

Mechanical products — Methodology for reduction of environmental impacts in product design and development

National foreword

This British Standard is the UK implementation of EN 16524:2020. It supersedes PD CEN/TS 16524:2013, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee TPR/1/7, Technical Product Realization - BS 8887 Design for MADE.

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English Version

Mechanical products - Methodology for reduction of environmental impacts in product design and development

Produits mécaniques - Méthodologie de réduction des impacts environnementaux à la conception et au développement des produits

Mechanische Produkte - Methodik zur Verminderung der Umweltauswirkungen bei Produktgestaltung und Entwicklung

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European foreword

This document (EN 16524:2020) has been prepared by Technical Committee CEN/TC 406 “Mechanical products - Ecodesign methodology”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by May 2021, and conflicting national standards shall be withdrawn at the latest by May 2021.

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

This document supersedes CEN/TS 16524:2013.

The main changes compared to CEN/TS 16524:2013 are as follows:

- the document is to be converted into a European standard;
- the link with EN ISO 14001 has been strengthened for users willing to comply with that international standard;
- Clause 5 has been added to detail the preparatory step before implementing the methodology, which consists of an overview of the framework and the methodology;
- the life cycle analysis (LCA) is only referred to as an example of existing data on the product, when available; and
- the purpose of the Annex F on the possible use of life cycle assessment for determining the score of each environmental aspect has been clarified.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

Ecodesign methodologies can be divided into three types, depending on whether their purpose is the environmental assessment of products, the environmental improvement of products or to enable the two phases to be carried out during the same ecodesign project.

The environmental assessment phase of products in the ecodesign process can be an impediment for companies (owing to need for expertise, time and resources). Therefore, the methodology discussed in this document has been developed with the aim of helping designers to identify ways of improving the environmental performance of a product without carrying out a complete environmental assessment of the product (in terms of LCA).

Therefore, the approach consists for the company in restricting the scope of analysis to the characteristics defined by the constraints of the product, which takes into account the technical factors of the product, economic constraints, the practices of a company and its development strategies. Secondly, it consists of exploring the potential for environmental improvement within this restricted field.

This document is intended to give companies, in particular small and medium enterprises (SMEs), a pragmatic methodology to consider environmental aspects during their product design. It allows them to:

- Identify the environmental aspects of a product, including but not limited to energy aspects;
- Reduce the environmental impact of a product, taking into account capabilities of the company;
- Inform clients and public authorities about the environmental improvement approach on a mechanical product with this methodology (environmental claim).

The reduction of the environmental impact implies that the intended performance of the product (fitness for use, durability, etc.) is maintained.

To implement this methodology, the company staff will have sufficient knowledge and expertise in environmental issues; if not, external expertise can be addressed. When applying this methodology, management of the company can enter a learning process with the aim of defining and/or confirming its strategy for ecodesign, modifying its design process to enable the environmental issue to be taken into account, and creating new knowledge.

The aim of this document is not to measure the actual environmental performance of a product, nor to conduct a full life cycle assessment according to EN ISO 14040. Nevertheless, suitable data coming from more detailed studies e.g. LCA, carbon footprint, etc. can be used as inputs for this methodology (see an example in Annex F).

Figure 1 shows the relationship between this document and existing documents from ISO.

Objective of the approach	Generic ISO documents	Documents for mechanical products
To assess <i>measure the environmental performance of a product and identify the environmental aspects</i>	EN ISO 14040 EN ISO 14044	
To communicate <i>label, declare an eco-design approach or an environmental performance of a product according to a common reference</i>	EN ISO 14020 EN ISO 14021 EN ISO 14025	
To improve <i>implement actions which contribute to improve the environmental performance of the product</i>	ISO/TR 14062	EN 16524
To manage <i>have a life cycle thinking in relationship with the product design</i>	EN ISO 14001 EN ISO 14006	

NOTE More specific methodologies can exist for specific mechanical products.

Figure 1 — Relationship between this document and existing ISO documents

This document can assist the company to comply with the requirement of EN ISO 14001 and the recommendations of EN ISO 14006, to establish, implement and maintain a procedure to identify the environmental aspects of its products.

This document is not intended to support or to demonstrate compliance with any specific implementing measures of the Framework Directive 2009/125/EC (Energy-related Products). It can provide methodologies for identifying the more relevant environmental aspects in order to propose alternative design options to improve the environmental performance of the product.

This document is not intended for calculation of environmental footprint.

1 Scope

This document describes a methodology for reducing the overall environmental impact through product design and development that is tailored to mechanical products as defined in 3.1.

This methodology is particularly well suited to the redesign of an existing product; it can also be applied for the design of a new product provided the necessary assumptions regarding a (virtual) reference product are taken.

It addresses companies which have decided to integrate an ecodesign approach to optimize environmental impacts within the product life cycle, in relation to the other product aspects, such as functionality, quality, costs, etc.

It also helps to meet some requirements of EN ISO 14001:2015 on the integration of environmental aspects in the design of products.

NOTE 1 This document targets persons who are directly involved in the design and development of mechanical products, as well as managers responsible for defining corporate policies, and decision-makers. The proposed methodology is intended to kick-start ecodesign initiatives within companies as part of a continuous improvement approach.

This document also includes a template that companies can use as part of the communication on their environmental approach.

This document is neither intended nor suitable to compare products (even similar) of different suppliers.

This document is neither intended nor suitable for product certification purposes.

NOTE 2 An example for the implementation of the methodology is given in Annex D; the background of the algorithm used for this methodology is explained in Annex E.

