

Carbon Footprint of Product (CFP), GHG emission reductions and avoided emissions from EE products

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2024/9/27

Agenda



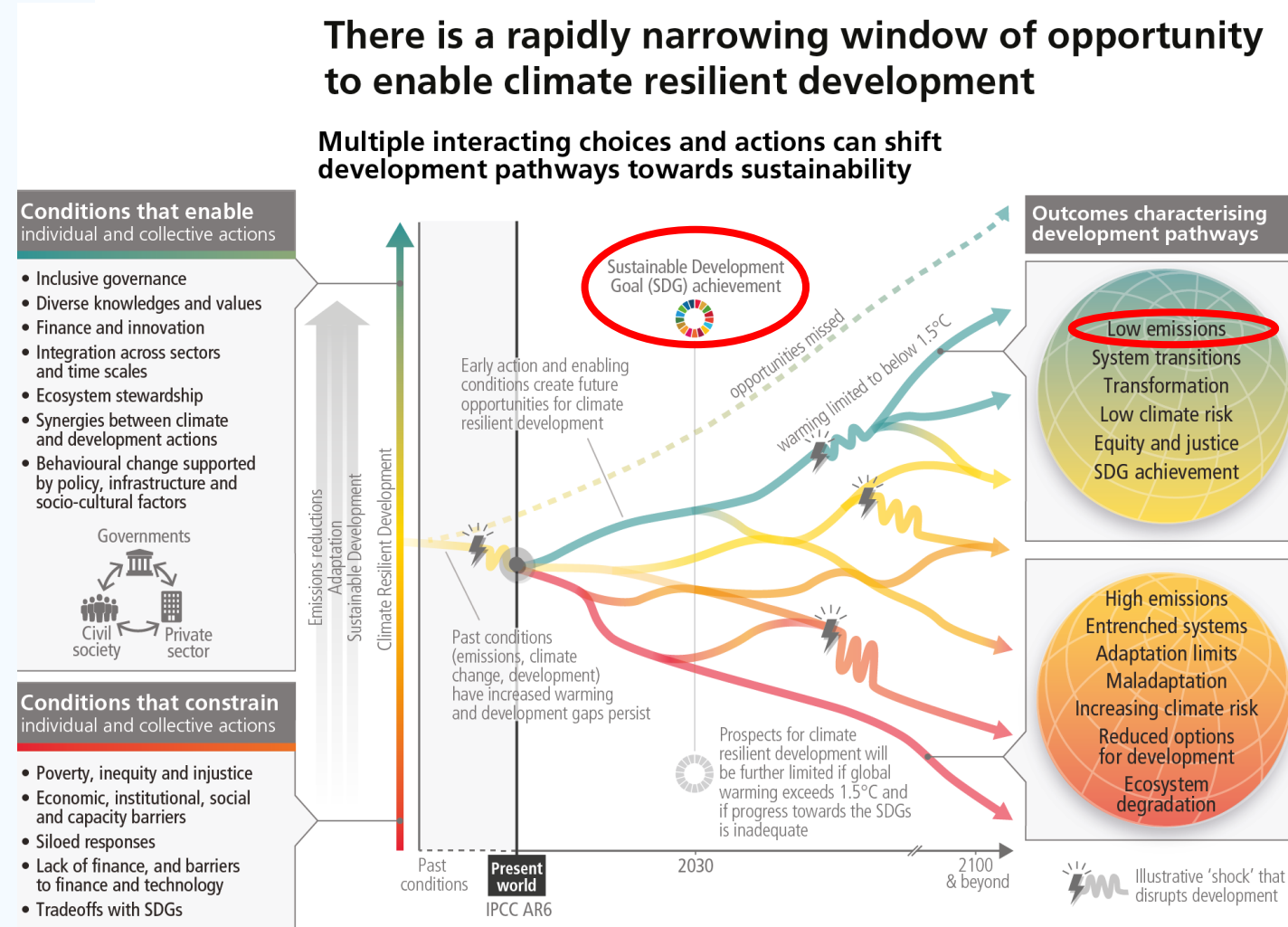
- 1. Overview of TC111 WG17 and IEC63372**
- 2. IEC 63372 CDV**
 - 2.1 Summary of IEC 63372 CDV**
 - 2.2 CFP**
 - 2.3 GHG emission reductions and avoided emissions**
- 3. Future Work related to CFP**

1 . Overview of TC111 WG17 and IEC 63372

1.1 Summary of IPCC the 6th Integrated Report

- “ Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850–1900 in 2011–2020. ”
- “Global GHG emissions in 2030 implied by nationally determined contributions (NDCs) announced by October 2021 make it *likely* that warming will exceed 1.5°C during the 21st century and make it harder to limit warming below 2°C. ”
- “The choices and actions implemented in this decade will have impacts now and for thousands of years”

Source: IPCC AR6 Synthesis Report



Source: IPCC AR6 Synthesis Report SPM.6

1.2 Why do we develop IEC63372?

- Is it enough to reduce Scope 1, 2 and 3?
- Can EE products and systems accelerate to reduce Greenhouse gas?
- How can we quantify the **CFP** of EE products and systems, and **emission reductions** and **avoided emissions** from EE products and systems?



IEC 63372 is developed for contribution to **transition toward low carbon society and decarbonization**

1.3 Overview of TC111 WG17

Title of Working Group: Greenhouse gas (GHG)
Scope: Standardization activity by considering neutral framework and quantification methods and communication for GHG emissions and GHG emission reduction by EE products, service and system.
International Experts: over 70 member, 18 national committees, 1 Liaison
Convenor: Takako Hiruta

Region	Number of experts
Asia	26
Africa	11
Europe	19
America	14
Liaison	2
Total	73



The first F2F meeting at Delft in Netherlands in 2022 6

1.4 Overview of IEC 63372

- IEC std. no.: IEC 63372
- Type of IS: International Standard with Horizontal Function
- Title: QUANTIFICATION AND COMMUNICATION OF GHG EMISSIONS AND EMISSION REDUCTIONS/
AVOIDED EMISSIONS FROM ELECTRIC AND ELECTRONIC PRODUCTS AND SYSTEMS
– PRINCIPLES, METHODOLOGIES, REQUIREMENTS AND GUIDANCE
- Previous documents: IEC TR 62725: 2013 CFP
IEC TR 62726: 2014 GHG emission reductions project

Termination of the stability period of the 2 TRs: 2020

IEC 63372 is composed of updates of 2 IEC TRs and avoided missions

2. IEC63372 CDV

2.1 Summary of IEC63372 CDV

2.1.1 IEC 63372 and other standards

Standardization Org.	Scope	Carbon Footprint of Product	GHG Emissions at Organization Level	GHG Emission reductions	Avoided Emissions at product level	Avoided Emissions at organization level
ISO 	General	ISO 14067	ISO 14064-1	ISO14064-2 (project)	N/A	ISO 14064-1 amd. Annex
IEC 	EE Product	IEC 63372 CDV 6.1 (IEC TR 62725)	N/A	IEC 63372 CDV 6.2 (IEC TR 62726)	IEC 63372 CDV 6.3	IEC 63372 CDV 6.3.9 (methods of accumulation)
ITU-T 	ICT*	See note**	ITU-T L. 1420	ITU-T L. 1430	ITU-T L. 1480	ITU-T L. 1480
GHG Protocol / Wbcds/ WRI 	General	Product Life Cycle Accounting 	- A Corporate Accounting and Reporting Standard - Corporate-Value-Chain (Scope 3) Accounting Reporting Standard 	The GHG protocol for Project Accounting 	N/A	Guidance on Avoided Emissions 

Note: * ICT = Information and Communication Technology

** ITU-T L.1410 is composed of 2 parts; part 1: a framework and guidance for LCA based on ISO14040 and ISO 14044, covering not only CFP but all environmental aspects, part 2: comparative analysis based on LCA results of an ICT product system

General

2.1.2 IEC 63372 CDV Index & Chapter Summary

1. Scope

- Principle, methods, requirements and guidance for quantification and communication of CFP, GHG emission reductions, and avoided emissions from EE products and system

2. Normative Reference

- Normative reference: IEC 63366 (PCR for LCA), ISO14067 (CFP)

3. Terms and Definition

- Terms and abbreviations
 - Critical term: Avoided Emissions

4. Principles

- Principles : Life Cycle Thinking (LCT), Appropriateness, Completeness, Consistency, Accuracy, Transparency, Conserveness, Priority to scientific approach, Avoiding double counting

5. Strategy

- Pathway to low carbon and decarbonization, how to reduce GHG emissions in value chain

6. Quantification

- How to quantify CFP, emission reductions and avoided emissions

7. Verification and Validation

- Verification of the results: One-party verification, monitoring

8. Communication and Disclosure

- Requirements of communication: baseline scenario for avoided emissions, double counting avoided emissions
 - CFP: based on ISO14025

2.1.3 Scope and Normative Reference

Key points:

- GHG emissions quantification such as CFP is based on **Product Category Rules**
- Product includes both **goods and service**
- **Basic Horizontal Function** – Product TCs should develop the documents based on the IEC 63372 when a product TC develop GHG standards for specific product.
In case of no standard for a product TC, can use the IEC63372
- Normative reference standards: IEC 63366 Product category rules (PCR) and ISO 14067 (CFP)
 - The requirements related to EE products and systems are applied to the standards.

