YACHTS, SMALL CRAFTS, OTHER VESSELS AND COMPONENTS THEREOF

PRODUCT CATEGORY CLASSIFICATION: UN CPC 49311, 49315, 49316, 49319, 494

PCR 2015:06

DRAFT VERSION 2.0 FOR SECOND OPEN CONSULTATION. DO NOTE USE OR CITE.

VALID UNTIL 20XX-YY-ZZ

DRAFT VERSION FOR SECOND OPEN CONSULTATION

INTRODUCTION TO OPEN CONSULTATION

This draft PCR was available for a first open consultation from 2022-05-16 until 2022-07-15 and is now available for a second open consultation from 2023-05-02 until 2023-06-01. Feel free to forward the draft to any other stakeholder you might think is relevant, including colleagues and other organizations.

We are interested in comments from stakeholders on:

- General
  - Alignment with PCRs available in other programmes for type III environmental declarations, industry-specific LCA guides or similar.
- Scope of PCR
  - Product category definition and description
  - Classification of product category using CPC codes
- Goal and scope, life cycle inventory and life cycle impact assessment
  - Functional unit/declared unit
  - System boundary
  - Allocation rules
  - Data quality requirements
  - Examples of databases for generic data
  - Impact categories and impact assessment methodology
- Additional information

Comments may be sent directly to the PCR Moderator (contact details available in Section 1). There is a template for comments on www.environdec.com that may be used.

For questions about the PCR, please contact the PCR moderator. For general questions about the International EPD® System, EPD or PCR development, please contact the Secretariat via pcr@environdec.com.

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1 INTRODUCTION

This document constitutes Product Category Rules (PCR) developed in the framework of the International EPD® System: a programme for type III environmental declarations[1] according to ISO 14025:2006, ISO 14040:2006, ISO 14044:2006, and product-specific standards such as EN 15804 and ISO 21930 for construction products. Environmental Product Declarations (EPD) are voluntary documents for a company or organisation to present transparent, consistent and verifiable information about the environmental performance of their products (goods or services).

The rules for the overall administration and operation of the programme are the General Programme Instructions (GPI), publicly available at www.environdec.com. A PCR complements the GPI and the normative standards by providing specific rules, requirements and guidelines for developing an EPD for one or more specific product categories (see Figure 1). A PCR should enable different practitioners using the PCR to generate consistent results when assessing products of the same product category.

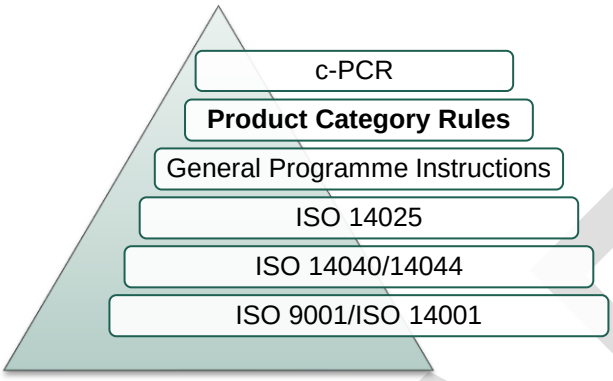

Figure 1 The hierarchy between PCRs, standards and other documents.

Within the present PCR, the following terminology is adopted:

- The term “shall” is used to indicate what is obligatory, i.e. a requirement.
- The term “should” is used to indicate a recommendation, rather than a requirement. Any deviation from a “should” requirement shall be justified in the PCR development process.
- The terms “may” or “can” is used to indicate an option that is permissible.

For definitions of further terms used in the document, see the normative standards.

A PCR is valid for a pre-determined period of time to ensure that it is updated at regular intervals. The latest version of the PCR is available at www.environdec.com. Stakeholder feedback on PCRs is very much encouraged. Any comments on this PCR may be sent directly to the PCR Moderator and/or the Secretariat during its development or during its period of validity.

Any references to this document shall include the PCR registration number, name and version.

The programme operator maintains the copyright of the document to ensure that it is possible to publish, update, and make it available to all organisations to develop and register EPDs. Stakeholders participating in PCR development should be acknowledged in the final document and on the website.

[1] Type III environmental declarations in the International EPD® System are referred to as EPDs, Environmental Product Declarations.

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1.1 ROLE OF THIS DOCUMENT AND COMPLEMENTARY PCRS

This PCR document serves as the main PCR for yachts, small crafts, other vessels and components thereof. Yachts, small crafts and other vessels are henceforth named “vessels”. The parts making up the vessels, in this document, are henceforth termed “components”.

Vessels can be classified into Commercial vessels (UN CPC Code 4931) and Pleasure and Sporting vessels (UN CPC Code 494). EPD for Pleasure and Sporting vessels shall be based on this PCR using the functional units defined in Sections 4.1.1 and 4.1.2.

This PCR can also be used for the development of complementary PCR (c-PCR) for Commercial vessels. Such a c-PCR shall be linked to the function of the vessel and Commercial vessels can have a multitude of different functions. Commercial vessels can have the propulsion system which is predominant compared to the total installed power, for those Commercial vessels the main function is to float and to sail on the water surface, while Commercial vessels whose auxiliary systems are predominant compared to the total installed power have a main function linked to the systems installed onboard.

This PCR allows for an EPD for Commercial vessels to be produced using:

- This PCR only for Commercial vessels whose main function is to float and to sail on the water surface.
- This PCR together with a c-PCR for Commercial vessels whose main function is linked to the auxiliary systems installed onboard.

To distinguish the function of sailing and floating from the specific functions of Commercial vessels in this PCR, the 80/20 principle has been used and further described in Section 2.2.

An EPD of Commercial vessels based on this PCR together with a c-PCR shall use a functional unit as required by the c-PCR.

The manufacturing of a vessel starts with the design phase and ends with its launch. Many vessels, being durable goods, may be subjected to improvements during their lifespan to keep up with technological developments, this is the case for sports or work boats, for instance. In order to meet the need of publishing an EPD at the different periods of vessels’ lifespan (i.e., the design, the on-site manufacturing and the use phase). This PCR allows for the development of three different types of EPDs of vessels, depending on the product life stage at which the EPD is developed:

- Project EPD: this type of EPD shall be developed during the design phase of the vessel is in concept and detailed design.
- Product EPD: this type of EPD shall be developed during the construction phase of the vessel at the shipyard.
- Use phase EPD: this type of EPD shall be developed during the use phase of the vessel, i.e. at a stage subsequent to the delivery of the customer.

This approach is useful to give the possibility to use the EPD tool in public tenders from the design phase of a boat, this is a possible application for the project EPD. In addition, the Use phase EPD will be useful to track the environmental improvements and performance of boats during their use phase. This may allow sponsors or investors to justify and provide evidence of the environmental impact of sport boats or to enter work boats already built and operating in their use phase into public procurement.

Vessels may be considered as floating shells containing great number of different components, there are generic components and specific components. Specific components are those that meet at least one of the following criteria:

1. Comply with international standards and/or rules of the maritime sector.
2. They shall present, in the technical datasheet, a feature that identifies the component as distinctive for the marine industry.
3. Are expressly developed for the maritime sector.

Only specific components are covered by this PCR.

The distinctive characteristic of the component shall be declared in EPD and verified during the EPD verification process.

C-PCR can be developed only for specific components designed to be installed on vessels covered by the scope of this PCR.

An EPD of components based only on this PCR shall use a declared unit as described in Section 4.1.3.

An EPD of components based on this PCR together with a c-PCR shall use a functional unit as required by the c-PCR.

1.2 DEVELOPMENT OF C-PCR AND USE OF EXISTING PCRS

A complementary PCR (c-PCR) may be developed for Commercial vessels or specific components (which are listed in Table 2) as described in Section 1.1. The development of a c-PCR for specific components shall be supported by the evidence of the applicability of international standards and/or regulations of the naval sector, to the component under request. The development of a c-PCR follows the regular PCR development procedure. Read more at www.environdec.com.

A c-PCR should include:

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- general information, such as scope of the c-PCR, programme-related information and information about its development; and
- specifications regarding goal and scope, LCI and LCIA, e.g., system boundaries, declared and functional unit, and other calculation rules; and
- further specifications on EPD contents, e.g., environmental indicators and additional information.

A c-PCR shall be compliant with the following specification:

- system boundary, as described in Section 4.3;
- operating profiles, if applicable, as described in Section 4.7.6.3.
- further specifications and additional requirements on LCA calculations and EPD content in relation to the main PCR (this document), for example regarding system boundaries, declared or functional unit, environmental indicators and additional information. All c-PCRs currently available and under development are displayed at www.environdec.com.

2 GENERAL INFORMATION

2.1 ADMINISTRATIVE INFORMATION

Name:	Yachts, small crafts, other vessels and components thereof
Registration number and version:	2015:06, draft version 2.0
Programme:	The International EPD® System
Programme operator:	EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden. Website: www.environdec.com E-mail: info@environdec.com
PCR Moderator:	Alessandro Bordignon – Quota Sette s.r.l. alessandro.bordignon@quotasette.it
PCR Committee:	Quotasette s.r.l., MaPPIng LCA, Northern Light s.r.l., MolBNL (University of Trieste – Department of Engineering and Architecture), Water Revolution Foundation, MICAD s.r.l., NavalDesign&Consulting SRL, European Boating Industry (EBI)
Date of publication and last revision:	*To be added by the Secretariat*
Valid until:	*To be added by the Secretariat*
Schedule for renewal:	A PCR is valid for a pre-determined time period to ensure that it is updated at regular intervals. When the PCR is about to expire, the PCR Moderator shall initiate a discussion with the Secretariat how to proceed with updating the PCR and renewing its validity. A PCR may be also updated without prolonging its period of validity, provided significant and well-justified proposals for changes or amendments are presented. See www.environdec.com for the latest version of the PCR. When there has been an update of the PCR, the new version should be used to develop EPDs. The old version may however be used for 90 days after the publication date of the new version, as long as the old version has not expired.
Standards conformance:	General Programme Instructions of the International EPD® System, version 4.0, based on ISO 14025 and ISO 14040/14044.
PCR language(s):	At the time of publication, this PCR was available in English. If the PCR is available in several languages, these are available at www.environdec.com. In case of translated versions, the English version takes precedence in case of any discrepancies.

2.2 SCOPE OF PCR

2.2.1 PRODUCT CATEGORY DEFINITION AND DESCRIPTION

This document provides main Product Category Rules (PCR) for the assessment of the environmental performance of yachts, small crafts, other vessels and vessel components and the declaration of this performance by an EPD.

See Section 6 for definitions of key terms used in this main PCR.

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The term vessel refers to anything that can float and has a propulsion and manoeuvring system. This description covers many different types of vessels with different functions and sizes. However, they all have the following minimum characteristics in common:

- a hull with associated structures that gives the floating characteristic,
- a propulsion system that allows the vessel to move across the water surface, and
- a manoeuvring system that allows the direction of movement to be set.

In some vessels, the manoeuvring system is integrated with the propulsion system (as in vessels with rudders or cycloidal propellers).

This PCR covers pleasure vessels and, vessels used for recreational, leisure and sporting competition with a Gross Tonnage (GT) <500, which corresponds to UN CPC Code 494

This PCR covers also the following commercial vessel types:

- CPC Code: 49311: Large yachts: vessel, used in private or commercial trade for leisure purposes with GT>500.
- CPC Code: 49311: Passenger vessel: Vessels designed for the transport of more than 12 passengers without arrangements for accommodations.
- CPC Code 49315: Fishing vessel: Vessel designed for fishing and preserving the catch.
- CPC Code 49316: Tugs and pusher craft: Vessels designed for pushing or towing other vessels or barges.
- CPC Code 49319: Lifeboats: Small boats or raft kept in another vessel that people can use to leave the vessel in emergency.
- CPC Code 49319: Research vessels: vessels designed for conducting scientific research.
- CPC Code 49319: Supply vessels: Vessel designed to operate in the offshore industry with oil and gas platforms or with offshore wind turbines.

For commercial vessels the 80/20 principle is introduced to distinguish between vessels whose main function is to float and to sail on the water surface, and commercial vessels whose main function is linked to the auxiliary systems installed onboard. The reason behind this separation is that commercial vessels are usually equipped with a set of specific components which are needed to fulfil the peculiar vessel function for which the vessel is designed. This could be, for example, cranes or winches for handling cargo, refrigerators for storing fishery products, accommodation for passengers, etc. These components are commonly designed for land-based applications and then adapted to be installed on board. Depending on the size of the vessel, these specific components may be predominant in terms of power consumption, weight and environmental impacts compared to the components required for the main function that all vessels have in common, i.e., to float and sail on the water surface. Thus, two categories of Commercial vessels have been identified in this document:

- Commercial vessels whose main function is to float and to sail on the water surface are those commercial vessels whose propulsion power i.e., the maximum power that can be transmitted to the elements that provide thrust to the vessel, is greater than 80% of the total installed power on board.
- Commercial vessels whose main function is related to the auxiliary systems installed onboard are those commercial vessels whose propulsion power i.e., the maximum power that can be transmitted to the elements that provide thrust to the vessel, doesn't exceed 80% of the total installed onboard.

This PCR covers also specific components, i.e., components designed to be installed onboard vessels covered by the scope of this PCR, which shall satisfy standards and rules characteristic of the naval sector. Examples include components necessary for safe navigation and maneuvering, such as power system components, steering system components, mooring and anchoring system components, etc. These components can be defined as a feature of the maritime industry because the materials, technical standards, rules to be satisfied, and production processes are specifically designed for application in the maritime field.

Later in this document, different life cycle system boundaries are provided according to the main function of the component. Thus, Table 1 reports a list of components, grouped according to their main functions, covered by this PCR. The components installed

onboard can vary significantly according to the vessel function and size thus the examples of components reported in the last column of Table 1 is a non-exhaustive list for explanatory purpose.

Table 1 Classification and description of vessel specific components covered by this PCR and for which c-PCRs may be developed.

SPECIFIC COMPONENT GROUPS		DESCRIPTION	EXAMPLE
Hull and structures	HS	Main external surfaces such as hull, decks with necessaries structures.	Hull, Deck, Superstructure, Structures, Hull Appendages, Masts, Rollbars, Equipment Bases, …
Machinery & Propulsion	MP	All elements needed to move the boat and to produce energy on board.	Main Propulsion, Energy generation, , Steering System, Maneuvering Thrusters, Stabilizing Systems…
Ship systems	SS	System essential for navigation and for vessel safety.	Fuel Oil System, Bilge System, Black & Grey Water System, Fire Fighting System, Fire Extinguishing System, Sea Water System, Exhaust Gas System, Heat Exchange System, Air Vent System, Refrigeration System, Waste Oil & Sludge System, Ballast System, Lubricating Oil System, Scupper System, …
Ship Electrical Systems & Electronics	SE	Electrical system essential for navigation and for vessel safety.	Fire Detection System, Navigation System, Communication System, Dynamic Positioning System, Cathodic Protection, Cathodic Antifouling System, …
Insulation and fitting structures	IS	Internal surfaces coatings.	Fire & Noise Insulation, Vibration Control System, Floor System, Ceiling System, Wall System, …
Deck machinery and equipment	DE	Groups of components installed on external areas needed for navigation and safety of the boat.	Mooring Equipment, Navigation lights, Door & Hatches, Windows & Portholes, Ladders & Gangways, Shell Doors, Lifts, Cranes, Tender, Life & Fire Appliances, Deck Outfitting, Technical Area Outfitting, Rigging & Sailing Equipment, ...
Paintings	PA	Surfaces treatment.	Varnish, paint, gelcoat, antifouling paint, filler, fairing compound

2.2.2 GEOGRAPHICAL SCOPE

This PCR may be used globally.