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.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

mechanical product

product manufactured by companies from mechanical engineering and metalworking industry

EXAMPLE Mechanical products such as capital goods (machinery, production systems, components), tools, household goods, optical parts, measuring instruments.

3.2

reference product

existing product of the company to be re-designed, with the same intended use

Note 1 to entry: A similar product existing on the market, or the Technical Specification of a product can also be used as a reference.

3.3 environmental aspect

EA
element of an organisation's activities or products or services that interacts or can interact with the environment

Note 1 to entry: For this document, environmental aspects are categorized into Raw Materials acquisition, Manufacturing, Use, Product End-of-life, Hazardous substances, Transport and distribution, Packaging.

[SOURCE: EN ISO 14001:2015, 3.2.2. Changes made to original terminological entry: abbreviation "EA" has been added, note 1 and 2 to entry have been replaced by new note 1 to entry.]

3.4 design option environmental design option

DO
measure intended to improve a specific environmental aspect within the product life cycle, in relation to the other product aspects, such as functionality, quality, costs, etc.

3.5 scoring of environmental aspects

SEA
representation of the relative importance of the product's environmental aspects over its life cycle

Note 1 to entry: This SEA does not express the environmental performance of the product.

3.6 design option indicator

DO indicator
qualitative or quantitative indicator representative of a given design option, used to track this option during the design phase

3.7 environmental aspect indicator

EA indicator
qualitative or quantitative indicator associated with a particular environmental aspect, as representative as possible of this environmental aspect, used to keep a multi-criteria view of the environmental performance of the product during its development

Note 1 to entry: "Multi-criteria view" means the consideration of all environmental aspects to avoid a shift of impact (e.g. change of material can result in lower recyclability coefficient).

3.8 recoverability

ability of component parts, materials or both that can be diverted from an end-of-life stream to be recovered

Note 1 to entry: See Figure 2.

[SOURCE: ISO 22628:2002, 3.9. Changes made to original terminological entry: Note 1 to entry has been added.]

3.9**recyclability**

ability of component parts, materials or both that can be diverted from an end-of-life stream to be recycled

Note 1 to entry: See Figure 2.

[SOURCE: ISO 22628:2002, 3.7. Changes made to original terminological entry: Note 1 to entry has been added.]

3.10**material recyclability coefficient*****r***

percentage by mass (mass fraction in percent) of a material potentially able to be recycled

3.11**reusability**

ability of component parts that can be diverted from an end-of-life stream to be exploited

Note 1 to entry: See Figure 2.

	Recovery		Undefined residue
(Component parts) Re-use	(Materials) Recycling	(Materials) Energy recovery	(Materials)
Recyclability rate			
Recoverability rate			
Product mass			

Figure 2 — Different kinds of exploitation at the end-of-life stage

3.12**ecodesign**

integration of environmental aspects into product design with the aim of improving the environmental performance of the product throughout its whole life cycle

[SOURCE: Directive 2009/125/EC]

3.13**project team**

multidisciplinary team with recognized environmental competencies, supported by management, and involving all corporate functions likely to be impacted

EXAMPLE R&D, Design Office, Purchasing, Manufacture, Logistics, Marketing, etc.

4 Symbols and abbreviations

The abbreviated terms necessary for the understanding of this document are the following:

BOM	Bill Of Materials or equivalent technical description of the product
DO	Design Option
EA	Environmental Aspect
EoL	End-of-Life
ErP	Energy related Products (European Directive)
ELV	End-of-Life Vehicles (European Directive)
EL-R	End-of-Life Recyclability
M	Manufacturing aspect
Pkg	Packaging aspect
PEL	Product End-of-Life aspect
RM	Raw Material aspect
S	Hazardous Substances aspect
SEA	Scoring of Environmental Aspect
T	Transport and distribution aspect
U	Use aspect
RoHS	Restriction on Hazardous Substances (European Directive)
WEEE	Waste Electrical and Electronic Equipment (European Directive)

5 Overview of the framework for the methodology (Preparatory step 0: strategic analysis)

5.1 General

The methodology described in this document shall be applied by a multidisciplinary project team with recognized environmental competencies, supported by management, and involving all corporate functions likely to be impacted.

Management of the company shall be involved at the key steps of the methodology, especially when ranking the design options and the development of associated technical solutions that require defining the main actors, the needed time, and the available resources.

NOTE The team concept is used with the purpose of combining different competencies and functions, and does not necessarily require different physical persons.

Figure 3 provides a framework in which context it can be assessed whether the application of the methodology would be appropriate/beneficial for the company. There are two main go/no go points:

- The first after the general strategic and product analysis for the company,
- The second after the conclusion of the case study to extend the use of the methodology for other products of the company.

