भारतीय मानक **IS/ISO 20294 : 2018**

Indian Standard

ग्राफ़िक प्रौद्योगिकी — ई-मीडिया की कार्बन फुटप्रिंट गणना के लिए परिमाणन और संचार

Graphic Technology — Quantification and Communication for Calculating the Carbon Footprint of E-media

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NATIONAL FOREWORD

This Indian Standard which is identical to ISO 20294 : 2018 ‘Graphic technology — Quantification and communication for calculating the carbon footprint of e-media’ issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Graphic Art Technology Sectional Committee and approval of the Management and Systems Division Council.

The text of the International Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words ‘International Standard’ appear referring to this standard, they should be read as ‘Indian Standard’; and

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

Annex A, Annex D, Annex E are for informative and Annex B, Annex C, Annex F and Annex G are for integral part <this standa>

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Introduction

Reduction of worldwide greenhouse gas (GHG) emissions is central to the mitigation of climate change (see Annex A), considered to be arising from natural and anthropogenic activities. Specificity and consistency in calculating GHG emission values is important for governments, non-governmental organisations (NGOs), industry and consumers involved in climate change discussions and policy development. Global markets and financial interests demand transparency and there is no common model used for carbon footprint studies, which leads to confusion and misinformation: data sets are very difficult to compare if they are calculated using different models and criteria. The publishing industry and associated industries [manufacturers of electronic media (e-media) devices, servers, networks, cloud-based data management systems and digital content developers] have made progress in recent years as the reach of digital technology has extended to all parts of society and commerce across the globe. However, it is extremely difficult to track and quantify emissions associated with e-media.

Standards can provide a common model that minimises variability and complexity and provides the market with a method for developing tools that are easy to use and that follow a common methodology. The results of carbon footprint studies can be used to provide the basis of a data corpus that governments, NGOs, industry, and media consumers and specifiers can use for reference to further refine carbon footprinting processes. These data must be gathered using tools which use a consistent calculation method and must be accurate, defensible and trustworthy. This document is intended as a first step towards subsequent work that can provide such assurance. It is a framework for calculating and communicating the carbon footprint of examples of e-media and follows an equivalent methodology to that outlined in ISO 16759.

This document is a starting point, taking the first steps towards developing accurate and comprehensive carbon footprint data for examples of e-media. It is important to understand that we are at the beginning of a process that will take years to stabilize, define and implement fully. What we can achieve now is necessarily primitive because of the lack of data, practice and plural experience. Over time, carbon footprint studies will create a body of sector-specific data. Capturing all of the data associated with e-media products is currently extremely difficult because e-media data products exist only in digital form. They can be used in many contexts and viewed on many different devices, so their carbon footprint can be substantial, even though it bears no relation to the value of the content. To understand the environmental impact of e-media, a framework methodology for capturing carbon footprint data is required as a starting point for consistent carbon footprint calculations over time.

This document has been developed to provide such a model for e-media, including the tools required to access the data and devices on which e-media are stored for streamed or downloaded use. It references the delivery devices and the data components that together deliver electronic content to end users. It is written for manufacturers of electronic e-media devices, servers, networks, cloud-based data management systems, digital content developers, consumers, related industry associations and providers of carbon footprinting tools. It offers a program-neutral method for calculating and communicating the carbon footprint of e-media content products, based on calculated carbon dioxide equivalent (CO_2e) values, for the single impact category of climate change. Life span is distinguished from life cycle because digital data do not reach end of life. Digital data (contents) are perpetual; however, digital data (contents) also have a life span during which time they are viable and usable, and after which they are generally stored or deleted. This single criteria approach provides the foundation for future work addressing multi-criteria impacts which assess all potential impacts that e-media can have on the environment.

Multi-criteria calculations based on all four phases of life cycle assessment (LCA), as outlined in ISO 14040, are not within the scope of this document. Further information for conducting LCA is outlined in ISO 14044. This document also references IEC/TR 62921, a quantification methodology for GHG emissions for computers and monitors, developed as part of international efforts to provide GHG calculation guidance for electronic products. According to IEC/TR 62921, quantification of the carbon footprint of e-media content products requires a defined goal and scope for the carbon footprint of a product (CFP) study. IEC/TR 62921 also requires a specification of the system boundaries and process inventory as the basis for calculations. It allows for calculations of the whole or partial life span of

contents and the life cycle of e-media devices, while e-media are constituted of contents and e-media devices. The life span is assessed using the same method as LCA.

This document provides the foundation to develop calculation models that will increase over time in consistency, transparency, robustness and accountability for e-media carbon footprint quantifications and their communication. It can provide the following benefits to companies:

— enables accountable and transparent carbon footprint information to be obtained for all parties in the supply chain, including consumers and media buyers;

— enables consistency in carbon footprint calculator design, to aid relevance and applicability for different e-media product sectors and geographies;

— provides e-media publishers, distributors, buyers and consumers with a means of quantifying and communicating the carbon footprint of e-media using a common methodology and defined boundaries;

— encourages media buyers and consumers of e-media to make informed media investment, purchase and usage decisions, using information validated with calculation, communication and reporting tools that are consistent with this document;

— facilitates continuous monitoring of the carbon footprint of e-media as part of their overall environmental impact, and encourages constant improvement;

— provides reliable and consistent CO_2 emissions data for e-media;

— provides a model for gathering e-media data for emissions management and reduction;

— provides a model for data assumptions for media usage;

— can be used as part of GHG emissions management;

— facilitates performance tracking and progress in GHG emissions reduction.

This document includes examples of carbon footprint studies and guidance for communicating and verifying carbon footprint information to device developers, content creators, distributors, publishers, consumers, industry and any other interested parties.

Use of this document facilitates the calculation of the carbon footprint of e-media products and similar digital content delivered digitally to an electronic device such as a desktop computer, laptop, tablet, smartphone, e-reader or equivalent electronic device. Its principles can be extended to all digitally delivered media, including movies and audio and are not restricted to media that are alternatives to print.

Where the results of a carbon footprint study for e-media are intended to be communicated to businesses and consumers, the communication should follow standards of completeness as defined here and in other ISO standards, such as ISO 14020.

Indian Standard

GRAPHIC TECHNOLOGY — QUANTIFICATION AND COMMUNICATION FOR CALCULATING THE CARBON FOOTPRINT OF E-MEDIA

1 Scope

This document specifies the requirements for quantifying the carbon footprint of those processes, materials and technologies within the user's knowledge and control that are necessary for the delivery and use of e-media. It covers requirements to account for e-media archiving, distribution, use and storage. It is based on a life cycle assessment (LCA) approach, using defined system boundaries and a specified functional unit as the basis for complete or partial carbon footprinting studies. These data can be referenced throughout supply chains for individual e-media products.

This document is applicable to a carbon footprint of a product (CFP) study of e-media regarding contents and e-media devices.

This document provides a framework for carbon calculators that organisations can follow and that can be used as the structure for market- or sector-specific carbon footprinting tools. Studies and tools constructed within this framework methodology provide carbon footprint quantifications of e-media that can be validated, verified and provide reference for future studies.

This document does not assess any social or economic aspects or impacts, or any other environmental aspects and related impacts potentially arising from the life cycle of a product.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

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

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

3.1 Terms relating to carbon footprint

3.1.1
carbon footprint
net amount of *GHG emissions* (3.2.4) and GHG removals, expressed in *carbon dioxide equivalents* (3.2.2)

3.1.2
carbon footprint of a product
CFP
carbon footprint (3.1.1) of a *product system* (3.1.3)

3.1.3
product system
collection of processes with elementary and product flows performing one or more defined functions and which models the *life cycle* (3.3.5) of a product

3.1.4
product category rules
PCR
set of specific rules, requirements and guidelines for developing Type III environmental declarations and footprint communications for one or more product categories

3.1.5
comprehensive carbon footprint
product-specific *carbon footprint* (3.1.1) that includes the carbon impacts for each component and process in the *life cycle* (3.3.5) of a product

3.1.6
streamlined carbon footprint
product-specific *carbon footprint* (3.1.1) that includes simplified calculations of the carbon impacts for each component and process in the *life cycle* (3.3.5) of a product

3.2 Terms relating to greenhouse gases

3.2.1
greenhouse gas
GHG
gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere and clouds

Note 1 to entry: Water vapour and ozone are also anthropogenic as well as natural GHGs but are not included as recognized GHGs due to difficulties in calculating their *global warming potential* (3.2.3).