2.1.4 Principles

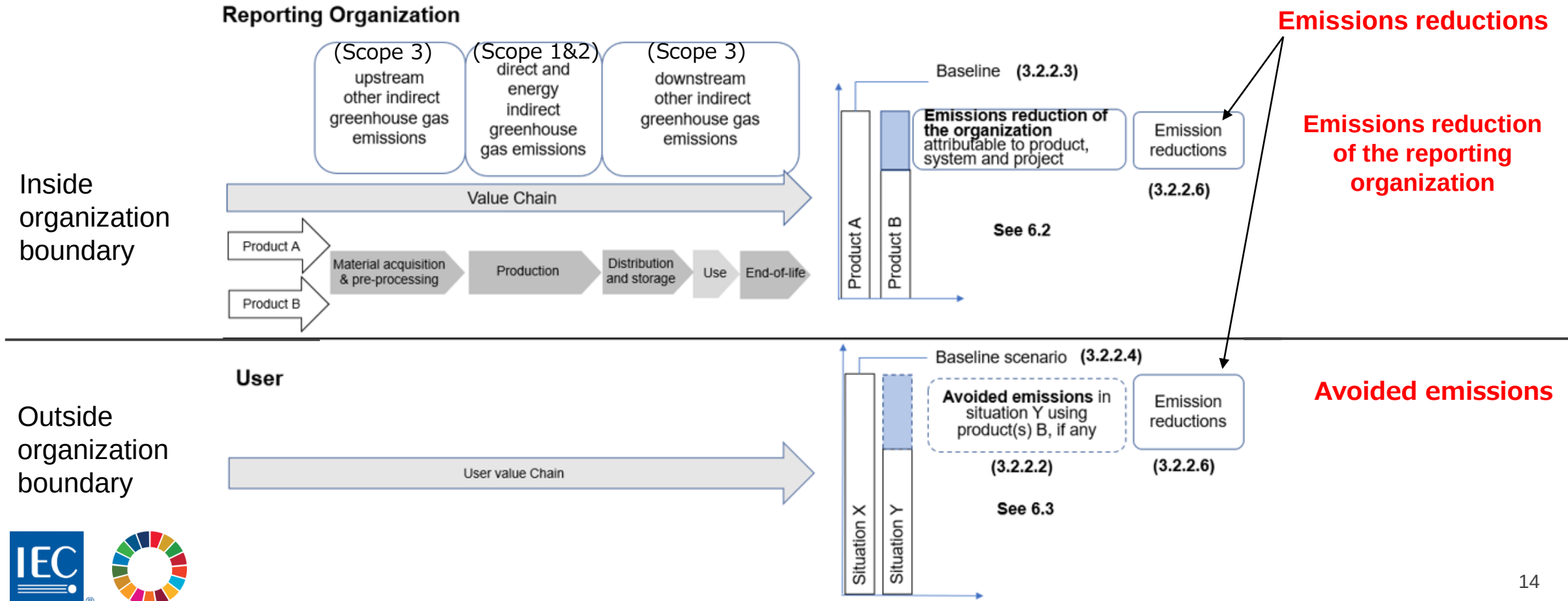
- Life Cycle Thinking (LCT) - IEC 62430:2019
- Relevance – ISO14067:2018 5.2, ISO 14064-2 4.2
- Completeness – ISO 14067:2018 5.7, ISO 14064-2: 2019 4.3
- Consistency – ISO14067:2018 5.8, ISO 14064-2:2019 4.4
- Accuracy – ISO14067:2018 5.10, ISO14064-2:2019 4.5
- Transparency – ISO 14067:2018 5.11, ISO14064-2:2019 4.6
- Conservativeness – ISO 14064-2: 2019 4.7
- Priority of scientific approach
- Avoidance of double counting – ISO 14067 5.12

2.1.5 Strategy toward Net-zero

To achieve low carbon society and decarbonization, organizations must reduce GHG emissions => **but how? and what?**

=> Need information how much a new product or a new system can reduce or increase the GHG emissions

=> Who should be provided the information?: **Manufacturer and system provider** can share **Avoided emissions**



2.2 CFP

2.2.1 What is the Carbon Footprint of Product?

- **Carbon Footprint of Product (CFP)**

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

=> **Cradle to Grave**

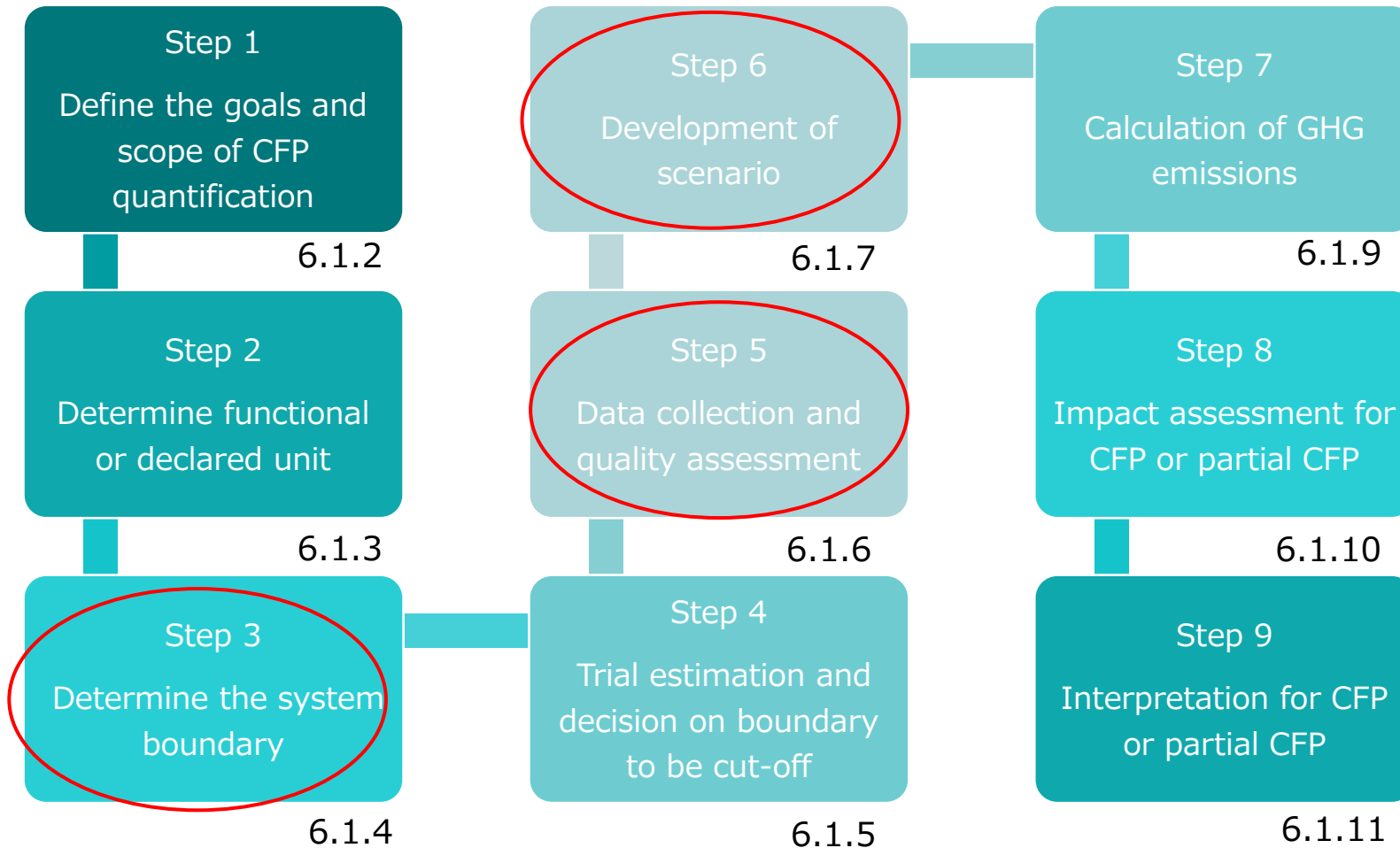
- **Partial Carbon Footprint of Product (Partial CFP)**

sum of GHG emissions and GHG removals of one or more selected process(es) in a product system, expressed as CO2 equivalents and based on the selected stages or processes within the life cycle

