

TECHNICAL REPORT



Quantification methodology for greenhouse gas emissions for computers and monitors

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IEC TR 62921:2016

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QUANTIFICATION METHODOLOGY FOR GREENHOUSE GAS EMISSIONS FOR COMPUTERS AND MONITORS

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IEC TR 62921, which is a Technical Report, has been prepared by technical area 13: Environment for AV and multimedia equipment, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This second edition cancels and replaces the first edition published in 2015.

The text of this Technical Report is based on the following documents:

Enquiry draft	Report on voting
100/2598/DTR	100/2717/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
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- replaced by a revised edition, or
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INTRODUCTION

Many organizations are looking to adopt product greenhouse gas emissions reporting mechanisms, including:

- computer and monitor manufacturers, as well as their suppliers and downstream users;
- governmental agencies including France, China, Japan, Korea and the European Commission;
- retailers and non-regulatory agencies.

There have been several international and regional efforts to provide guidance for calculating product greenhouse gas emissions. Some of these efforts include IEC TR 62725, ITU-T L.1410, ETSI TS 103 199, and Greenhouse Gas Protocol ICT Sector Supplement.

Unfortunately, some lack of specificity within these documents allows for variability that can create a significant difference in product greenhouse gas emission results, depending on how a practitioner interprets the information. Throughout the process of developing IEC TR 62725, there was significant discussion regarding the need for further specificity, transparency and pragmatism in methodology guidance for products covered under IEC TC 100, including computers and monitors. There is an urgent need to enable methodologies that offer accurate and defensible estimates of impact in a rapid and effective manner. This Technical Report aims to fill in some of those gaps.

This Technical Report builds upon the structure laid out by IEC TR 62725. Its goal is to support universal streamlined product greenhouse gas methodologies for practitioners, with a further goal of harmonizing the various regional efforts currently in progress.

This Technical Report's quantification methodology aims to be compliant with, and therefore be used within, a number of these broader standards efforts. It will provide detailed guidance for estimating greenhouse gas emissions for computers and monitors, in order to obtain consistent, accurate results. The benefit of consistent results is that they can assist multiple efforts, including but not limited to:

- supporting customer enquiries;
- instituting sustainable design practices;
- initiating conversations around emissions reduction strategies with suppliers and downstream users;
- targeting data collection within the supply chain in order to address data quality issues.

QUANTIFICATION METHODOLOGY FOR GREENHOUSE GAS EMISSIONS FOR COMPUTERS AND MONITORS

1 Scope

This Technical Report outlines detailed guidance to streamline the quantification of greenhouse gas emissions for computers and monitors. Other audio, video and multimedia products, such as e-readers, phones, and storage equipment, can be included in future revisions of this Technical Report.

For this Technical Report, computers and monitors include notebooks, desktops, integrated desktop computers, tablets, thin clients, workstations and monitors.

This Technical Report provides specific guidance for the use of streamlining techniques that minimize cost and resources needed to complete greenhouse gas emissions quantifications. In addition, the product category rules (PCR) section of this Technical Report recommends “state-of-the-art” process and data assumptions in order to reduce uncertainty. Lastly, this Technical Report provides an example of how a calculation could be performed.

2 Terms and definitions

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

2.1

carbon footprint of a product CFP

sum of greenhouse gas emissions and removals in a product system, expressed as CO₂ equivalents and based on a life cycle assessment using the single impact category of climate change

Note 1 to entry: The CO₂ equivalent of a specific amount of a greenhouse gas is calculated as the mass of a given greenhouse gas multiplied by its global warming potential.

Note 2 to entry: Results of the quantification of the CFP are documented in the CFP study report expressed in mass of CO₂e per functional unit.

[SOURCE: ISO/TS 14067:2013, 3.1.1.1, modified – Notes 2 and 3 have been removed and Note 4 has been renumbered as Note 2.]