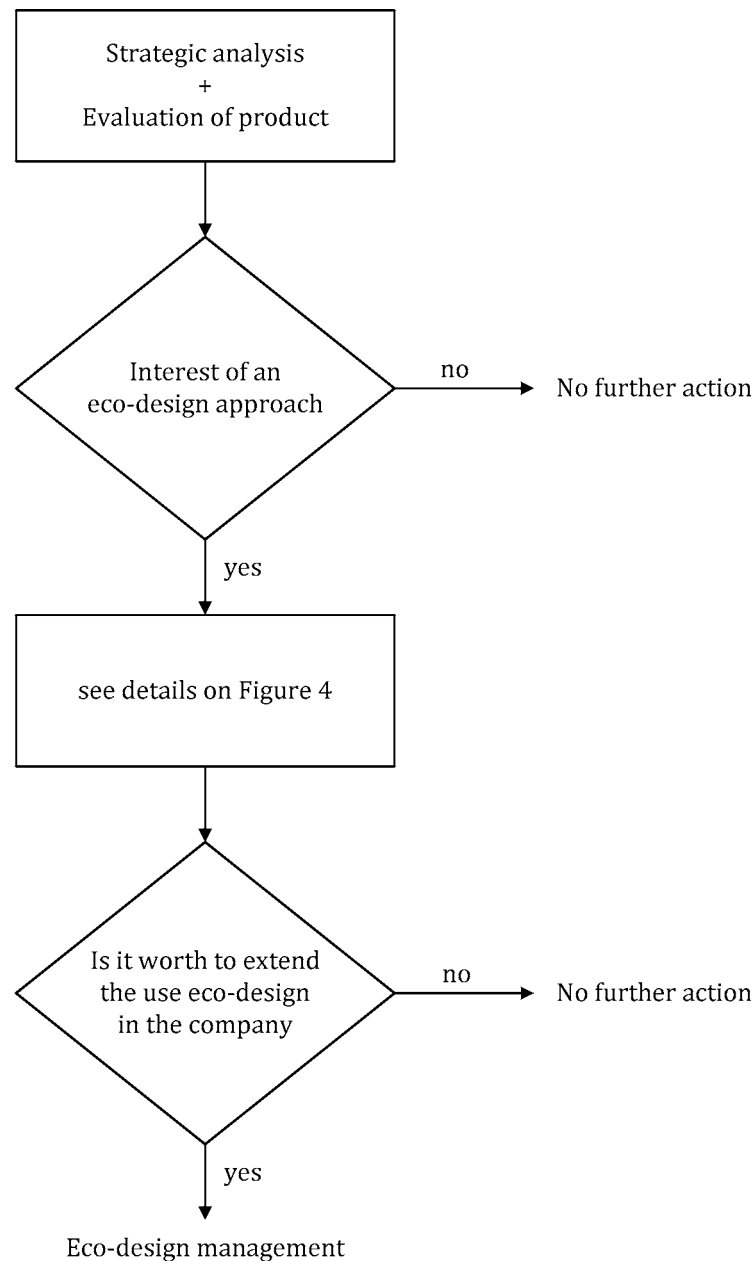


Figure 3 — Framework to assess the opportunity to apply the methodology

5.2 Preparatory step 0: strategic analysis at company level

5.2.1 Objective

Before starting an ecodesign approach, it is worthwhile to better understand the context of the company and the project, in terms of:

- Legal applicable requirements, market needs or requirements (specifications),
- Customers' unexpressed needs (their own legal requirements or constraints),
- Feedbacks in the company (case studies, green procurement, existing practices for environment, etc.),

- Available standards, ecolabels, practices in the sector,
- Competitors' behaviours or practices (their communication on environmental issues, certification, etc.),
- Possible Suppliers' contributions.

5.2.2 Procedure

A benchmark on the various points enumerated above shall be done.

Based on the results of the strategic analysis combined with an economic analysis (which costs, which gains, etc.), top management will have sufficient data to determine if ecodesign can serve the company's strategy and if it is relevant to launch an ecodesign project. The SWOT (Strength/Weaknesses/Opportunities/Threats analysis) tool can be interesting to have a final decision.

5.2.3 Documentation of the preparatory step 0

- Report on strategic analysis, including all information mentioned above,
- Formal decision of the top management whether or not an ecodesign project (according to this document) should be started.

6 Description of the methodology

6.1 General

After the preparatory step 0 (strategic analysis, see Clause 5), the methodology described in this document, which is based on five steps set out below that are linked with the design and development process for a product (see Figures 4 and 5), shall be applied:

- Step 1: determination of the scoring of the environmental aspects of the reference product,
- Step 2: selection/ranking of design options,
- Step 3: choice of suitable DO and EA indicators related to the reference product,
- Step 4: evaluation of the redesign using DO and EA indicators,
- Step 5: final assessment and consideration for future activities.

The objective and the procedure to be followed for each step are described in 6.2 to 6.6. The procedures are specified in the form of instructions.

The output documents of each step are inputs for the next step and shall be validated by the project team before going to this next step.

NOTE In this document, "methodology" is used for the overall approach of reducing environmental impacts; "method" is used for specific tasks, such as an indicator calculation.

Step 0 – Strategic analysis (5.2)