2.2.3 EPD VALIDITY

An EPD based on this PCR shall be valid for a 5-year period starting from the date of the verification report (“approval date”), or until the EPD has been de-registered from the International EPD® System.

An EPD shall be updated and re-verified during its validity if changes in technology or other circumstances have led to:

- an increase of 10% or more of any of the declared indicators of environmental impact,
- errors in the declared information, or
- significant changes to the declared product information, content declaration, or additional environmental, social or economic information.

If such changes have occurred, but the EPD is not updated, the EPD owner shall contact the Secretariat to de-register the EPD.

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3 PCR REVIEW AND BACKGROUND INFORMATION

This main PCR was developed in accordance with the PCR development process described in the GPI of the International EPD® System, including open consultation and review.

3.1 OPEN CONSULTATION

3.1.1 VERSION 1.0

This PCR was available for open consultation from 2015-04-22 until 2015-06-22 during which any stakeholder was able to provide comments by contacting the PCR Moderator and/or the Secretariat.

3.1.2 VERSION 2.0

This main PCR was available for a first open consultation from 2022-05-16 until 2022-07-15 and a second open consultation from 2023-05-02 until 2023-06-01, during which any stakeholder was able to provide comments by contacting the PCR Moderator and/or the Secretariat.

Stakeholders were invited via e-mail or other means to take part in the open consultation and were encouraged to forward the invitation to other relevant stakeholders. None of the stakeholders that provided comments during the open consultation agreed to be listed as contributors in the PCR and at www.environdec.com.

3.2 PCR REVIEW

3.2.1 VERSION 1.0

PCR review panel:	The Technical Committee of the International EPD® System. A full list of members is available at www.environdec.com. The review panel may be contacted via info@environdec.com. Members of the Technical Committee were requested to state any potential conflict of interest with the PCR Committee, and if there were conflicts of interest they were excused from the review.
Chair of the PCR review:	Greg Doudrich

3.2.2 VERSION 2.0

PCR review panel:	The Technical Committee of the International EPD® System. A full list of members is available at www.environdec.com. The review panel may be contacted via info@environdec.com. Members of the Technical Committee were requested to state any potential conflict of interest with the PCR Committee, and if there were conflicts of interest they were excused from the review.
Chair of the PCR review:	*To be added by the Secretariat*
Review dates:	*To be added by the Secretariat*

3.3 EXISTING PCRS FOR THE PRODUCT CATEGORY

As part of the development of this main PCR, existing PCRs and other internationally standardized methods that could potentially act as PCRs were considered to avoid unnecessary overlaps in scope and to ensure harmonisation with established methods of relevance for the product category. The existence of such documents was checked among the following EPD programmes and international standardisation bodies:

- International EPD® System. www.environdec.com.
- AENOR Global EPD

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- Institut Bauen & Umwelt e.V.
- Norwegian EPD Foundation / EPD Norge
- SCS Global Services
- PEP Ecopassport
- KITECH
- EPD Italy
- EPD Denmark
- Stichting MRPI
- EPD Ireland
- RTS EPD
- Programme INIES

No existing PCRs or other relevant internationally standardized methods with overlapping scope were identified.

3.4 REASONING FOR DEVELOPMENT OF PCR

This main PCR was developed to enable publication of EPDs for this product category based on ISO 14025, ISO 14040/14044 and to be used as the basis for complementary PCRs (c-PCR) for more specific product categories within its scope (which then shall be used together with this main PCR to develop EPDs). The PCR (together with a c-PCR, if available) enables different practitioners to generate consistent results when assessing the environmental impact of products of the same product category, and thereby it supports comparability of products within a product category.

3.5 UNDERLYING STUDIES USED FOR PCR DEVELOPMENT

The methodological choices made during the development of this main PCR (functional/declared unit, system boundary, allocation methods, impact categories, data quality rules, etc.) were primarily based on the following underlying studies:

- Fourth IMO GHG Study 2020 – Final report (MEPC 75/7/15)
- IMO - Marine Environment Protection Committee. MEPC 75/7/15 - Reduction of GHG emissions from ships. Fourth IMO GHG Study 2020. vol. 53. 2020.
- Water Revolution Foundation internal report on shore power demands and impacts calculations based on the main used marinas for yachts over 30 meters. The content of the report is going to be submitted to a scientific journal.
- Mio, A., Fermeglia, M., Favi, C., “A critical review and normalization of the life cycle assessment outcomes in the naval sector. Bibliometric analysis and characteristics of the studies”, 2022 Journal of Cleaner Production, https://doi.org/10.1016/j.jclepro.2022.133268
- Mio, A., Fermeglia, M., Favi, C., “A critical review and normalization of the life cycle assessment outcomes in the naval sector. Articles description”, 2022, Journal of Cleaner Production, https://doi.org/10.1016/j.jclepro.2022.133476.

PCRs used to support methodological choices:

- Business jets (PCR 2018:09 - UN CPC 49623)
- Public and private buses and coaches (PCR 2016:04 - UN CPC 49112 & 49113)
- Rolling stock (PCR 2009:05 - UN CPC 495)

Buildings (2.01) (PCR 2014:02)PCR used as a benchmark for structural setting:

- Construction products (PCR 2019:14 - EN 15804:A2)

Supporting LCA-based studies (not public) performed in parallel to the PCR development:

- LCA for pre-certified EPD of 100 feet sailing yacht;
- LCA of optimist with novel materials.

4 GOAL AND SCOPE, LIFE CYCLE INVENTORY AND LIFE CYCLE IMPACT ASSESSMENT

The goal of this section is to provide specific rules, requirements, and guidelines for developing an EPD for the product category as defined in Section 2.2.1.

4.1 FUNCTIONAL/DECLARED UNIT

Vessels can have different functions, from the commercial one to vessels used for pleasure or sporting competitions. Still, the main function of vessels is to move and to float on the water following operational profiles. The operational profile is how the vessel is used on average in a year during its lifetime. Section 4.7.6.3 reports the main operational profiles that shall be chosen during the use phase to perform the life cycle assessment of a vessel. This section describes the functional units that shall be used, for small and large vessels, respectively, and the declared unit that shall be used for components. Throughout this document small vessels are defined as those vessels with GT< 500. Those vessels shall use the functional unit described in Section 4.1.1. Large vessels are those vessels with GT over 500. Those vessels shall use the functional unit described in Section 4.1.2. This subdivision follows the subdivision in the SOLAS Convention, published by IMO, as well as in other international regulations and codes such as LY-3 or CYC 2020.

Also, knowing that the use phase is the most critical life cycle stage for environmental impacts of vessels, the operational profile is considered in the functional unit. For EPDs based on this PCR, comparability is always guaranteed only between environmental assessments carried out with the same activity chosen as operational profile and functional unit.

The functional/declared unit shall be stated in the EPD. The environmental impact shall be given per functional/declared unit. A description of the function of the product should be included in the EPD, if relevant.

4.1.1 FUNCTIONAL UNIT FOR SMALL VESSELS

The functional unit is defined as 1 ton of vessel for 1 average year of use according to the selected main operational profile. The average year shall be calculated with respect to the reference service life (RSL) of the vessel.

A 'year of use' shall be calculated from the weighted average of the values listed in the operational profile (see Table 4) or using primary data if the EPD is developed during the use phase of the vessel for one reference service life.

The mass is calculated for the light craft condition (m_{LC}) as defined by ISO 8666:2020 for all vessels complying with the scope of the PCR, without any constraint on the size.

4.1.2 FUNCTIONAL UNIT FOR LARGE VESSELS

The functional unit of a large vessel is 1 gross tonnage (GT) provided for 1 average year of use according to the selected main operational profile. The average year shall be calculated with respect to the RSL of the vessel.

For large vessels the gross tonnage (GT) is preferable to the tons used for representing the functional unit of other vessels (see Section 4.1.1) since the GT is the most used parameter for indicating the vessel size, by considering the measure of its internal volume (see section 6). The gross tonnage (GT) shall be calculated as described in the international convention on tonnage measurement of ships (Tonnage) adopted by IMO on 1969.

Large yacht is a vessel used in private or commercial trade for leisure purposes with GT > 500 as defined in Section 2.2.1.

One ‘year of use’ for the large yacht shall be calculated through the weighted average of the values listed for “Annual Leisure” in the operational profile (see Section 4.7.6.3). For all other vessels over 500 GT, the operating profile that best represents the vessel's operational activities shall be selected among the available options.

4.1.3 DECLARED UNIT FOR COMPONENTS

EPDs for vessel components based on this PCR document without using a complementary PCR (c-PCR) shall use a declared unit, which shall be 1 unit of the component or defined and specified using the International System of Units (SI units), for example 1 kg of the component, and relate to the typical applications of the component. EPDs for vessel components based on this PCR document together with a c-PCR may use a functional unit if allowed by the c-PCR. For information about c-PCR, see Section 1.2 and Section 1.3.

4.2 TECHNICAL SPECIFICATION, LIFESPAN AND REFERENCE SERVICE LIFE (RSL)

The life of a vessel structure is usually really long, especially for larger vessels. However, after many hours of use, machineries, engines, and batteries may need major overhaul. Furthermore, also fittings and some structures need to be refurbished because they reach their end of life before the end of life of the entire vessel. Substantial modifications are usually conducted about 30 years after the launch of the vessel: after this time frame the vessel is dismantled or is subjected to a general refitting where the main structural elements on board are renewed and, sometimes, even the scope of the vessel is changed.

The reference service life (RLS) of a vessel shall be defined as 30 years. For example, if the lifespan of a vessel is expected to be 10 years, the potential impact of three vessels must be considered.

The technical characteristics that shall be preserved during RSL of a vessel are those related to the two main functions: floating and moving on water. Maintenance activities during the lifespan of the vessels aim to preserve these two functions.

The lifespan and RSL are not applicable to components in this PCR, but they may be defined in a c-PCR, if applicable. This is because EPDs for components based only on this PCR use a declared unit.

4.3 SYSTEM BOUNDARY

The scope of this PCR and EPDs based on it is cradle to grave for vessels and cradle to gate or cradle to gate with option for components.

4.3.1 LIFE-CYCLE STAGES FOR VESSELS

For the purpose of different data quality rules and for the presentation of results, the life cycle of the product is divided into the following life cycle stages and life cycle modules, applicable to vessels:

- Upstream processes (from cradle-to-gate);
- Core processes (from gate-to-gate);
- Downstream processes (from gate-to-grave), this life cycle stage is divided into following life cycle modules:
  - Operational stage;
  - Maintenance processes;
  - End of Life processes.

In the EPD, the environmental performance of each included life-cycle stage and modules above shall be reported separately and in aggregated form. The processes included in the scope of the PCR and belonging to each life cycle stage are described in Sections 4.3.1.1–4.3.1.3.

4.3.1.1. Upstream processes

The following unit processes are part of the product system and shall be classified as upstream processes:

- Extraction and production of raw material for all main parts and components, thinners, and cleaning products,
- Reuse processes of material from other product activities,
- Recycling processes of secondary materials from other product life cycles,
- Production of semi-products used in the core processes, if applicable,
- Production of distribution and consumer packaging, if applicable,
- Production of moulds, pads, and other auxiliary products,

  Production of all components, equipment and various products used on board,
- Generation of electricity and production of fuels, steam and other energy carriers used in the upstream processes,
- External transportation to the core processes (including generation of electricity and production of fuels and other energy carriers used in this transportation).

Upstream processes not listed may also be included. All elementary flows at resource extraction shall be included, except for the flows that fall under the general cut-off rule in Section 4.5.

4.3.1.2. Core processes

The following unit processes are part of the product system and shall be classified as core processes:

- Hull, deck and related structures production,
- Superstructures and related structures production,
- Generation of electricity and production of fuels, steam and other energy carriers used in core processes.
- Transport and movement of the moulds within the production site and between different production sites,
- Transport of the product between workstations,
- Transport of the product to the pier,
- Hull and superstructure assembly processes,
- Installation of all systems, components and equipment of the vessel,
- Surface treatments (e.g., fairing and painting),
- Maintenance (e.g., of the machines),
- Scrapping of moulds,
- Waste treatment of waste generated during manufacturing,
- Activities carried out to verify the compliance of the product requirements before the yacht is delivered to the customer,

Core processes not listed may also be included. Manufacturing of a minimum of 95% of the total weight of the declared product including packaging shall be included.

The following processes shall not be included:

- manufacturing of production equipment, buildings and other capital goods (with a few exceptions, see Section 4.3.2),
- business travel of personnel,
- travel to and from work by personnel, and
- research and development activities.

4.3.1.3. Downstream processes

Downstream processes are divided in a operational stage , maintenance and an end-of-life stage

The following unit processes are part of the product system and shall be classified as downstream processes:

- Operational stage:
  - Transport of the yacht from the yard, or where it is assembled and launched, to the customer or retailer ((including generation of electricity and production of fuels and other energy carriers used in this transportation),
  - end-of-life treatment of transportation packaging, including transportation.
  - Activities linked to the use of the vessel as described in Section **Fel! Hittar inte referenskälla.**, e.g., use of electricity or water, use activities causing direct emissions,
  - end-of-life treatment of consumable product and waste component linked to use of the vessel, including transportation,
  - generation of electricity and production of fuels, steam and other energy carriers used in Operational stage.
- Maintenance processes:
  - Set of scheduled routine maintenance activities,
  - production of material needed to perform maintenance activity,
  - Extraordinary maintenance, if necessary to guarantee the safety and technical characteristics of the vessels,
  - Extraordinary maintenance to improve the performance of vessel, if applicable,
  - end-of-life treatment of maintenance activity, including transportation,
  - generation of electricity and production of fuels, steam and other energy carriers used in maintenance processes.

- End-of-life processes:
  - Transport to the shipyard for the disposal,
  - Landing and disassembling of the elements installed on board and disassembly of the hull and superstructure,
  - Disposal of the elements installed on board and of the materials used for the hull and superstructures construction.

The following processes shall not be included:

- manufacturing of production equipment, buildings and other capital goods,
- business travel of personnel,
- waste generated by crew and passenger,
- travel to and from work by personnel, and
- end-of-life processes of packaging waste.