2.2

comprehensive carbon footprint of a product

carbon footprint of a product (2.1) that is product-specific and includes the carbon impacts for every component and process in that product’s life cycle

2.3

computer

device which performs logical operations and processes data

Note 1 to entry: Computers are composed of, at a minimum:

- a) a central processing unit (CPU) to perform operations;
- b) user input devices such as a keyboard, mouse, digitizer or game controller; and
- c) a computer display screen to output information.

[SOURCE: ENERGY STAR® Program Requirements for Computers]

2.4 desktop

computer whose main unit is designed to be located in a permanent location, often on a desk or on the floor

Note 1 to entry: Desktops are not designed for portability and are designed for use with an external monitor, keyboard, and mouse. Desktops are intended for a broad range of home and office applications, including point of sale applications.

[SOURCE: ENERGY STAR® Program Requirements for Computers]

2.5 greenhouse gas emissions GHG emissions

total mass of greenhouse gases released to the atmosphere over a specified period of time

[SOURCE: ISO 14064-1:2006, 2.5, modified – Use of the plural in the terms.]

2.6 integrated desktop computer

computer in which the computing hardware and monitor are integrated into a single housing, and which is connected to a.c. mains power through a single cable

Note 1 to entry: Integrated Desktop Computers come in one of two possible forms:

- a) a system where the monitor and computer are physically combined into a single unit; or
- b) a system packaged as a single system where the monitor is separate but is connected to the main chassis by a d.c. power cord and both the computer and monitor are powered from a single power supply.

As a subset of desktops, integrated desktop computers are typically designed to provide similar functionality as desktops.

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[SOURCE: ENERGY STAR® Program Requirements for Computers]

2.7 monitor

product with a display screen and associated electronics, often encased in a single housing, that as its primary function produces visual information from a computer, workstation, or server

Note 1 to entry: Visual information input can be received via one or more inputs (e.g., VGA, DVI, HDMI, DisplayPort, IEEE 13994, USB), external storage (e.g. USSB flash drive, memory card), or a network connection.

[SOURCE: ENERGY STAR® Program Requirements for Displays]

2.8 notebook computer

computer designed specifically for portability and to be operated for extended periods of time both with and without a direct connection to AC mains power source

Note 1 to entry: Notebooks include an integrated monitor, a non-detachable, mechanical keyboard (using physical, moveable keys) and pointing devices.

[SOURCE: ENERGY STAR® Program Requirements for Computers]

2.9 primary data

data collected from specific processes in the studied product's life cycle

[SOURCE: GHG Protocol Product standard:2011]

2.10**primary aggregated data**

data that are collected directly from suppliers or industry associations on a product type (not specific product) and aggregated

Note 1 to entry: This is an approach in which single components can be sourced from multiple suppliers each with multiple facilities and multiple downstream suppliers. Primary data for every item is impossible.

2.11**product category rules****PCR**

set of specific rules, requirements and guidelines for quantification and communication on the carbon footprint of a product for a specific product category

[SOURCE: ISO TS 14067:2013, 3.1.4.12, modified — “for developing Type III environmental declarations for one or more product categories” has been replaced by “for quantification and communication on the carbon footprint of a product for a specific product category”.]

2.12**secondary data**

process data that are not from specific processes in the studied product’s life cycle

[SOURCE: GHG Protocol Product standard:2011]

2.13**state-of-the-art**

<data and processes> developed stage of technical capability at a given time as regards products, processes and services, based on the relevant consolidated findings of science, technology and experience

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[SOURCE: ISO/IEC Guide 2:2004, 1.4, modified — The domain “<data and processes>” has been added before the definition.]

2.14**streamlined carbon footprint of a product**

carbon footprint of a product (2.1) that involves some level of simplification compared to a comprehensive carbon footprint

Note 1 to entry: Typical approaches to streamlining a product carbon footprint calculation consist of simplifying data collection and/or reducing the number of data inputs required.

