GSMA

Quantifying the Carbon Savings of Circularity: Mobile Phones and Network Equipment

Guidance for Telecommunications Operators

February 2025

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive.

Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach.

This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

We invite you to find out more at gsma.com.

epi Consulting is a leading UK-based sustainability consultancy focused on improving environmental and social outcomes within global supply chains. The epi team has been delivering emissions reduction, life cycle assessment (LCA), eco design, circular economy, responsible sourcing and supplier engagement projects for global corporate clients for more than 15 years.

We invite you to find out more at epiconsulting.co.uk.

Acknowledgements

The GSMA and epi Consulting would like to thank the members of the GSMA Circular Economy for Mobile Devices Project Group as well as experts from the following organisations for their contributions and insights, without which it would not have been possible to develop this guidance:

- Adtran
- AT&T
- BT Group
- Cisco
- Ericsson
- MTN
- Nokia
- Orange
- Proximus
- Sagemcom
- Telefónica
- Telstra
- Vodafone

Authors: Alan Riley (epi Consulting), Alastair Spear (epi Consulting).

GSMA contributors: Steven Moore, George Kamiya.

Table of Contents

GSMA

Key Questions Addressed by this Guidance

What aspects of circularity are covered in this guidance?

There are a variety of strategies and initiatives that can increase the circularity of mobile handsets, customer premises equipment ("CPE") and active network equipment. These include measures to extend the lifespans of devices and equipment (for example, improving durability, providing ongoing software support, enabling repair and refurbishment), as well as actions to reduce the environmental impact of production (for example, using recycled and recyclable materials and renewable energy). At the network level, circularity can be further advanced through infrastructure sharing, modular design and energy efficient operations, which maximise equipment utilisation and resource efficiency.

The guidance in this paper focuses on the refurbishment or repair of mobile handsets, routers, active network equipment and other ICT products to extend their life. See 3. Defining Circularity in the Context of Carbon Accounting for more information.

Refurbished products may undergo varying levels of reprocessing, from light cosmetic reconditioning to heavy remanufacturing. For practical purposes, telecommunication operators ("operators") may consider an average refurbishment scenario when specific data is unavailable.

What do existing standards say about carbon accounting for refurbished or repaired ICT products?

Although the literature does not explicitly address product circularity or the treatment of products with additional use cycles, it offers relevant carbon accounting guidance through two key approaches (see 5. Carbon Accounting Approaches for more information).

- **Scope 1, 2 and 3 Inventory Accounting:** Inventory Accounting is an approach that quantifies actual greenhouse gas (GHG) emissions associated with an organisation's activities, allocating them across Scope 1, Scope 2, and the Scope 3 Categories.

  In the same way as newly manufactured products, significant emissions associated with repaired or refurbished products, including upstream, core and downstream activities, must be attributed within an organisation's emissions inventory.

  Due to a relatively lower carbon impact within the production stage of their lifecycle, refurbished products typically have lower attributed embodied emissions per unit compared to newly manufactured products. This lower emissions burden can be reflected accordingly within the inventory calculations, ideally via a specific product or supplier-level method. Inventory methods are discussed further in 6. Inventory Accounting: Scope 1, 2 and 3 Impacts of Circularity.
- **Project-Based Accounting:** Project-Based Accounting, also known as consequential accounting or intervention accounting, estimates the impacts or changes in GHG emissions resulting from specific projects, actions, or interventions relative to a counterfactual baseline scenario.

  Within this approach, circular products can be considered to partially or fully substitute newly manufactured products, with a counterfactual product being selected to represent the most likely product chosen in the absence of the circular option. In this case, the estimated difference in emissions between the two scenarios (Circular and Counterfactual Scenarios) can be quantified (often referred to as "avoided emissions"). Note that standards require any Project-Based Accounting claims to be reported as a separate disclosure outside of the emissions inventory.

How can operators calculate the emissions associated with refurbishing or repairing ICT products?