=> **Cradle to Gate**



2.2.2 Steps of quantification of CFP



CFP requirements and guidance
based on **PCR IEC 63366 FDIS** and
CFP ISO14067:2018

LCA is fundamental of CFP.

In Annex B

Example of calculations in use phase

$$GHG\ emissions = \sum_{i=1}^p (EE\ consumption_i \times CEI_i)$$

$EE\ consumption_i$ (kWh)

CEI_i Carbon emissions intensity
(kgCO₂e/kWh)

2.2.3 System Boundary – Step3

Items to be considered for EE products and systems

- Hardware : material usage, energy consumption, transport, waste
- Software : Electricity usage and paper usage by the designers
- Consumables, peripherals, other support products: information media like CD, printer's cartridge, energy consumption for cooling, lighting, power supply equipment, printout like manuals
- Packaging/shipping materials,
- Storage of goods : cooling and lighting
- Transport : fuel consumption during transport

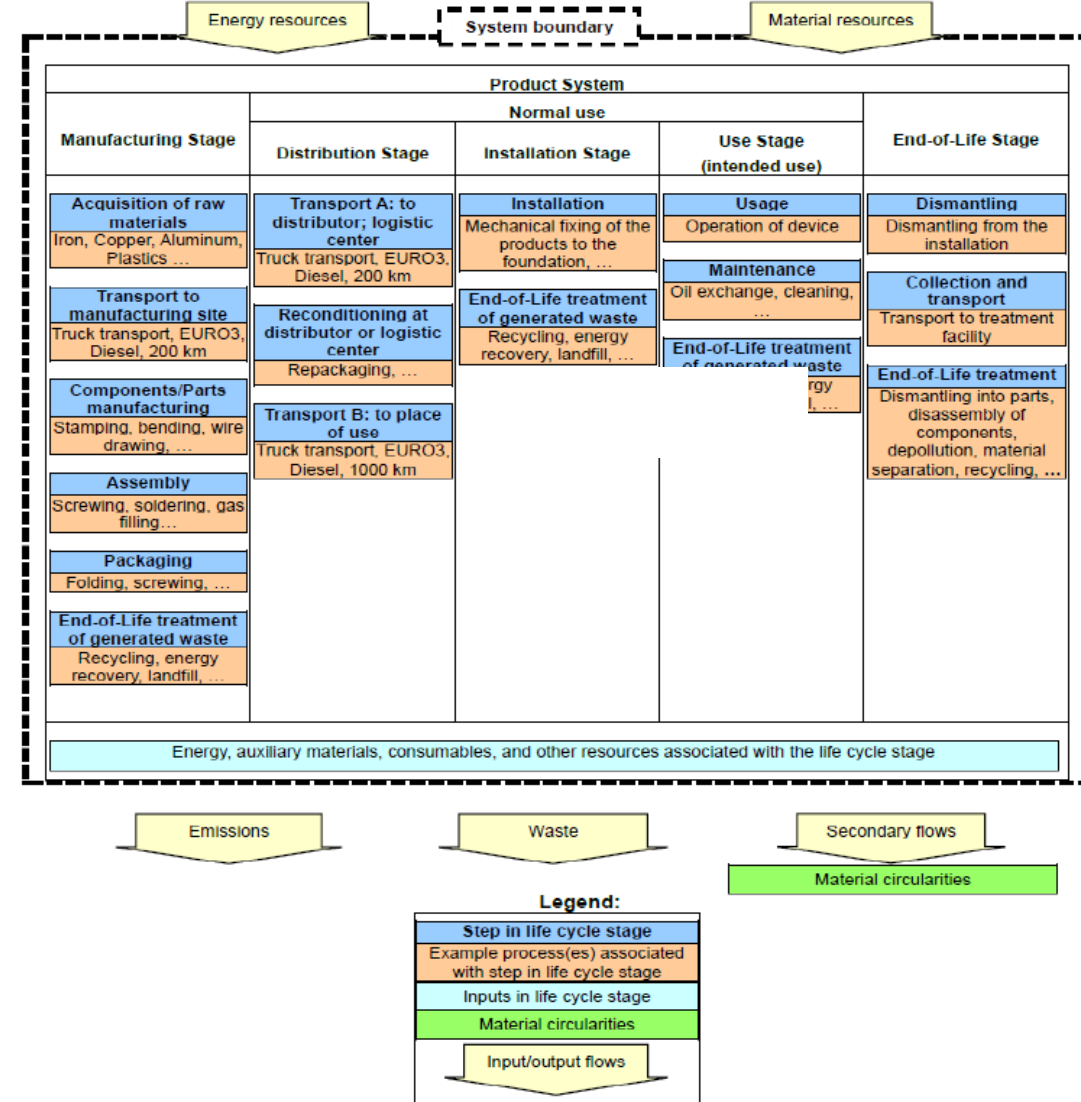


Figure 5 – Example of Scheme of the analysed product system's boundaries (modified IEC 63366, Figure 2)

2.2.3 Data collection and quality assessment - Step 5

Data collection

- **Primary data**

Requirement: site specific data for the processes that the organization has financial or operational control

Recommendation: to get partial CFP for parts, materials, and services from suppliers.

- **Secondary data**

Can use secondary data.

ex. Life cycle database, industry association, IPCC databadata from another or similar process and activity data controlled by the organization or the suppliers

Data quality assessment

Requirement: characterized by both quantitative and qualitative aspects

Two-step approach for data quality evaluation

Step 1

Time-related coverage, geographical coverage, technology coverage, precision

Step 2

completeness, representativeness, consistency, reproducibility, source of data, uncertainty of the information

2.2.4 Scenario Development –Step 6

Transport Scenario

Requirements

- transportation and distribution of purchased components and materials
- transportation and distribution of sold products to users

Recommendations

- distance
- Size and weight for products
- means of transportation, such as air, ship, etc.
- loading rate, empty return ratio,
- Fuel efficiency or emission intensity factors

Use and Maintenance Scenario

Requirements

- Product energy consumption and/or dissipation during service life
- Carbon emission intensity
- Use of consumables
- Operation and maintenance

End of Life Scenario

Requirements

- Scenario recommended from preparation for disposal and recycle
 - collection, packaging, and transport of EoL products
 - dismantling of components from EoL products, shredding and sorting
- Scenario from disposal, recycle
 - Material recycling process
 - Incineration and sorting of bottom ash
 - Landfilling, landfill maintenance
 - GHG discharge for product containing gas

2.2.5 Extrapolation rule

Extrapolation rule is a rule that allows the CFP calculation for a representative product of a product family to be applied to the other products in the same product family, rather than calculating for each product model.

- 6.1.12 Extrapolation rule

If no rules are set in the PSR, the following steps shall be followed to define extrapolation rule(s):

- Perform the LCA of representative products of the homogenous product family;
- Identify and quantify the products parameters (physical characteristics) that vary between the different products of the homogeneous product family (e.g., dimensions, weight of parts, materials, energy consumption...), and run a sensitivity analysis to identify influential parameters and define an extrapolation rule; and
- Document the extrapolation rule(s) and the process to define it in the LCA report.