[SOURCE: ISO 14064-1:2006, 2.1, modified — the original Note has been removed and Notes 1 and 2 to entry have been added.]

3.2.2
carbon dioxide equivalent
CO_2 equivalent
CO_2e
unit for comparing the radiative force of a *GHG* (3.2.1) to that of carbon dioxide

[SOURCE: ISO/TS 14067:2013, 3.1.3.2, modified — the Notes have been removed]

3.2.3
global warming potential
GWP
index, based on radiative properties of *GHGs* (3.2.1), measuring the radiative forcing following a pulse emission of a unit mass of a given GHG in the present-day atmosphere integrated over a chosen time horizon, relative to that of carbon dioxide (CO_2)

[SOURCE: ISO/TS 14067:2013, 3.1.3.4, modified.]

3.2.4
greenhouse gas emission
GHG emission
release of a *GHG* (3.2.1)into the atmosphere

[SOURCE: ISO/TS 14067:2013, 3.1.3.5, modified.]

3.2.5
greenhouse gas emission factor
GHG emission factor
coefficient relating activity data with the *GHG emission* (3.2.4)

3.2.6
greenhouse gas source
GHG source
mechanical or natural process that releases a *GHG* (3.2.1) into the atmosphere

EXAMPLE Electrical energy use where the electrical energy has been created from fossil fuel resources.

3.3 Terms relating to life cycle assessment

3.3.1
allocation method
method by which inputs and outputs are allocated to different examples of *e-media* (3.5.1)

3.3.2
energy
sources of *GHG emissions* (3.2.4) used for the provision and use of the product during its *life cycle* (3.3.5)

3.3.3
functional unit
quantified and defined single iteration of an example of *e-media* (3.5.1), for use as a reference unit in a *CFP* (3.1.2) study

EXAMPLE A single download of an e-book to an e-media device.

[SOURCE: ISO 16759:2013, 3.3.5, modified — In the definition “a printed product” has been replaced by “e-media” and a new example has been provided.]

3.3.4
interpretation
process of explaining the results of a *life cycle assessment* (3.3.6) such that it is relevant to the goal and scope of a *CFP* (3.1.2) study

3.3.5
life cycle
consecutive and interlinked stages related to a product from raw material acquisition or generation from natural resources to end-of-life treatment

[SOURCE: ISO/TS 14067:2013, 3.1.5.2, modified — definition revised and Note 1 to entry deleted.]

3.3.6
life cycle assessment
LCA
compilation and evaluation of the inputs, outputs and potential environmental impacts of a *product system* (3.1.3) throughout its *life cycle* (3.3.5)

3.3.7
life cycle inventory analysis
LCI
phase of *life cycle assessment* (3.3.6) involving the compilation and qualification of inputs and outputs for a product throughout its *life cycle* (3.3.5)

3.3.8
process
set of interrelated or interacting activities that transforms inputs into outputs

[SOURCE: ISO 16759:2013, 3.3.11]

3.3.9
primary data
quantified value of a *process* (3.3.8) or an activity obtained from a direct measurement or a calculation based on direct measurements

Note 1 to entry: Primary data need not necessarily originate from the product system under study because primary data might relate to a different but comparable product system to that being studied.

Note 2 to entry: Primary data can include *GHG emission factors* (3.2.5) and/or GHG activity data.

3.3.10
secondary data
data which do not fulfil the requirements for primary data

Note 1 to entry: Secondary data can include data from databases and published literature, default emission factors from national inventories, calculated data, estimates or other representative data, validated by competent authorities.

Note 2 to entry: Secondary data can include data obtained from proxy processes or estimates.

3.3.11
transparency
open, comprehensive, accessible, clear and understandable presentation of information

[SOURCE: ISO 16759:2013, 3.8.4]

3.3.12
uncertainty
unpredictability of the consequences, extent or magnitude of circumstances, conditions or events

Note 1 to entry: Uncertainty information typically specifies quantitative estimates of the likely dispersion of values and a qualitative description of the likely causes of the dispersion.

[SOURCE: ISO 16759:2013, 3.8.5, modified — definition revised.]

3.3.13
aggregated data
data combined from different sources that relate to broad categories, classes or groups

3.3.14
life span
expected time of a product's serviceable use or period of use

Note 1 to entry: Life span refers exclusively to data in the context of this document.

3.4 Terms relating to organisations and consumers

3.4.1
consumer
individual purchasing products or services for personal or private use

3.4.2
organization
company, corporation, firm, business, authority or institution with its own administration and purpose

3.4.3
supply chain
linked and interdependent processes that result in the delivery of content with *e-media* (3.5.1) to end users

3.4.4
unit process
smallest element considered in the *life cycle inventory analysis* (3.3.7) for which input and output data are quantified

[SOURCE: ISO 14040:2006, 3.34]

3.4.5
user
individual using *e-media* (3.5.1)

3.4.6
provider
publisher or printer offering and delivering content with *e-media* (3.5.1) for individual use

3.4.7
use profile
data associated with the likely usage of *e-media* (3.5.1)

3.4.8
usage pattern
data associated with the likely discernible regularity of *e-media* (3.5.1) use

3.5 Terms relating to electronic media

3.5.1
electronic media
e-media
digital *data* (3.5.3) contents unit accessed with an *e-media device* (3.5.2) and delivered electronically

3.5.2
e-media device
electronic device that presents digital content, such as a smartphone, computer (tablet, laptop, desktop) or digital audio player (DAP)

3.5.3
data
information known or assumed as fact

3.5.4
data management
process of keeping track of all *data* (3.5.3) and/or information related to the creation, production, distribution, storage and use of *e-media* (3.5.1), and associated processes

3.5.5
content management
processes involved in the creation, production, distribution, manipulation, storage and use of digital content

3.5.6
electronic device
device that performs specific tasks using electronic components

3.5.7
screen
monitor lit from behind on which *e-media* (3.5.1) content can be read or viewed

3.5.8
cloud
collection of networked remote servers

3.5.9
operating system
computer program that manages electronic hardware and provides common services for software applications

3.5.10
e-media storage
process and location of digital *data* (3.5.3) in readiness for subsequent distribution and use

3.5.11
computer
general purpose device that can be programmed to carry out a finite set of arithmetic or logical operations

3.5.12
usage ratio
hours required for reading an example of *e-media* (3.5.1) divided by the service life of the *e-media devices* (3.5.2) based on hours per day

3.5.13
megabyte
1 000 000 bytes

3.6 Terms relating to electronic media delivery

3.6.1
streaming
process of delivering digital data direct to an *e-media device* (3.5.2) in real time via an electronic network

3.6.2
download
data moved from a remote to a local device

3.6.3
plastic
synthetic or semi-synthetic organic material used in certain categories of *e-media devices* (3.5.2)

3.7 Terms relating to information and communication technology

3.7.1
smartphone
mobile phone with an *operating system* (3.5.9) that allows it to perform additional functions, such as image capture, GPS navigation and media playing, in addition to basic telephony

3.7.2
tablet
self-contained mobile computer with integrated touchscreen, larger than a smartphone

3.7.3
distribution
process of delivering *e-media* (3.5.1) to end users

3.7.4
archive
storage of content for perpetual access

3.7.5
server
digital system of computer programmes operating in a client-server environment and running on single or multiple computers to provide network, archive and data management services to connected devices

4 Principles for carbon footprint quantification

4.1 General requirements

The following principles are the basis for and shall be used to guide the application of the requirements of this document. ISO/TS 14067 is the generic and mandatory reference for this document. Double-counting of GHG emissions and removals within the studied product system is avoided when the allocation of the same GHG emissions and removals occurs only once (see 5.5.3.3.2).

4.2 Life cycle perspective

In the assessment and communication of the carbon footprints of e-media, all stages defined in the goal and scope of the study shall be included. The goal and scope define the parameters of the system boundary and are the basis for the study's inventory of calculations, including parameter, model and scenario uncertainties. This allows for partial carbon footprint calculations, relating to defined parts of an e-media distribution and usage chain. A partial CFP shall, as a minimum, represent the emissions arising from all relevant stages relating to e-media archiving, distribution, storage and use.