The emissions calculation process broadly follows three key steps:

1. Setting Boundaries: Clearly outline system boundaries to include the entire cradle-to-grave life cycle of the product (see 8. Setting Boundaries When Calculating Savings for more information). For circular products, this should encompass:

- Upstream Reverse Logistics: Emissions from product collection and transportation.
- Reprocessing: Emissions from the reprocessing of materials and components (including sourcing additional components if necessary).
- Downstream Forward Logistics: Emissions associated with distributing circular products.
- Use-Phase: Emissions impact during the expected (usually shorter) use cycle of the circular product.
- End-of-Life Treatment (EoLT): Consider including the EoLT of replacement components, although this stage typically has minimal impact. For simplicity, EoLT should focus on the disposal or recycling of replacement components, provided the first use cycles EoLT has already been accounted for.

2. Embodied Emissions Allocation: For circular products, an allocation procedure is required to determine how, and whether, to allocate embodied emissions impacts between the first and subsequent use cycles. A cut-off approach is recommended, where the second use cycle accounts only for the additional emissions from reprocessing, transportation, and the second use-phase. EoLT should be limited to the disposal or recycling of replacement components (see 9. Allocating Embodied Emissions Across Product Use Cycles for more information).

3. Data Gathering: Data for circular products can be acquired at a product, supplier, or industry-average level. Emissions factors are derived at each level through physical activity data, such as product-based Life Cycle Assessments (LCAs) or economic activity data (for example circular spend combined with supplier-level emissions factors). Proxies and assumptions may also be considered in cases of low data availability. This area is particularly relevant for Inventory Accounting and is covered in more detail in section 6.1 Key Considerations When Using Inventory Accounting.

This is a general view of the calculation process, but users should note there are specific considerations depending on the purpose of the calculation (see sections 6. Inventory Accounting: Scope 1, 2 and 3 Impacts of Circularity, 7. Project-Based Accounting: Avoided Emissions of Circularity, and 10. Combined Approach: Carbon Savings of Circular Initiatives for more information).

How can operators realise emissions savings from refurbishment within their Scope 1, 2 and 3 inventory?

Inventory Accounting is an attributional approach where each reporting period reflects the footprint of products sourced and sold or deployed by the organisation within that period. Consequently, transitioning the product mix to a greater proportion of lower-carbon products compared to the previous year will typically result in a year-on-year reduction in the attributed emissions.

Refurbishment initiatives, unless hindered by a reliance on highly emissions-intensive transportation methods (such as air freight) or the use of older models of products with more negative use-phase emissions impacts, generally result in a lower-carbon product per unit, compared to newly manufactured units. Assuming the volume of products sourced remains constant, the emissions inventory figures for the products can be expected to decrease over time as operators displace newly manufactured products with refurbished products. See section 10. Combined Approach: Carbon Savings of Circular Initiatives for more information.

How do operators quantify avoided emissions from refurbishment or repair initiatives?

The "Project-Based Accounting" approach can be used to calculate the emissions savings of a "Circular Scenario" versus a hypothetical "Counterfactual Scenario", which is often expressed as "avoided emissions" (see section 7. Project-Based Accounting: Avoided Emissions of Circularity). The process is made up of four steps based on the following formula:

Avoided Emissions = Counterfactual Scenario Emissions − Circular Scenario Emissions

- **Define the Circular Scenario:** Calculate the emissions generated within the boundaries of the refurbished or repaired product (typically this includes reverse logistics, reprocessing, forward logistics, and the usage emissions from the second life use-phase).
- **Define the Counterfactual Scenario:** Identify the emissions associated with a comparable product that would most likely be selected in the absence of the circular product. This is the "Counterfactual Scenario" and serves as a comparative scenario for analysis.
- **Calculate Avoided Emissions:** Subtract the emissions of the Circular Scenario from the Counterfactual Scenario. Within the calculation, consider using a multiplier for the substitution rate, if the circular product does not perfectly substitute the counterfactual product. For example, if a refurbished mobile has an expected life of 2 years and the newly manufactured handset in the Counterfactual Scenario has an expected life of 3 years, it may be prudent to assume 1.5 refurbished units substitute 1 newly manufactured one.
- **Communicate the Impact:** Present the avoided emissions to stakeholders with transparent disclosure of the method and assumptions used.

What emissions savings can operators expect from sourcing refurbished products?