3.2.1.19

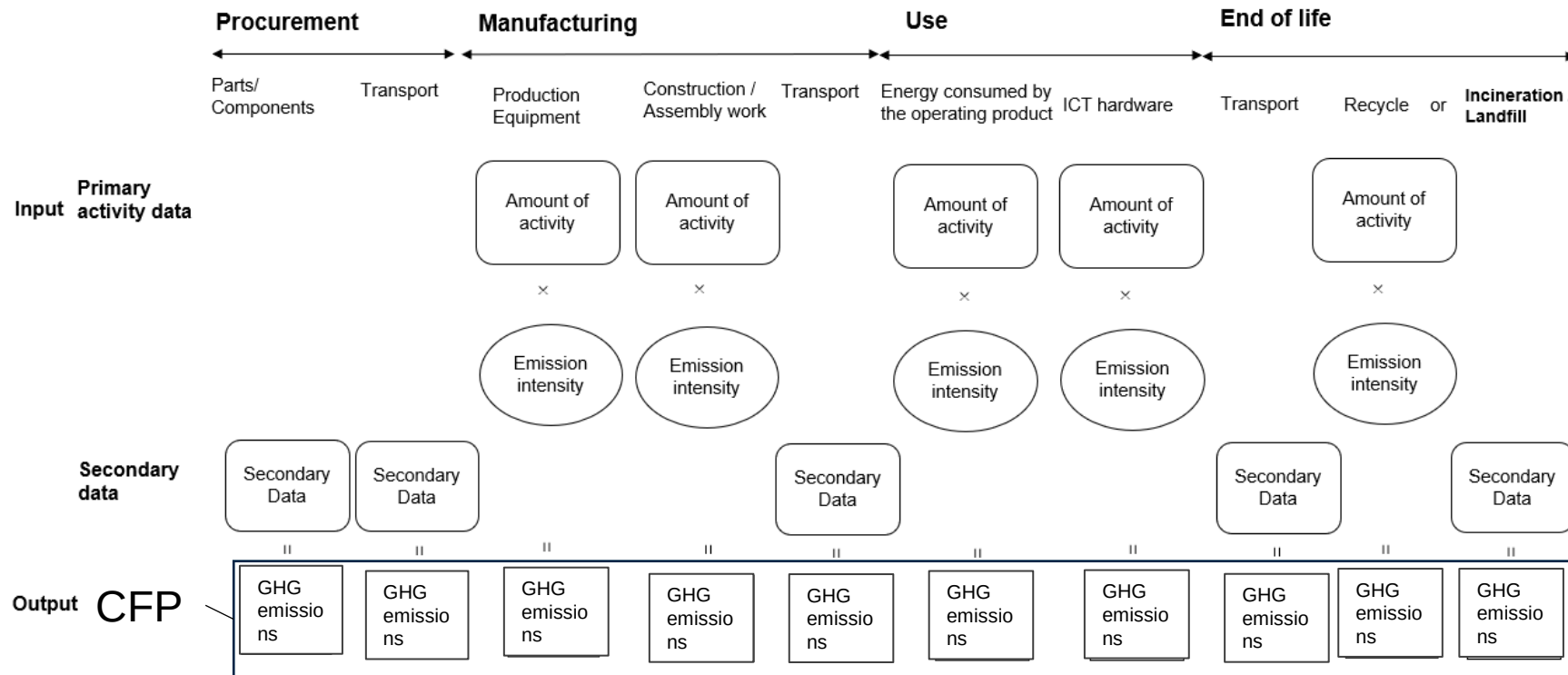
product family

set of products or services sharing explicitly defined and managed common and variable features and relying on the same domain architecture to meet the common and variable needs of specific markets

Note to entry: “Product families” are defined by product standards and could need product specific rules (PSRs), “product range” are defined by manufacturers.

2.2.6 Annex B example of CFP quantification (1)

- Example of CFP calculation model



GHG emissions for each process or life stage

$$GHG\ emissions = \sum_{i=1}^p (activity_i \times EF_i)$$

Total GHG emissions CO₂e(kg) = amount of activity × emissions intensity

$activity_i$ = amount of activity defined in a unit in accordance with the emission factor (kg or kWh)

EF_i = the emission factor for the activity which can be associated to a country or a region (kgCO₂e/activity_{*i*})

GHG emissions of an EE product at use stage

$$GHG\ emissions = \sum_{i=1}^p (EE\ consumption_i \times CEI_i)$$

GHG emissions = electricity consumption × carbon emission intensity

p = the number of products in a system in operation

$EE\ consumption_i$ = electricity consumption of an EE product or system (kWh)

CEI_i = the carbon emission intensity of electricity mix (kgCO₂e/kWh)

2.3 GHG emission reductions and Avoided emissions

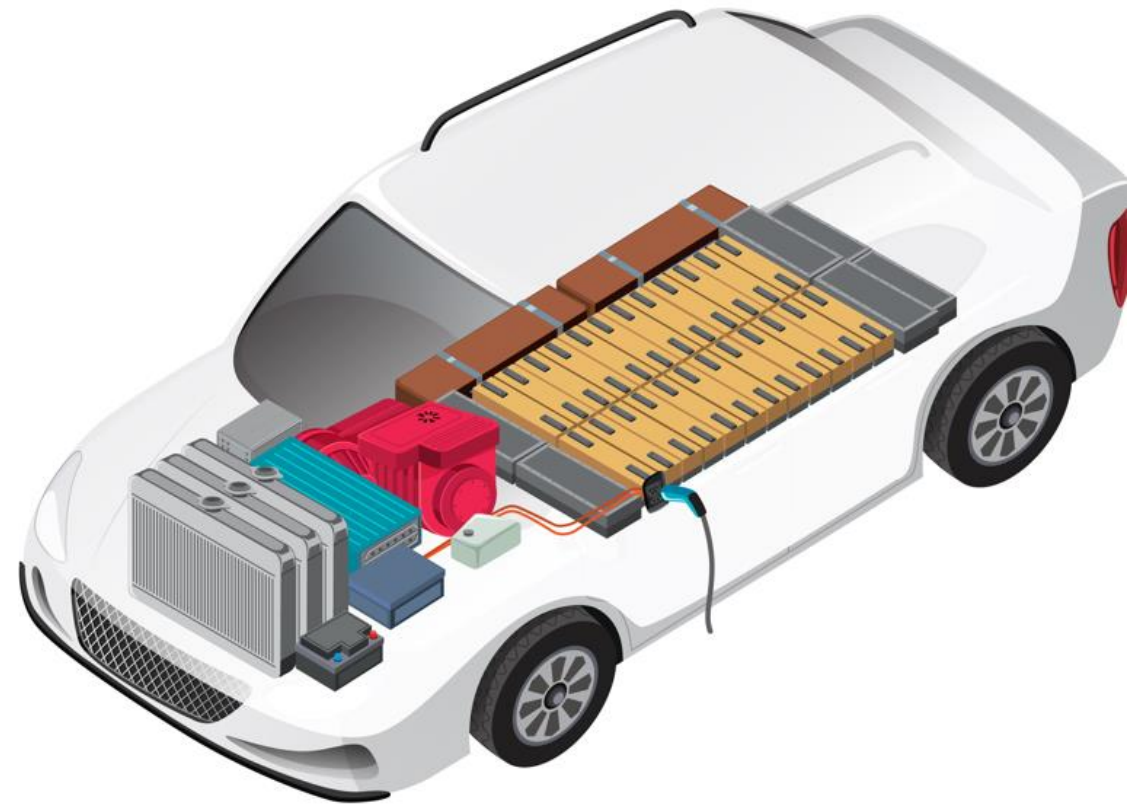
2.3.2 What is Avoided Emissions?

Avoided emissions: GHG emission reductions that occurs outside the organization boundaries of the reporting organization

Does “outside of the organizational boundaries of the reporting organization” mean out of scope 1, 2 and 3?

What should we compare when calculating avoided emissions?

Can we claim avoided emissions of our products installed in a final product that enables avoided emission?



