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Sustainability in buildings and civil engineering works – Data templates for the use of environmental product declarations (EPDs) for construction products in building information modelling (BIM)

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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 of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 59, *Buildings and civil engineering works*, Subcommittee SC 17, *Sustainability in buildings and civil engineering works,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 350, *Sustainability of construction works,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Environmental product declarations (EPDs) are Type III environmental declarations (see ISO 14025) that provide quantified environmental data using predetermined parameters based on ISO 14040 and ISO 14044 and, where relevant, additional environmental information. ISO 21930, EN 15804:2012+A1:2013 and EN 15804:2012+A2:2019 are standardized sources of the core product category rules (PCR) to develop EPDs for construction products to provide modular data to enable consistent assessment of environmental impacts at the construction works level.

All types of assessment at construction works level are complex; and building information modelling (BIM) provides a process for describing and displaying information required in the planning, design, construction, operation and end-of-life of constructed facilities. The BIM approach is expanding to encompass all aspects of the built environment, including civil infrastructure, utilities and public spaces. Designers, owners and other stakeholders in the construction sector are increasingly looking to BIM to assist them in addressing the environmental impacts of construction works.

The ISO 19650 series sets out the recommended concepts and principles for business processes to support the management and production of information during the life cycle of constructed assets when using BIM. To do this, standardization is of the highest importance. Machine-interpretable data are essential to providing a reliable and sustainable exchange of information; and a data template supports the standardized provision of data in machine-interpretable data sheet formats for use in BIM. The data provided in EPDs, like other construction product data, are therefore needed in a machine-interpretable format to enable their use in BIM.

Data templates enable construction project stakeholders to exchange information about construction objects throughout the life cycle of a constructed asset, using the same data structure, terminology, and globally unique identifiers to enable the data to be machine-interpretable and interoperable. Data templates should be standardized and made available across the built environment sector through data dictionaries based on ISO 12006-3.

This document provides and explains the data template structure to support the provision of both EPD and generic life cycle assessment (LCA) data in standardized machine-interpretable data sheet formats to assist in the assessment of the environmental performance of the construction works over its life cycle. The mechanism used in this document to enable this is a data template created following ISO 23386 and ISO 23387 and the resulting data sheet.

This includes both mandatory and optional data from different types of EPD, such as, average EPD (see ISO 21930:2017, Annex B), and other relevant information necessary for use of EPDs at the construction works level within a BIM environment. Figure 1 shows the relationship between data, data templates, data sheets, BIM and environmental assessment at the construction works level.
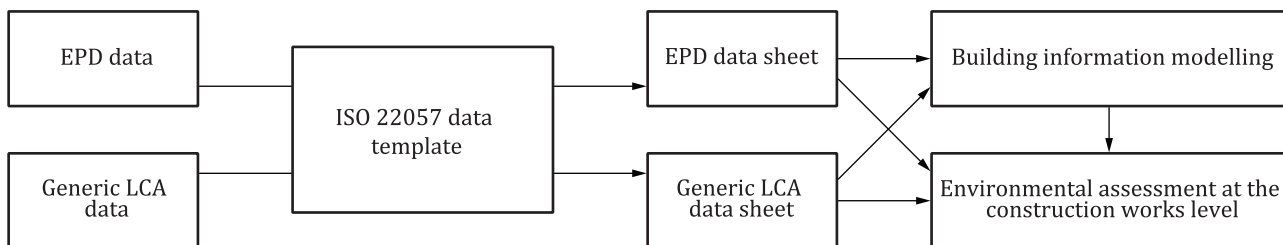
Figure 1 — Relationship between data, data templates, data sheets, BIM and environmental assessment at the construction works level

Providing the data from an EPD according to ISO 21930, EN 15804:2012+A1:2013 or EN 15804:2012+A2:2019 in machine-interpretable format means some information needs to be standardized in ways not considered in those standards. Historically, the indicator data for gate-to-grave information modules from a machine-interpretable EPD were often not used because the description of the scenario information was not concurrently provided in machine-interpretable format; and/or the data were not provided in a sufficiently flexible fashion to allow adaption for different scenarios at

the construction works level. Responding to these needs, this document provides specifications for the provision of gate-to-grave scenario data for an EPD in machine-interpretable formats, so the data are more appropriate for environmental assessment at the construction works level when using BIM.