4.3.2 INFRASTRUCTURE AND CAPITAL GOODS

In general, the production and end-of-life processes of infrastructure or capital goods used in the product system should not be included within the system boundaries. They may be included when infrastructure and capital goods are known to be relevant in terms of their environmental impact, or when a generic LCI dataset includes infrastructure/capital goods, and it is not possible, within reasonable effort, to subtract the data on infrastructure/capital goods from this dataset. If an infrastructure/capital good is produced with the intention to be used one or a few times only (e.g., a manufacturing plant or machinery constructed to produce only one product), this infrastructure/capital good shall be included.

The inclusion or exclusion of infrastructure/capital goods shall be transparently described for upstream, core and downstream processes in the LCA report and in the EPD.

If infrastructure/capital goods are included, the following disclaimer shall be included in the results sections of the LCA report and in the EPD (land use and toxicity indicators shall only be mentioned if declared in the EPD):

The results of the impact categories abiotic depletion of minerals and metals, land use, human toxicity (cancer), human toxicity, non-cancer and ecotoxicity (freshwater) may be highly uncertain in LCAs that include capital goods/infrastructure in generic datasets, in case infrastructure/capital goods contribute greatly to the total results. This is because the LCI data of infrastructure/capital goods used to quantify these indicators in currently available generic datasets sometimes lack temporal, technological and geographical representativeness. Caution should be exercised when using the results of these indicators for decision-making purposes.¨

4.3.3 LIFE-CYCLE STAGES FOR COMPONENTS

For the purpose of different data quality rules and for the presentation of results, the life cycle of the components is divided into three life cycle stages:

- Upstream processes (from cradle-to-gate)
- Core processes (from gate-to-gate)
- Downstream processes (from gate-to-grave)

This PCR can be used for specific components EPD with different scopes, based on the product category:

- For components “machinery and propulsion” that have most of the impacts during the use stage, a cradle to grave approach shall be used.
- For other components to which the impacts of a vessel are not directly related, a cradle to gate approach can be used (if the criteria set out in section A.3 of GPI 4.0 are met).

In the EPD, the environmental performance associated with each of the three life-cycle stages above shall be reported separately and in aggregated form. The processes included in the scope of the PCR and belonging to each life cycle stage are described in Sections 4.3.3.1 - 4.3.3.3.

4.3.3.1. Upstream processes

The following unit processes are part of the product system and shall be classified as upstream processes:

- extraction and processing of raw materials,

- recycling processes of secondary materials from other product life cycles,
- production of input each part of components,
- relevant services, such as transport of raw materials and components along the upstream supply chain to a distribution point (e.g. a stockroom or warehouse),
- production of distribution and consumer packaging, and
- generation of electricity and production of fuels, steam and other energy carriers used in upstream processes.
- transportation of materials and parts to the manufacturing of the components,

Upstream processes not listed may also be included. All elementary flows at resource extraction shall be included, except for the flows that fall under the general cut-off rule in Section 4.5.

4.3.3.2. Core processes

The following unit processes are part of the product system and shall be classified as core processes:

- manufacturing of the component,
- maintenance of manufacturing equipment,
- end-of-life treatment of manufacturing waste, even if carried out by third parties, including transportation, and
- generation of electricity and production of fuels, steam and other energy carriers used in core processes.

Core processes not listed may also be included. Manufacturing of a minimum of 99% of the total weight of the declared product including packaging shall be included.

The following processes shall not be included:

- manufacturing of production equipment, buildings and other capital goods,
- business travel of personnel,
- travel to and from work by personnel, and
- research and development activities.

4.3.3.3. Downstream processes

The following unit processes are part of the product system and shall be classified as downstream processes:

- transportation of the components to shipyard,
- components use, e.g. use of electricity, fuel or water, use activities causing direct emissions,
- maintenance activities with production and transport of material used in maintenance activities,
- end-of-life treatment of the used component and its packaging, including transportation, and
- generation of electricity and production of fuels, steam and other energy carriers used in downstream processes.

4.3.4 OTHER BOUNDARY SETTING

4.3.4.1. Boundary towards nature

Boundaries to nature are defined as where the flows of material and energy resources leaves nature and enters the technical system (i.e., the product system). Emissions cross the system boundary to nature when they are emitted to air, soil or water.

4.3.4.2. Boundary towards other technical systems

Boundaries towards other technical systems define the flow of materials and components to/from the product system under study and from/to other product systems. If there is an inflow of recycled material to the product system in the production/manufacturing stage, the transport from the scrapyard/collection site to the recycling plant, the recycling process, and the transportation from the recycling plant to the site where the material is being used shall be included. If there is an outflow of material or component to recycling, the transportation of the material to the scrapyard/collection site shall be included. The material or component going to recycling is then an outflow from the product system.

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See Section 4.6 for further guidance.

4.3.4.3. Temporal boundary

The temporal boundary defines the time period for which the life cycle inventory data is recorded, e.g., for how long emissions from waste deposits are accounted. As default, the time period over which inputs to and outputs from the product system is accounted for shall be 100 years from the year that the LCA model best represents, considering the representativeness of the inventory data. This year shall, as far as possible, represent the year of the publication of the EPD.

4.3.4.4. Geographical boundary

The geographical boundary defines the geographical coverage of the LCA. This shall reflect the physical reality of the product under study, accounting for the representativeness of technology, input materials and input energy.

4.4 SYSTEM DIAGRAM

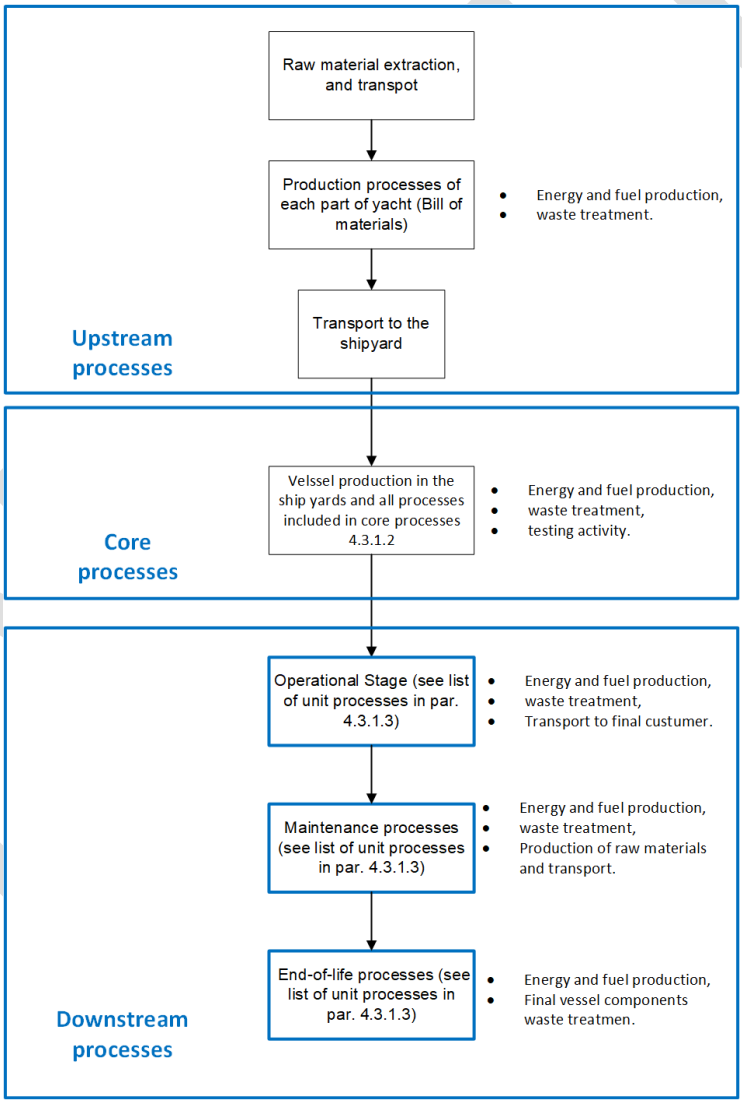

Figure 2 System diagram illustrating the processes that shall be included in the vessels product system, divided into upstream, core and downstream processes. The illustration of processes to include may not be exhaustive. The boxes in blue indicate the life cycle stages and modules that shall be considered and declared separately in the presentation of results in EPD.

YACHTS, SMALL CRAFTS AND OTHER VESSELS
PRODUCT CATEGORY CLASSIFICATION: UN CPC 49311, 49315, 49316, 49319, 494

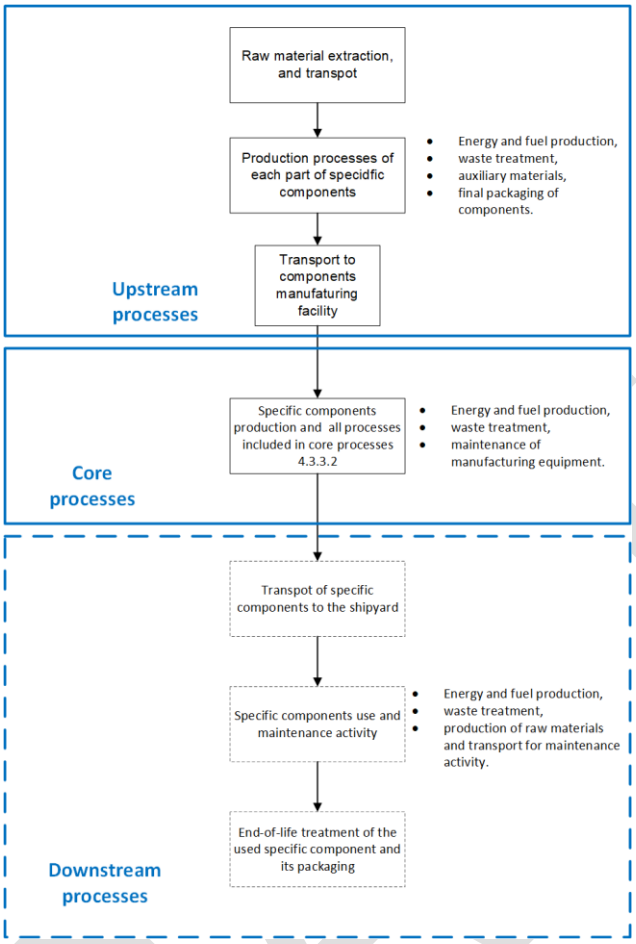

Figure 3 System diagram illustrating the processes that shall be included in the components product system, divided into upstream, core and downstream processes. The illustration of processes to include may not be exhaustive. The hatched lines indicate processes that can be excluded and the boxes in blue indicate the life cycle stages that shall be considered and declared separately in the presentation of results in EPD.

4.5 CUT-OFF RULES

4.5.1 CUT OFF RULES FOR VESSELS

Table 2 Cut-off rules for vessels

Life cycle stage	Cut-off criteria
Upstream processes	Data for Life Cycle Inventory (LCI) to and from the product system contributing to a minimum of 95% of the total inflows to the core module shall be included.
Core processes	Data for elementary flows to and from the product system contributing to a minimum of 99% of the declared environmental impacts shall be included, in other words, the included inventory data shall together give rise to at least 99% of the results of any of the environmental impact categories.
Downstream processes	

It is important to emphasize that, in general, the cut-off of inventory data should be avoided, and all available inventory data shall be used. Using cut-off rules shall not give the impression of “hiding” information but rather facilitating the data collection for practitioners. Exclusion of inventory data based on the cut-off rule shall be documented in the LCA report and inflows not included in the LCA shall be documented in the EPD.

The check for cut-off rules in a satisfactory way is through the combination of expert judgment based on experience of similar product systems and sensitivity analysis in which it is possible to understand how the input or output could affect the final results.

For upstream processes, if material production data is unavailable, a scenario using the production process of the material present in the greatest quantity, in mass, in the vessel shall be considered. The transport of that material shall be modelled as 500 km by lorry.

4.5.2 CUT OFF RULES FOR COMPONENTS

All available elementary flows shall be included. Data for elementary flows to and from the product system contributing to a minimum of 99% of the declared environmental impacts shall be included, in other words, the included inventory data shall together give rise to at least 99% of the results of any of the environmental impact categories (not including inventory data of processes that are explicitly outside the system boundary described in Section 0).

The cut-off of inventory data, based on the above cut-off rule, should be an output of a sensitivity analysis, alone or in combination with expert judgment based on experience of similar product systems. Further, the cut-off shall be possible to verify in the verification process, hence the exclusion of inventory data based on the cut-off rule shall be documented in the LCA report, and the EPD developer shall provide the information the verifier considers necessary to verify the cut-off.

It is important to emphasize that, in general, the cut-off of inventory data should be avoided, and all available inventory data shall be used. Using cut-off rules shall not give the impression of “hiding” information but rather facilitating the data collection for practitioners.

4.6 ALLOCATION RULES

Allocation can be divided into allocation of co-products, i.e., allocation of unit processes that generate several products, and allocation of waste, i.e., allocation of unit processes that generate materials that are, for example, landfilled recovered, recycled or reused, and which require further processing to cease being waste and become products (see criteria for end-of-waste state in Section 4.6.2).

The principles for allocation of co-products and allocation of waste are described separately in the following subsections.

4.6.1 CO-PRODUCT ALLOCATION

The following hierarchy of allocation methods shall be followed for co-product allocation:

1. Allocation shall be avoided, if possible, by dividing the process to be allocated into sub-processes and collecting the inventory data for each sub-process.
2. If allocation cannot be avoided, the inventory data should be partitioned between the different co-products in a way that reflects the underlying physical relationships between them, i.e., allocation should reflect the way in which the inventory data changes if the quantities of delivered co-products change.
3. If a physical relationship between the inventory data and the delivery of co-products cannot be established, the inventory data should be allocated between the co-products in a way that reflects other relationships between them. For example, inventory data might be allocated between co-products in proportion to their economic values. If economic allocation is used, a sensitivity analysis exploring the influence of the choice of the economic value shall be included in the LCA report.

4.6.2 ALLOCATION OF WASTE TREATMENT PROCESSES

Allocation of waste shall follow the polluter pays principle and its interpretation in EN 15804: “processes of waste processing shall be assigned to the product system that generates the waste until the end-of-waste state is reached.” The end-of-waste state is reached when all the following criteria for the end-of-waste state are fulfilled (adapted from EN 15804):

- the recovered material, component or product is commonly used for specific purposes;
- a market or demand, identified e.g., by a positive economic value, exists for such a recovered material, component or product;
- the recovered material, component or product fulfils the technical requirements for the specific purposes and meets the existing legislation and standards applicable to products; and
- the use of the recovered material, product or construction element will not lead to overall adverse environmental or human health impacts.