Use case of avoided emissions: EV battery

2.3.1 Critical terms and definitions (1)

3.2.2.2

avoided emissions

avoided greenhouse gas emissions

greenhouse gas emission reduction that occurs outside the organization boundaries of the reporting organization as a quantifiable consequence to a situation of the use of its product, system or project compared to a baseline scenario

Note to entry: Avoided emissions cover the user value of GHG emissions reductions compared to a reference situation. It does not cover the GHG emission reductions related to direct GHG emissions, energy indirect GHG emissions and other indirect GHG emissions of reporting organization.

[SOURCE: ISO 14050:2020 3.9.16 modified — “direct” has been changed to “quantifiable”. “to a situation”, “system, or project or project compared to a baseline scenario” and “Note to entry” have been added.]

avoided emissions is a kind of GHG emission reductions

separate from Scope 1, 2, 3 emissions =>

Do not subtract avoided emissions from Scope 3 downstream emissions

3.2.2.6

greenhouse gas emission reduction

GHG emission reduction

1)

calculated decrease of GHG emissions between a baseline scenario and a target situation or

2) between a baseline and a target product, system or project

Note 1 to entry: GHG emission reduction can occur at any life cycle stage of the product such as manufacturing, distribution, use and end of life.

[SOURCE: IEC TR 62726:2014, 3.10 modified — “project” has been changed to “a target situation”. “or between a baseline and a target product, system or project” has been added.]

1) **Avoided emissions =**

baseline scenario vs target situation

2) **GHG emission reductions** other than avoided emissions =

baseline vs target product, system or project

2.3.1 Critical terms and definitions (2)

3.2.2.3

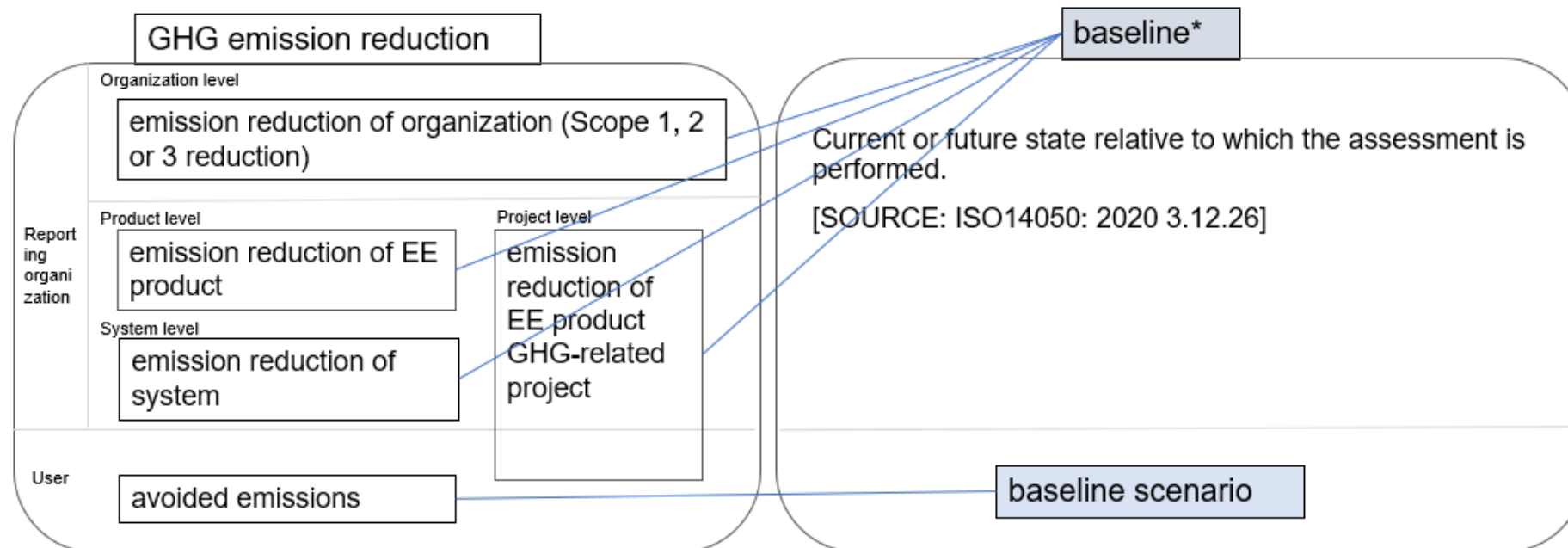
baseline

current or future state relative to which the assessment is performed

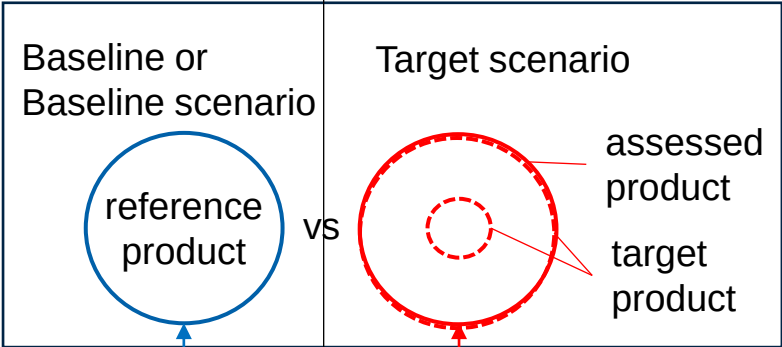
3.2.2.4

baseline scenario

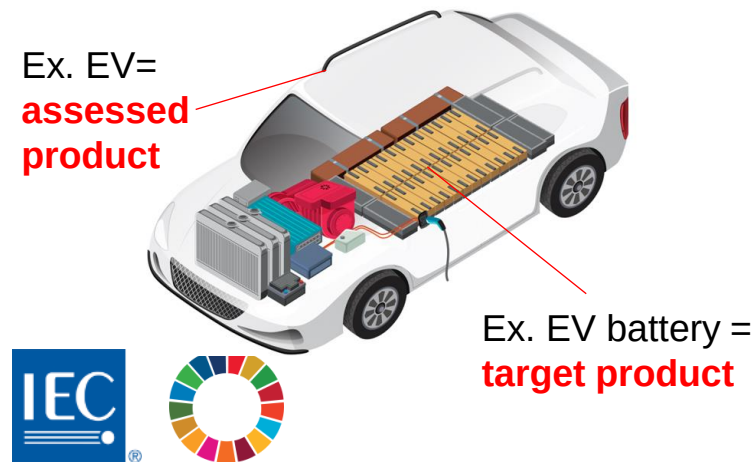
estimated reference situation that best represents the conditions most likely to occur in the absence of a target product or assessed product, system or project



2.3.1 Critical terms and definitions (3)



The functional unit of **reference product** is same as that of **assessed product**