Typically, savings of up to 80% or more per unit can be achieved by sourcing refurbished products instead of newly manufactured products. However, the size of the saving is dependent on a number of factors. Often the most important variables are the significance of use-phase emissions in the overall lifecycle and the relative use-phase impact of the counterfactual product. For example, the use-phase impact is relatively minor for mobiles but much more significant for active network equipment (up to 80%+ of the overall life cycle footprint). If a refurbished unit is less energy efficient than the one selected as the newly manufactured product in the counterfactual baseline scenario, this can have a large impact on, or even negate, the lifecycle emissions savings.

In rare cases, refurbishment savings can also be negated by other lifecycle factors outside of the use-phase, such as when air freight is utilised to transport used products internationally to and from the refurbishment facility, incurring a large incremental carbon impact from aviation fuel.

The overall savings an operator may expect within the organisational-level inventory depend on the types and quantities of product refurbished, the emissions intensity of the refurbishment operation, the usage intensity of the refurbished product, the extent to which refurbished products substitute newly manufactured products (the level of equivalence), and the specific measurement and allocation procedures applied to account for products within the emissions inventory.

Please refer to the **Excel Model** accompanying this paper for a more comprehensive breakdown of key variables, or refer to Annex A: Worked Examples and Typical Savings for an overview of the typical savings across a selection of product categories.

How can operators model the carbon savings of circularity for their specific products?

Please refer to the **Excel Model** accompanying this paper. It allows operators to enter their own custom baselines and scenarios and to model the carbon impacts of refurbishment initiatives for specific products within the mobiles, CPE or active network equipment product categories.

How To Use This Guidance

There are three primary use cases for applying the guidance in this paper:

A. Accounting for Circular Products within Scope 1, 2 and 3 Emissions Inventories

- **Description:** Setting boundaries, measuring and allocating the emissions of refurbished or repaired products within the Scope 1, 2 and 3 inventories.
- **Example:** As part of a broader circularity program, a telecommunications operator has started offering refurbished routers on a leasing model, replacing their previous practice of selling newly manufactured routers. They need to understand the reporting implications, including Scope 1, 2, and the relevant Scope 3 Categories, in line with standards and guidance, and how this approach differs from what has been done previously.
- **Audience:** Carbon reporting professionals responsible for regulatory and voluntary carbon emission disclosures.
- **Relevant section of this paper:** 6. Inventory Accounting: Scope 1, 2 and 3 Impacts of Circularity