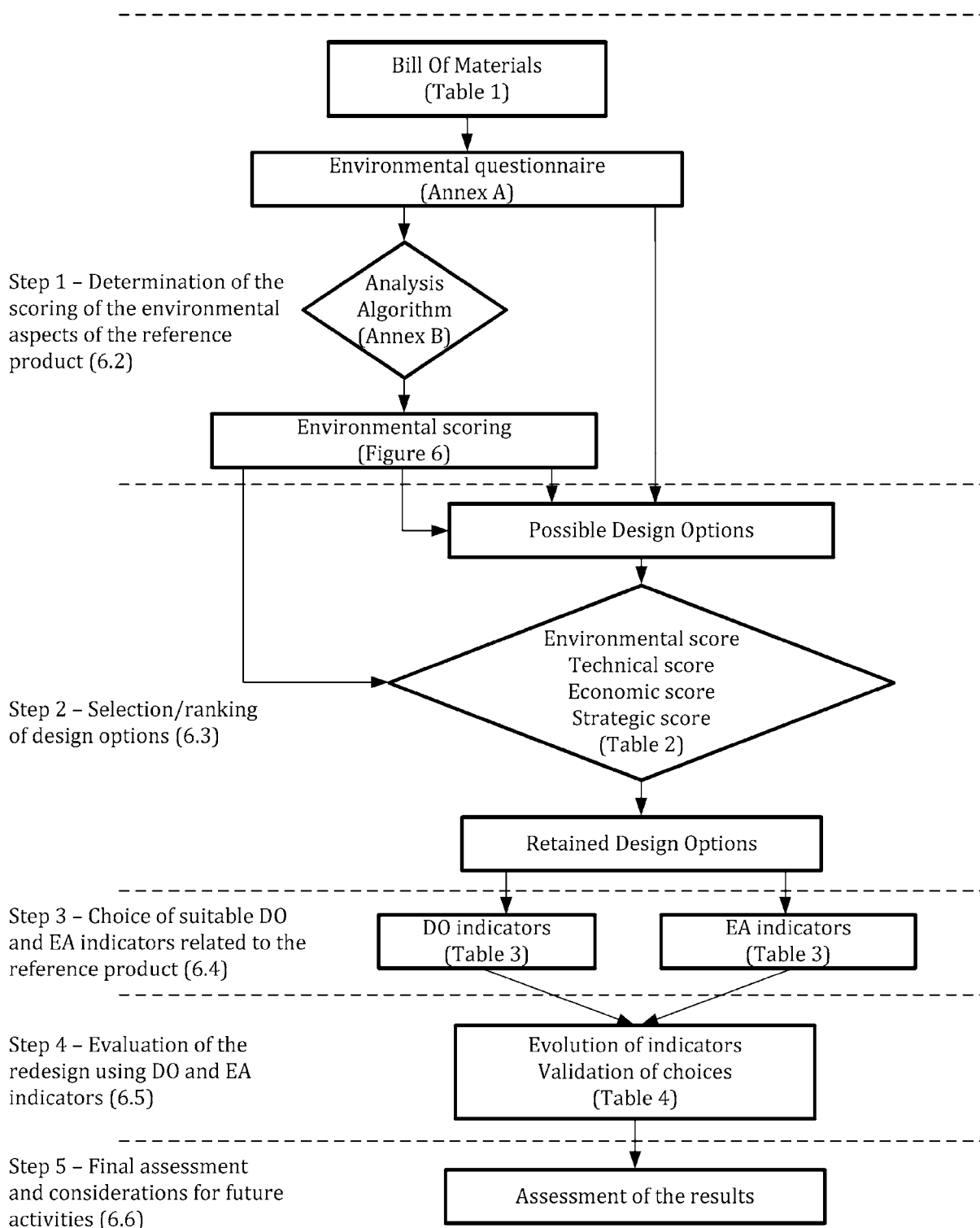


Figure 4 — Schematic illustration of the methodology

Typical stages of the product design and development process (acc. to ISO/TR 14062:2002)

