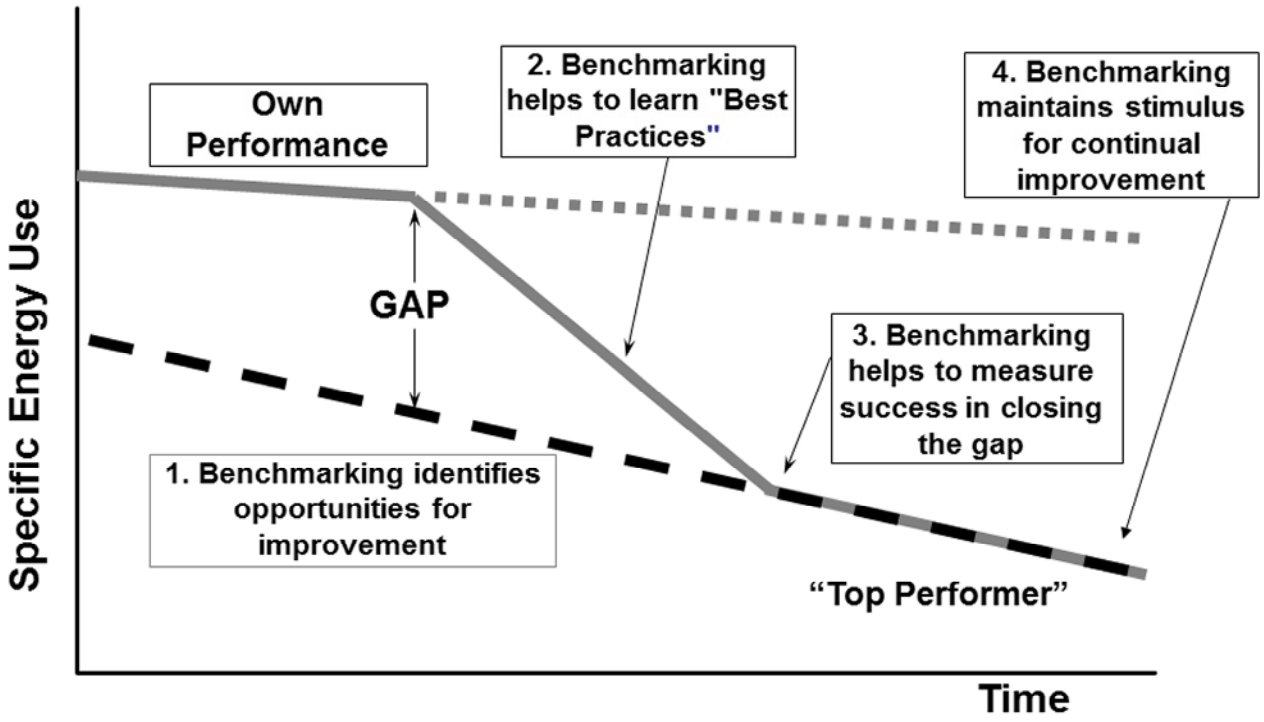

Figure F. 1 — Role of benchmarking as a management tool

According to the management system of the organisation, the energy efficiency benchmarking can be used as an important element in the Plan-Do-Check-Act methodology to improve the energy efficiency.

Energy efficiency benchmarking will establish the difference in specific energy use, the gap, with the best performer. This will identify the improvement actions to be taken.

Implementing these actions, monitoring progress and recalibrating the benchmarking could become part of the continual improvement cycle.

Bibliography

[1] EN 15900:2010, *Energy efficiency services – Definitions and requirements*

[2] CEN/CLC/TR 16103, Energy management and Energy efficiency - Glossary of terms

[3] EN ISO 50001:2011, Energy management systems – Requirements with guidance for use (ISO 50001:2011)

[4] Bess Final report (Intelligent Energy Europe project, EIE/07/103/S12.466702)

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