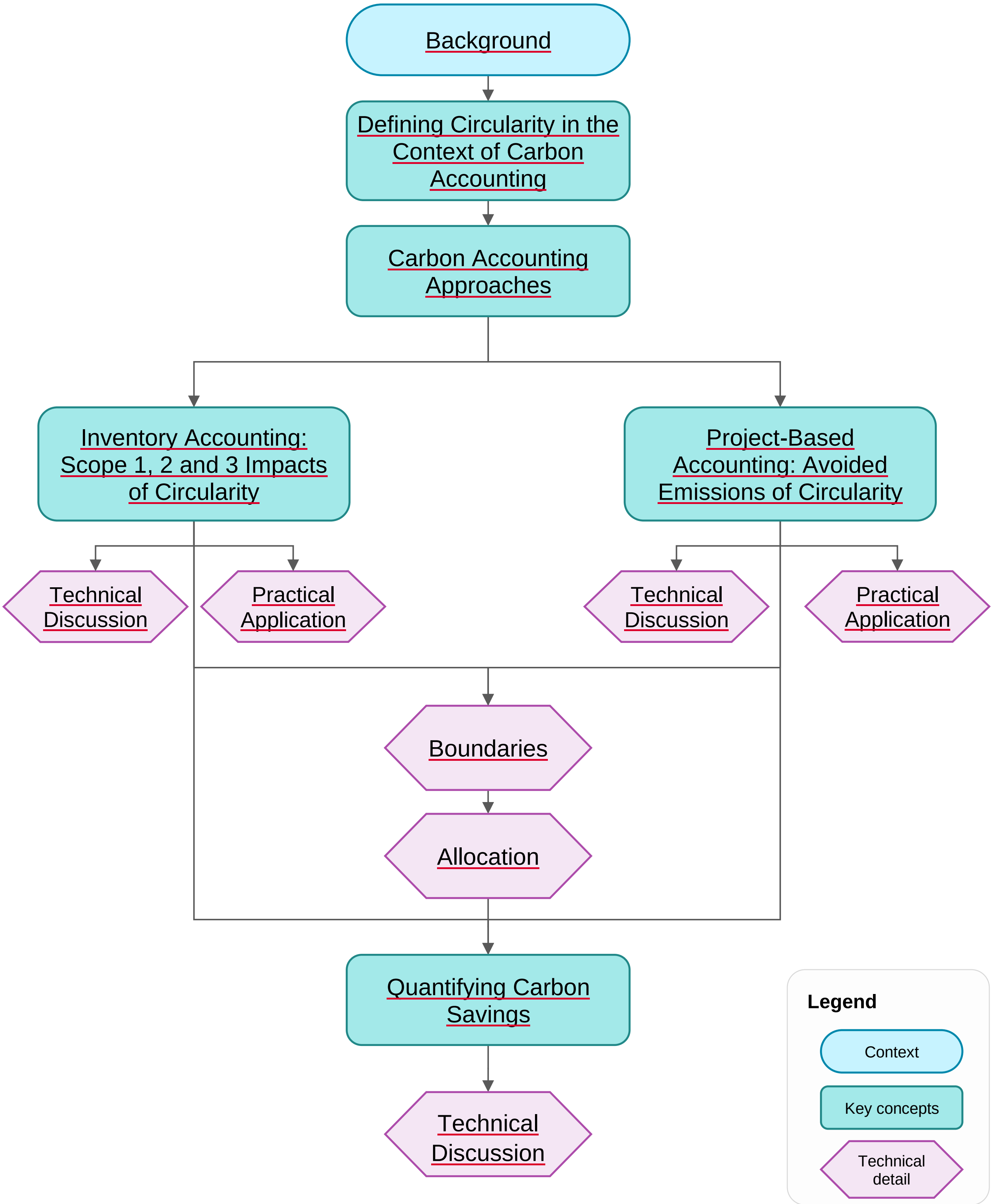
B. Calculating External "Avoided Emissions" Claims for Circular Initiatives

- **Description:** Calculating a fair and justifiable avoided emissions claim that quantifies the impact of product repair or refurbishment initiatives, for external publication.
- **Example:** A telecommunications operator has started selling refurbished mobiles and plans to promote the initiative to customers. As part of the promotion, the company wants to quantify the carbon savings associated with refurbished mobiles. They need to understand how to calculate these savings in a justifiable way, in accordance with the relevant standards and guidelines.
- **Audience:** Sustainability communications professionals responsible for ensuring the accuracy of external claims regarding carbon savings.
- **Relevant section of this paper:** 7. Project-Based Accounting: Avoided Emissions of Circularity

C. Calculating the Inventory Savings from Circular Initiatives for Internal Appraisals

- **Description:** Accurately calculating how current or future refurbishment initiatives may impact the emissions inventory, to support internal planning and decision-making.
- **Example:** A telecommunications operator is considering purchasing refurbished servers for its operations instead of newly manufactured ones. They need guidance on how to calculate the carbon benefits of this initiative, ensuring that the comparisons are accurate and comprehensive and reflect the potential impacts on the emissions inventory.
- **Audience:** Sustainability and strategy professionals or business leaders responsible for transition planning and meeting overall sustainability goals and targets.
- **Relevant section of this paper:** 10. Combined Approach: Carbon Savings of Circular Initiatives

Figure 1 **Overview of the Guidance**



The key concepts and messages from this paper are accessible through the links in the teal rectangles. For those seeking technical details, please refer to the pink hexagons.

Worked examples that illustrate the guidance are provided in Annex A: Worked Examples and Typical Savings. For further insight into savings calculations and to run scenarios specific to your refurbished products, note that there is an **Excel Model** accompanying this document that provides detailed output.

1. Background

The urgent need for action on climate change, as well as other circularity-linked environmental issues such as waste, resource scarcity, pollution and biodiversity loss, is now well understood across the telecommunication operator ("operator") community.

As of November 2024, over 150 companies in the telecommunications industry (including 62 mobile network operators) have set validated Science-Based Targets (SBTs), with a further 51 committed to do so[1]. These targets require companies to set stretching targets to reduce Greenhouse Gas (GHG) emissions across Scopes 1 and 2, and also Scope 3 if Scope 3 emissions represent 40% or more of their total emissions.