The above outlined principle means that the generator of the waste shall carry the full environmental impact until the point in the product life cycle in which the end-of-waste criteria are fulfilled. Waste may have a negative economic market value, and then the end-of-waste stage is typically reached after (part of) the waste processing and further refinement, at the point at which the waste no longer has a negative market value. This allocation method is (in most cases) in line with a waste generator’s juridical and financial responsibilities. See the GPI for further information and examples.

4.6.3 VESSELS END-OF-LIFE, REFITTING AND MAINTENANCE

Due to the extended useful lives of vessels, disposal procedures are frequently highly unpredictable and strongly influenced by accidental events and owners' preferences.

A vessel is in an end-of-life state, i.e., it can be defined as waste, when it has completely lost its two main functions of floating and moving on water and it is supposed to be dismantled and/or recycled either for technical or economic motivations.

A vessel is in an end-of-waste state when a refitting is carried out to restore its floating and moving on water features, after the definition of the vessel as waste.

When a vessel reaches the end-of-waste state, the refitted vessel starts a new life cycle and the environmental impacts related to the life cycle modules: Upstream processes, Core processes, Operational stage, Maintenance processes shall be allocated to the previous life cycle. The environmental impacts related to the activities and the raw materials required during the refitting operations shall be allocated to the new lifecycle, in accordance with the polluters pay principle (EN 15804:2021).

When a vessel has not reached the end-of-life state, but its component groups ”Hull and structures”, ”Machinery and propulsion”, and the fittings installed onboard (i.e. fixed and loose furniture, sanitary, mirrors, upholstery and cushions, lighting fixtures, households appliances, gym/spa equipment, teak outfit, etc...) have all undergone replacements of at least 80 wt% for each one, the vessel can be considered to have been refitted, starting a new product life cycle. The environmental impacts related to the upstream processes, core processes, use stage and maintenance activities shall be allocated to the previous lifecycle. The environmental impacts related to the activities and the raw materials required during the refitting operations shall be allocated to the new life cycle, in accordance with the polluters pay principle (EN 15804:2021).

When a vessel has not reached an end-of-life state and its main product groups ”Hull and structures”, ”Machinery and propulsion”, and the fittings installed onboard have not undergone replacements of at least 80 % in weight for each one, the vessel cannot be considered to have been refitted. The activities and raw materials required throughout these operations are classified as extraordinary maintenance in this circumstance, as indicated in Section 4.7.4.6. All input and output streams connected to this extraordinary maintenance activity shall be allocated to the number of years equal to the difference between the age of the vessel during the study period and the 30 years of reference service life (RSL).

In the marine sector, there is an important market for components that can be reused more than once, in different vessels, which corresponds to reuse in different product systems. When an input component in the EPD vessel is defined as reused, its environmental impact shall be allocated with the number of life cycles. This rule applies to components that have not reached their end-of-waste state. The list of components defined as reusable and the number of life cycles used for the allocation of environmental impacts, shall be described and justified within the LCA report. This rule does not apply to components belonging to the “Hulls and structure” group. Vessels and “Hulls and structures” components recovered and then prepared for re-use, in accordance with the GPI, shall be considered as secondary material. The application of this rule shall be detailed and justified in the LCA report, where it shall be clearly indicated which parts of the vessel are considered secondary material. When entering a new life cycle, vessels and “Hulls and structures” components are considered to have reached the end-of-waste state.

This rule is included in the PCR to encourage the recovery of hulls and structural parts of vessels that are abandoned in yards, marinas, wilderness, or other sites because they are commercially and technically difficult to recover or there is no longer a clearly identifiable owner.

4.7 DATA QUALITY REQUIREMENTS AND SELECTION OF DATA

Life cycle inventory data are classified into specific data and generic data, where the latter can be selected generic data or proxy data. The data categories are defined as follows:

- specific data (also referred to as “primary data” or “site-specific data”):
  - data gathered from the actual manufacturing plant where product-specific processes are carried out;
  - actual data from other parts of the life cycle traced to the product under study, for example site-specific data on the production of materials or generation of electricity provided by contracted suppliers, and transportation data on distances, means of transportation, load factor, fuel consumption, etc., of contracted transportation providers; and
  - LCI data from databases on transportation and energy ware that is combined with actual transportation and energy parameters as listed above.
- generic data (sometimes referred to as “secondary data”), divided into:
  - selected generic data: data (e.g. commercial databases and free databases) that fulfil prescribed data quality requirements for precision, completeness, and representativeness (see below Section 4.7.1),
  - proxy data: data (e.g. commercial databases and free databases) that do not fulfil all of the data quality requirements of “selected generic data”.

4.7.1 RULES FOR USING GENERIC DATA

For generic data to be classified as “selected generic data”, the following requirements apply:

- datasets shall be based on attributional LCA modelling (e.g., not be based on marginal data and not include credits from system expansion),
- the reference year shall be as current as possible and should be representative for the validity period of the EPD,
- the cut-off rule (as described in Section 4.5) shall be met on the level of the product system,
- datasets shall represent average values for a specific reference year; however, how data are generated could vary, e.g. over time, and then they should have the form of a representative annual average value for a specified reference period (such deviations shall be justified and declared in the EPD), and
- the representativeness of the data shall be assessed to be better than ±5%, in terms of the environmental impact calculated on the basis of the data, of data that is fully representative for the given temporal, technological and geographical context.

If selected generic data that meets the above data quality requirements are not available, proxy data may be used. The environmental impacts associated with proxy data shall not exceed 10% of the overall environmental impact of the product system.

The EPD may include a data quality declaration to demonstrate the share of specific data, selected generic data and proxy data contributing to the results of the environmental impact indicators.

4.7.2 EXAMPLES OF DATABASES FOR GENERIC DATA

Generic data made available via the Global LCA Data Access (GLAD; https://www.globallcadataaccess.org/) network may be used. Please note that other data that fulfil the data quality requirements may also be used.

4.7.3 DATA QUALITY REQUIREMENTS FOR DIFFERENT TYPES OF VESSELS EPD

This section defines the data categories shall be used for the development of EPDs in the three main phases of a vessel's life cycle:

- Concept and detailed design (type of EPD developed: Project EPD),
- Construction (type of EPD developed: Product EPD), and
- Use phase (type of EPD developed: Use phase EPD).

Table 3 Type of data for each life cycle modules

Point of the time of the assessment:		Concept and detailed design[1]	Construction	Use phase
Type of EPD to be produced:		Project EPD	Product EPD	Use phase EPD
Life cycle modules:	Upstream processes	Generic data	Specific data, generic data	Specific data, generic data
	Core processes	Generic data	Specific data	Specific data, generic data
	Operational stage	Generic data	Generic data	Specific data
	Maintenance			
	End of life processes	Generic data	Generic data	Generic data

[1] specific data shall be used for quantification of the gross amounts.

Any data should preferably represent average values for a specific year. However, the way data are being generated could vary e.g. over time, and they could therefore have the form of a representative annual average value for a specified reference period.

4.7.4 DATA QUALITY REQUIREMENTS FOR COMPONENTS LIFE CYCLE STAGES

It is mandatory to use specific data for the core processes. For the upstream and downstream processes generic data may also be used if specific data are not available.

4.7.5 OTHER MODELLING GUIDANCE PER COMPONENTS LIFE-CYCLE STAGES

Below are further data quality requirement per life-cycle stage for components. Exceptions to the requirements may be accepted, if justified in the EPD; such exceptions are subject to the approval by the verifier on a case-to-case basis.

4.7.5.1. Upstream processes

- Data referring to processes and activities upstream in a supply chain over which the EPD owner direct management control shall be specific and collected on site.
- Data referring to contractors that supply main parts, packaging, or main auxiliaries should be requested from the contractor as specific data, as well as infrastructure, where relevant.
- Data on transport of main parts and components along the supply chain to a distribution point (e.g. a stockroom or warehouse) where the final delivery to the manufacturer can take place, should be specific and based on the actual transportation mode, distance from the supplier, and vehicle load.
- In case specific data is lacking, selected generic data may be used. If this is also lacking, proxy data may be used (see section 4.7).
- For upstream processes modelled with specific data, generation of electricity used shall be accounted for in this priority:
    1. Specific electricity mix as generated, or purchased from an electricity supplier, demonstrated by a Guarantee of Origin or similar as provided by the electricity supplier.
    2. Residual electricity mix of the electricity supplier on the market.
    3. Residual electricity mix on the market[2].
    4. Electricity consumption mix on the market.

  The residual electricity mix is the mix when all contract-specific electricity that has been sold to other customers has been subtracted from the total consumption mix.

  "The market" in the above hierarchy shall be defined as being the (residual or consumption) grid mix of the country where the electricity is used, with exceptions for specified countries for which a sub-national electricity grid mix shall be used: Australia, Brazil, Canada, China, India, and USA. The mix of electricity used in upstream processes shall be documented in the EPD, where relevant.
- Packaging: specific data shall be used for the consumer packaging production if it is under the direct control of the organization or if the environmental impact related to the consumer packaging production is more than 10% of the total product environmental indicators. In other cases, generic data may be used. When consumer packaging shows the organization's logo, the LCA report should report the exerted/non-exerted direct control on the production of consumer packaging by the organization.

4.7.5.2. Core processes

- Transport from the final delivery point of raw materials, chemicals, main parts (see above regarding upstream processes) to the manufacturing plant/place of service provision should be based on the actual transportation mode, distance from the supplier, and vehicle load, if available.
- Goods: Specific data shall be used for the assembly of the product and for the manufacture of main parts as well as for on-site generation of steam, heat, electricity, etc., where relevant.
- Services: Specific data shall be used for the consumption of materials, chemicals, steam, heat, electricity, etc., necessary for execution of the service
- For electricity used in the core processes, generation of electricity used shall be accounted for in this priority:
    1. Specific electricity mix as generated, or purchased from an electricity supplier, demonstrated by a Guarantee of Origin or similar as provided by the electricity supplier.
    2. Residual electricity mix of the electricity supplier on the market.

[2] The composition of the residual grid mixes on the market are available for all EU countries and a few additional European countries through the Association for Issuing Bodies (AIB) at https://www.aib-net.org/facts/european-residual-mix.

3. Residual electricity mix on the market[3].
4. Electricity consumption mix on the market[4]. This option shall not be used for electricity used in processes over which the manufacturer (EPD owner) has direct control, as long as the composition of the residual grid mix has been publicly disclosed[5].

The residual electricity mix is the mix when all contract-specific electricity that has been sold to other customers has been subtracted from the total consumption mix.

"The market" in the above hierarchy shall be defined as being the (residual or consumption) grid mix of the country where the electricity is used, with exceptions for specified countries for which a sub-national electricity grid mix shall be used: Australia, Brazil, Canada, China, India, and USA. The mix of electricity used in the core processes shall be documented in the EPD, where relevant.

- Waste treatment processes of manufacturing waste should be based on specific data, if available.

4.7.5.3. Downstream processes

This section set the general rule for all downstream life cycle modules.

- Data for the use stage are usually based on scenarios, but specific data should be used when available and relevant.
- Considering that for components belonging to the component group "Machinery and Propulsion" most of the environmental impacts are in the use stage it is important that, for these components, also these impacts are assessed. Thus, in order to quantify the consumption of the propulsion system or generators installed on board during their use, an operational profile shall be selected, from those listed Table 4 that best represents the possible use of the vessel on which the component is designed to be installed. Further information on how to assess the use phase may be developed in the c-PCR.
- Data on the emissions from the use stage should be based on documented tests, verified studies in conjunction with average or typical product use, or recommendations concerning suitable product use. Whenever applicable, test methods shall be internationally recognised.
- The use of electricity in the region/country where the product is used (as specified in the geographical scope of the EPD) shall be accounted for in the following priority:
    1. Residual electricity mix on the market[6].
    2. Electricity consumption mix on the market.

  The residual electricity mix is the mix when all contract-specific electricity that has been sold to other customers has been subtracted from the total production mix.

  "The market" in the above hierarchy shall be defined as being the (residual or consumption) grid mix of the country where the electricity is used, with exceptions for specified countries for which a sub-national electricity grid mix shall be used: Australia, Brazil, Canada, China, India, and USA.

  The mix of electricity used in the downstream processes shall be documented in the EPD, where relevant.
- The transport of the product to the customer shall be described in the EPD, where relevant, and be accounted for in this priority:
    1. Actual transportation modes and distances to specific a customer or market, representing the geographical scope of the EPD.
    2. A weighted average of transportation modes and distances, based on transportation to several customers or markets, representing the geographical scope of the EPD.
    3. Calculated as a fixed long transport, such as 1000 km transport by lorry.

[3] The composition of the residual grid mixes on the market are available for all EU countries and a few additional European countries through the Association for Issuing Bodies (AIB) at https://www.aib-net.org/facts/european-residual-mix.

[4] For electricity markets without trade of Guarantees of Origin (or similar), the residual mix will, however, be identical to the consumption mix.

[5] If the composition of the residual grid mix has not been publicly disclosed, the second or third options in the above hierarchy are not feasible and thus the fourth option is the only remaining option (if the first option is not chosen).

[6] The composition of the residual grid mixes on the market are available for all EU countries and a few additional European countries through the Association for Issuing Bodies (AIB) at https://www.aib-net.org/facts/european-residual-mix.

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4.7.6 OTHER MODELLING GUIDANCE PER VESSEL LIFE-CYCLE STAGE

Below are further data quality requirement per life-cycle stage for vessels. Exceptions to the requirements may be accepted, if justified in the EPD; such exceptions are subject to the approval by the verifier on a case-to-case basis.

4.7.6.1. Upstream processes

- Data referring to processes and activities upstream in a supply chain over which the EPD owner direct management control shall be specific and collected on site.
- Data referring to contractors that supply main parts, packaging, or main auxiliaries should be requested from the contractor as specific data, as well as infrastructure, where relevant.
- Data on transport of main parts and components along the supply chain to a distribution point (e.g. a stockroom or warehouse) where the final delivery to the manufacturer can take place, should be specific and based on the actual transportation mode, distance from the supplier, and vehicle load.
- In case specific data is lacking, selected generic data may be used. If this is also lacking, proxy data may be used (see section 4.7.1).

For upstream processes modelled with specific data, generation of electricity used shall be accounted for in this priority:

1. Specific electricity mix as generated, or purchased from an electricity supplier, demonstrated by a Guarantee of Origin or similar as provided by the electricity supplier.
2. Residual electricity mix of the electricity supplier on the market.
3. Residual electricity mix on the market .
4. Electricity consumption mix on the market[7].

The residual electricity mix is the mix when all contract-specific electricity that has been sold to other customers has been subtracted from the total consumption mix.

“The market” in the above hierarchy shall be defined as being the (residual or consumption) grid mix of the country where the electricity is used, with exceptions for specified countries for which a sub-national electricity grid mix shall be used: Australia, Brazil, Canada, China, India, and USA. “The market” in the above hierarchy may correspond a national electricity market, if this can be justified.

The mix of electricity used in upstream processes shall be documented in the EPD, where relevant.