Steps in the methodology

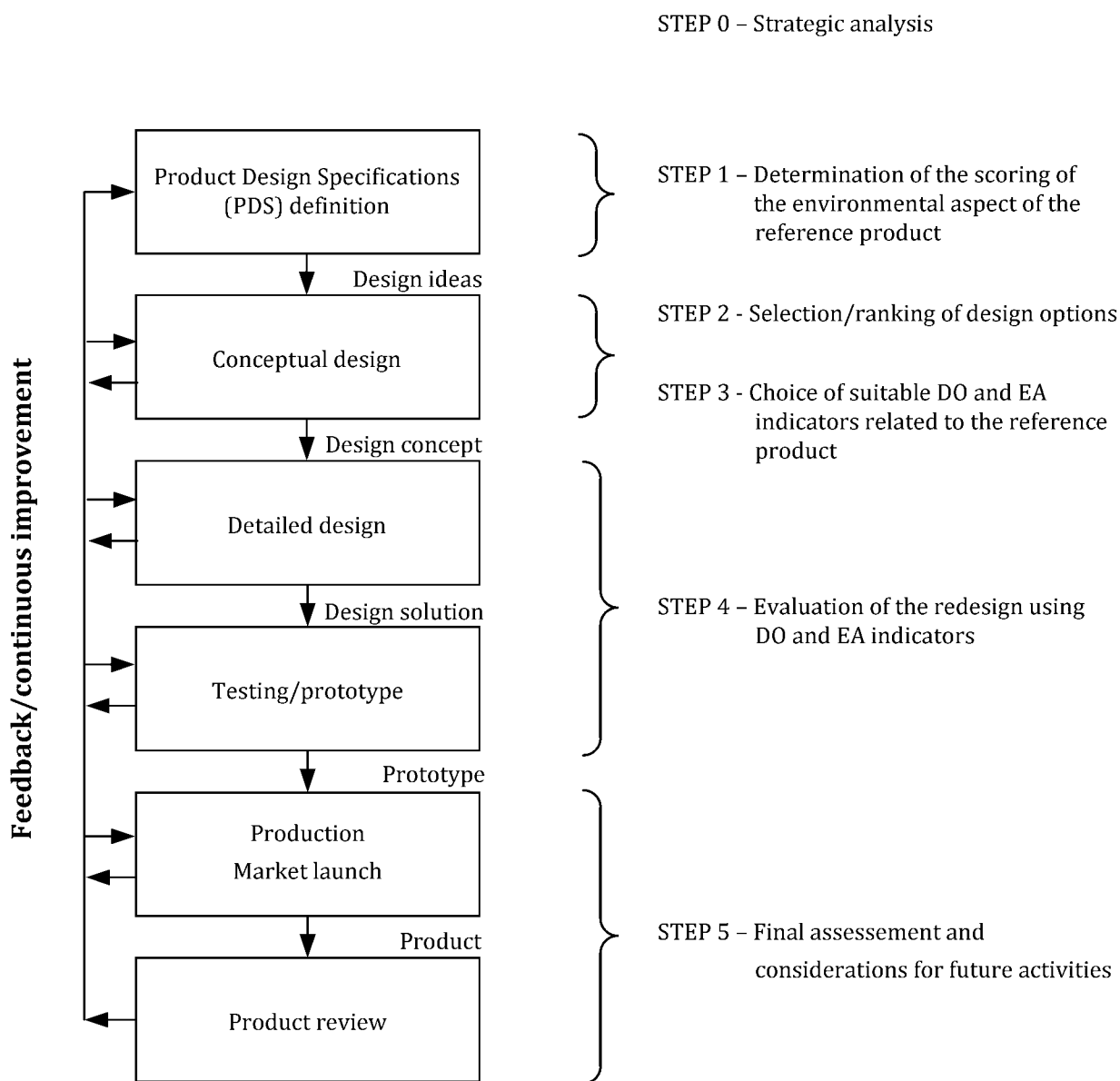


Figure 5 — Interrelation of the methodology with the design and development process

6.2 Step 1: determination of the scoring of the environmental aspects of the reference product

6.2.1 Objective

This step shall make it possible to determine the scoring of the environmental aspects (SEA) of the reference product which will be the base line for further improvements, i.e. to rank the seven environmental aspects listed below according to their relative importance for the environmental impact of the product:

- Raw materials (RM): aspect relating to the choice of materials, components (purchased), and fluids used in the product composition (excluding packaging);

- Manufacturing (M): aspect relating to all the processes required to develop/manufacture the complete product (excluding packaging), internally and externally (number of parts, “polluting” operations, etc.);
- Use (U): aspect relating to all the resources required to use the product (energy consumption, type of energy source, influence on energy consumption within an assembly, product requiring consumables, servicing, product lifetime, etc.);

NOTE 1 This aspect combines the phases “installation and maintenance” and “use” of the 2009/125/EC Directive.

- End-of-life (PEL): aspect taking account of the reduction of the product impact at end-of-life and of its recyclability coefficient;
- Hazardous substances (S): aspect relating to substances contained in a product likely to be regulated by European legislation (for instance, heavy metals classified as hazardous or flame retardants classified as hazardous);

NOTE 2 The phase “End-of-life” of the 2009/125/EC Directive is split into two aspects: end-of-life and hazardous substances.

- Transport and distribution (T): aspect relating to the geographic distribution (regional, national, European level, worldwide) of the number of suppliers and subcontractors, shipment volumes, etc;
- Packaging (Pkg.): aspect taking into account raw materials, transport, manufacturing, the amount, the reuse, the recyclability, the biodegradability of packaging, etc.

NOTE 3 The phase “Packaging, transport and distribution” of the 2009/125/EC Directive is split into two aspects: transport and distribution and packaging.

In other words, this ranking permits to identify which environmental aspects are significant for the referenced product, allowing the company to concentrate its efforts on what is worth to improve.

NOTE 4 The proposed SEA is not aimed to compare two products, even similar. It is not intended to measure the actual environmental performance of the product.

6.2.2 Procedures

6.2.2.1 Describe the reference product and the project perimeter

- a) Product name (trade designation, project reference, etc.),
- b) Description of the reference product,
- c) Main technical characteristics of the product,
- d) Types of markets aimed for the product:
 - 1) B to B, state the industrial sectors,
 - 2) B to C.
- e) Known (stated) expectations from relevant market players in terms of strategies for optimizing the environmental impact of the product (see Table C.1 for those strategies and examples of related design options).

6.2.2.2 The Bill Of Materials or equivalent technical description of the product (BOM) and its packaging should be drawn up. It comprises the list of parts, their mass, their material(s), their material recyclability coefficient, the identified hazardous substances, and in case of purchased components, the supplier name and location. A proposed template is given in Table 1.

If this BOM is not available, an estimation of the number of parts and the ratio of materials contained in the product or the BOM of a similar product can be used as a first approach.

Decompose the product and its components up to the necessary level to represent:

- The recyclability coefficient (refer to question QB9 in Table A.1),
- The number of parts (refer to question QB1 in Table A.1),
- The knowledge of possible hazardous substances (refer to question QB11 in Table A.1).

For assemblies and other components that are not broken down to their most elementary level, such as purchased components, assess the number of parts, nature and quantity of materials from technical data sheet and maintenance notice, or by asking the supplier.

NOTE 1 Without this information, the component will be considered as one single non-homogeneous material, and thus will penalise the recyclability coefficient.

For fasteners, count one single part per type of fastener of the same material.

For products with a high number of parts (e.g. more than 100), in order to optimize the time needed to create the BOM, the decomposition into parts can stop at subassembly level; in such cases, the subassembly may be decomposed into homogeneous materials rather than parts; columns 2 and 4 of Table 1 are not filled.

NOTE 2 For such products, the relevance of meeting the exact numbers/masses of the parts diminishes regarding its impact on the results of the environmental questionnaire D.2.3 and the analysis algorithm D.2.4.

Coating including painting can be counted as a separate part to pay specific attention to its environmental impact.