Alongside emissions targets, 16 leading operators[2] representing one billion mobile connections around the world have signed up to new circularity targets[3] developed with the GSMA, to increase take-back of mobiles and ensure recovered mobiles don't end up in a landfill or incinerated.

The focus across the industry is now increasingly turning to how delivery of these targets can be more closely measured, planned and managed, particularly driven by emerging regulatory requirements such as CSRD Transition Plan requirements in the EU, and the emergence of guidance such as the TPT (Transition Plan Taskforce) in the UK, elements of which have been incorporated into international IFRS S2 reporting requirements.

Delivery of SBTs and Climate Transition Plans require companies not only to target and reduce emissions but also to be able to reliably measure, calculate and report these emissions via their GHG inventories, aligned to accepted standards, such as the Greenhouse Gas Protocol (GHGP).

To help operators calculate their inventories in line with relevant standards and guidance, in 2023 the GSMA, GeSI and ITU collaboratively developed the Scope 3 Guidance for Telecommunications Operators[4], which has been widely adopted by the industry, helping to improve and harmonise assessment and reporting of Scope 3 GHG emissions across the operator community.

In parallel, the GSMA Achieving Climate Targets guidance, also released in 2023, identified the significant role that the use extension of devices has to play in delivering near-term science-based targets, contributing around 7% of the theoretical reduction pathway to 1.5-Degree Scenario Targets[5].

1.1 What This Guidance Covers

This paper provides a detailed exploration of how operators can understand, quantify and account for the impacts of circularity initiatives (including repairing and refurbishing products) on their emissions. Centred on the product categories of mobile handsets, customer premises equipment (CPE), and active network equipment, it examines carbon accounting approaches, including Inventory Accounting and the calculation of "avoided emissions." By doing so, the paper provides a comprehensive framework for assessing the carbon benefits of circular practices.

---

[1] https://sciencebasedtargets.org/companies-taking-action
[2] As of December 2024: BT Group, Deutsche Telekom, Globe Telekom, GO Malta, Iliad, KDDI, NOS, NTT Docomo, Orange, Proximus, Safaricom, Singtel, SoftBank, Tele2, Telefónica and Telenor.
[3] https://www.gsma.com/newsroom/press-release/mobile-industry-eyes-five-billion-dormant-phones-sitting-in-desk-drawers-for-reuse-or-recycling/
[4] https://www.gsma.com/solutions-and-impact/connectivity-for-good/external-affairs/wp-content/uploads/2023/07/Scope-3-Guidance-2023.pdf
[5] https://www.gsma.com/solutions-and-impact/connectivity-for-good/external-affairs/gsma_resources/achieving-climate-targets/, page 50

The paper evaluates critical methodological considerations and offers insights into current implementation practices by operators, drawing on extensive research and interview findings. It is accompanied by an Annex A: Worked Examples and Typical Savings featuring worked examples and an **Excel Model**, which illustrate how these strategies can lead to tangible emissions savings.