4.7.6.2. Core processes

- Transport from the final delivery point of raw materials, chemicals, main parts, and components (see above regarding upstream processes) to the manufacturing plant/place of service provision should be based on the actual transportation mode, distance from the supplier, and vehicle load, if available.
- Goods:
  - For Project EPD: Generic data may be used for the assembly of the product and for the manufacture of main parts as well as for on-site generation of steam, heat, electricity, etc., where relevant.
  - For Product EPD: Specific data shall be used for the assembly of the product and for the manufacture of main parts as well as for on-site generation of steam, heat, electricity, etc., where relevant.
  - For Use phase EPD: Specific data shall be used, if available, for the assembly of the product and for the manufacture of main parts as well as for on-site generation of steam, heat, electricity, etc., where relevant.
- Services:
  - For Project EPD: Generic data may be used for the consumption of materials, chemicals, steam, heat, electricity, etc., necessary for execution of the service;
  - For Product EPD: Specific data shall be used for the consumption of materials, chemicals, steam, heat, electricity, etc., necessary for execution of the service;

[7] The composition of the residual grid mixes on the market are available for all EU countries and a few additional European countries through the Association for Issuing Bodies (AIB) at https://www.aib-net.org/facts/european-residual-mix.

- For Use phase EPD: Specific data shall be used, if available, for the consumption of materials, chemicals, steam, heat, electricity, etc., necessary for execution of the service;

- For electricity used in the core processes, generation of electricity used shall be accounted for in this priority:

    1. Specific electricity mix as generated, or purchased from an electricity supplier, demonstrated by a Guarantee of Origin or similar as provided by the electricity supplier.
    2. Residual electricity mix of the electricity supplier on the market.
    3. Residual electricity mix on the market[8].
    4. Electricity consumption mix on the market[9]. This option shall not be used for electricity used in processes over which the manufacturer (EPD owner) has direct control, as long as the composition of the residual grid mix has been publicly disclosed[10].

The residual electricity mix is the mix when all contract-specific electricity that has been sold to other customers has been subtracted from the total consumption mix.

“The market” in the above hierarchy shall be defined as being the (residual or consumption) grid mix of the country where the electricity is used, with exceptions for specified countries for which a sub-national electricity grid mix shall be used: Australia, Brazil, Canada, China, India, and USA. “The market” in the above hierarchy may correspond a national electricity market, if this can be justified.

The mix of electricity used in the core processes shall be documented in the EPD, where relevant.

- Waste treatment processes of manufacturing waste should be based on specific data, if available.

4.7.6.3. Operational stage

The following processes shall be included:

- Transport from shipyard to customer:

  The transport of the product to the customer shall be described in the EPD, where relevant, and be accounted for in this priority:

    1. Actual transportation modes and distances to specific a customer or market, representing the geographical scope of the EPD.
    2. A weighted average of transportation modes and distances, based on transportation to several customers or markets, representing the geographical scope of the EPD.
    3. Calculated as a fixed long transport, such as 1000 km transport by lorry.

  The final transport phase should include delivery handling, such as:

  - vessel shifting,
  - barge usage,
  - dry dock operations, and
  - launch operations.

- Fuel production for the activities of the vessel.

- For Use phase EPD specific data shall be used to consider emissions related to the average fuel consumption and average annual electricity consumption. However, to ensure comparability, an operational profile shall be selected, from those listed Table 4, that best represents the actual activity of the vessel.

[8] The composition of the residual grid mixes on the market are available for all EU countries and a few additional European countries through the Association for Issuing Bodies (AIB) at https://www.aib-net.org/facts/european-residual-mix.

[9] For electricity markets without trade of Guarantees of Origin (or similar), the residual mix will, however, be identical to the consumption mix.

[10] If the composition of the residual grid mix has not been publicly disclosed, the second or third options in the above hierarchy are not feasible and thus the fourth option is the only remaining option (if the first option is not chosen).

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- For Product and Use phase EPDs overall emissions related to annual operating activities of the vessel shall be calculated as the sum of two main contributions:
  - emissions related to average annual fuel consumption ($FC_{y,ave}$ $[kg/yr]$) as calculated using Eq.(1), and
  - emissions related to average annual electricity consumption ($EC_{y,ave}$ $[kWh/yr]$), as calculated using Eq.(12).

The annual average fuel consumption does not apply to engines different than internal combustion engines, e.g., electric motors.

The annual average fuel consumption ($FC_{y,ave}$ $[kg/yr]$) for the product system shall be calculated dividing the total fuel consumption (FC_{tot} $[kg]$) by the vessel reference service life (RSL) of 30 years, following Eq. (1):

$$FC_{y,ave} = \frac{FC_{tot}}{30} \quad (1)$$

If more than one vessel is required to guarantee the reference service life of 30 years, the total fuel consumption (FC_{tot} $[kg]$) shall be obtained as the sum of the vessel total fuel consumption ($FC_{v,tot}$ $[kg]$) using Eq. (2)

$$FC_{tot} = \sum_{v=1}^{t} FC_{v,tot} \quad (2)$$

where:

$FC_{v,tot}$ $[kg]$: total fuel consumption for vessel *v*

t: vessels required to guarantee the reference service lifetime of 30 years

The vessel overall fuel consumption ($FC_{v,tot}$ $[kg/lifetime]$) for the entire lifetime of the vessel *v* shall be calculated as the sum of the annual vessel fuel consumption specific for each year (FC_y $[kg/yr]$), following Eq. (3). The equation embeds a correction factor for taking into consideration the increment of fuel consumption due to performance depletion of the vessel during its lifetime.

$$FC_{v,tot} = \sum_{y=0}^{p} FC_y = \sum_{y=0}^{p} FC_{opt} * 1.005^y \quad (3)$$

where:

FC_y $[kg/yr]$: annual fuel consumption for year *y*

FC_{opt} $[kg/yr]$: annual fuel consumption calculated at the beginning of the lifecycle

p: the total lifetime of the vessel

Since the operational stage is strongly user-dependent, a set of relevant scenarios is provided for the sake of harmonization. The operational stage shall be based on one of the available annual scenarios, selecting the operational profile that best represents the expected usage from Table 4.

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Table 4 Operating profiles

Activity	Fast Cruise	Slow Transit	Sailing	Manoeuvring	At Anchor	At Port	Dry Dock, At Port (w/o cons)	Total
Classification [i]	1	2	3	4	5	6	7	
Load	0.85	0.35	0.10*	0.10	0.10*	0.10**	0	
	[hours]	[hours]	[hours]	[hours]	[hours]	[hours]	[hours]	[hours]
Day boating	40.0	80	0	35	500	150	7955	8760
Warm Season Leisure (Habitable boats < 500 GT)	40.0	80	0	35	1500	2200.	4905	8760
Annual Leisure (Habitable boats >500 GT)	80	660	0	130	3000	4400	490	8760
Warm Season Excursions	600	360	0	400	800	2200	4400	8760
Annual Transfer	3000	960	0	400	0	900	3500	8760
Annual Professional	2400	860	0	400	200	900	4000	8760
Habitable optional sailing	120	0	360	70	1500	2200	4510	8760
Recreational and Sporting Optional Sailing	120	0	360	70	1500	500	6210	8760
Recreational and Sporting Integral Sailing	0	0	260	0	0	0	8500	8760
Sporting motor vessels	200	60	0	0	0	0	8500	8760

*This load shall be used only if the vessel is not equipped with auxiliary generators and/or other source of power.
**This load shall be used only if the vessel is not equipped with a connection to shore power, nor with auxiliary generators and/or other source of power.

Each provided scenario refers to a peculiar combination of operational activities, which are briefly described underneath. The descriptions are intended to provide guidance for a correct selection among the available scenarios. The selection of the scenario that best represents the expected operational activities shall be based on customer experiences, surveys, market analysis, documented practices, or expert judgements.

Day boating: The vessel usage occurs predominantly during warm seasons for recreational activities. The vessel cannot move without the propulsion provided by the engine. This operational profile should be used by vessels without any kind of accommodation arrangement.

Warm Season Leisure (Habitable boats < 500 GT): The vessel usage occurs predominantly during warm seasons for recreational activities. The vessel cannot move without the propulsion provided by the engine. This operational profile should be used by pleasure vessels with accommodation arrangement and GT < 500.

Annual Leisure (Habitable boats > 500 GT): The vessel is used for leisure purposes all year long. The vessel cannot move without the propulsion provided by the engine. This profile shall be used by large yachts.

Warm Season Excursions: The vessel usage occurs predominantly during warm seasons for recreational activities of passengers. The vessel cannot move without the propulsion provided by the engine. This operational profile should be used by vessels designed for organized excursions to specific locations for tourists.

Annual Transfer: The vessel usage occurs all year long for the transfer of passengers. The vessel cannot move without the propulsion provided by the engine. This operational profile should be used by vessels used as passenger ferries.

Annual Professional: The vessel usage occurs all year long for professional purposes and services to other vessels. The vessel cannot move without the propulsion provided by the engine. This operational profile should be used by: Research vessels, Fishing vessels, Tugs and pusher craft, Supply vessels.

Recreational and Sporting Optional Sailing: The vessel usage occurs predominantly during warm seasons for recreational activities. The vessel is equipped with sail and can move without the propulsion provided by the engine (e.g., sailboats). The engine is mainly used for manoeuvring and transfer in the absence of wind.

Recreational and Sporting Integral Sailing: The vessel usage occurs predominantly during warm seasons for recreational and sporting activities. If engines are installed, their maximum total power shall not exceed 12 kW. This operational profile should be used by sailing vessels without any kind of accommodation arrangement and by human-powered boats

Sporting motor vessels: The vessel usage occurs predominantly during warm seasons for sporting activities. This operational profile should be used by personal watercraft, waterjet propulsion equipment, and motorboats used for races.

A description of each operational activity is provided underneath:

Activity 1 – Fast Cruise*:* main propulsion system running at 85% MCR (maximum continuous rating) and the vessel is electrically powered by generators and/or other source of power (e.g., storage batteries), if present.

Activity 2 – Slow Transit*:* main propulsion system running at 35% MCR and the vessel is electrically powered by generator and/or other sources of power (e.g., storage batteries), if present.

Activity 3 – Sailing: the vessel is electrically powered by generators and/or other sources of power (e.g., storage batteries) if present. If the vessel is not equipped with auxiliary generators, the fuel consumption of the main engine shall be calculated, considering the system running at 10% MCR.

Activity 4 – Manoeuvring: main propulsion system running at 10% MCR, all thrusters running. The vessel is electrically powered by generators and/or other source of power (e.g., storage batteries), if present.

Activity 5 – At Anchor*:* the vessel is electrically powered by main engines or generators and/or other source of power (e.g., storage batteries), if present. If the vessel is not equipped with auxiliary generators and/or other source of power, the fuel consumption of the main engine shall be calculated, considering the system running at 10% MCR.

Activity 6 – At Port: the vessel is docked in port and electrically powered by the energy coming from shore, from the main engines or from the generators and/or other source of power (e.g. storage batteries), if present. If the vessel is equipped with a connection to shore power, the electricity consumed from the grid shall be calculated considering the electrical power required by the vessel systems, according to the specific electricity mix, national residual mix or national production mix, using this order of priority. If the vessel is not equipped with a connection to shore power and generators and/or other source of onboard power are present, the fuel consumption and/or the energy consumption shall be calculated considering the electrical power required by the vessel systems. If the vessel is not equipped with a connection to shore power nor with auxiliary generators and/or other source of power, the fuel consumption of the main engine shall be calculated, considering the system running at 10% MCR.

Activity 7 – Dry Dock, At Port (w/o cons): Main engines and generators system are switched off. The vessel is towed to a dry dock for maintenance or docked at a port without any energy consumption.

The annual fuel consumption (FC_y $[kg/yr]$) shall be calculated as the sum of the annual fuel consumption specific for each activity, following Eq. (4):

$$FC_y = \sum_{i=1}^{7} FC_i \quad (4)$$

where:

FC_i: annual activity fuel consumption for the activity *i*

i: classification of each activity following Table 4

The annual activity fuel consumption for activity *i* (FC_i $[kg/yr]$) shall be calculated as the product of the specific activity fuel consumption (SFC_i $[kg/h]$) and the hours of activity i defined for the selected scenario (H_i $[h/yr]$) as reported in Table 4, following Eq. (5)

$$FC_i = SFC_i * H_i \quad (5)$$

The sources of information used for the calculation of the specific activity fuel consumption (SFC_i $[kg/h]$) for each activity i shall be accounted for in the following priority:

- fuel consumption primary data, if available. The methodology published by IMO on the Fourth IMO GHG Study 2020[11].
- Retrieved on the manufacturer's documentation.

The specific activity fuel consumption (SFC_i $[kg/h]$) is calculated as the sum of the engines specific fuel consumption considering both the propulsion engines (SFC_E $[kg/h]$) and the auxiliary engines/boilers ($SFC_{A|B}$ $[kg/h]$), following Eq.(6).

$$SFC_i = SFC_E + SFC_{A|B} = \sum_{j=1}^{m} SFC_{E,j} + \sum_{k=1}^{l} SFC_{A|B,k} \quad (6)$$

where:

SFC_E $[kg/h]$ is the specific fuel consumption of propulsion engines

$SFC_{A|B}$ $[kg/h]$ is the specific fuel consumption of auxiliary engines and internal combustion boilers

$SFC_{E,j}$ $[kg/h]$ is the specific fuel consumption of propulsion engine *j* at different loads

m is the number of internal combustion engines for propulsion

$SFC_{A|B,k}$ $[kg/h]$ is the specific fuel consumption of auxiliary engine or internal combustion boiler *k*

l is the number of internal combustion engines installed for auxiliary services and internal combustion boilers

To calculate the specific engine j fuel consumption for propulsion ($SFC_{E,j}$ $[kg/h]$), the following priority shall be used:

1. Specific fuel consumption certified by a third-party certification body,
2. Specific fuel consumption self-declared by manufacturer,
3. Specific fuel consumption as calculated by Fourth IMO GHG Study 2020[11], as reported below.

The engine specific fuel consumption ($SFC_{E,j}$ $[kg/h]$) is assumed to vary as a function of its load following Eq.(7):

$$SFC_{E,j} = SFC_{E,j,base} * (0.455 * Load_i^2 - 0.71 * Load_i + 1.280) * Power_j \quad (7)$$

where:

$Load_i$ [unitless] varies from 0 to 1 and indicates the engine load with respect to MCR (from 0 to 100% MCR). The $Load_i$ coefficient to be applied for each activity *i* is reported in Table 4.

$Power_j$ [kW] is the power of internal combustion engine *j* installed for propulsion of the vessel.