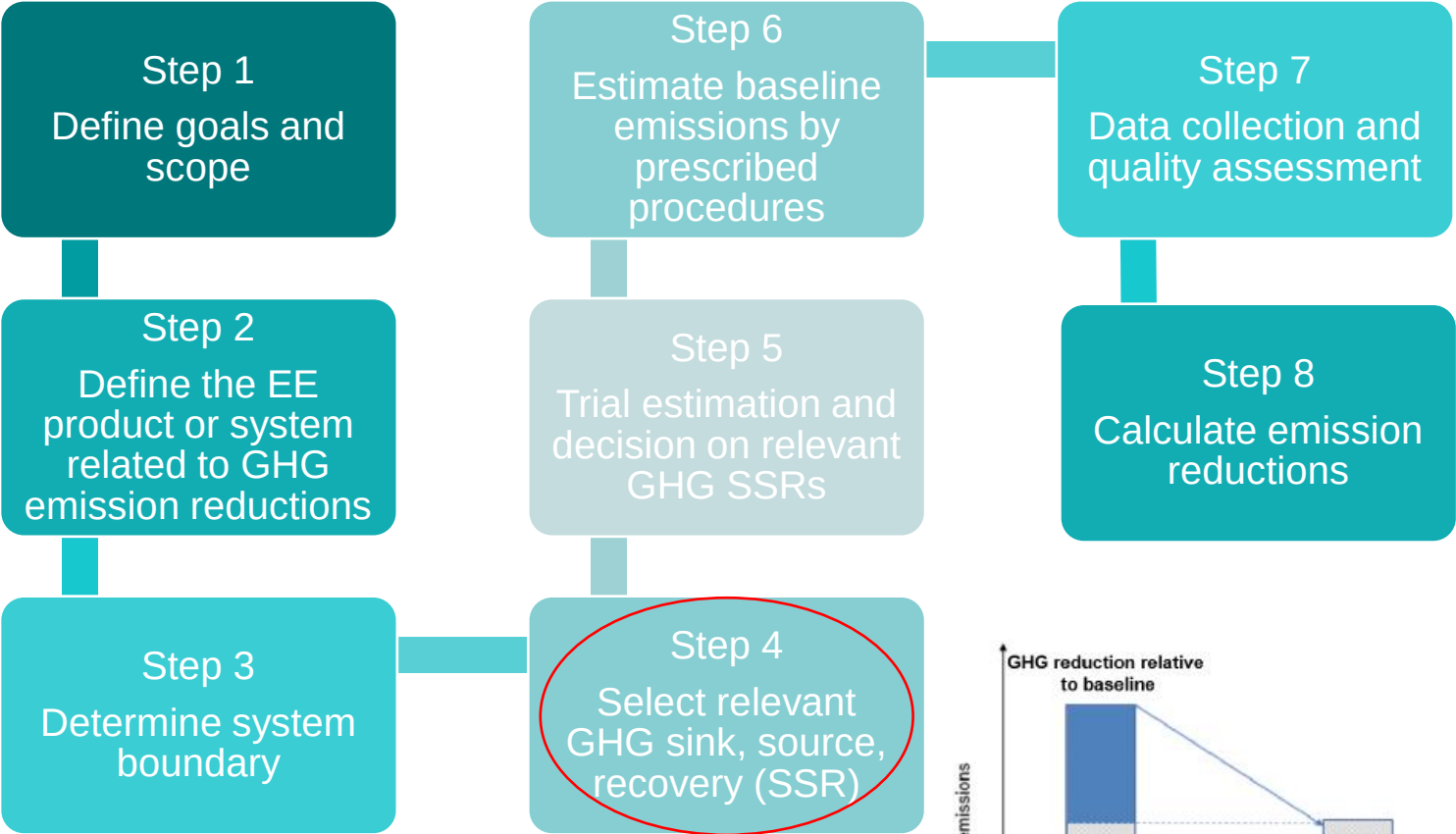


3.2.2.1 assessed product
product or system that the related GHG emissions are assessed in a study of the GHG emission reductions or avoided emissions
[SOURCE: IEC TR 62726:2014, 3.1, modified — “system that the related GHG emission” and “in a study of GHG emissions reductions or avoided emissions” have been added. “whose related GHG emissions are” and “for a product-related project” has been deleted.]

3.2.2.17 target product
product which enables GHG emission reductions and avoided emissions
Note 1 to entry: The target product is different from the assessed product when the target product is an intermediate product (e.g., inverter driver circuit) to be integrated into the assessed product (e.g., an air conditioner) and enable the assessed product to reduce GHG emissions.
[SOURCE: IEC TR 62726:2014, 3.26, modified – “and avoided emissions” has been added.]

3.2.2.15 reference product
product or system whose related GHG emissions are assessed for a baseline or a baseline scenario

2.3.2 Basic steps of GHG emission reductions study

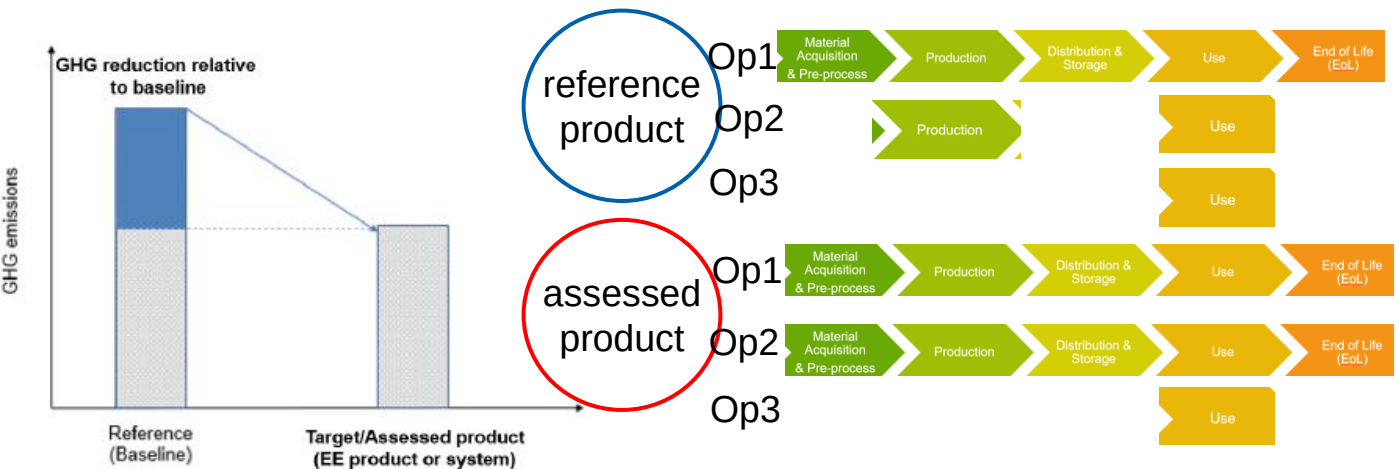


Step 4: 3 options can be selected

Option 1: include all life cycle of both an assessed product and of reference product/function

Option 2: select all life cycle of assessed product and select life cycle phase(s) of reference product (Conservative)

Option 3: select life phase(s) of assessed product and reference product/reference function



2.3.3 Calculation formula of GHG emission reductions

GHG emission reductions = Baseline emissions – calculated emissions in a scenario using an assessed product or system

Product level

Basic formula

$$Ri = Bi - Pi$$

R_i : the GHG emission reductions of a target product or an assessed product i ;

B_i : the relevant GHG emissions of the reference product corresponding to product i as the baseline

P_i : the relevant GHG emissions of the assessed product i in the specified situation

Organization level

emission reductions per unit in a specific year

$$Ri(y) = Bi(y) - Pi(y)$$

$R_{i(y)}$: the emission reductions per unit of an assessed product i in year y

$B_{i(y)}$: the baseline relevant GHG emissions per unit of the reference product/function corresponding to the assessed product i in year y

$P_{i(y)}$: the relevant GHG emissions per unit of the assessed product i in year y

Organization level

Emission reduction per unit a year accumulated to the overall emissions reduction of the EE product, system or project