NOTE This can include separate disclosure of GHG emissions and storage or removal in order to demonstrate and clarify GHG emission values.

4.3 Relative approach and functional unit

The carbon footprint study shall be structured around a single defined functional unit of and example of e-media and the results calculated relative to it. The functional unit shall be defined as specifically as possible, including all criteria relating to the assumed example of e-media, and use profiles as determined in the goal and scope of the study. A functional unit is a reference to which input and output data are normalized and represents the performance of a product system for use as a reference in a CFP study. Comparisons of the carbon footprints of different e-media can only be made if the functional units are the same, i.e. normalized to the same functional unit. Examples of functional units and their determinant criteria are available in Annex G.

4.4 Relevance

According to the goal and scope of the CFP study, GHG sources and sinks, together with carbon storage, data and methods selected, shall be suitable for the assessment of the GHG emissions, storage and removals arising from e-media.

NOTE This can include separate disclosure of GHG emissions and storage or removal in order to demonstrate and clarify GHG emission values.

4.5 Completeness

According to the goal and scope of the CFP study, all relevant GHG sources that provide a direct and meaningful contribution to the assessment of GHG emissions arising from e-media shall be included.

4.6 Consistency

According to the goal and scope of the CFP study, assumptions, methods and data shall be applied and gathered in the same way throughout the CFP study of an example of e-media.

4.7 Accuracy

According to the goal and scope of the CFP study, bias and uncertainties shall be reduced as far as is practical; inaccuracies, influencing factors and uncertainties shall be stated as part of the CFP study.

4.8 Transparency

All relevant issues shall be addressed within the goal and scope of the CFP study and documented accurately, with full disclosure and a clear audit trail. Assumptions, reference methodologies and data sources used shall be disclosed. Estimates and areas of possible bias and uncertainty shall be explained and highlighted.

4.9 Assumptions for content use

The usage model shall be defined based on likely scenarios for distribution models, archiving, data delivery models and device usage expectations.

4.10 Avoidance of double counting

Double counting of GHG emissions and removals shall be avoided.

EXAMPLE E-media storage and data sources distributed from shared data centres.

4.11 Implementation criteria

Calculations shall be based on the following unit processes:

1) those that make a measurable contribution to the carbon footprint;

2) those for which emissions data are not expected to make a measurable contribution to the carbon footprint and which can therefore be estimated;

3) those for which several unit processes can be merged.

NOTE As a minimum this includes e-media devices, energy for storage, archiving, distribution and use, and can include other factors.

4.12 Uncertainty

Environments that are only partially understood or observed are unavoidably vulnerable to uncertainty. Uncertainty is inevitable in measuring the carbon footprints of e-media, because e-media exist only in digital form, and often in multiple iterations. E-media are distributed electronically via the Internet along unspecified digital network pathways, and many copies are stored both online and offline for purposes of secure archiving and data redundancy. E-media can be viewed on a range of electronic devices, from smartphones to digital television screens, the carbon footprint of which varies according to the device and model. All of these factors introduce elements of uncertainty that shall be identified and quantified wherever possible according to the goal and scope of the CFP study.

5 Methodology

5.1 General Requirements

For the calculation of the carbon footprints of e-media to conform to this document, the product life span or life cycle GHG emissions shall be calculated using the methodological framework outlined here or with a carbon footprinting tool that is consistent with this document. The life span relates to contents and life cycle relates to e-media devices. The study shall be based on goal and scope definition, inventory analysis, impact assessment and interpretation, and the communication of the results.

Assessments of product GHG emissions shall be carried out using the principles of LCA. Unless otherwise indicated, the assessment of and example of e-media's life cycle GHG emissions shall be made based on the product's attributes and the functional unit, as defined in the goal and scope.

The functional unit for example of e-media is defined according to the goal of the CFP study which shall specify assumed usage scenarios (see Annex B). The footprints of electronic e-media can be based on informative reference data from manufacturers.

The carbon footprinting studies for e-media cannot be absolute, because there are too many uncertainties and unknowable facts. Product life span and/or life cycle, distribution patterns and usage assumptions shall be defined as part of a product and use profile, according to the goal and scope of the CFP study. Data collection and calculations shall be related to defined goal and scope of a carbon footprint study.

Assessment of the GHG emissions based on life span/life cycles of e-media shall be done so that the mass of GHG is reported for each functional unit, as defined in the goal and scope of the CFP study. Statistical simulation using a recognized statistical model shall be used as a means of establishing baseline/benchmark values and to establish carbon footprint data values.

Assessments shall perform the following functions:

a) define the goal and scope of the study, the processes measured in order to calculate an example of e-media's life cycle or partial life cycle GHG emissions based on the defined system boundary and inventory as defined in the goal and scope;

b) explain the assumptions made for the usage of examples of e-media, including the device expectations;

c) determine the sequence and interaction of these processes based on the production workflow and unit process definitions;

d) identify the criteria to be included in a carbon footprint calculation for the measurement of the example of e-media's life cycle or partial life cycle GHG emissions;

e) avoid double counting;

f) define variables for examples in devices (generic versus specific);

g) specify generic media categories versus specific ones;

h) provide assumed life span/life cycle of different e-media (functional units);

i) provide a method of cut-off rules to confine the number of inputs;

j) estimate downloads versus streamed media, frequency and duration of view (i.e. the difference between on-screen and printed view) based on defined expectations;

k) provide resources and data required for calculation of the example of e-media's life cycle or partial life cycle GHG emissions;

l) for outsourced processes, the organization shall ensure that GHG emission measurements are transparent and that they are consistent with recognized standards applied throughout the supply chain;

m) specify uncertainties.

5.2 Goal and scope

5.2.1 General

The goal of e-media carbon footprint studies is to quantify the GHG emissions of e-media over their life span/life cycle or partial life span/life cycle based on either LCA, or over that part of its life span/life cycle for which the criteria for calculating the carbon footprint are known and within the control of the entity conducting the CFP study. Where they are not known and within the entity's control, expected

usage scenarios shall be defined, including content usage and devices. E-media carbon footprint studies should be carried out using recognized streamlined carbon footprinting methods[1)].

5.2.2 LCA carbon footprint

LCA carbon footprint studies shall include the following mandatory elements:

a) why the study is being done;

b) for and by whom the study is being done and on what date;

c) the intended use of the study;

d) a definition of the functional unit;

e) the start and completion dates for the study's data collection period;

f) the calculation techniques to be used;

g) reporting processes;

h) where the study, including data collection, compilation and calculation, is conducted;

i) a method for combining channel and content emissions values;

j) use of cut-off rules for parameterisation to confine the number of inputs;

k) estimation of uncertainties.

5.2.3 System boundary

A definition of the system boundary for the CFP study shall include the following mandatory elements:

a) an explanation of how the system boundaries have been drawn;

b) an explanation of why the system boundaries are drawn as they are;

c) an inventory analysis listing all processes, materials and life cycle stages to be addressed in the calculation (examples of processes to consider are listed in Annex C);

d) definitions of the relationships between LCA and life cycle inventory analysis (LCI) phases and how the study can be used for subsequent calculations;

e) a statement to account for what is excluded from the study and why;

f) an explanation of any uncertainties, ambiguities or assumptions;

g) conditions for use of value choices and optional elements.

5.2.4 Scope of e-media carbon footprint studies

The scope of an e-media CFP study shall be consistent with the goal of the study. In defining its scope, the following criteria shall be considered:

a) the functional unit;

b) assumptions for life span and/or life cycle;

c) the system boundary;

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1) iNEMI eco-impact evaluator, Orange, PIAI, Japan CFP and China CFP (under development) are examples of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of these products.

d) the inventory of processes which are the basis of calculations;

e) allocation procedures;

f) data and data quality requirements and expectations;

g) limitations;

h) uncertainties;

i) reporting.

The scope of the study can be revised due to unforeseen limitations, constraints or additional information. Modifications and explanations shall be documented.

A summary of processes which can be considered for inclusion in the inventory of processes is included in Annex C, which shall be used for data collection items within the system boundary.