The baseline fuel consumption ($SFC_{E,j,base}$ $[kg/kWh]$) related to the internal combustion engine *j* shall be identified. The baseline fuel consumption is the propulsion engine, auxiliary engine and auxiliary boiler lowest specific fuel consumption identified in their loading curve, in other words, the most fuel-efficient point. The selection of the correct baseline fuel consumption ($SFC_{E,j,base}$ $[kg/kWh]$) shall follow this priority:

1. Retrieved on the engine manufacturer's documentation,
2. Self-declared baseline specific fuel consumption,
3. Selected from Table 5, which comprehends a wide range of combinations between engines and fuel types, based on IMO information[12].

[11] IMO, 2021. Fourth IMO GHG Study 2020: Safe, secure and efficient shipping on clean ocean, London: International Maritime Organization (IMO).

[12] IMO, 2021. Fourth IMO GHG Study 2020: Safe, secure and efficient shipping on clean ocean, London: International Maritime Organization (IMO).

Table 5 Baseline specific fuel consumption for typical marine engines

Internal Combustion Engine Type	Fuel Type	$SFC_{E,j,base}$ $[kg/kWh]$
Slow-Speed Diesel (SSD)	HFO	0.175
	MDO	0.165
	MeOH	0.350
Medium-Speed Diesel (MSD)	HFO	0.185
	MDO	0.175
	MeOH	0.370
High-Speed Diesel (HSD)	HFO	0.195
	MDO	0.185
LNG-Otto SS (dual-fuel, slow-speed)	LNG + MDO	0.148 LNG + 0.0008 MDO (pilot)
LNG-Otto MS (dual-fuel, medium-speed)	LNG	0.156
LNG-Diesel (dual-fuel)	LNG + MDO	0.135 LNG + 0.006 MDO (pilot)
Lean Burk Spark-Ignited (LBSI)	LNG	0.156
Gas Turbines	HFO	0.305
	MDO	0.300
	LNG	0.203

The description of each internal combustion engine is provided underneath:

Slow-Speed Diesel (SSD): All main engines where the main propulsion type description contains “Oil” are assumed to be two-stroke engines with an engine speed lower than or equal to 300 RPM.

Medium-Speed Diesel (MSD): All engines where the main propulsion type contains “Oil” with an engine speed ranging from 300 to 900 RPM.

High-Speed Diesel (HSD): All engines for which the main propulsion type contains “Oil” with an engine speed above 900 RPM

LNG-Otto SS: Two-stroke, slow-speed, dual-fuel engines that operate similar to the Otto cycle.

LNG-Otto MS: Four-stroke, medium-speed, dual-fuel engines that operate on the Otto cycle. These engines were identified as any four-stroke LNG engine with an engine speed above 300 RPM, except those engines identified as LBSI (see below). Also, this category includes LNG engines not otherwise classified under any other LNG category.

LNG-Diesel: Two-stroke, slow-speed, dual-fuel engines that operate on the Diesel cycle.

Lean Burk Spark-Ignited (LBSI): Four-stroke, medium-speed, mono-fuel engines that are low-pressure-injection and ignite the gas/air mixture in the cylinder using a spark.

Gas turbine: Vessels whose propulsion type is specified as “Gas Turbine”, or vessels previously classified as Oil Engines (SSD or MSD) but with the fuel type classified as “Gas”.

Steam Turbine and boiler: Vessels whose propulsion type classification contains “Steam Turbine”. This includes ships fueled by oil-based fuels and those powered by LNG or boil-off gas.

As reported by IMO[13], auxiliary engines and boilers are not dependent on their load. Hence, the specific fuel consumption of auxiliary engine or internal combustion boiler k ($SFC_{A|B,k}$ $[kg/h]$) is governed solely on the power demand ($Power_k$ $[kW]$) and its baseline fuel consumption ($SFC_{A|B,k,base}[kg/h]$) as shown in Eq.(8):

$$SFC_{A|B,k} = SFC_{A|B,k,base} * Power_k \quad (8)$$

The selection of the correct baseline fuel consumption ($SFC_{A|E,k,base}$ $[kg/h]$) should follow this priority:

1. Retrieved on the engine manufacturer’s documentation,

[13] IMO, 2021. Fourth IMO GHG Study 2020: Safe, secure and efficient shipping on clean ocean, London: International Maritime Organization (IMO).

2. Self-declared baseline specific fuel consumption,
3. Selected from Table 6, which comprehends a wide range of combinations between engines and fuel types, based on IMO information[14].

Table 6 Baseline specific fuel consumption for typical auxiliary engines and/or boilers

Internal Combustion Engine Type	Fuel Type	$SFC_{A\|E,base} - [kg/kWh]$
Boilers	HFO	0.340
	MDO	0.320
	LNG	0.285
Auxiliary engines	HFO	0.195
	MDO	0.185
	LNG	0.156

Data on the pollutant emissions from the operational stage shall be based on fuel specific emission factors, which have been published on the Fourth IMO GHG Study 2020, Appendix M[15].

The annual emissions from the operational phase shall be accounted for in the following priority:

1. Calculated using the methodology described in MEPC 75/7/15 - Reduction of GHG emissions from ships. Fourth IMO GHG Study 2020, Appendix N[16],
2. Calculated based on available database information that satisfies the minimum requirements for data quality reported in Section 4.7.1,
3. Calculated based on documented experimental data, e.g., manufacturer declarations.

If engines different from internal combustion engines contribute to propulsion and/or auxiliary services supply, the emissions related to the generation of the energy carrier (e.g., electricity stored in batteries, hydrogen, etc.) shall be included in the operational stage total emissions.

The annual average electricity consumption ($EC_{y,ave}$ $[kWh/yr]$) for the product system shall be calculated dividing the total electricity consumption (EC_{tot} $[kWh]$) by the product system reference service life of 30 years, following Eq. (9).

$$EC_{y,ave} = \frac{EC_{tot}}{30} \quad (9)$$

If more than one vessel is required to guarantee the reference service life of 30 years, the total fuel consumption (EC_{tot} $[kg]$) shall be obtained as the sum of the vessel total electricity consumption ($EC_{v,tot}$ $[kg]$) using Eq. (10)

$$EC_{tot} = \sum_{v=1}^{t} EC_{v,tot} \quad (10)$$

where:

$EC_{v,tot}$ $[kWh]$: total electricity consumption for vessel *v*

t: vessels required to guarantee the reference service lifetime of 30 years

The vessel overall electricity consumption ($EC_{v,tot}$ $[kWh/lifetime]$) for the entire lifetime of the vessel *v* shall be calculated as the sum of the annual vessel electricity consumption specific for each year (EC_y $[kWh/yr]$), following Eq. (11). The equation embeds a correction factor for taking into consideration the increment of energy consumption due to performance depletion of the vessel during its life span.

$$EC_{v,tot} = \sum_{y=1}^{p} EC_y * 1.005^y \quad (11)$$

[14] IMO, 2021. Fourth IMO GHG Study 2020: Safe, secure and efficient shipping on clean ocean, London: International Maritime Organization (IMO).

[15] IMO, 2021. Fourth IMO GHG Study 2020: Safe, secure and efficient shipping on clean ocean, London: International Maritime Organization (IMO).

[16] IMO, 2021. Fourth IMO GHG Study 2020: Safe, secure and efficient shipping on clean ocean, London: International Maritime Organization (IMO).

where:

EC_i: annual activity electricity consumption for the activity *i*

i: classification of each activity following Table 4

The operational stage shall be based on one of the available annual scenarios, selecting the operational profile that best represents the expected usage from Table 4. The same operational profile shall be used for fuel and electricity consumptions.

The annual electricity consumption (EC_y $[kWh/yr]$) shall be calculated as the sum of the annual electricity consumption specific for each activity of Table 4, following Eq. (12):

$$EC_y = \sum_{i=1}^{7} EC_i \quad (12)$$

where:

EC_i: annual activity electricity consumption for the activity *i*

i: classification of each activity following Table 4

The annual activity electricity consumption for activity *i* (EC_i $[kWh/yr]$) shall be calculated as the electrical engine *k* installed power ($Power_k$ $[kW]$) times the load ($Load_i$ [unitless]) and the hours (H_i $[h/yr]$) of activity *i* defined for the selected scenario as reported in Table 4, following Eq. (13)

$$EC_i = Power_k * Load_i * H_i + EC_g \quad (13)$$

EC_g $[kWh/yr]$ is the electricity consumption of the onboard generators for providing the electrical power required by the vessel systems and shall be calculated following Eq. (14):

$$EC_g = \sum_{i=1}^{6} H_i * SEC_g \quad (14)$$

Where $SEC_g[kW]$ is the power required by the vessel systems.

4.7.6.4. Maintenance processes

It includes the activities and materials related to the ordinary and scheduled maintenance for the entire vessel reference service life of 30 years.

Maintenance involves activities such as painting the vessel and replacing components, or sets of components, with a total weight that does not exceed 80% of the weight of the corresponding component group as defined in Table 1. If the weight is greater than 80% the activity is defined as refitting, as described in Section 4.6.3.

The extraction and production of replacements/spare parts for maintenance shall be included, as well as the energy required for the replacement procedure.

For Use phase EPD the frequency of ordinary and scheduled maintenance activities shall be based on specific data as an average of maintenance activities in previous years.

For Project and Product EPD the frequency of ordinary and scheduled maintenance activities shall be accounted in the following priority:

1. Requirement by the regulation that addresses the specific type of vessel (e.g. classification society, standards);
2. Requirement by the equipment suppliers;
3. Based on available datasets from other vessel, with same main operating profile and similar overall length, that satisfies the minimum requirements for data quality reported in section 4.7.1.

Besides the frequency, the average of the potential maintenance activities done during these fixed appointments shall be defined. For example, the averaged maintenance activities are: cleaning the hull, painting the vessel, replacing sacrificial anodes, change of oil and filters of machinery and equipment.

Extraordinary maintenance refers to activities that involve making changes or improvements to the vessel that are not performed annually. All input and output flows associated with this activity should be allocated based on the number of years, calculated as the difference between the vessel's reference service life of 30 years and its age during the study's reference period.

4.7.6.5. End-of-life processes

This module shall include the activities and materials related to the treatment processes of the installed components and the hull, deck and structures materials.

Scenarios for the end-of-life state shall be technically and economically practicable and compliant with current regulations in the relevant geographical region based on the geographical scope of the EPD. Key assumptions regarding the end-of-life state scenario shall be documented in the LCA report.

The following guidelines have been developed and adopted to assist States in the early implementation of the IMO Convention's technical standards:

2011 Guidelines for the Development of the Inventory of Hazardous Materials, adopted by resolution MEPC.197(62)

2011 Guidelines for the Development of the Ship Recycling Plan, adopted by resolution MEPC.196(62)

2012 Guidelines for Safe and Environmentally Sound Ship Recycling, adopted by resolution MEPC.210(63)

2012 Guidelines for the Authorization of Ship Recycling Facilities, adopted by resolution MEPC.211(63)

2012 Guidelines for the survey and certification of ships under the Hong Kong Convention, adopted by resolution MEPC.222(64)

2012 Guidelines for the inspection of ships under the Hong Kong Convention, adopted by resolution MEPC.223(64).

4.7.7 DATA QUALITY DECLARATION

EPDs may include a declaration of the quality of data used in the LCA calculations.

4.8 ENVIRONMENTAL PERFORMANCE INDICATORS

The EPD shall declare the default environmental performance indicators and their methods as described at the website (www.environdec.com/indicators), which includes both inventory indicators and indicators of potential environmental impact. The source and version of the impact assessment methods and characterisations factors used shall be reported in the EPD. Alternative regional impact assessment methods and characterisation factors may be calculated and displayed in addition to the default list. If so, the EPD shall contain an explanation of the difference between the different sets of indicators, as they may appear to the reader to display duplicate information.

If the default list of environmental performance indicators and methods at the website is updated, the previous version of the list is valid in parallel to the new version during a transition period of 90 days, as described at the website.

Apart from the required inventory indicators, other inventory data may also be declared in the EPD, if relevant and useful for EPD users. Such data shall not be declared in the main body of the EPD, but in an annex.

The following indicator of potential environmental impact shall also be declared:

Particulate matter (PM) adopted from EF 3.0 Method, with model from Fantke et al. (2016) in UNEP (2016), and Disease incidences as indicator.

4.9 INCLUDING MULTIPLE PRODUCTS IN THE SAME EPD

4.9.1 MULTIPLE PRODUCTS FROM THE SAME COMPANY

Several sets of results, reflecting different products, are not allowed to be declared in the same EPD. However, similar products from a single or several manufacturing sites covered by the same PCR and manufactured by the same company with the same major steps in the core processes may be grouped and thereby included in the same EPD. For such an EPD, there are three options:

- For each indicator, declare the average results of the included products. This average shall be weighted according to the production volumes of the included products, if relevant. In this option, the average content shall be declared in the content declaration.
- Declare the results of one of the included products – a representative product. The choice of the representative product shall be justified in the EPD, using, where applicable, statistical parameters. For example, the choice may be based on production volumes. In this option, the content of the representative product shall be declared in the content declaration.
- For each indicator, declare the highest result of the included products (i.e., the results of a "worst-case product", which may be the results of one or several of the included products). In this option, the content declaration shall include the lowest amounts of recycled and biogenic content of the included products and their packaging, respectively, and the information on environmental

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and hazardous properties of substances shall reflect the highest share and most hazardous such substances contained in any of the included products.

The first two options are only possible if none of the declared environmental impact indicator results differ by more than 10% between any of the included products. The third option is possible also if variations are larger than 10%.

The option chosen shall be clearly described in the EPD.

4.9.2 SECTOR EPDS

The International EPD® System allows for an industry association to develop an EPD in the form of a Sector EPD. A Sector EPD declares the average product of multiple companies in a clearly defined sector in a clearly defined geographical area. Products covered in a sector EPD shall follow the same PCR and the same declared/functional unit shall be applied.

Any communication of the results from a Sector EPD should contain the information that the results are based on averages obtained from the sector as defined in the EPD. The communication shall not claim that the sector EPD results are representative for a certain manufacturer or its product.

The following information shall also be included a Sector EPD:

- a list of the contributing manufacturers that the Sector EPD covers,
- a description of how the selection of the sites/products has been done and how the average has been determined, and
- a statement that the document covers average values for an entire or partial product category (specifying the percentage of representativeness) and, hence, the declared product is an average that is not available for purchase on the market.

5 CONTENT AND FORMAT OF EPD

EPDs based on this PCR shall contain the information described in this section. Flexibility is allowed in the formatting and layout provided that the EPD still includes the prescribed information. A generic template for EPDs is available at www.environdec.com.

The EPD content shall:

- be in line with the requirements and guidelines in ISO 14020 (Environmental labels and declarations – General principles),
- be verifiable, accurate, relevant and not misleading, and
- not include rating, judgements or direct comparison with other products[17].

An EPD should be made with a reasonable number of pages for the intended audience and use.

The content of EPDs published in machine-readable format shall correspond with the content of the underlying EPD.