Table 1 — Example of Bill of Materials

Product											
Part	Amount of constituent subparts of a part n	Quantity of parts in the product N	Number of components in the product $N \cdot n$	Unit mass m (kg)	Total mass $N \cdot m$ (kg)	Material	Material recyclability coefficient r	Mass of recyclable material $N \cdot m \cdot r$ (kg)	Identified hazardous substance	Supplier name ^b	Supplier location ^b
Total			$\Sigma N \cdot n =$								
Total product mass ^c M_{tot} (kg) =		Identified mass of the product, (kg) $\Sigma N \cdot m =$									
% identified mass of the product = %		Identified product recyclability coefficient, T_r ^d =									
Packaging											
Part	Amount of constituent subparts of a part n	Quantity of parts in the packaging N	Number of components in the packaging $N \cdot n$	Unit mass m (kg)	Total mass $N \cdot m$ (kg)	Material	Material recyclability coefficient r	Mass of recyclable material $N \cdot m \cdot r$ (kg)	Identified hazardous substance	Supplier name ^b	Supplier location ^b
^a Recognized (standardized) recyclability coefficient for the given material, or the estimated recyclability coefficient stated in this subclause.											
^b In case of purchased parts.											
^c Measured value of the product mass.											
^d Estimated coefficient using a recognized (standardized) formula for the given product, or use of a choice as specified in 6.2.2.3 excluding packaging.											

6.2.2.3 Calculation of recyclability coefficient

Some methodologies already exist to evaluate the recyclability coefficient.

First choice: Create your own data based on practical tests of disassembly and recycling of your product or similar products or coming from collaboration with waste collection and treatment companies at end-of-life (EoL) or eco-organization.

Second choice: Use data and methodology available for a specific product category (e.g. ISO 22628, ISO 16714, IEC/TR 62635).

Third choice: When no recognized formula and data are available for the recyclability coefficient of the reference product, use the following simplified Formula (1):

$$T_r = \frac{\left(\sum N \cdot m \cdot r\right)}{M_{\text{tot}}} \cdot 100 \% \quad (1)$$

where

- T_r is the estimated recyclability coefficient (expressed in %);
- M_{tot} is the measured value of the total product mass (excluding packaging) (expressed in kg);
- N is the quantity of parts in the product;
- m is the unit mass of a part (expressed in kg);
- r is the material recycling rate, with the following typical values, except specific data known by the company:
 - $r = 0,95$ for metallic materials,
 - $r = 0,3$ for plastic materials (source: Plastics Europe Association),
 - $r = 0,8$ for parts made of several unidentified metals,
 - $r = 0,5$ for parts made mainly of metals, plus 1 or 2 other non-metallic materials,
 - $r = 0$ for parts made of several plastics, for dual parts or metallic parts encased with plastics,
 - $r = 0,05$ for elastomers (source: LRCCP — Laboratoire de Recherches et de Contrôle du Caoutchouc et des Plastiques¹),
 - $r = 0,05$ for electronic components,
 - $r = 0,5$ for glass.

NOTE 1 An example for drawing up the BOM is given in Table D.1.

NOTE 2 This simplified formula can be used as DO or EA indicator, subject to be based on specific data for r .

NOTE 3 Others values can be used if more relevant.

NOTE 4 For setting-up reference values to support the calculation of recyclability/recoverability rates of electronic product, IEC/TR 62635 and JRC technical report [17] are used.

¹ French Rubber and Plastics Research and Control Laboratory

6.2.2.4 Scoring of environmental aspects

6.2.2.4.1 Using the algorithm

Complete the environmental questionnaire stated in Annex A, answering all the questions using the choices given in the questionnaire only (the answer “don't know” refers to the worst case scenario) and justify your answers where applicable. These answers are used to produce the reference product's SEA from the algorithm given in Annex B and also to provide input to the company's assessment on design options and on the overall assessment.

Apply the analysis algorithm given in Annex B based on the answers to the questions (the reference of the question from Annex A is identified on the algorithm).

6.2.2.4.2 Register the scores (1 to 4) obtained for each environmental aspect

NOTE 1 The so obtained SEA gives a description of the most important environmental aspects to consider during the ecodesign of the product, even if these aspects are already partly considered by the company.

EXAMPLE 1 A product is made of renewable RM; however, the score for RM environmental aspect is at level 4 in the SEA. This score of 4 means that RM aspect plays a very important role in the global SEA of the product, compared with the other aspects. If a company has already chosen renewable RM, it shows that this choice was relevant and it will be possible to take advantage of it when ranking the design options (see 6.3), but this choice does not modify the SEA.

EXAMPLE 2 A product has a very low energy consumption compared with another product of the product line; however, the score for the environmental aspect U is at level 4 for both. The score of 4 means that U aspect (related to energy consumption) plays a very important role in the SEA of both products, compared with the other environmental aspects. This score does not allow the conclusion that one of both products is more energy-efficient. For that, the use of indicators is necessary (see 6.4).

NOTE 2 These scores can be given in graph format (see Figure 6).

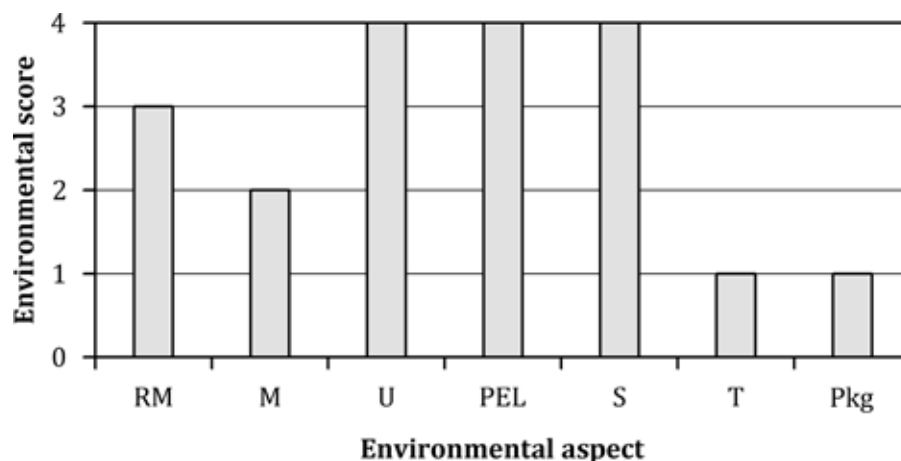


Figure 6 — Example for recording the result of scoring of the environmental aspects

NOTE 3 For companies who already have performed LCA on the reference product (or a similar product), Annex F gives an example of possible use of corresponding LCA results to establish the EA scoring (Step 1 of the methodology of this document).