$$Ry = n1 * R1(y) + n2 * R2(y) + \dots + nt * Rt(y)$$

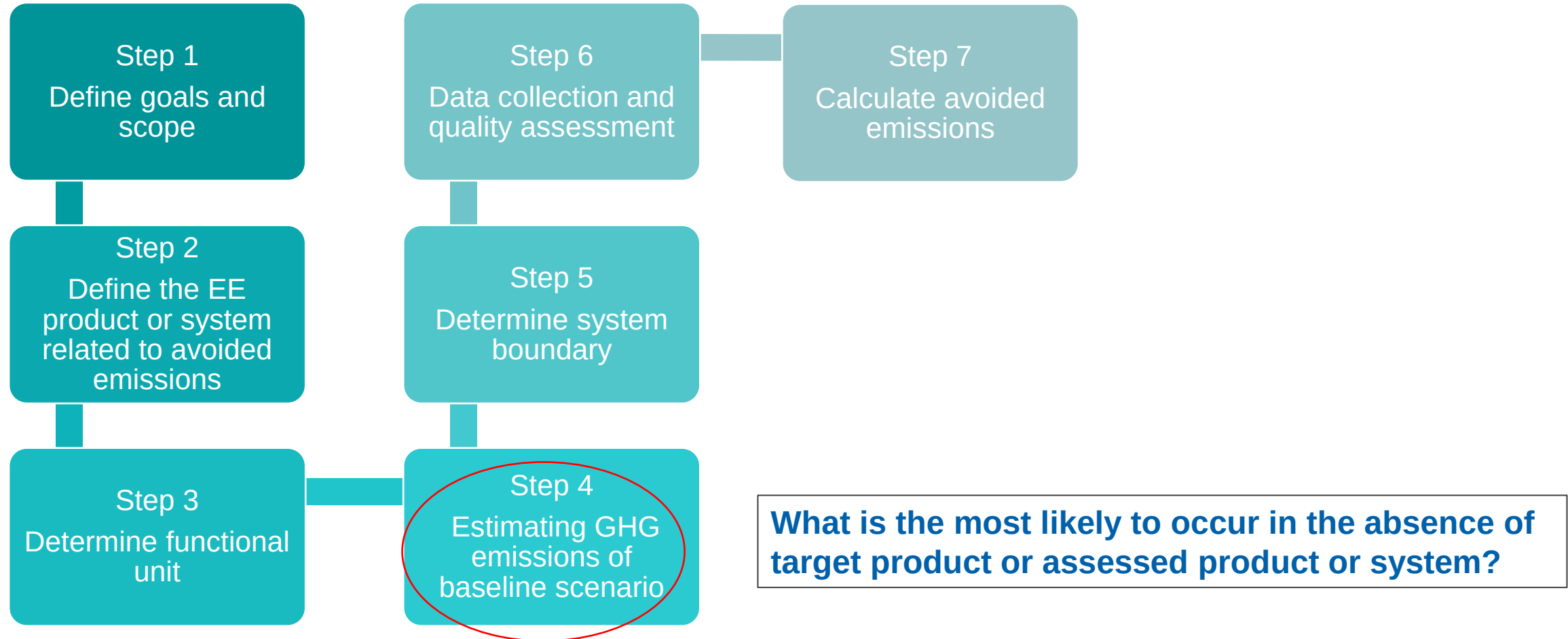
$R_{(y)}$: the total emission reduction of the product in a year

n_1 : number or the capacity of the 1st assessed product introduced to or existing in the market in year y

nt : number or the capacity of the xth assessed product introduced to or existing in the market in year

$Rt_{(y)}$: the emission reductions per unit of the xth assessed product in year y

2.3.5 Basic steps of quantification of avoided emissions



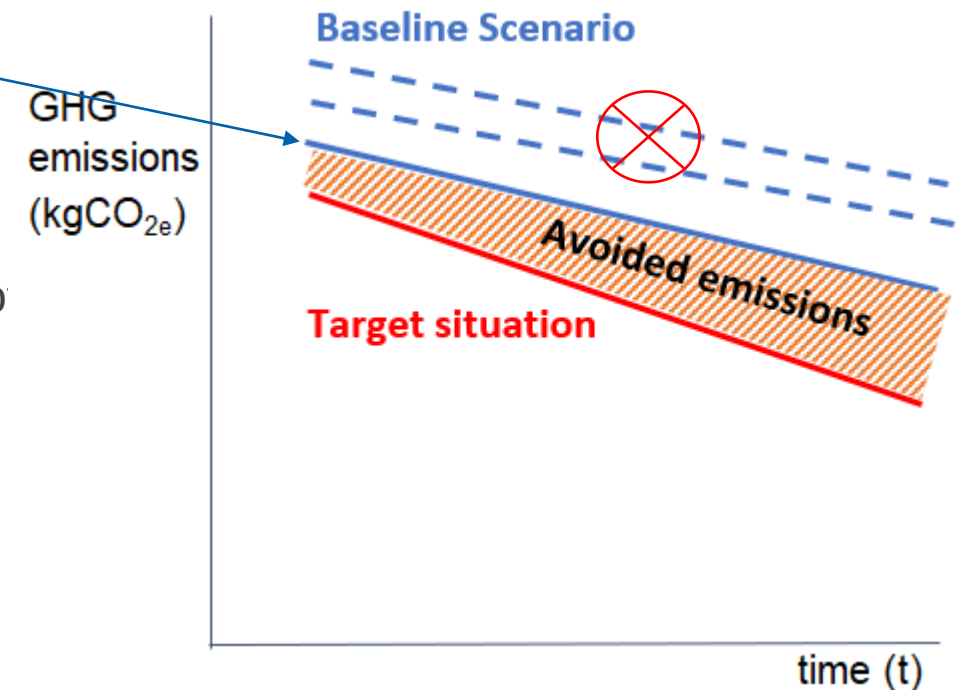
2.3.6 Baseline Scenario (1)

Calculation results of avoided emissions is variable depending on selection of baseline.

Select appropriate baseline scenario to avoid greenwash.

3 possible options to select baseline scenario in 6.3.5

- a) **common practice** before new technology that have penetrated the market e.g. a product with the highest market share
- b) Product(s) that is/are **publicly acknowledged as the average** of the product category e.g. MEPS, energy label product
- c) **Previous version of the product(s) of the same company**
In this case, need **justification** of the relationship of assessed product and a chosen reference product



To avoid greenwashing, the baseline scenario must be conservative.
=> Principles “Conservativeness”

2.3.6 Baseline Scenario (2)

Possible differences of future baseline scenario

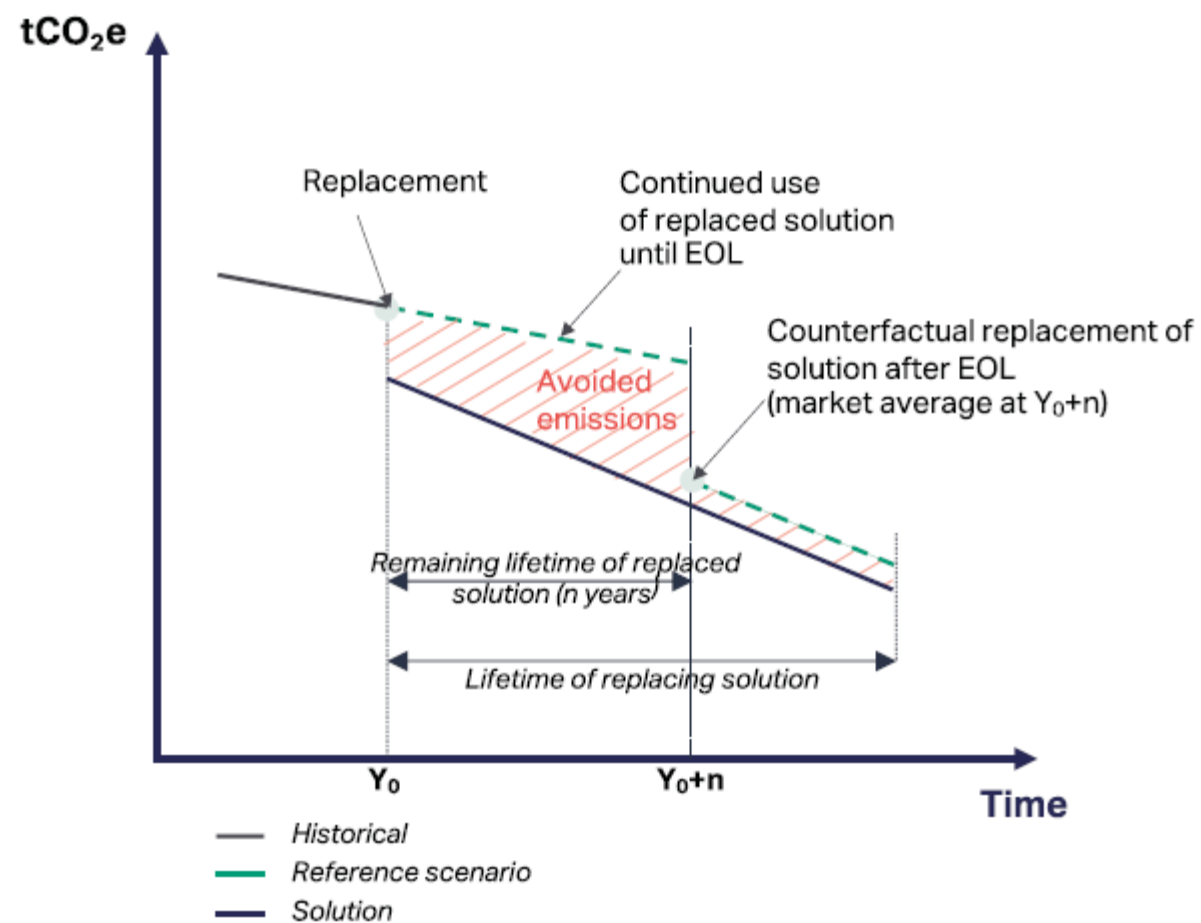
Foreseeable:

regulatory requirements implementation schedule
end of life product and new product release