5.1 EPD LANGUAGES

EPDs should be published in English but may also be published in additional languages. If the EPD is not available in English, it shall contain an executive summary in English including the main content of the EPD. This summary is part of the EPD and, thus, also subject to the verification process.

5.2 UNITS AND QUANTITIES

The following requirements apply for units and quantities:

- The International System of Units (SI units) shall be used where available, e.g., kilograms (kg), Joules (J) and metres (m). Reasonable multiples of SI units may be decided in the PCR to improve readability, e.g., grams (g) or megajoules (MJ). The following exceptions apply:
  - Resources used for energy input (primary energy) should be expressed as kilowatt-hours (kWh) or megajoules (MJ), including renewable energy sources, e.g., hydropower, wind power and geothermal power.
  - Water use should be expressed in cubic metres (m^3)
  - Temperature should be expressed in degrees Celsius (°C),
  - Time should be expressed in the units most practical, e.g., seconds, minutes, hours, days or years.
  - Results of the environmental performance indicators shall be expressed in the units prescribed by the impact assessment methods, e.g. kg CO_2 equivalents.
- Three significant figures[18] should be adopted for all results. The number of significant digits shall be appropriate and consistent.
- Scientific notation may be used, e.g. 1.2E+2 for 120, or 1.2E-2 for 0.012.
- The thousand separator and decimal mark in the EPD shall follow one of the following styles (a number with six significant figures shown for illustration):
  - SI style (French version): 1 234,56
  - SI style (English version): 1 234.56

  In case of potential confusion or intended use of the EPD in markets where different symbols are used, the EPD shall state what symbols are used for thousand separator and decimal mark.
- Dates and times presented in the EPD should follow the format in ISO 8601. For years, the prescribed format is YYYY-MM-DD, e.g., 2017-03-26 for March 26th, 2017.
- The result tables shall:

[17] Therefore, results of normalization are not allowed to be reported in the EPD.

[18] Significant figures are those digits that carry meaning contributing to its precision. For example with two significant digits, the result of 123.45 shall be displayed as 120, and 0.12345 shall be displayed as 0.12. In scientific notation, these two examples would be displayed as $1.2*10^2$ and $1.2*10^{-2}$.

- Only contain values or the letters “ND” (Not Declared). It is not possible to specify ND for mandatory indicators. ND shall only be used for voluntary parameters that are not quantified because no data is available.[19]
- Contain no blank cells, hyphens, less than or greater than signs or letters (except “ND”).
- Use the value “0” only for parameters that have been calculated to be zero.
- Footnotes shall be used to explain any limitation to the result value.

5.3 USE OF IMAGES IN EPD

Images used in the EPD, especially pictures featured on the cover page, may in themselves be interpreted as an environmental claim. Images such as trees, mountains, wildlife that are not related to the declared product shall therefore be used with caution and in compliance with national legislation and best available practices in the markets in which the EPD is intended to be used.

5.4 EPD REPORTING FORMAT

The reporting format of the EPD shall include the following sections:

- Cover page (see Section 5.4.1)
- Programme information (see Section 5.4.2)
- Product information (see Section 5.4.3)
- Vessels specification (see Section 5.4.4), not applicable for components EPD
- Content declaration (see Section 5.4.5)
- Environmental performance (see Section 5.4.6)
- Additional environmental information (see Section 5.4.7)
- Additional social and economic information (see Section 5.4.8)
- References (see Section 5.4.10)

The following sections shall be included, if relevant:

- Differences versus previous versions (see Section 5.4.9)
- Executive summary in English (see Section 5.4.11)

5.4.1 COVER PAGE

The cover page shall include:

- Product name and image
- Name and logotype of EPD owner
- The text “Environmental Product Declaration” and/or “EPD”
- Programme: The International EPD® System, www.environdec.com
- Programme operator: EPD International AB
- Logotype of the International EPD® System
- EPD registration number as issued by the programme operator[20]
- Date of publication (issue): 20XX-YY-ZZ
- Date of revision: 20XX-YY-ZZ, when applicable
- Date of validity; 20XX-YY-ZZ

[19] This requirement does not intend to give guidance on what indicators are mandated (“shall”) or voluntary.

[20] The EPD shall not include a “registration number” if such is provided by the certification body, as this may be confused with the registration number issued by the programme operator.

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- A note that *"An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com."*
- A statement of conformity with ISO 14025.
- For EPDs covering multiple products: a statement that the EPD covers multiple products and a list of all products covered by the EPD.
- Type of EPD: Project EPD, Product EPD, or use-stage EPD as defined in section 4.7.3.
- For Sector EPDs: a statement that the EPD is a Sector EPD.

In the case of EPDs registered through a regional hub (a regional or national programme based on and fully aligned with the International EPD® System through an agreement with the programme operator), "Programme", "Programme operator", and "Logotype" shall be expanded to include a reference to the regional programme and the organisation responsible for it.

Where applicable, the cover page shall also include the following information:

- Information about dual registration of EPD in another program, such as registration number and logotype.
- A statement of conformity with other standards and methodological guides.

5.4.2 PROGRAMME INFORMATION

The programme information section of the EPD shall include:

- Address of programme operator: *EPD International AB, Box 210 60, SE-100 31 Stockholm, Sweden, E-mail: info@environdec.com*
- The following statement on the requirements for comparability of EPDs, adapted from ISO 14025: *"EPDs within the same product category but from different programmes may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison."*
- A statement that the EPD owner has the sole ownership, liability and responsibility of the EPD
- Information about verification[21] and the PCR in a table with the following format and contents:`

Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
PCR: *<name, registration number, version and UN CPC code(s)>*
PCR review was conducted by: *<name and organisation of the review chair, and information on how to contact the chair through the programme operator>*
Life cycle assessment (LCA)
LCA accountability: *<name, organization>*
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☐ EPD verification by individual verifier Third-party verifier: *<name, organisation, and signature of the third-party verifier>* Approved by: The International EPD® System
OR
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☐ EPD verification by accredited certification body

[21] If the EPD has been verified by an approved individual verifier who has received contractual assistance from a certification body that is not accredited, this certification body shall not be included in this table.

Third-party verification: *<name, organisation>* is an approved certification body accountable for the third-party verification The certification body is accredited by: *<name of accreditation body & accreditation number, where applicable>*
OR
Independent third-party verification of the declaration and data, according to ISO 14025:2006 via: ☐ EPD verification by EPD Process Certification* Internal auditor: *<name, organisation>* Third-party verification: *<name, organisation>* is an approved certification body accountable for third-party verification Third-party verifier is accredited by: *<name of accreditation body & accreditation number, where applicable>* *For EPD Process Certification, an accredited certification body certifies and reviews the management process and verifies EPDs published on a regular basis. For details about third-party verification procedure of the EPDs, see GPI v4, Section 7.5.
Procedure for follow-up of data during EPD validity involves third-party verifier22: ☐ Yes ☐ No

5.4.3 PRODUCT INFORMATION

The product information section of the EPD shall include:

- address and contact information to EPD owner,
- description of the organisation. This may include information on products- or management system-related certifications (e.g. ISO 14024 Type I environmental labels, ISO 9001- and 14001-certificates and EMAS-registrations) and other relevant work the organisation wants to communicate (e.g. SA 8000, supply-chain management and social responsibility),
- name and location of production site,
- product identification by name, and an unambiguous identification of the product by standards, concessions or other means,
- identification of the product according to the UN CPC scheme system. Other relevant codes for product classification may also be included, e.g.
  - Common Procurement Vocabulary (CPV),
  - United Nations Standard Products and Services Code® (UNSPSC),
  - Classification of Products by Activity (NACE/CPA),
  - Australian and New Zealand Standard Industrial Classification (ANZSIC), or
  - Global Trade Item Number (GTIN).
- a description of the product,
- a description of the technical purpose of the product, including its application/intended use,
- a description of the background system, including the main technological aspects,
- for EPDs covering multiple products: a description of the selection of products/sites, a list of contributing manufacturers (if Sector EPD), etc. (see Section 4.9),
- geographical scope of the EPD, i.e., for which geographical location(s) of use and end-of-life the product's performance has been calculated,

[22] Procedure for follow-up the validity of the EPD is at minimum required once a year with the aim of confirming whether the information in the EPD remains valid or if the EPD needs to be updated during its validity period (see Sections 7.3.2 and 7.4.9 of the GPI). The follow-up can be organized entirely by the EPD owner or together with the original verifier via an agreement between the two parties. In both approaches, the EPD owner is responsible for the procedure being carried out. If a change that requires an update (see Section 6.5 of the GPI) is identified, the EPD shall be re-verified by a verifier.

- declared/functional unit ,
- Selected operational profile, not applicable for components EPD,
- reference service life (RSL) and/or technical/actual lifespan,
- The distinctive characteristic of the component that define it as specific component, not applicable for vessels EPD,
- declaration of the year(s) covered by the data used for the LCA calculation and other relevant reference years,
- reference to the main database(s) for generic data and LCA software used, if relevant,
- system diagram of the processes included in the LCA, divided into the life cycle stages,
- Description if the EPD system boundary is “cradle-to-gate” or “cradle-to-grave”, not applicable for vessels EPD,
- information on which life-cycle stages are not considered (if any), with a justification of the omission, and
- references to any relevant websites for more information or explanatory materials.

This section may also include:

- name and contact information of organisation carrying out the underlying LCA study,
- any additional information about the underlying LCA-based information, such as cut-off rules, data quality, allocation methods, and other methodological choices and assumptions,
- a description of the material properties of the product with a declaration of relevant physical or chemical product properties, such as density, etc., and
- if end-of-life treatment is not included, the EPD shall contain a statement that it shall not be used for communicating environmental information to consumers/end users of the product.

5.4.4 VESSELS SPECIFICATION

For EPDs of vessels, the type of vessel shall be declared in the EPD, according to the specification reported in Table 7. This section is applicable only for vessel EPD.

Table 7 Main specifications of vessels that shall be declared in the EPD.

MANDATORY INFORMATION	**EXPLANATION**
Vessel Type	Passenger vessel, fishing vesselpleasure boat, etc.
Length Over All	m *[meters]*
Beam	m *[meters]*
Draft	m *[meters]*
Gross Tonnage	GT *[gross tonnes]*
Displacement (Light Ship)	T *[tonnes]*
Propulsion Power	kW *[kilowatt]*
Total installed power	kW *[kilowatt]*
VOLUNTARY INFORMATION	**EXPLANATION**
Vessel Name	*[name]*
Hull Material	Steel, Aluminum, Fiberglass, Carbon, Wood, etc.
Vessel Delivery	*[date]*
Propulsion System	Conventional, Hybrid, Diesel Electric, etc.
Cruise Speed, Max Speed	kn *[knots]*
N° Passengers	*[numerical]*
N° Crew	*[numerical]*
Classification Society	RINA, LR, ABS, BV, GL, DNV, etc.
Additional Class Notations	*[as per classification society]*
Code/Flag State	LY3 or PYC or other safety code

Vessel Keel Lay	*[date]*

If some mandatory information is not applicable for the vessel under study, the motivation shall be given in the LCA report.

5.4.5 CONTENT DECLARATION

The content declaration section shall declare the weight of one unit of product, as purchased, and contain information about the content of the product in the form of a list of materials and chemical substances including information on their environmental and hazardous properties. The gross weight of each material/substance shall be declared, including a minimum of 95% of the materials/substances in one unit of vessel and a minimum of 99% of the materials/substances in one unit of component

The content declaration does not apply to proprietary materials and substances covered by exclusive legal rights including patent and trademarks. In general, an indication that a product is “free” of a specific hazardous material or substance should be done with caution and only when relevant, following the rules in ISO 14021 on self-declared environmental claims.

Information on the hazardous properties of materials and chemical substances should follow the requirements given in the latest revision of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS),[23] issued by the United Nations or national or regional applications of the GHS. As an example, the following regulations should be used for EPDs intended to be used in the European Union:

- Regulation (EC) No 1907/2006 of the European parliament and of the council of 18 December 2006 concerning the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH); and
- Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling, and packaging of substances and mixtures.

5.4.5.1. Information about recycled materials

When a product is made in whole or in part with recycled materials, the provenience of the materials (pre-consumer or post-consumer) shall be presented in the EPD as part of the content declaration.

To avoid any misunderstanding about which material that may be considered “recycled material”, the guidance given in ISO 14021 shall be considered. In brief, the standard states that:

- only pre-consumer or post-consumer materials (scraps) shall be considered in the accounting of the recycled materials, and
- materials coming from scrap reutilization (such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it) shall not be considered as recycled content.

5.4.5.2. Information about packaging

As packaging is strongly connected with the product, the producer shall provide information about packaging in the EPD, when applicable. Packaging may be classified as:

- Distribution Packaging: packaging designed to contain one or more articles or packages, or bulk materials, for the purposes of transport, handling and/or distribution (ISO 21067-1:2016, Section 2.2.6)
- Consumer Packaging: packaging constituting, with its content, a sales unit for the final user or consumer at the point of retail (ISO 21067-1:2016, Section 2.2.7).

Consumer packaging is generally the outcome of eco-design processes, or other activities, under direct control of the organisation. Many critical categories with strict legal requirements belong to consumer packaging category like food contact packaging and pharmaceutical packaging.

The weight of the packaging per product, and the type and function of the packaging, shall be reported in the EPD for components and, if applicable, for vessel.

A statement of the source of the materials (pre-consumer or post-consumer) shall be presented in the EPD when the packaging is made in whole or in part by recycled materials.

[23] The GHS document is available at www.unece.org.

5.4.6 ENVIRONMENTAL PERFORMANCE

To help the reader of the EPD to interpret the results, if the EPD is on vessels, this section of the EPD shall include the following statement: ”Different EPDs shall only be compared if the vessels are subject to the same technical and design characteristics imposed by applicable standards and laws”

5.4.6.1. Environmental impacts

The EPD shall declare the environmental impact indicators, per declared/functional unit, per life-cycle modules and in aggregated form, using the default impact categories, impact assessments methods and characterisation factors available at www.environdec.com/indicators. The source and version of the impact assessment methods and characterisation factors used shall be reported in the EPD.

The following impact indicator shall be declared in addition to the default impact indicators: Particulate matter (PM) adopted from EF 3.0 Method, with model from Fantke et al. (2016) in UNEP (2016), and Disease incidences as indicator.

Alternative regional life cycle impact assessment methods and characterisation factors may be calculated and displayed in addition to the default list and the additionally mandatory indicator above. If so, the EPD shall contain an explanation of the difference between the different sets of indicators, as they may appear to the reader to display duplicate information.

5.4.6.2. Use of resources

The EPD shall declare the indicators for resource use listed at www.environdec.com/indicators per declared/functional unit, per life-cycle modules and in aggregated form.

5.4.6.3. Waste production and output flows

Waste generated along the whole life cycle production chains shall be treated following the technical specifications described in the GPI. The EPD shall declare the indicators for waste production and output flows as listed at www.environdec.com/indicators per declared/functional unit, per life-cycle modules and in aggregated form.