5.2.5 Life cycle stages

The life span/life cycle stages and the inventory of processes to be included in the carbon footprinting studies of e-media shall be defined in the goal and scope of the study. Each life span/life cycle and process shall be individually quantified.

The following life span/life cycle stages shall be covered:

< Contents to provide e-media products >

The full life span shall be the following three stages:

— production stage;

— distribution stage;

— use stage (e-media device).

The production stage includes both the raw material acquisition stage and the production stage and excludes carbon impact regarding contents-creation processes such as coverage, photography and writing.

< e-media device >

The full life cycle shall be the following four stages:

— production stage;

— distribution stage;

— use stage;

— end-of-life stage.

The production stage includes both the raw material acquisition stage and the production stage.

NOTE A summary of the life span/life cycle stages for e-media devices is included in Annex C.

5.3 System boundary definitions

The system boundary determines which unit processes shall be included in the CFP study, based on its goal and scope. A distribution and usage workflow schematic shall be determined specific to the functional unit under study as the basis for calculating the input and output data of each process in the flow. The goal and scope and therefore the system boundary setting shall be consistent with the objectives for the intended use of the study.

In defining the system boundary, where processes are iterative the number of iterations shall be stated alongside assumptions for archiving, distribution, local storage and usage and the associated emissions. These numbers can be estimated; however, the basis for the estimation shall be defined.

Calculations done in accordance with this document shall include all emissions of those unit processes within the defined system boundary. Care shall be taken to avoid double counting, and to take into account all uncertainties and accumulative or shared numbers. Any unit process should be included in the calculations and shall be considered as a contribution as required in ISO 14044.

5.4 Time boundary for data

The time boundary shall be representative of the assumed and defined life span/life cycle and assumed storage requirements of the specified functional unit of and example of e-media, as defined in the goal and scope of the study including requirements for long-term storage and archiving. Time boundary assumptions shall be accurately specified and justified according to the expected life span/life cycle for the e-media product under study, as defined in the goal and scope of the CFP study, including assumed storage requirements.

5.5 Carbon footprint quantification of life-cycle stages

5.5.1 Inventory analysis

Inventory analysis is the first step in calculating the carbon footprints of e-media. It consists of several stages (see ISO 14044): data collection, data validation and checking, relation of data to unit processes and functional units, refining the system boundary (for instance, excluding processes that make no significant contribution, or including previously excluded data that do have an impact) and allocation (so that shared processes are not double counted, especially across networks and data centres).

The inventory analysis shall begin with an inventory of all stages necessary to distribute e-media, as defined in the goal and scope of the CFP study.

Preliminary inventory analysis shall refine or determine the following with reference to data used in the calculation of carbon footprints of e-media:

a) the example of e-media's functional unit (see Annex B);

b) system boundary (see C.1);

c) use profile;

d) life span/life cycle;

e) storage and usage patterns.

It should be based on the amount of megabytes of the e-media products.

5.5.2 Data collection for each life-cycle stage

Data are used to quantify the inputs and outputs of unit processes. Data related to the example of e-media's GHG emissions shall be included according to the system boundary. Process-specific data shall be collected for all processes included in the system boundary and listed in the inventory of the CFP study.

The data shall be identified as primary or secondary data for which all sources shall be listed. However, primary data for distributed e-media are virtually impossible to source because methods to establish the carbon footprints of e-media are still in their infancy. For this reason, secondary data shall be used, whenever primary data are unavailable. Aggregated data, for instance collected via questionnaires, can replace primary data or secondary data subject to how they are to be used.

Secondary data shall only be used for inputs where it is not possible to collect primary data, and their use shall be clearly identified.

NOTE Secondary data can be published material, national inventories and other generic sources.

Primary and secondary data from industry databases for media calculations can be collected from sources in multiple locations. Measures shall be taken to ensure uniformity and consistency. These measures shall be fully explained. Data quality shall be defined for all sources, particularly for energy relating to archiving, distribution, storage and use.

Allocation of embedded emissions values shall also be transparent, and a mechanism for normalizing variability shall be implemented and fully described.

Data collection methods shall be outlined and explained, including explanations of uncertainties.

Data requirements shall be complementary and compatible with requirements as stated in International Standards used in the publishing and electronics industries, such as ISO 16759 and IEC/TR 62921.

5.5.3 General requirements applied to all stages

5.5.3.1 General

Data for all stages shall be validated and related to unit processes and the example of e-media's expected usage. Data relevance and calculations shall be explained and documented for each functional unit. To ensure reliability and quality, data for all stages shall include a definition of the characteristics of the data needed for the study and any related assumptions.

5.5.3.2 Precision of data

Primary data shall be used for all individual processes where the collection of primary data is possible. The type of data to be collected is to be clarified (e.g. primary, aggregated, secondary, approximate, estimated).

Where data are estimated, the basis of the estimation and justification for it shall be given. Missing data and data allocations, for instance for shared resource use, shall be documented.

5.5.3.3 Cumulative and allocation method

5.5.3.3.1 General

Data inputs for the carbon footprint study shall be calculated based on accessible data and data assumptions. The source of the data shall be defined in line with the goal and scope of the carbon footprint study.

Data accumulations for the production, distribution and usage of the functional unit shall be based on the size of the example of e-media data file use profile and usage patterns, avoiding double counting, and be fully documented. Data allocations shall be made according to their applicability to the functional unit and the allocation model documented.

5.5.3.3.2 Allocation procedure

The study shall identify processes shared with other e-media, such as archiving and distribution, and deal with them according to the following considerations:

— allocation should be avoided by dividing the unit process to be allocated into multiple sub-processes and collecting the input and output data related to these sub-processes;

— alternatively, the example of e-media product system should be expanded to include the additional functions related to the shared processes;

— where allocation is unavoidable, the inputs and outputs of the system shall be allocated uniformly between its different e-media.

Specific rules on allocation criteria:

— when allocating impacts of contents to a download (= per download), the estimated number of downloads should be used;

— when impacts of production, distribution and end of life related to e-media devices are allocated to "per covered example of e-media", its use hours shall be used.

Impact of e-media devices per the example of e-media under study = impact per e-media device × usage ratio of the example of e-media under study.

Service life shall be set according to product characteristics and catalogue specifications, from maintenance replacement period, or from durable years of depreciation.

Use hours per day shall refer to the literature or calculated from the scenario in Annex D describing use hours per day for e-media devices.

CFP can be quantified and displayed according to its actual and estimated number of downloads. The relationship expression is defined in Annex E. The estimated number of downloads shall be the actual number of downloads of e-media, which has almost the equivalent content types and data capacity to the original example of e-media under study, for the last year.

5.5.3.4 Related scenarios

Related scenarios should seek to represent the actual pattern of shared resource use at each stage. Where not otherwise justified, the determination of the related scenarios shall be based on the functional unit.

5.5.3.5 Energy sources and use

Energy use for the use of e-media shall use recognized country energy factors and document their source to account for the carbon impact for their region. If site-specific data are available from a local energy supplier these data shall be used. Transparency in multi-site production shall be used to avoid double-counting and ensure parity.

Electricity data in the calculation shall include emissions arising from the energy supply system. For the e-media industry, energy calculation reports shall, where possible, include the total units consumed for all energy sources throughout the supply chain required to deliver e-media to an end user and for usage, as defined in the goal and scope of the CFP study. This shall include emissions arising from renewable and non-renewable energy, including direct usage, indirect usage where energy is purchased from third parties, and other indirect emissions. When electricity is generated on site, such as solar or wind power, and consumed for an example of e-media under study, life cycle data for the electricity shall be used for that product. If mixed energy sources are used, the amounts shall be allocated to the product under study.

If an electricity supplier can deliver a specific electricity product and can guarantee that the sale and associated emissions of that electricity are not double counted, the data for that electricity shall be used for the example of e-media under study. If specific GHG data for the electricity product are not provided, the GHG emissions associated with the national grids where the life cycle stage occurs shall be used. If a country has several unconnected grids or several countries share a common grid instead of having national grids, the relevant grid from which the power is obtained shall be used.

Data from recognized databases should be used if specific life cycle data on a process within the energy supply system are unavailable. The treatment of electricity shall be documented and double counting avoided.

Energy reports shall include the total units consumed for all energy sources throughout the supply chain, as defined in the goal and scope of the CFP study.