Unforeseeable:

new technology which can be dominant in the market
quickly

=> **Need periodical review**



Source : Fig 21, GUIDANCE on AVOIDED EMISSIONS, wbcscd

2.3.7 Calculation formula of avoided emissions

Avoided emissions = estimated emissions of baseline scenario – estimated emissions in a scenario using an assessed product or system

Product level

Basic formula

$$R = B - P$$

R : the avoided emissions of an assessed product in the specified situation

B : the relevant GHG emissions of the reference product used in the baseline scenario

P : the relevant GHG emissions of the assessed product in the specified situation

Organization level

Total annual avoided emission of all products or systems in a year

$$Ry = n_1 * R_1(y) + n_2 * R_2(y) + \dots + n_t * R_t(y)$$

$R(y)$: the total avoided emissions of the assessed products in a year y

n_1 : number or the capacity of the 1st assessed product introduced to or existing in the market in year y

n_t : number or the capacity of the x th assessed product introduced to or existing in the market in year y

$R_t(y)$: avoided emissions per unit of the x th assessed product in year y

2.3.8 Two approaches of total emission reductions/avoided emissions

Organization level

Select either one option

- accumulation based on products' lifetime GHG emissions reduction or avoided emissions
- accumulation based on products' annual GHG emission reductions or avoided emissions

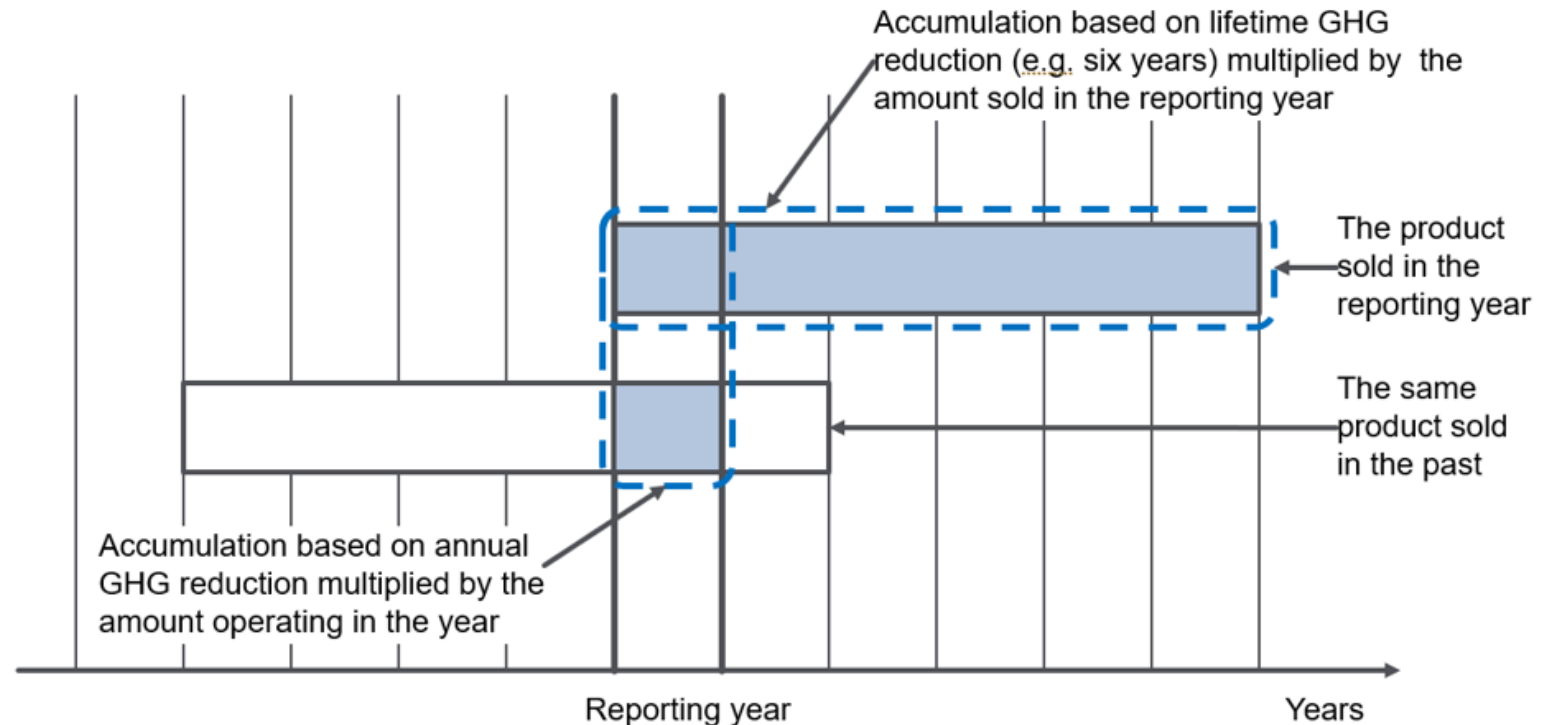


Figure 7 – Two options for accumulation

3.Future Work related to CFP

3.1 IEC63372 development

Approved CDV on July 2024, we're preparing next document



Working Draft	CD 1	CD 2	CDV	FDIS/IS
Started WG17 in Feb 2021	- Circulated CDV1 in July 2022 - Closed comments in Oct. 2022 - Meeting in Delft in Nov.	- Circulated CD2 in July 2023 - Closed comments in Sep. 2023 - Observations in Oct. 2023 to Jan. 2024	- Circulated in May. 2024 - Closed comments in July Approved CDV on July 28	Prepare next doc in Sep. 2024 to Nov. 2024 - Target of next doc: Dec. 2024 - Target of IS published: 2025 Q1

3.2 Communication of CFP

- In EU, Ecodesign Requirements for Sustainable Products Regulation (ESPR, (EU)2024/1781) and new battery regulation ((EU) 2023/1542) requires CFP disclosure.

	2024 Q2	2024 Q3	2024 Q4	2025 Q1	2025 Q2	2025 Q3	2025 Q4	2026 Q1	2026 Q2	2026 Q3	2026 Q4	2027 Q1	2027 Q2	2027 Q3
Battery Regulation														
														
	CE Marking + DoC			Wheel Bin Mark				CFP Declaration		General Info		Battery Passport + SOH		QR Code + Carbon Label
ESPR														
														
				1 st Delegated Act				Digital Registry+ Unsold Products Scrap Prohibited				Expected Delegated Act for ERP		

- In IEC, SC3D and TC111 has been discussing CFP data exchange in JahG 22. Will continue to work for CFP data exchange.

Needs and requests of CFP communication will increase more.

Summary

- **More acceleration of GHG reductions** is necessary by 2030
- **IEC 63372** is GHG standard with **basic horizontal** function
- **CFP** is based on **PCR IEC 63366** and **CFP ISO14067**
- **Life Cycle Assessment** is fundamental for **CFP** quantification
- **CFP information and communication** is more required.
- **Avoided emissions** is useful information for EE products and systems users whoever want **to accelerate GHG emission reductions**.
- Avoided emissions must not be overestimated **to avoid greenwashing**





Thank you

ご清聴ありがとうございました

Appendix: Examples of avoided emissions calculation

Annex D (informative) Examples of Avoided emissions

D.1 Electrical equipment (General).....

D.2 Electrical equipment in a system (General)

D.3 Final product - Heat pump.....

D.4 Intermediate product in a product – DC-DC Converter for EV.....

D.5 Intermediate product in a product – Electric Vehicle (EV) battery in an EV

D.6 System – Insulation products

D.7 System – Storage hybrid cloud solution

D.8 System in a bigger system

D.9 System – Cooling technology system

D.10 System – Energy Management System (EMS) of buildings.....

D.11 Service – Image-based infrastructure inspection services

D.12 Service – Virtual Desktop Services for telework

D.13 Service – Health consultation.....

D.14 Service – Virtual Power Purchase Agreements (VPPAs)