2.15**slate****tablet**

computer designed for portability that meets all of the following criteria:

- a) includes an integrated display with a diagonal size greater than 1 650 mm (6,5 inches) and less than 4 420 mm (17,4 inches);
- b) lacking an integrated, physical attached keyboard in its as-shipped configuration;
- c) includes and primarily relies on touchscreen input (with optional keyboard);
- d) includes and primarily relies on a wireless network connection (e.g., Wi-Fi, 3G, etc.); and
- e) is primarily powered by an internal battery (with connection to the mains for battery charging, not primary powering of the device)

[SOURCE: ENERGY STAR® Program Requirements for Computers]

2.16 thin client

independently-powered computer that relies on a connection to remote computing resources (e.g., computer server, remote workstation) to obtain primary functionality

Note 1 to entry: Main computing functions (e.g. program execution, data storage, interaction with other Internet resources) are provided by the remote computing resources.

Note 2 to entry: Thin clients covered by this Technical Report are

- a) limited to devices with no rotational storage media integral to the computer and
- b) designed for use in a permanent location (e.g. on a desk) and not for portability.

[SOURCE: ENERGY STAR® Program Requirements for Computers]

2.17 uncertainty analysis

systematic procedure to quantify the uncertainty introduced in the results of a life cycle inventory analysis due to the cumulative effects of model imprecision, input uncertainty and data variability

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 14040:2006, 3.33, modified – The note has been changed.]

2.18 workstation

high-performance, single-user computer typically used for graphics, CAD, software development, financial and scientific applications among other compute intensive tasks

[SOURCE: ENERGY STAR® Program Requirements for Computers]
http://www.energystar.gov/program/requirements_for/Computers/ad-94f2-Bd64329ad0a/iec-tr-62921-2016

3 Symbols and abbreviations

AC	alternating current
CAD	computer-aided design
CFP	carbon footprint of a product
CPU	central processing unit
DQI	data quality inventory
DR	distinction rate
DVI	digital visual interface
EE product	electrical and electronic product
EoL	end-of-life
FS	false signal rate
HDD	hard disk drive
HDMI	high-definition multimedia interface
ICs	integrated circuits
ICT	information and communications technology
IEEE	institute of electrical and electronics engineers
kg CO ₂ e	kilograms of carbon dioxide equivalent
LCA	like cycle assessment
LCD	liquid crystal display

LCI	life cycle inventory
LCIA	life cycle impact assessment
LCT	life cycle thinking
ODD	optical disk drive
PAIA	product attribute to impact algorithm
PCR	product category rules
PSU	power supply unit
PWB	printed wiring board
SSD	solid state drive
TEC	typical energy consumption
USB	universal serial bus
VGA	video graphics array
VT	validation team

4 Principles

4.1 Comparing streamlined CFP to comprehensive CFP

4.1.1 General

The carbon footprint of a product estimates the total potential contribution of a product to global warming by quantifying all significant greenhouse gas emissions and removals over the product's life cycle. Comprehensive CFPs are product-specific and include the carbon impacts for every component and process in that product's life cycle. A comprehensive CFP takes a significant amount of resources, time, and data demands to complete.

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Given these challenges, streamlined CFP approaches are critical, particularly in industries such as the information and communications technology (ICT) industry, which have complex products and rapid product-development cycles. The streamlined approach reduces the amount of time and resources needed for data gathering and calculation in order to achieve the needed level of accuracy. Therefore, the streamlining approach follows the rule that only the materials, components and processes that are associated with the most significant product carbon impacts are included in the analysis.

While many different definitions of a streamlined CFP exist, the common characteristic is that they all involve some level of simplification, as compared to a comprehensive CFP. With comprehensive CFPs rarely being executed, it is this collection of streamlined CFP approaches that represent a common approach to CFP. These streamlined approaches, when executed according to recognized practices, reduce the burden of a CFP, while still allowing the necessary goals of the CFP to be achieved (see Figure 1).