The use of electrical energy shall be given as a CO_2 emission and the emission factor used shall be stated. To facilitate comparison, the amount of electrical energy shall be communicated consistently using a constant unit, for instance kWh or MJs.

Energy use relating to raw material acquisition, management and extraction: iron, wood, rubber, aluminium, silicon, chemicals, plastic, glass and so on shall be calculated if included in the goal and scope of the CFP study. Sources for this data and its relevance shall be documented.

Energy use for the manufacturing and content delivery processes shall reflect not only the power consumption for active use of the example of e-media under study, but also the power required to deliver and store it.

5.5.3.6 Supply and internal transport determination (optional)

If included in the goal and scope of the CFP study, the energy required to transport all stages of e-media contents and e-media devices shall be calculated, including from the consumer, customer or e-media device manufacturer, and related cloud storage both short and longer term and the data redundancy and delivery mechanism (see Annex C).

Examples of transport include the following:

a) raw materials to processing site;

b) e-media device from e-media device manufacturer or consumer to disposal facility (for landfill, recycling, reuse).

c) content storage and content management in the cloud;

d) content distribution mechanisms;

e) content delivery to consumers and support activities;

f) consumer content access;

g) consumer content reading/viewing.

5.5.3.7 Regional differences and seasonal variations

E-media (contents and e-media devices) produced at multiple sites and then assembled prior to final distribution shall be measured according to the parameters at each site and for each process contributing to the manufacture of the end product.

5.5.3.8 Performance tracking

Performance tracking can be used to monitor GHG emission changes over time. If a CFP study is to be used to calculate the change in an example of e-media's carbon footprint, the following requirements shall be met:

a) the time boundary shall be defined;

b) the change shall be calculated for e-media with identical functional units;

c) the change shall be calculated between two assessments or within one comparative assessment carried out in conformity with this document;

d) when two assessments are made, the change shall be calculated using equivalent goals and scopes, inventories, system boundaries and reference data in order to make fair comparisons.

5.5.3.9 Disposal/recycling (optional)

If disposal and recycling of e-media devices are included in the goal and scope of a CFP study, the following information relating to GHG emissions shall be included in the study:

a) means of transport undertaken by the manufacturer or consumer for the collection and removal of waste e-media devices;

b) means of incineration, composting or landfilling;

c) recycling for reuse.

Any assumptions made regarding disposal/recycling shall be based on published factual information and shall be fully documented. E-media devices shall be recycled or disposed of in line with appropriate health, safety and environmentally acceptable practices.

NOTE Waste generated during production is included in the calculation (see 5.2).

5.5.3.10 Corporate carbon footprint (optional)

Corporate carbon footprint calculations are not required by this document. However, if they are included in the goal and scope of the CFP study, they shall follow allocation procedures and include total GHG emissions and transportation.

NOTE Transportation can include employee and goods transportation to and from facilities.

5.5.4 Production stage for contents

The carbon footprint study shall assess the emission factors associated with the production for contents using the inventory of activities relating to each process as the basis for the assessment according to the goal and scope.

The range of data to be collected for the production stage for contents shall be specified according to the goal and scope of the CFP study. The production stage includes both the raw material acquisition stage and the production stage. Subject to these parameters, collection items and collection methods for data on, for example, energy consumption or input and discharged matter shall be specified, while considering the following:

a) where products are produced at two or more sites and only limited data are to be collected from the principal site as defined in the goal and scope of the carbon footprint study, this site shall be identified;

b) the data of GHG emissions and input amounts per unit related to production should be collected.

5.5.5 Distribution stage for contents (optional)

The distribution stage constituted by system development processes and system operation and maintenance processes can be excluded as the emissions of e-media are usually negligible and very difficult to reliably determine. The data collection items of system operation and maintenance processes are energy consumptions for data centres including servers, archive storage, network and related technologies.

5.5.6 Use stage for contents

The carbon footprint study shall assess the emission factors associated with the use for contents using the inventory of activities relating to each process as the basis for the assessment according to the goal and scope.

Collection items and collection methods for data on, for example, energy consumption shall be specified, considering the following subject to the goal and scope of the carbon footprint study.

The data of GHG emissions and input amounts per unit related to download and streaming should be collected.

5.5.7 Production stage for e-media devices

The CFP study shall assess the emission factors associated with the production for contents using the inventory of activities relating to each process as the basis for the assessment according to the goal and scope.

The range of data to be collected for the production stage for e-media devices shall be specified according to the goal and scope of the CFP study. The production stage includes both the raw material acquisition stage and the production stage. Subject to these parameters, collection items and collection methods for data on, for example, energy consumption or input and discharged matter shall be specified, while considering the following:

a) where products are produced at two or more sites and only limited data are to be collected from the principal site as defined in the goal and scope of the CFP study, this site shall be identified;

b) the data of GHG emissions and input amounts per unit related to production should be collected.

5.5.8 Distribution stage for e-media devices

When part of the goal and scope of the CFP study, data regarding the distribution stage for e-media devices shall be acquired. The range of data to be collected concerning the distribution stage for e-media devices shall be specified in the goal and scope, and distribution stages included in the CFP study shall be included in the inventory of processes. If data are unavailable distribution values can be calculated based on common scenarios.

Collection items and collection methods for data on, for example, energy consumption shall be specified, considering the following subject to the goal and scope of the carbon footprint study:

a) the data of GHG emissions and input amounts per unit related to delivery, storage and use should be collected;

b) where unsold e-media is returned, quantities and methods shall be clarified.

5.5.9 Use stage for e-media devices

For the electricity consumption of e-media devices when using e-media, use the following formula:

$$K = t \times P$$

where

K is electricity consumption of the covered example of e-media with the e-media device (kWh);

t is time required for reading a covered example of e-media (h);

P is electric power of the e-media device (kW).

For e-media devices that consume electricity via a page-turn function, use the following formula:

$$K = n \times P_{\mathrm{p}}$$

where

n is the number of example pages of e-media;

P_{p} is the electric power per page by e-media device (kWh/page).

5.5.10 End-of-life stage for e-media devices (optional)

This document does not require end-of-life calculations. However, if they are included in the goal and scope of a CFP study, the range of data to be collected concerning the disposal/recycling stage of a product shall be specified.

Stored digital data do not have an end of life in the sense of LCA, and so it is with e-media. This document assumes that, whereas the devices required to store, back-up, distribute and use e-media have an end of life, e-media contents do not. Their life span is endless and, whereas some e-media contents will be deleted, it is likely that most will not, and their associated emissions should reflect this.

6 Reporting

6.1 General

The format and purpose of the report shall be defined in the goal and scope of the study, and the results of the study objectively, accurately and completely reported without bias in a CFP report or communication (see ISO/TS 14067). All information relating to the study shall be presented clearly and with sufficient data such that the reader can understand the complexities and uncertainties inherent to the work. Comparisons of the carbon footprints of e-media shall be possible for carbon footprint calculators that have been made using this document. When performing product comparisons, the guidelines provided in Annex F shall be observed.

Emissions and carbon footprint data shall be communicated consistently. Values shall reflect all emissions that have occurred in subsidiary systems used to archive, distribute, use and store e-media.

The expectation for reporting is the same for private and public data reporting; however, there is no requirement that carbon footprinting studies for e-media shall be published.

6.2 Documentation requirements

6.2.1 General

The goal, scope, system boundary and inventory shall be fully documented and reported in a CFP study report which can address CFPs or partial CFPs. Emissions shall be calculated at a frequency suitable for the example of e-media as defined in the goal and scope.

Documents relating to measurements of emissions should be controlled by the collector to provide evidence of conformity to interested internal and external parties. Documents can be summarized in a CFP study report. The report is used to disclose the quantification of a CFP study along with the basis of the decisions taken regarding the study's goal and scope, system boundary and inventory of processes. It shall also show that the provisions of this document are met.

6.2.2 Reporting requirements

The summary report of a CFP study for e-media should be prepared as either a CFP external communication report or a CFP performance tracking report (see ISO 14044).

Both shall include the following content:

a) the results of the quantification of the CFP;

b) an evaluation based on the completeness, sensitivity and consistency checks;

c) an assessment of uncertainty of inputs, outputs and calculation methods;

d) an explanation of any allocation methods used, plus associated documentation.