6.2.3 Documentation of Step 1

The following documents shall be available as a result of Step 1:

- BOM of the reference product;
- completed questionnaire;
- SEA of the reference product;

They shall be used as inputs for Step 2.

6.3 Step 2: selection/ranking of design options

6.3.1 Objective

For each environmental aspect derived from Step 1, relevant design options (DO) on how to improve the product's environmental performance shall be selected and ranked, taking into account the other technical, economic and strategic constraints relating to the design project.

6.3.2 Procedure

6.3.2.1 Using Annex C, select, for each environmental aspect, the design options (DO) that are most relevant to the reference product's SEA and register these options as specified in Table 2.

The DO specified in Annex C are general design options for the reference product. The company should reconsider these general options and adapt them (where necessary) to be appropriate for the product under study.

6.3.2.2 Rank the design options (DO) by weighting them using the environmental, technical, economic and strategic scores, as stated in Table 2.

NOTE 1 Technical and economic scores allow prioritising the design solutions which confer to the product good environmental performances. For example, when a product characteristic is already very good, possible action to improve it is low. This does not contradict the fact that this environmental aspect is relevant and is not to be downgraded; consequently, the corresponding DO is relevant from a technical perspective.

NOTE 2 Consistency between company strategy and environmental DOs is a key factor of the methodology. It makes it necessary to engage and involve the top management of the company to ensure appropriate support when the essential design choices are made.

6.3.2.3 Decide which DOs shall be retained. For each EA with a significant environmental score, retain those DOs which have a higher final score.

NOTE A number of three DOs is considered to be reasonable.

Table 2 — Selection and ranking of design options

EA	STEP 2							STEP 3	STEP 4
	Design option (DO)	Environmental score a	Technical score b	Economic score c	Strategic score d	Final score e	Design option retained f		
^a Allocate each DO with the environmental score (0 to 4) as obtained from the SEA. ^b Allocate each DO with a technical score (0 to 4) defined as follows: 0: improvement direction not technically feasible; not compatible with customer specifications; 1: DO that creates no conflict from a technical perspective, but the improvement directions can conflict with other major constraints (large-scale investments, safety, etc.); 2: improvement direction likely to be considered, but preparatory R&D studies required; medium to long-term; 3: existing technical solution; feasibility to be tested; 4: solution that can be rolled out to a short timescale, or solution already rolled out by the company, or product characteristic that the company wants to promote. ^c Allocate each DO with an economic score (1 to 4) defined as follows: 1: High implementation cost 2: Reasonable investment (R&D studies, ...) 3: Low cost solution 4: DO providing immediate payback ^d Allocate each DO with a strategic score (1 to 3) defined as follows: 1: solution that conflicts with other company strategic directions or with market expectation; 2: solution of “neutral” strategic importance but that offers certain advantages in terms of brand image (in relation to other business sectors, stakeholder demands, etc.); 3: solution with a top-ranking strategic advantage (regulations/specifications/customer requests, savings on certain steps in the life cycle, etc.). ^e Determine the final score for each of the design options by multiplying the 4 previous scores. The project team may adapt the formula by weighting some of the scores, considering that the environmental score shall not be weighted lower than the technical, economic and strategic scores. This approach allows the project team to voluntarily consider any important aspect which is not assessed as highest priority in the scoring diagram. ^f Answer by “Yes” or “No”.									

6.3.3 Documentation of Step 2

The following documents shall be available as a result of Step 2:

- selection and ranking of considered design options,
- list of design options which have been retained for further consideration.

They shall be used as inputs for Step 3.

6.4 Step 3: Choice of suitable DO and EA indicators related to the reference product

6.4.1 Objective

Each design option, which has been retained, shall be linked to a qualitative or quantitative indicator, referred to as the “DO indicator” (see examples in Table C.1), which is used to track the various possible scenarios during the design phase.

Each relevant Environmental Aspect (EA) shall also be represented by an indicator called “EA indicator” (see examples in Table C.2); the objective is to achieve a multi-criteria view by considering all environmental aspects, to avoid a shift of impact (see also NOTE 2 in 6.4.2).

6.4.2 Procedure

6.4.2.1 Define an indicator for each design option (“DO indicator”) (examples are given in Table C.1).

It is not required to characterize every “DO indicator” in quantitative terms. A decision can be taken based on a simple upwards or downwards “trend”.

Define an “EA indicator” for each Environmental Aspect. This indicator shall be as representative as possible of the environmental impact of the relevant aspect; it can be chosen from the list of DO indicators (see Table C.1) or specifically defined (examples are provided in Table C.2).

NOTE 1 An “EA indicator” can combine several “DO indicators”. If there is only one single Priority Design option for the given Environmental Aspect, the DO indicator can also be used as the EA indicator provided that this indicator is representative of the environmental impact for this particular aspect.