GSMA

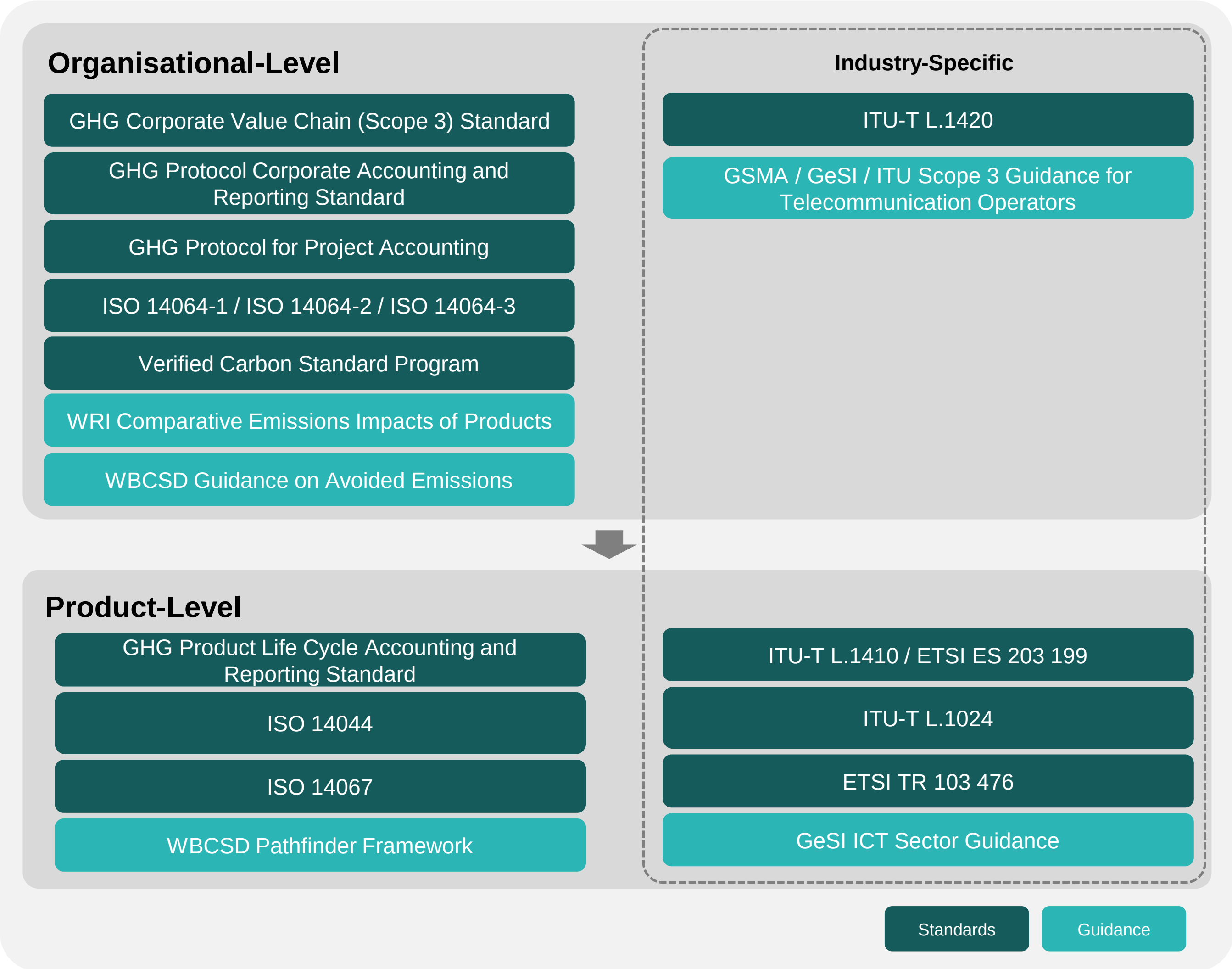
2. The Standards and Guidance Landscape

In developing this paper, standards and guidance ("literature") for carbon accounting were considered, encompassing both cross-industry frameworks and sector-specific approaches within the Information Communication Technology (ICT) industry. While standards provide formal, often mandatory requirements to demonstrate conformance, guidance documents offer practical recommendations to supplement the standards and support effective implementation.

In most cases, existing literature does not specifically address circularity or the treatment of the extended life of products, but they do provide relevant direction on carbon accounting approaches. Standards and guidance exist at both an organisation-level (such as the GHGP Corporate Value Chain (Scope 3) Standard) and at a product-level (such as ISO 14067). Organisation-level literature provides frameworks for carbon accounting at scale. Product-level literature demonstrates how to measure and account at a unit-level, in terms of the product life cycle.

A broad overview of relevant organisational-level and product-level literature is provided below, and throughout the paper will be cited when relevant, within each thematic section.

Figure 2 **Standards and Guidance for Carbon Accounting**



2.1 Organisational-Level Standards and Guidance

Organisational-level literature provides relevant information from three primary perspectives, which inform methods of quantifying and accounting for the carbon savings of circularity:

- Standards such as the GHGP and the Scope 3 Guidance for Telecommunications Operators inform how emissions from circularity initiatives should feed into the Scope 1, 2 and 3 emission Inventory Accounting that operators know and use today.
- The Project-Based Accounting approach defines how “avoided emissions” should be calculated by organisations when implementing projects such as circularity initiatives.
- Standards for assurance engagements on GHG statements also exist at an organisational-level and, while assurance is not a core focus of this paper, it can provide some useful input on matters relating to the interpretation of standards.