NOTE For more information, see ISO 14044.

6.3 Interpretation of the carbon footprint of a product

6.3.1 General

A life cycle analysis GHG emissions policy and procedural document should be available to all parties involved in e-media production and distribution, including consumers.

6.3.2 Life cycle interpretation phase

Annex E provides further information of calculation results.

6.3.2.1 General

The life cycle interpretation phase of a CFP study comprises several elements, as follows:

a) identification of the significant factors based on the results of the LCI and LCA phases of LCA;

b) an evaluation that considers completeness and consistency checks;

c) conclusions, limitations and recommendations.

The results of the LCI or LCA phases shall be interpreted according to the goal and scope of the study. The interpretation shall include an assessment and a sensitivity check of the significant inputs, outputs and methodological choices in order to understand any uncertainties of the results.

NOTE Examples of calculation results are shown in Table E.1.

6.3.3 Allocation method

The selected allocation method shall be reported in detail.

7 Communication requirements

7.1 General

This document does not require communication of CFP reports, but an organization can decide to communicate its contents.

The CFP study report, either a CFP communication report or a CFP performance tracking report (see ISO/TS 14067), should be available to all interested parties involved in e-media production and distribution, including consumers, according to the purpose of the study.

The CFP study report should include the following content:

a) quantitative description of the CFP study's original goal and scope, and justification for any modifications to it;

b) a definition of the system boundary and the basis of its selection;

c) the life cycle stages covered in the study;

d) an inventory of unit processes that are the basis of calculations;

e) data;

f) interpretation of the results of the study, including assumptions, conclusions, uncertainties and limitations;

g) the time period for which the carbon footprint study can be considered representative;

h) the time period for the carbon storage of the example of e-media under study, if calculated;

i) an assessment of any uncertainties;

j) an explanation of any allocation methods used.

NOTE For more information, see ISO 14044.

7.2 Interpretation and comparison

The results of a carbon footprint study can be used for comparison only if the CFP quantification and communications are identical in all respects. This requires that they shall address the same product category definition and description based on function, performance and use expectations.

Such product definitions shall have identical functional units and equivalent system boundaries and data descriptions. Comparison of CFPs is only possible if the calculation of CFPs follows an identical CFP quantification and communication model as explained in Annex F.

7.3 Product definitions and product category rules

Where possible these product definitions should be elaborated into product category rules (PCRs), which can be applied to other functional units with the same characteristics. Users of a CFP study should then be able to understand how examples of e-media can be assigned to a particular product category, because their PCRs will be the same.

Communication can be in the form of a CFP external report or a CFP performance tracking report, which reports carbon footprint calculations over time (see Table 1).

Table 1 — General requirements and guidelines for CFP communications options

	CFP external communication report	CFP performance tracking report
Not publicly available CFP communication	No programme No CFP-PCR Optional verification	No programme No CFP-PCR Optional verification
Publicly available CFP communication	Optional programme Optional CFP-PCR Third-party verification or communication report	Optional programme Optional CFP-PCR Third-party verification or communication report

CFP communications report the carbon footprint calculation of a specific set of PCRs. In the document PCRs are expressed as a functional unit to provide the foundation for the CFP calculation. The CFP-PCRs resulting from a CFP study that follows this document can be used as the basis of formal PCRs for e-media.

CFP external communication reports and CFP performance tracking reports can be used as the basis for additional reports, including CFP-PCR claims, CFP-PCR labels and CFP-PCR declarations.

Annex A
(informative)

Inventory analysis of input criteria used to define the product profile

A.1 General

The characteristics of e-media are used to define the criteria that are the basis for calculating its carbon footprint. The functional unit can be a single example of e-media, a collection of e-media or enhanced e-media.

A.2 Inventory analysis of input criteria used to define the product profile

The following list includes the elements of different e-media which can be used to determine the functional unit for a CFP study if e-media devices are included in the goal and scope of the study. These various criteria apply to different categories and types of e-media; however, the specific characteristics applicable to different products will vary with the product type.

Contents

— digital data volume as determined by the data format;

— digital pages as determined by the data format;

— characters (language);

— category of contents (e.g. novel, newspaper, magazine);

— downloaded versus streamed.

E-media devices

— types of e-media devices;

— electricity consumption;

— CFP data of e-media devices (from e-media devices manufacturers);

— other.

A.3 Examples of functional units

— a single download and single reading of an e-media file of a specified size to tablets;

— a single year of downloads of e-media files of a specified size to tablets.

Annex B
(normative)

Operations and materials in processes and data collection itemswithin the system boundary

B.1 General

This document requires a specification of a CFP study's system boundaries and a process inventory. Together the two provide the basis for calculations in a CFP study. Calculations can be made for the whole or part life cycles of e-media, for all processes in the production of e-media.

B.2 Data collection items within system boundary

Figure B.1 summarizes the sources for data collection and definitions of a system boundary. These are the foundations for carbon footprinting studies for e-media. Figure B.2 illustrates an example of the life cycle/life span flow of contents.