5.4.7 ADDITIONAL ENVIRONMENTAL INFORMATION

An EPD may declare additional environmentally relevant information, in addition to the LCA results of the section on environmental performance results. The additional environmental information may cover various aspects of specific relevance for the product, for example:

- The release of dangerous substances into indoor air, soil, and water during the use stage;
- Instructions for proper use and maintenance of the vessel / component, e.g. to minimise energy or water consumption or to improve the durability of the vessel / component;
- Information on key parts of the vessel / component that determine its durability;
- Information on recycling including, e.g. suitable procedures for recycling the entire vessel / component or selected parts and the potential environmental benefits gained;
- Information on a suitable method of reuse of the vessel / component (or parts) and procedures for disposal as waste at the end of its life cycle;
- Information regarding disposal of the vessel / component, or inherent materials, and any other information considered necessary to minimise the product’s end-of-life impacts;
- More detailed description of an organisation’s overall environmental work, in addition to the information listed under section 5.4.3, such as:
  - the existence of any type of organised environmental activity, and
  - information on where interested parties may find more details about the organisation’s environmental work.
- Water Footprint according to ISO 14046 Environmental management -- Water footprint -- Principles, requirements and guidelines;
- Application of the eco-design practice for the studied vessel/component, also assessed in terms of the avoided environmental impact, evaluated by means of LCA calculation applying the rules foreseen by this PCR in coherence with the LCA study on which the EPD under development is based. The impact categories used for this analysis shall be declared in the EPD (e.g., durability, materials, ...);

- Information about special system and/or feature that are aimed to reduce any kind of environmental impact (i.e., heat recovery system, filters, solar panels, wind turbines, etc.);
- Noise emissions (not applicable for components EPD): The information on noise emission of the vessel may be include, but is not limited to, outside noise measured during:
  - "Anchor" condition sound pressure level
  - "Underway" condition sound pressure level
  - "Harbor" (moored) condition sound pressure level

  The measurements shell be in accordance with the standard "ISO 2923:1996 Acoustics — Measurement of noise on board vessels", together with the specification as per IMO Resolution 468[12] "Code on noise levels on board ships".
- Environmental performances can be declared using the following additional functional unit: 1 small or large vessel for 1 average year of use according to the selected main operating profile, not applicable for components EPD[24];
- To promote eco-design and the correct use of the vessel during the use stage by consumers, it is possible to present results in this paragraph using a different operational profile (even with different primary data or statistics from those in this paragraph) than the one used to express the results in the Environmental performance section. The calculations for evaluating these results must follow the same assumptions as the model used to calculate the results in the Environmental performance section and must be expressed using the same environmental indicators.

Any additional environmental information declared shall be substantiated and verifiable, and be derived using appropriate methods and be specific, accurate, not misleading, and relevant to the specific product. Quantitative information is preferred over qualitative information.

In addition to the above general guidance the following information shall be reported in the EPD, when applicable:

- EEDI calculated as described in: MARPOL Annex VI To promote eco-design and the correct use of the boat during the use stage by consumers, it is possible to present results in this paragraph using a different operational profile (even with different primary data or statistics from those in this paragraph) than the one used to express the results in the Environmental performance section. The calculations for evaluating these results must follow the same assumptions as the model used to calculate the results in the Environmental performance section and must be expressed using the same environmental indicators.

5.4.8 ADDITIONAL SOCIAL AND ECONOMIC INFORMATION

The EPD may also include other relevant social and economic information as additional and voluntary information. This may be product information or a description of an organisation's overall work on social or economic sustainability, such as activities related to supply chain management or social responsibility.

Any additional social and economic information declared shall be substantiated and verifiable, and be derived using appropriate methods and be specific, accurate, not misleading, and relevant to the specific product. Quantitative information is preferred over qualitative information.

5.4.9 DIFFERENCES VERSUS PREVIOUS VERSIONS

For EPDs that have been updated, the following information shall be included:

- a description of the differences versus previously published versions, and
- a revision date on the cover page.

5.4.10 REFERENCES

A reference section shall be included, including a list of all sources referred to in the EPD, including the GPI (including version number), and PCR (registration number, name, and version) used to develop the EPD.

[24] This is added to make it easier to communicate the results from a marketing perspective and to make the results easier for consumer facing EPDs to understand. If this additional information is presented, the following statement should be added: "These results do not guarantee comparability between different EPDs, but are presented only to give full information to the consumer".

5.4.11 EXECUTIVE SUMMARY IN ENGLISH

The executive summary, if included (see Section 5.1), shall contain relevant summarised information related to the programme, product, environmental performance, information related to pre-certified EPDs, and information related to sector EPDs. Besides this, further information may be added such as additional environmental, social or economic information, references as well as differences versus previous EPD versions.

6 LIST OF ABBREVIATIONS AND GLOSSARY

ANZSIC	Australian and New Zealand Standard Industrial Classification
CPC	Central product classification
CPV	Common procurement vocabulary
EPD	Environmental product declaration
GPI	General Programme Instructions
GTIN	Global trade item number
ISO	International Organization for Standardization
LCA	Life cycle assessment
LCI	Life cycle inventory
NACE/CPA	Classification of products by activity
ND	Not declared
PCR	Product category rules
REACH	Restriction of chemicals
RSL	Reference service life
SI	The International System of Units
UN	United Nations
UNSPSC	United Nations standard products and services code
DP –	Dynamic Positioning System
EEDI	Energy Efficiency Design Index
GT	Gross Tonnage
IMO	International Maritime Organization
MCR	Maximum Continuous Rating
MEPC	Marine Environment Protection Committee of the IMO (International Maritime Organization)
RCD	Recreational Craft Directive
m_{LC}	Light craft condition
wt%	Percentage by weight

6.1 GLOSSARY

Vessel: a floating object able to move autonomously on the water surface with a propulsion and manoeuvring system;

Yacht: a vessel that is in private or commercial use for sport or leisure;

Large yacht: Vessel which is engaged in in trade or private use, with a tonnage greater than 500 GT calculated following IMO - International Convention on Tonnage Measurement of Ships.

Small crafts: Vessel with a displacement, in light craft condition, calculated as described in the ISO 8666:2020, not greater than 1000 kg;

Propulsion system: set of elements needed to provide thrust to the vessel;

Manoeuvring system: set of elements needed to control the vessel direction and position;

Total installed power: sum of the power that can be generated ore stored on board, for example by main engines, generators, solar panels, batteries etc...

Propulsion power: portion of the total installed power that can be transmitted to the elements that provide the thrust to the vessels

Light craft condition (m_{LC}): the displacement of a vessel in tonnes as described by ISO8666: 2020

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SOLAS: International Convention for the Safety of Life at Sea, 1974 as amended by the IMO.

MARPOL: The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes.It was developed through the International Maritime Organization (IMO), a United Nations agency that deals with maritime safety and security, as well as the prevention of marine pollution from ships. MARPOL is the main international agreement covering all types of pollution from ships. Air pollution from ships is specifically addressed in Annex VI of the MARPOL treaty. Annex VI includes requirements applicable to the manufacture, certification, and operation of vessels and engines, as well as fuel quality used in vessels in the waters of the United States. The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations - and currently includes six technical Annexes. Special Areas with strict controls on operational discharges are included in most Annexes.

Dynamic Positioning System: is a computerized control system allowing a vessel to automatically maintains its position and heading (fixed location or predetermined track) by means of thrusters and/or propulsion forces.

Energy Efficiency Design Index: Mandatory measure to reduce emissions of greenhouse gases (GHGs) adopted by Parties to MARPOL Annex VI represented in the Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO). The amendments to MARPOL Annex VI Regulations for the prevention of air pollution from ships, add a new chapter 4 to Annex VI on Regulations on energy efficiency for ships to make mandatory the Energy Efficiency Design Index (EEDI), for new ships, and the Ship Energy Efficiency Management Plan (SEEMP) for all ships. The regulations apply to all ships of 400 gross tonnage and above and entered into force on 2013. The EEDI is a non-prescriptive, performance-based mechanism that leaves the choice of technologies to use in a specific ship design to the industry. As long as the required energy-efficiency level is attained, ship designers and builders would be free to use the most cost-efficient solutions for the ship to comply with the regulations.

Gross Tonnage: is the total volume of a vessel, expressed in units of 100 cubic feet (gross ton), with certain open structures, deckhouses, tanks, etc., exempted. It is an index related to a ship's overall volume and it is not a measure of the ship's displacement (mass). See ”IMO - International Convention on Tonnage Measurement of Ships”.

International Maritime Organization: as a specialized agency of the United Nations, IMO is the global standard-setting authority for the safety, security and environmental performance of international shipping. Its main role is to create a regulatory framework for the shipping industry that is fair and effective, universally adopted and universally implemented. IMO measures cover all aspects of international shipping – including ship design, construction, equipment, manning, operation and disposal – to ensure that this vital sector for remains safe, environmentally sound, energy efficient and secure.

Maximum Continuous Rating: is defined as the maximum output that an engine is capable of producing continuously under normal conditions over a year.

Recreational Craft Directive: DIRECTIVE 2013/53/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on recreational craft and personal watercraft and repealing Directive 94/25/EC

7 REFERENCES

CEN (2013) EN 15804:2012+A1:2013, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

CEN (2019) EN 15804:2012+A2:2019, Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products.

EPD International (2021) General Programme Instructions for the International EPD® System. Version 4.0, dated 2021-03-29. www.environdec.com.

ISO (2000) ISO 14020:2000, Environmental labels and declarations – General principles.

ISO (2004) ISO 8601:2004 Data elements and interchange formats – Information interchange – Representation of dates and times.

ISO (2006a) ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures.

ISO (2006b) ISO 14040:2006, Environmental management – Life cycle assessment – Principles and framework.

ISO (2006c) ISO 14044: 2006, Environmental management – Life cycle assessment – Requirements and guidelines.

ISO (2014) ISO 14046:2014, Environmental management – Water footprint – Principles, requirements and guidelines.

ISO (2015a) ISO 14001:2015, Environmental management systems – Requirements with guidance for use.

ISO (2015b) ISO 9001:2015, Quality management systems – Requirements.

ISO (2016a) ISO 21067-1:2016, Packaging – Vocabulary – Part 1: General terms.

ISO (2016b) ISO 14021:2016, Environmental labels and declarations - Self-declared environmental claim (Type II environmental labelling).

ISO (2017) ISO 21930:2017, Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services.

ISO (2018a) ISO 14024:2018, Environmental labels and declaration – Type I environmental labelling – Principles and procedures.

ISO (2018b) ISO/TS 14067:2018, Greenhouse gases – Carbon footprint of products – Requirements and guidelines for quantification and communication

EC Regulation No. 1907/2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), 2006

EC Regulation 1272/2008/EC on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006, 2008

IMO SR/CONF/45 Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009

IMO SOLAS International Convention for the Safety of Life at Sea, 1974

IMO MARPOL 73/78

Annex I Regulations for the Prevention of Pollution by Oil

Annex II Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk

Annex III Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form

Annex IV Prevention of Pollution by Sewage from Ships

Annex V Prevention of Pollution by Garbage from Ships

Annex VI Regulations for the Prevention of Air Pollution from Ships

IMO Resolution MEPC.197(62) Guidelines for the Development of the Inventory of Hazardous Materials, 2011

IMO Resolution MEPC.196(62) Guidelines for the Development of the Ship Recycling Plan, 2011

IMO Resolution MEPC.203(62) Inclusion of Regulation on Energy Efficiency for Ships in MARPOL Annex VI

IMO Resolution MEPC.210(63) Guidelines for Safe and Environmentally Sound Ship Recycling, 2012

IMO Resolution MEPC.211(63) Guidelines for the Authorization of Ship Recycling Facilities, 2012

IMO Resolution MEPC.222(64) Guidelines for the Survey and Certification of Ships under the Hong Kong Convention, 2012

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IMO MEPC.1/Circ.815 Guidance on treatment of innovative energy efficiency technologies for calculation and verification of attained EEDI, 2013

IMO Resolution MEPC.223(64) Guidelines for the inspection of ships under the Hong Kong Convention, 2012

IMO Resolution MEPC.212(63) Guidelines On The Method Of Calculation Of The Attained Energy Efficiency Design Index (EEDI) For New Ships, 2012

IMO Resolution MEPC.214(63) Guidelines On Survey And Certification Of The Energy Efficiency Design Index (EEDI), 2012

IMO Resolution MEPC.254(67) Guidelines on survey and certification of the Energy Efficiency Design Index (EEDI), 2014

IMO Resolution MEPC.245(66) Guidelines on the method of calculation of the attained Energy Efficiency Design Index for new ships, 2014

IMO Resolution MEPC.231(65) Guidelines for calculation of reference lines for use with the Energy Efficiency Design Index (EEDI), 2013

IMO, 2021. Fourth IMO GHG Study 2020: Safe, secure and efficient shipping on clean ocean, London: International Maritime Organization (IMO).

ISO 22628 Road vehicles-Recyclability and recoverability –Calculation method, 2002

ISO 2923 Acoustics — Measurement of noise on board vessels", together with the specification as per IMO Resolution 468[12] "Code on noise levels on board ships, 1996

8 VERSION HISTORY OF PCR

VERSION 2.0, 2023-XX-YY

- The PCR has been updated to comply with the latest version of the GPI (version 4.0).
- The PCR has been upgraded into a main PCR, enabling the development of c-PCRs for more specific product categories (vessels with specific functions and components) to be used together with the main PCR.
- The title of PCR is changed,
- the scope of the PCR has been changed by adding additional CPC codes to the PCR,
- the functional unit has changed and been divided into main functional unit for all vessels, functional unit for large vessel and declared unit for components,
- the system boundaries were changed to include a subdivision into life cycle modules, and the flowchart was updated,
- the system boundaries and flow chart for components are added,
- the cut-off rules have been modified to facilitate data collection by EPD implementers and it is added cut-off rules for components,
- the allocation rules were modified, the changes involved: the definition of end-of-life state of vessel, the allocation of reusable components, the definition and allocation of refitting and maintenance activities.
- in the data quality section, the possibility of making EPDs in three different phases of the vessel's life, i.e. in the design EPD, product EPD and use phase EPD, has been added,
- the section DATA QUALITY REQUIREMENTS AND OTHER MODELLING GUIDANCE FOR LIFE-CYCLE STAGE has been updated, with the inclusion of the main assumptions and modelling rules for the main life cycle modules,
- for components, the section DATA QUALITY REQUIREMENTS AND OTHER MODELLING GUIDELINES FOR THE LIFE CYCLE PHASE has been added.
- the section on product information and additional environmental information has been updated, providing the contents that must be presented in EPDs.

VERSION 1.01, 2019-09-06

- Clarified terms of use
- Editorial changes

VERSION 1.0, 2015-11-18

Original version

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