Figure 2 shows the relationship between this document and other standards for buildings and civil engineering works related to BIM and sustainability.
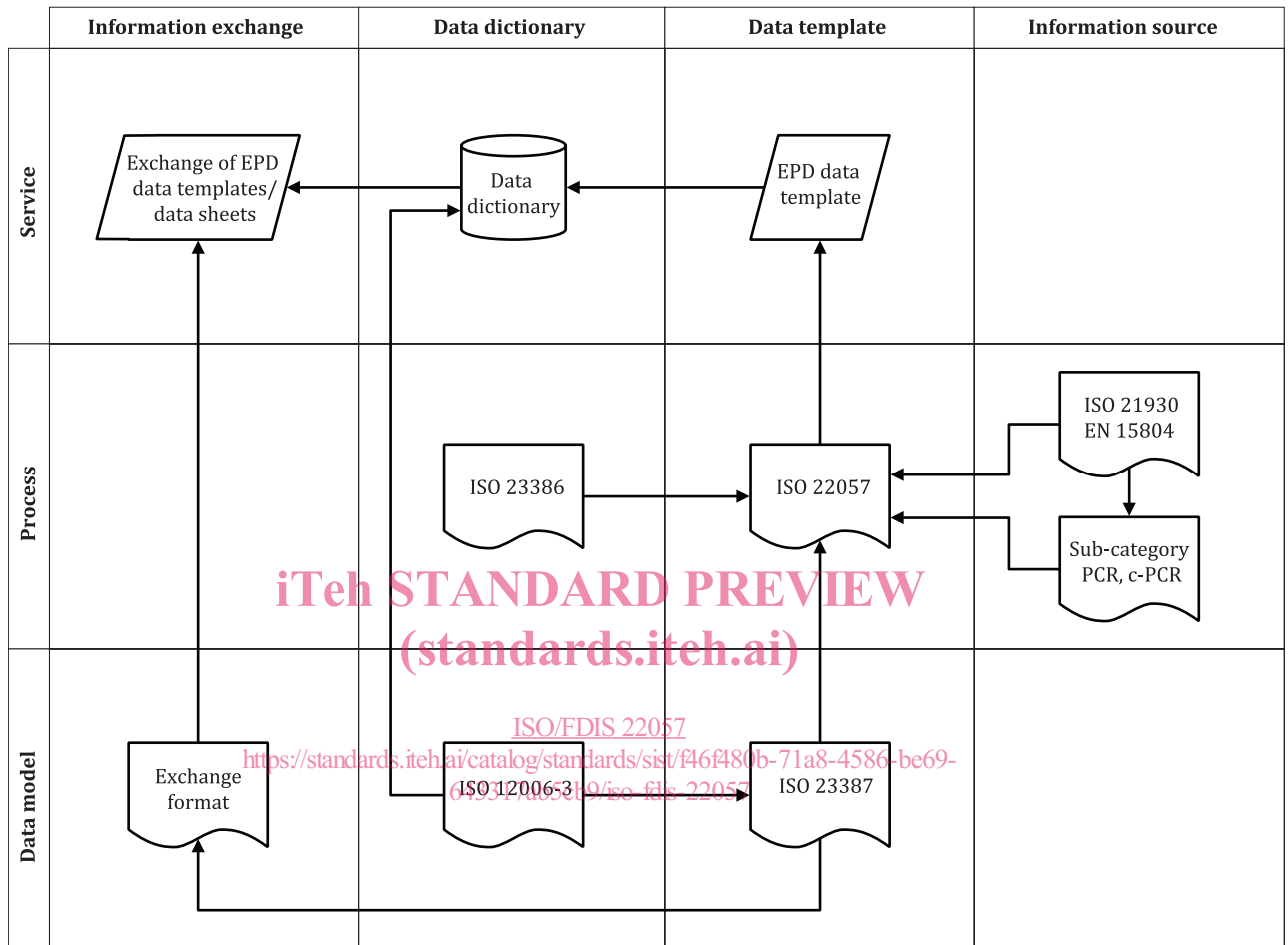
Figure 2 — Relationship between BIM standards and sustainability standards