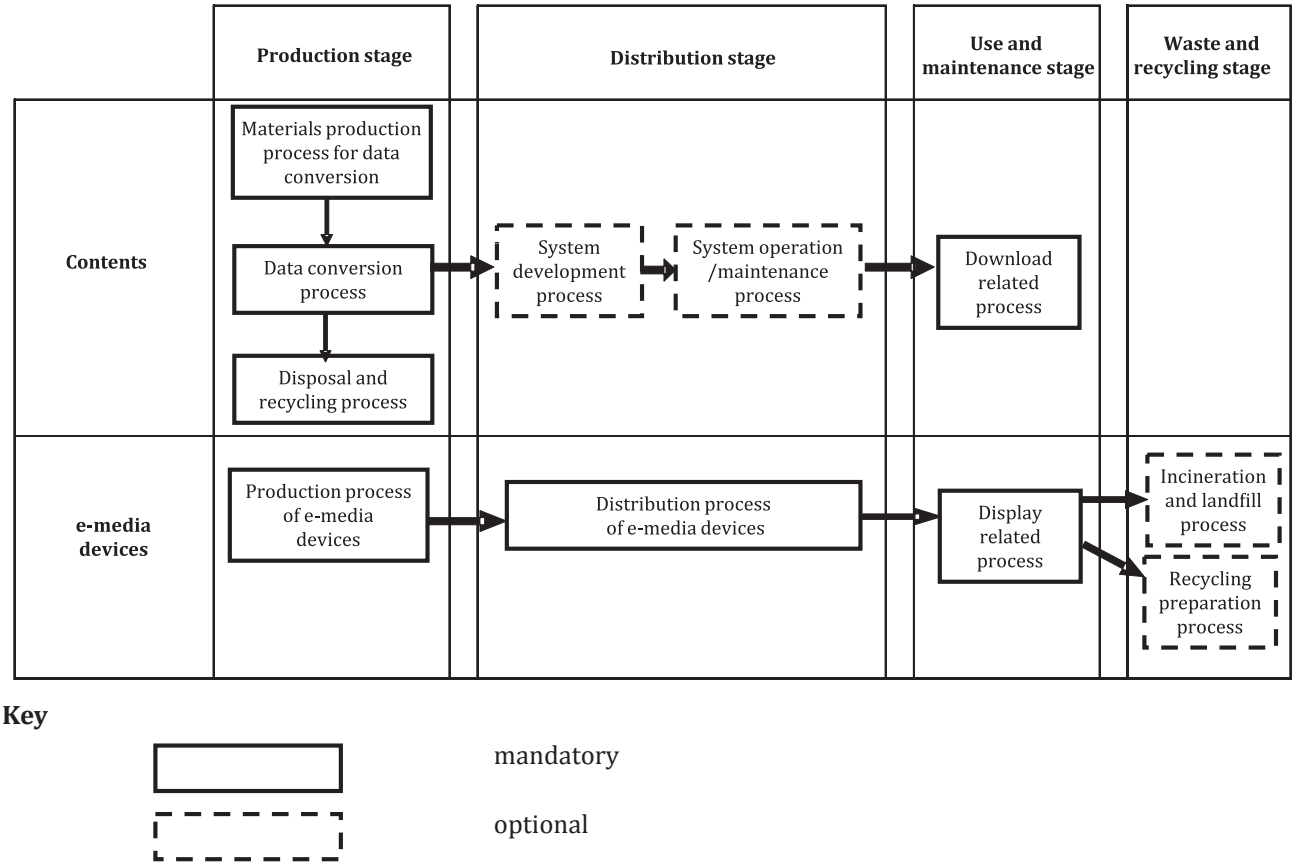


Figure B.1 — Data collection and system boundary for carbon footprint of e-media

B.3 Example of life cycle/life span flow of contents

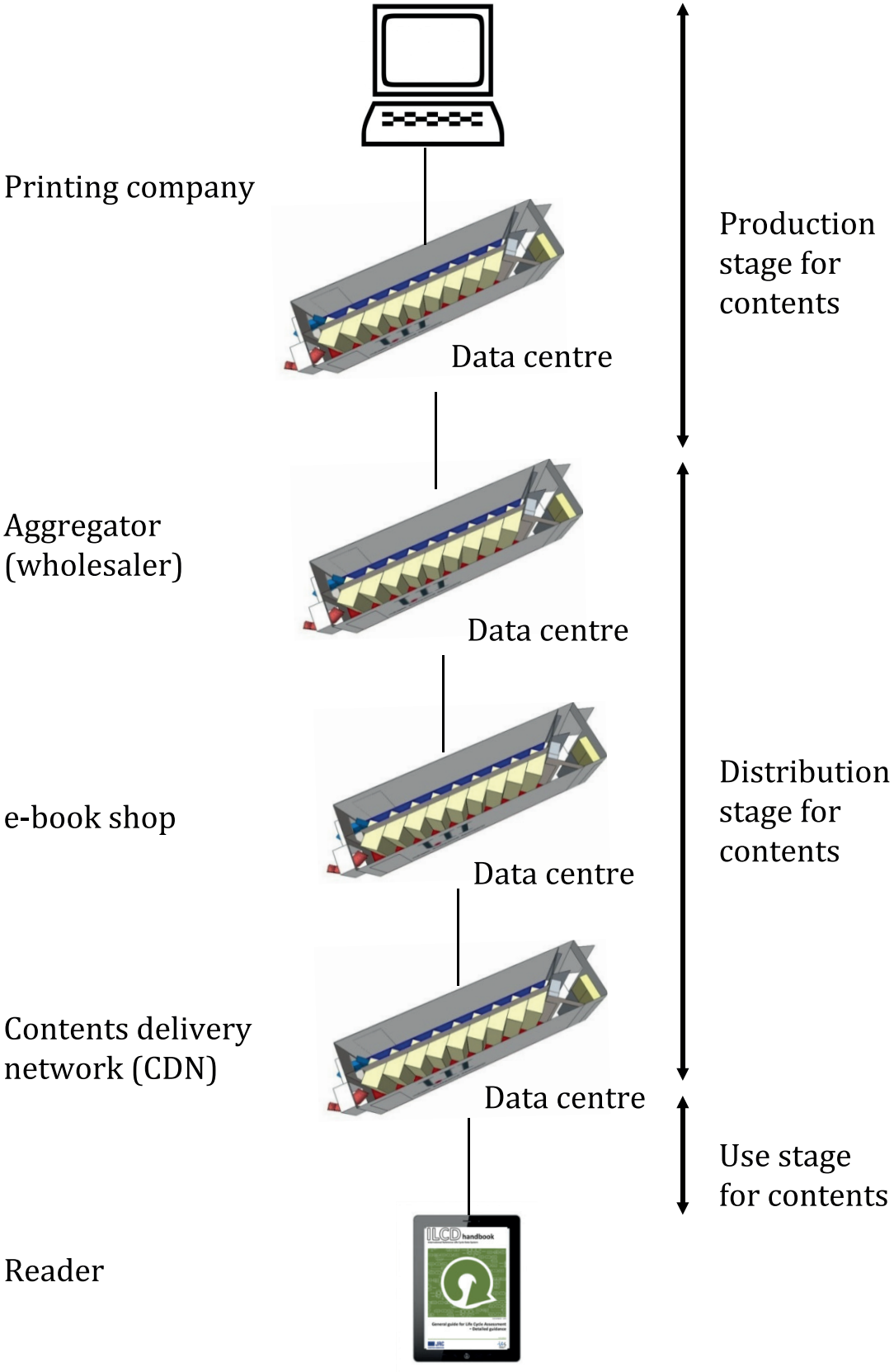


Figure B.2 — Example of life cycle/life span flow of contents

Annex C
(normative)

Allocation method regarding e-media devices

C.1 Allocation method

When impacts of production, distribution and end of life of devices used for e-media are allocated to the example of e-media under study, the following formula shall be referred to:

$$GHG = (GHG_{e,p} + GHG_{e,d} + GHG_{e}) \times t/(t_{sl} \times 365 \times t_{u,d})$$

where

GHG	is GHG emissions per the example of e-media under study, associated with e-media devices (kg-CO_2e);
t_{sl}	is the service life of the e-media device (y);
$t_{u,d}$	is the hours of use per day for the e-media device (h);
t	is the time needed for reading the example of e-media under study (h);
$GHG_{e,p}$	is the GHG emissions of e-media devices used in the production stage (kg-CO_2e/equipment);
$GHG_{e,d}$	is the GHG emissions of e-media devices used in the distribution stage (kg-CO_2e/equipment);
GHG_{e}	is the GHG emissions of e-media devices used in the waste and recycling stage (kg-CO_2e/equipment).

C.2 Use hours per day for e-media devices

C.2.1 General

The use hours per day of the e-media device can be calculated using the following scenario.

C.2.2 Questionnaire survey

Use hours per day ($t_{u,d}$) of e-media device, based on questionnaire survey targeting more than 500 respondents conducted by a third-party, may be used. However, its validity shall be verified.

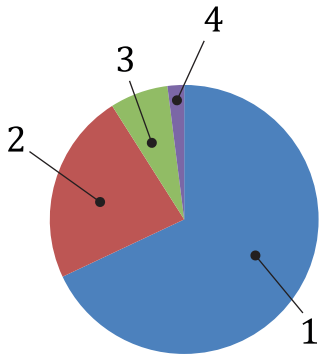
C.2.3 Value of CFP registration information

The value in CFP registration information can be used.

C.3 Supplementation of allocation method

Share process includes not only production but also distribution and end of life of an example of e-media. In the following calculation, "$t/(t_{sl} \times 365 \times t_{u,d})$" is the ratio of "hours needed for reading the example of e-media under study" to "use hours per day for the e-media devices". This can include surfing the

Internet, playing games and so on. Figure C.1 illustrates greenhouse gas emissions for iPads (Wi-Fi + cellular). Figure C.2 illustrates the use of different types of e-media device in Japan.