NOTE 2 If a company has performed a LCA, EA indicators resulting from that LCA can be used to evaluate the shift of impact.

Register the indicator types and names as specified in Table 3.

6.4.2.2 Define the methods required to characterize the DO indicators and EA indicators, such as:

- measurement or test methods (with indication of the standard or technical document to be used);
- calculation formula;
- calculation method (with indication of the standard or technical document to be used, and particular application conditions, if any).

Make sure that the methods relating to DO indicators and EA indicators are suitable for the project.

6.4.2.3 Determine the values of the indicators on the reference product.

Table 3 — Choice of suitable DO and EA indicators related to the reference product

EA	STEP 2	STEP 3				STEP 4
		Type of indicator (DO or EA)	Indicator name	Related methods	Indicator value of the reference product	

6.4.3 Documentation of Step 3

The following documents shall be available as a result of Step 3:

- list of selected DO indicators and EA indicators, together with any targets and reasons for the choices;
- list of corresponding methods;
- values of DO indicators and EA indicators for the reference product.

They shall be used as inputs for Step 4.

6.5 Step 4: evaluation of the redesign using DO and EA indicators

6.5.1 Objective

During design, technical choices shall be assessed using DO and EA indicators in order to confirm the defined directions, identify any problems (e.g. any potential opposing impact) and propose the necessary actions. During design, technical choices shall be assessed as early as possible using DO indicators.

6.5.2 Procedure

Throughout the whole design process, consider the chosen design options (during project reviews, for example) and check their relevancy through the DO and EA indicators or any other relevant indicators defined in line with company strategy (economic indicators for instance), taking into account the other product specifications. Once the design option is stabilized, register the indicator values as specified in Table 4.

Record the “know-why” related to the use of the methodology to allow the understanding of the choices made by the project team.

Table 4 — Evaluation of the redesign using DO and EA indicators

EA	STEP 2	STEP 3	STEP 4	
			Indicator value after redesign	Remarks

6.5.3 Documentation of Step 4

The following documents shall be available as a result of Step 4:

- DO indicators for chosen design options after the redesign of the product;
- EA indicators for environmental aspects after the redesign of the product ;
- recording of difficulties related to use of the methods.

They shall be used as inputs for Step 5.

6.6 Step 5: Final assessment and consideration for future activities

6.6.1 Objective

The results from Steps 1 to 4 shall be assessed considering the following points:

- improvement of product environmental quality – considering both pre and post-design (compliance with indicators for the retained design options, no downgrading of EA indicators);
- implementation of the methodology (management of the project, methods, etc.).

NOTE The company can also take advantage of the project to manage the knowledge acquired, so as to be able to reuse it for new projects in the view of building up a set of “routine” practices during the design process. Modifications can be proposed to the design process to allow consideration of the environmental issues.

6.6.2 Procedure

6.6.2.1 Improvement of product environmental quality

Characterize changes in DO and EA indicators realized as a result of the redesign of the product taking into account the compliance with legal and other requirements (e.g. customer specification).

6.6.2.2 Implementation of the methodology

Analyse the reliability and relevance of methods used to implement the methodology specified in this document (e.g. method to calculate indicators, method to assess the recyclability coefficient).

Review the design options chosen against the other design options that were not selected for the current project, but can have some potential for the future.

NOTE Applying the ecodesign methodology of this document satisfies some of EN ISO 14001 requirements. Annex G of this document provides the correspondence table between EN ISO 14001 and this document.

6.6.3 Documentation of Step 5

The following documents shall be available at the end of Step 5:

- a summarized presentation of the results (extension to other projects, modifications of internal procedures, need of training, etc.);
- complete documentation of the application of the methodology for the reference product as detailed in the previous steps;
- assessment of the relevance of the methods used and the selected design options.

7 Environmental claim

The manufacturer may decide to benefit from the implementation of this approach by issuing a self-declared environmental claim according to EN ISO 14021 for the relevant redesigned product(s). The manufacturer is free to decide on the format of this claim (physical marking on the product, label on the product, information included in the product instruction leaflet, etc.).

The content of this claim shall include the following:

- the scope of the claim (complete range of products or unique product, complete product or only a product component or its packaging) and identification of the product such as trade designation or reference;
- a reference to this document: "Product subject to an environmental improvement approach in accordance with EN 16524";
- a table or diagram summarizing changes in DO indicators and EA indicators as result of the redesign. This document shall also state the reference to the methods used for calculating or measuring these indicators (an example is provided in Table 5). The reference product shall be identified (previous company product with a version reference, or Technical Specification with a date, see definition 3.2).

NOTE 1 This claim does not replace the environmental labelling or marking which can be required by a specific regulation (for instance, consumer products or products covered by the Directive 2009/125/EC governing the ErP).

NOTE 2 For an environmental claim according to this document, it is not required to communicate the complete documentation stated in 6.6.3.

Table 5 — Example of documentation of DO indicators and EA indicators (pre and post-redesign)

EA	DO indicator for design option	Value of DO indicator		EA indicator	Value of EA indicator		Calculation or measurement method
		<i>Pre-redesign</i>	<i>Post-redesign</i>		<i>Pre-redesign</i>	<i>Post-redesign</i>	
<i>RM</i>	<i>Mass (kg)</i>	<i>105</i>	<i>98</i>	<i>CO₂ impact for the materials used in the product (kg CO₂ eq.)</i>	<i>288</i>	<i>257</i>	<i>Internal method XXX</i>
<i>..</i>	<i>..</i>	<i>..</i>	<i>..</i>	<i>..</i>	<i>..</i>	<i>..</i>	<i>..</i>