The requirements in this document are further supplemented by technical information about construction products and services, construction elements and integrated technical systems so they can be machine-interpretable. Technical information means requirements and conditions as stated in standards and specifications relevant for construction products. This document recommends the use of the same principles for structuring information (data template concepts) and the use of existing technical information created by other domain experts. Annex D offers guidance on the delivery of information according to the principles of this document according to the principles described in CWA 17316 and smart CE marking.

EXAMPLE   In Europe, Construction Products Regulation (CPR) experts are responsible for creating and maintaining technical information based on European harmonized standards.

This technical information in standards or technical specifications can already exist in a data dictionary; and EPD/LCA experts can use it for the technical description of products in an EPD.

This document is intended to help in understanding the different template concepts and their relation to EPD information and to enable users to create new concepts according to their specific needs.

NOTE   For example, experts developing sub-category PCR according to ISO 21930 or complementary PCR (c-PCR) according to EN 15804:2012+A2:2019 can create a data template for additional specific requirements in the sub-category PCR or c-PCR for the relevant product group.

Users of this document should be able to find the data template described in this document in existing data dictionaries; but in case there is a data dictionary that does not support the structure, they should be able to recreate the data template structure in their own implementations using the information provided in Annex A.

This document also ensures the alignment between the proposed approach in it and already existing formats like ILCD + EPD, INIES and OpenEPD (see Annex B).

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643317ab5cb9/iso-fdis-22057

Sustainability in buildings and civil engineering works – Data templates for the use of environmental product declarations (EPDs) for construction products in building information modelling (BIM)

1   Scope

This document provides the principles and requirements to enable environmental and technical data provided in EPDs for construction products and services, construction elements and integrated technical systems to be used in BIM to assist in the assessment of the environmental performance of a construction works over its life cycle.

This document gives requirements on structuring EPD information using a data template according to ISO 23386 and ISO 23387, to make EPD data machine-interpretable and to enable their integration into information-driven design, construction, use and end-of-life stages.

This document is applicable to structuring generic LCA data for use within a BIM environment, as these data are required in the absence of suitable EPD data to enable assessment of the environmental performance at the construction works level.

The assessment of environmental performance at the construction works level is not covered by this document.

2   Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6707-1, *Buildings and civil engineering works — Vocabulary — Part 1: General terms*

ISO 14040, *Environmental management — Life cycle assessment — Principles and framework*

ISO 14050, *Environmental management — Vocabulary*

ISO 21930, *Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services*

ISO 23386, *Building information modelling and other digital processes used in construction — Methodology to describe, author and maintain properties in interconnected data dictionaries*

EN 15804:2012+A1:2013, *Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products*

EN 15804:2012+A2:2019, *Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products*

3   Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6707-1, ISO 14040, ISO 14050, ISO 21930, EN 15804:2012+A2:2019 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1 Terms relating to environmental labelling and construction products

3.1.1
construction object
object (3.2.3) of interest in the context of a construction process

EXAMPLE 1   The construction object "wall" is a type of system.

EXAMPLE 2   The construction object "calcium silicate masonry unit" is a type of construction product.

Note 1 to entry: See ISO 21931-1:2010, 3.11 for the definition of "process" and ISO 6707-1:2020, 3.3.5.6 for the definition of "construction."

[SOURCE: ISO 12006-2:2015, 3.1.2, modified — EXAMPLEs 1 and 2 and note 1 to entry have been added.]