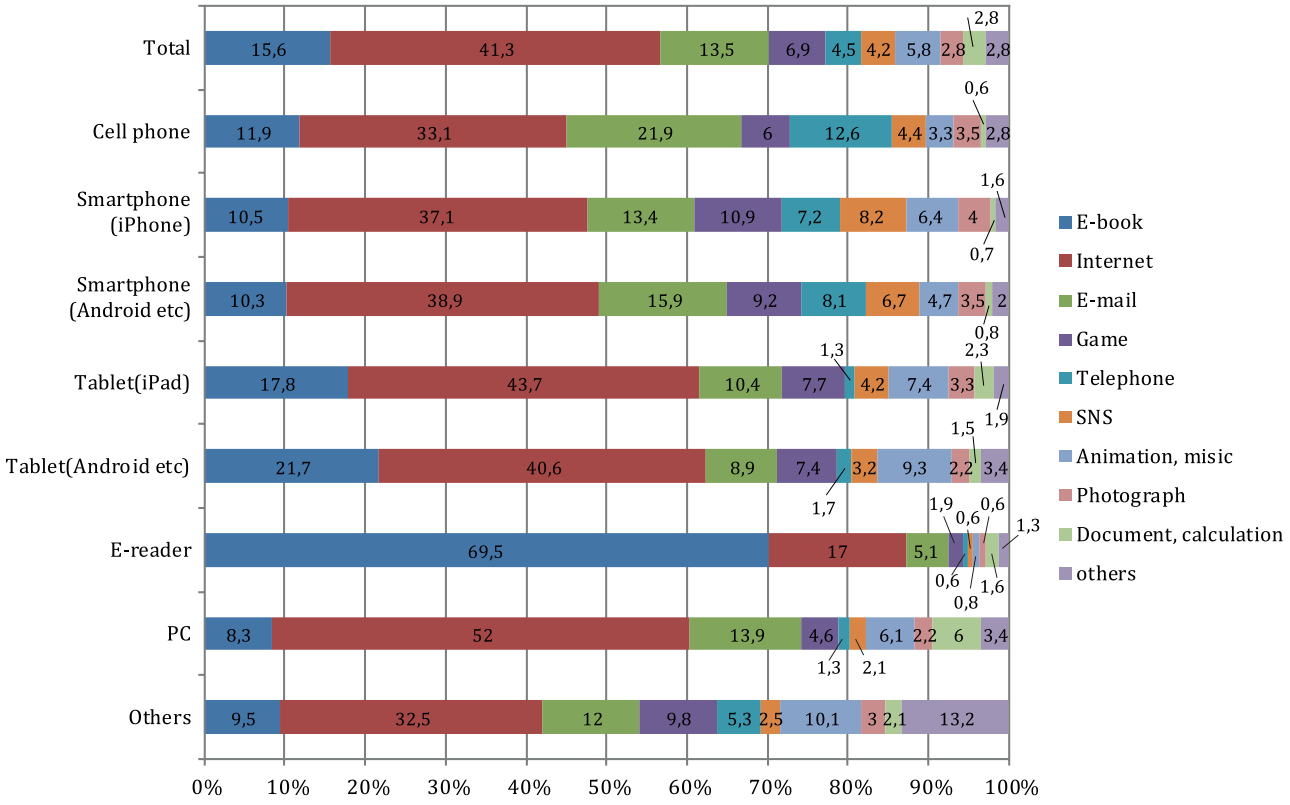
Key

1 production (68 %)
2 customer use (23 %)
3 transport (7 %)
4 recycling (2 %)

NOTE Total greenhouse gas emission: 170 kg CO_2e.

Figure C.1 — Greenhouse gas emission for iPads (Wifi and cellular)

The following is an example of a questionnaire survey conducted in Japan.



NOTE Figures comes from a survey of 52 463 people, May 2013, Japan.

Figure C.2 — Use of different types of e-media device

Annex D
(informative)

Method regarding the number of downloads

D.1 Allocation method

When the impact of the number of downloads of production of contents are allocated to the example of e-media, the following formula shall be referred to.

$$CFP = GHG_{dc,p}/n + GHG_{d,u,m} + GHG_{p} + GHG_{d} + GHG_{u,m} + GHG_{d,r}$$

where

CFP is the CFP of the e-media product under study (kg-CO_2e);

$GHG_{dc,p}$ is the GHG emissions of data conversion process in the production stage of contents (kg-CO_2e);

n is the number of downloads of the e-media product under study;

$GHG_{d,u,m}$ is the GHG emissions per download in the use and maintenance stage (kg-CO_2e /download);

GHG_{p} is the GHG emissions per example of e-media covered by the production stage of the e-media device (kg-CO_2e);

GHG_{d} is the GHG emissions per example of e-media covered by the distribution stage of the e-media device (kg-CO_2e);

$GHG_{u,m}$ is the GHG emissions per example of e-media covered by the use and maintenance stage of the e-media device (kg-CO_2e);

$GHG_{d,r}$ is the GHG emissions per e-media covered by the disposal and recycling stage of the e-media device (kg-CO_2e).

Annex E
(informative)

Calculation examples

The following calculations are provided as examples to demonstrate the results of this document. These case studies are provided to show how this document can be used to create carbon calculators and calculations that reflect the different needs of local markets, sectors and geographies, yet provide reasonably comparable results for different carbon footprinting studies.

A Japanese case of a CFP study of an e-book is shown in Table E.1.

Table E.1 — e-book results for Japan

	Process	Sub-process	Results (kg-CO2e/download)	
Contents	Production	Data creation	0,039	6,8 %
		Digitalization for conversion	0,002	0,3 %
	Distribution	Development for system	0,008	1,4 %
		Operations for system	0,034	5,9 %
	Use	Download	0,003	0,5 %
e-media device	Production	Production for e-media device	0,414	71,9 %
	Distribution	Distribution for e-media device	0,029	5,0 %
	Use	Use for e-media device	0,038	6,6 %
	End of life	End of life for e-media device	0,009	1,6 %
Total			0,576	100,0 %

Annex F
(normative)

Information to be included in e-media carbon footprint comparisons

This document does not allow comparison of products according to environmental superiority and preference. Comparison of CFPs is only possible if the calculation of CFPs follows identical CFP quantification and communication models. The results of any CFP studies, including comparative studies, may be used for external communication in accordance with ISO 14026.

Partial CFPs are not comparable unless they use identical functional units and the omitted processes of the product system are identical and/or not relevant for all compared products.

A CFP communication used for comparisons shall include the following information:

— the product category definition and description (e.g. function, technical performance and use);

— the product definitions for identical functional units;

— equivalent system boundaries;

— equivalent descriptions of data;

— identical criteria for inclusion of inputs and outputs;

— data quality requirements that have the same reproducibility;

— equivalent methods of data collection and data quality requirements;

— identical calculation procedures;

— equivalent allocations;

— equivalent instructions on the content and the format of the CFP communication.

Annex G
(normative)

Limitations of the CFP

G.1 General

Limitations of CFPs affect quantification of CFP. The two most important inherent limitations are

— focus on climate change as the single impact category;

— limitations related to the methodology.

The consequences of these limitations shall be reflected in the CFP study report (see 7.3).

For decision-making (e.g. design options), the following considerations should be undertaken to identify trade-offs and avoid unintended consequences:

a) the whole product life cycle should be included;

b) other impacts (e.g. health and safety, environmental) should be considered;

c) limitations as identified in this annex should be considered.

G.2 Focus on a single environmental issue

The CFP reflects the potential effect on the global radiative energy balance from the sum of GHG emissions and removals of a product system, expressed as CO2e, which are associated with acquisition of raw materials, design, production, transportation/delivery, use and the end-of-life treatment. The CFP can be an important environmental aspect of the life cycle of a product affecting the area of concern "climate change". A product's life cycle can have impacts related to other areas of concern (e.g. resource depletion, air, water, soil and ecosystems). An LCA can cover further areas of concern in addition to climate change, relevant for the product life cycle.

One objective of LCA is to allow an informed decision regarding environmental impacts. Climate change attributable to the CFP is only one of a variety of environmental impacts that can arise from a product's life cycle, and the relative importance of different impacts can vary with different products. In some cases, action to minimize a single environmental impact can result in greater impacts arising from other environmental aspects (e.g. activities to reduce water pollution can result in increased GHG emissions from the life cycle of a product, while the use of biomass to reduce GHG emissions can negatively affect biodiversity). Decisions about product impacts that are only based on a single environmental issue can be in conflict with goals and objectives related to other environmental issues. CFP or partial CFP should not be the sole component of a decision-making process.

G.3 Limitations related to the methodology

The CFP is calculated based on LCA methodology. ISO 14040 and ISO 14044 address its inherent limitations and trade-offs. These include the establishment of a functional or declared unit and the system boundary, the availability and selection of appropriate data sources, allocation procedure and assumptions regarding the transport, user behaviour and end-of-life scenarios. Some of the chosen data might be limited to a specific geographical area (e.g. national electricity grid) and/or might vary in time (e.g. seasonal variations). Value choices (e.g. for the selection of the functional or declared unit or allocation procedure) are also needed to model a life cycle.

These methodological constraints can have an influence on the outcome of the calculations. As a result, the accuracy of quantifying the CFP is limited and is also difficult to assess. Hence, other approaches such as energy-consumption-in-use assessment might be preferable in certain circumstances. However, establishing the importance of use-stage GHG emissions is not possible without first assessing the life cycle GHG emissions of a product.

Because of these limitations, the results of a quantification of the CFP in accordance with this document are often not a sound basis for comparisons. However, these results may be used for comparisons provided that, at a minimum, the requirements of Annex F and requirements for a separate footprint communication programme for the CFP or partial CFP information are met.

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