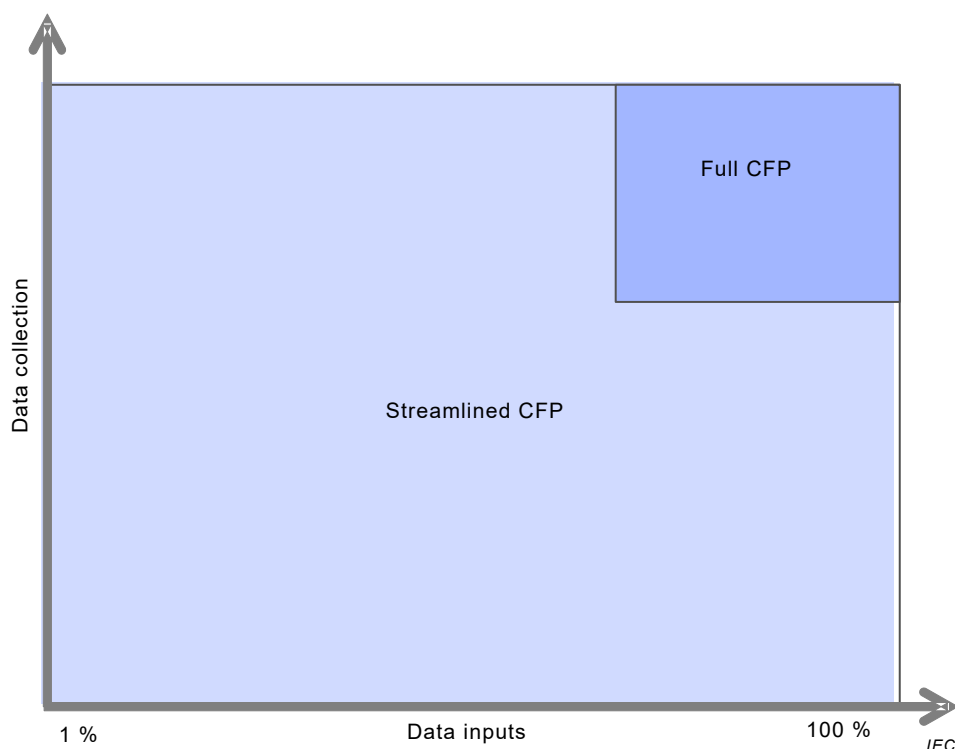


Figure 1 – Depiction of how streamlined CFP fits into comprehensive CFP

4.1.2 Level of streamlining

While streamlined CFPs are clearly less resource-intensive, the extent of streamlining that is possible is entirely dependent on the goal of the CFP and, more specifically, the questions that the CFP is attempting to answer. Typically, the more general the questions are that need to be answered, the more streamlined the CFP can be.

For example, high-level product CFPs, focused on understanding the overall impact of a product or which life cycle phases dominate product impact, can be completed using a streamlined CFP. For such cases, the additional resolution and specificity provided through a more comprehensive CFP are not needed.

However, if information is needed to assess specific materials or design choices around a product (i.e. evaluating materials used in packaging, or evaluating trade-offs in product design), then a more specific and detailed analysis is warranted. In this case, improved data collection and more primary data input can be required, leading to a more comprehensive CFP. In general, the more specificity that is required in the CFP results, the more comprehensive the CFP will need to be.

4.2 Viability of streamlined CFP

4.2.1 Streamlining in IEC TR 62725

Streamlined methodologies that apply a trial estimation approach are described in IEC TR 62725:2013, 6.4, 6.5, Annex B and Annex D. Rather than applying a quantitative cut-off threshold (e.g. less than 5 % of the total estimated emissions can be excluded from the CFP analysis) as described in IEC TR 62725, in the streamlined approach a high level statistical analysis using available data and Monte Carlo simulations is performed to determine the life cycle activities that are the biggest contributors to impact and uncertainty. Targeted data collection is then performed, based on this analysis, to confirm impacts and further reduce uncertainty to desired levels. Use of a streamlined approach informs the appropriate cut-off criteria in view of the workability and availability of the process data.