3.1.2
information module
compilation of *data* (3.3.1) to be used as a basis for an EPD, covering a unit process or a combination of unit processes that are part of the *life cycle* (3.1.3) of a product

[SOURCE: ISO 14025:2006, 3.13, modified — Reference to "a Type III environmental declaration" has been replaced by "an EPD".]

3.1.3
life cycle
consecutive and interlinked stages of a product (or service) system, from raw material acquisition or generation from natural resources to final disposal

Note 1 to entry: The life cycle stages include acquisition of raw materials, design, production, transportation/delivery, use, end-of-life treatment and final disposal.

[SOURCE: ISO 14001:2015, 3.3.3]

3.2 Terms relating to concepts, objects and properties

3.2.1
concept
unit of knowledge created by a unique combination of *characteristics* (3.2.2)

[SOURCE: ISO 1087:2019, 3.2.7, modified — Notes 1 and 2 to entry have been removed.]

3.2.2
characteristic
abstraction of a *property* (3.2.5)

Note 1 to entry: Characteristics are used for describing *concepts* (3.2.1) and *construction objects* (3.1.1).

[SOURCE: ISO 1087:2019, 3.2.1, modified — EXAMPLE has been removed; reference to "construction objects" has been added to note 1 to entry.]

3.2.3
object
any part of the perceivable or conceivable world

Note 1 to entry: An object is something abstract or physical toward which thought, feeling, or action is directed.

[SOURCE: ISO 12006-2:2015, 3.1.1]

3.2.4
domain
area of activity covering a science, a technique, a material, etc.

Note 1 to entry: A domain can be associated with a group to which the *property* (3.2.5) applies.

[SOURCE: ISO 23386:2020, 3.11]

3.2.5
property
inherent or acquired feature of an item or *object* (3.2.3)

EXAMPLE 1   Thermal efficiency, heat flow, sound reduction index, sound power level, colour.

EXAMPLE 2   'Being made of wood' as a property of a given construction product.

Note 1 to entry: One or more objects can have the same property.

[SOURCE: ISO 23386:2020, 3.17, modified — A reference to "object" in the definition, EXAMPLE 2 and note 1 to entry have been added.]

3.2.6
group of properties
collection enabling the *properties* (3.2.5) to be prearranged or organized

[SOURCE: ISO 23386:2020, 3.14, modified — Four notes to entry have been removed.]

3.2.7
identifier
string (3.3.12) of characters created by an organization to reference a *dataset* (3.3.5)

3.2.8
quantity
property (3.2.5) of a phenomenon, body, or substance, where the property has a magnitude that can be expressed by means of a number and a reference

EXAMPLE 1   Length, mass, electric current (ISQ base quantities).

EXAMPLE 2   Plane angle, force, power (derived quantities).

Note 1 to entry: Quantities can appear as base quantities or derived quantities.

[SOURCE: ISO 23386:2020, 3.16]

3.3   Terms relating to data

3.3.1
data
reinterpretable representation of information in a formalized manner suitable for communication, interpretation, or processing

[SOURCE: ISO 8000-2:2020, 3.2.2]

3.3.2
data template
data (3.3.1) structure used to describe the *characteristics* (3.2.2) of *construction objects* (3.1.1)

[SOURCE: ISO 23387:2020, 3.3, modified — Two EXAMPLES and two notes to entry have been removed.]

3.3.3
data sheet
completed *data template* ([3.3.2](#)) containing the relevant *values* ([3.4.3](#)) and other information representing the content of the EPD

3.3.4
data dictionary
centralized repository of information about *data* ([3.3.1](#)) such as meaning, relationships to other data, origin, usage and format

[SOURCE: ISO 23387:2020, 3.2, modified — The note to entry has been removed]

3.3.5
dataset
identifiable collection of *data* ([3.3.1](#))

EXAMPLE   Integer, Real, *Boolean* ([3.3.15](#)), *String* ([3.3.12](#)), Date, and GM_Point.

Note 1 to entry: A *data type* ([3.3.7](#)) is identified by a term, e.g. Integer.

[SOURCE: ISO/IEC 30182:2017, 2.6]

3.3.6
data quality
characteristics ([3.2.2](#)) of *data* ([3.3.1](#)) that relate to their ability to satisfy stated requirements

[SOURCE: ISO 14044:2006, 3.19]

3.3.7
data type
named set of *values* ([3.4.3](#))

[SOURCE: ISO 10161-1:2014, 3.2.1, modified — The preferred term "type" has been removed.]

3.3.8
enumerated value
data type ([3.3.7](#)) consisting of a set of named *values* ([3.4.3](#)) called elements, members, enumeral, or enumerators of the type

[SOURCE: ISO 23387:2020, 3.5, modified — The preferred term has been changed from "enumerated type value" to "enumerated value".]

3.3.9
globally unique identifier
GUID
unique *identifier* ([3.2.7](#)) generated using an algorithm

[SOURCE: ISO 23386:2020, 3.13, modified — Note 1 to entry has been removed.]

3.3.10
building information modelling
BIM
use of a shared digital representation of an asset to facilitate design, construction and operation processes to form a reliable basis for decisions

[SOURCE: ISO 23386:2020, 3.6]

3.3.11
machine-interpretable data
data (3.3.1) that is in a specific context and format and can be read and stored in a computer system such that action may be taken based on the content of the data

[SOURCE: ISO 10303-232:2002, 3.5.3, modified — The preferred term has been changed from "computer interpretable data " to "machine-interpretable data"; the EXAMPLE has been removed.]

3.3.12
string
sequence of elements of the same nature, such as characters or bits, considered as a whole

Note 1 to entry: A string may be empty [*null* (3.3.13)] or contain only one element.

[SOURCE: ISO/IEC 2382:2015, 2121583, modified — Reference to "null" has been added in note 1 to entry; two notes to entry have been removed.]

3.3.13
null
containing no elements

3.3.14
float number
data type (3.3.7) of real numbers that is used to define floating decimal points

3.3.15
boolean
data type (3.3.7) having two values: one and zero [which are equivalent to true and false]

[SOURCE: ISO 2146:2010, 4.6.1]

3.4 Other terms

3.4.1
reference document
publication that is consulted to find specific information, particularly in a technical or scientific *domain* (3.2.4)

EXAMPLE   See EN 771-1:2011+A1: 2015.

Note 1 to entry: A reference document can be associated with any *data* (3.3.1) present in a *data dictionary* (3.3.4). It can include the document date and version.

[SOURCE: ISO 23387:2020, 3.12]

3.4.2
unit
real scalar *quantity* (3.2.8), defined and adopted by convention, with which any other quantity of the same kind can be compared to express the ratio of the second quantity to the first one as a number

[SOURCE: ISO 23386:2020, 3.19, modified — Two admitted terms have been removed.]

3.4.3
value
number and reference together expressing magnitude of a *quantity* (3.2.8)

EXAMPLE 1   Length of a given rod: 5,34 m or 534 cm.

EXAMPLE 2   Mass of a given body: 0,152 kg or 152 g.

[SOURCE: ISO 23386:2020, 3.20, modified — Two admitted terms and EXAMPLES 3 to 10 have been removed.]

3.4.4
M
mandatory
information indicating that a *data* (3.3.1) element is required to be present within a specific record

[SOURCE: ISO 2146:2010, 4.4.1, modified — "shall" has been replaced by "is required to".]

3.4.5
O
optional
information indicating that a *data* (3.3.1) element is permitted to be present within a specific record

[SOURCE: ISO 2146:2010, 4.4.2, modified — "may" has been replaced by "is permitted to".]

3.4.6
in-use condition grade
designation representing a qualitative description of an in-use condition

Note 1 to entry: In-use condition grades are designated qualitatively in terms of not available, very high/very mild, high/mild, normal, low/severe, very low/very severe and not applicable.

Note 2 to entry: In-use condition grades are designated numerically using numbers in the range from 0 to 5, with 3 representing a "normal" condition.

[SOURCE: ISO 15686-8:2008, 3.7, modified — Note 1 to entry has been removed.]

3.4.7
factor category
category of in-use conditions that are considered in the determination of an ESL from an RSL

EXAMPLE 1   Inherent performance level, design level, work execution level, indoor environment, outdoor environment, usage conditions and maintenance level.

EXAMPLE 2   In-use conditions, such as temperature and moisture level, can be considered under the factor category, outdoor environment, in determining factor E.

Note 1 to entry: Factor categories are used in the factor method to determine the factors A to G and can be applicable in a similar way in any feasible alternative method.

4   Abbreviated terms

c-PCR	complementary product category rules
CPR	Construction Products Regulation
EPD	environmental product declaration
ESL	estimated service life
ILCD	International Reference Life Cycle Data System
LCA	life cycle assessment
LCI	life cycle inventory analysis
LCIA	life cycle impact assessment
PCR	product category rules
RSL	reference service life
UML	unified modelling language

5   Purpose of data templates

5.1   General

This document is relevant for EPDs defined in accordance with ISO 21930, EN 15804:2012+A1: 2013 and EN 15804:2012+A2:2019. This document is also relevant for LCA data prepared using the methodological requirements of ISO 21930, EN 15804:2012+A1:2013 and EN 15804:2012+A2:2019.

The requirements given in ISO 21930, EN 15804:2012+A1:2013 and EN 15804:2012+A2:2019 are structured following the ISO 23387 data template principles (see Clause 7). The intention of data templates is to provide a standardized data model to support the declaration of construction product information using a common technical language. When this construction product information is incorporated into the data templates, they become data sheets.

The properties and other terms defined here in the context of a digital EPD, and the data template, constitutes a part of a data dictionary. By using this document, the user should adopt these definitions and properties in their applied data dictionary, in order to facilitate communication of digital EPDs in information exchanges, see Figure 2.

Digital EPD information may be provided by different parties. It may also be modified at the construction works level under different circumstances and needs, which affect with whom the responsibility resides for the quality of data provided. The manufacturer or group of manufacturers have the responsibility for the information they provide for the digital EPD; any use, replacement or modification of the information is outside their responsibility.

EXAMPLE 1   The manufacturer providing the EPD supplies a "cradle to grave" data sheet and none of the parameters is changed. Thus, the manufacturer is responsible for data.

EXAMPLE 2   The manufacturer providing the EPD supplies a "cradle to grave" data sheet but a building assessor modifies the parameters of information modules B1 to C4 and module D so the data fits into the project's context. Thus, the manufacturer is responsible for the data in the unchanged information modules A1 to A5, but they are no longer responsible for the data used for information modules B1 to C4 and module D in the building assessment. The building assessor has responsibility for these data.

EXAMPLE 3   The manufacturer providing the EPD supplies a "cradle to gate" data sheet and a building assessor provides the data for information modules C1 to C4 and module D. Thus, the manufacturer is responsible for the data in the unchanged information modules A1 to A3 but is not responsible for the data used for information modules A4 and A5, information modules B1 to C4 and module D in the building assessment. The building assessor has responsibility for these data.

EXAMPLE 4   The manufacturer provides an EPD that is digitalised by another organization. Accurate digitalisation of EPD is the responsibility of the organization digitalising it.

5.2   EPD data and generic LCA data/information use

The purpose of providing EPD data and generic LCA data in data templates is to assist in the assessment of the environmental performance of the construction works over its life cycle and to align this information with any other construction product information, e.g. thermal transmittance, reaction to fire, warranty. Such an alignment makes the following processes more effective and efficient:

a)   specifying and selecting products based on technical requirements;

b)   comparing alternative products;

c)   predicting performance based on more accurate data about scenarios from contractors or other parties including end-of-life, e.g. how the product has been installed previously;

d)   setting out the basis for future benchmarks.

EXAMPLE   Data sheets can cover panels, e.g. a wood-based panel, with and without surface protection, based upon the same data template.