Operators should note that the GHGP organisational-level standards are currently under review. Some of the feedback provided in the GHGP consultation process is relevant for carbon accounting for circularity and may be acted upon in the future GHGP update, which could lead to changes in accepted GHG accounting standards. For a summary of the key relevant areas of GHGP feedback, see Appendix B.1 Relevant GHGP Survey Feedback for Circular Product Carbon Accounting.

2.2 Product-Level Standards and Guidance

Product-level documentation provides relevant information on several key areas related to quantifying the carbon savings of circularity:

- Standards such as the GHGP Product Life Cycle Accounting and Reporting Standard provide frameworks for measuring emissions impacts at a product-level. These can feed into organisational reporting on a consolidated basis via the product-level method.
- Life cycle assessment (LCA) and product carbon footprinting (PCF) methods such as ISO 14044, ISO 14067 and the industry-specific ITU-T L.1410 also provide useful instruction in this area as well as exploration of key topics for circularity, such as substitution and allocation approaches, that will be covered later in this paper.

GSMA

3. Defining Circularity in the Context of Carbon Accounting

When exploring the carbon savings of circularity, it is important to define “circularity” and how it impacts the organisational activities that factor into emissions calculations and accounting. Within this paper, the focus is on circularity initiatives that provide a product with an additional use cycle or extend the duration of use**.** This usually involves a level of reprocessing, which can range from a light cosmetic reconditioning to a heavier remanufacturing, such as a recertification process with the replacement of a large number of components, testing and repackaging.

Within the product-level literature, a range of reprocessing terms are defined (see Appendix B.2 Reprocessing Definitions within Literature), including remanufacturing, refurbishment, reuse, and repair. Each of these levels of reprocessing has a different impact across two dimensions; firstly, the emissions burden incurred from the reprocessing activity and, secondly, the degree to which the reprocessing restores the product to its newly manufactured state (level of functional equivalence).

3.1 Product Refurbishment

Despite the wide range of definitions in the literature, the industry reality is that it is often not practical for operators to account for various levels of reprocessing, due to the complexity it introduces to carbon accounting procedures, and the lack of granular data available on the treatment of each individual unit. Interviews and research on the topic suggest that it may be more practical for operators to work with an average **Product Refurbishment** case, reflecting an estimation of the typical impacts from remanufacturing, refurbishment, or reconditioning.

It should be noted that, per the Scope 3 Guidance for Telecommunication Operators, this case would not include “Goods that are being purchased or acquired by a telecommunication operator as new after a cosmetic refurbishment where the item has not been used are specifically excluded from reused, refurbished and repaired goods.” Per the guidance, “in this case, the product should be accounted for in full, including the emissions that arose from their extraction from raw materials, production and transportation associated with their original manufacture.”[6]

3.2 Device Repair Services

The Product Refurbishment case covers the most common life extension models of selling or deploying refurbished products. However, there is one other common circular practice that is not covered by Product Refurbishment. This is the repair of a customer-owned device, for example when a mobile handset with a cracked screen is repaired as a service provided by the operator.

Here, the customer brings their device to the operator who will have it repaired, generally via a third party repair partner, before it is returned to the customer. In this instance, ownership does not pass from the customer to the operator, and there is no direct “sold product” or “purchased goods” impact within the emissions inventory. A separate case is considered within this paper for **Device Repair Services**.

[6] https://www.gsma.com/solutions-and-impact/connectivity-for-good/external-affairs/wp-content/uploads/2023/07/Scope-3-Guidance-2023.pdf page 15

4. Industry Challenges in Carbon Accounting for Circularity

Alongside the literature review, this paper has been developed with operational realities in mind. Information from mobile operators and equipment vendors (including both OEMs and refurbishers) was collected and reviewed via two primary methods:

- **Desk-Based Research**: operator sustainability disclosures, CSR reports, press releases, and other publicly available studies, reports and whitepapers.
- **Interviews**: Held with mobile operators and equipment vendors to gain insights into the practicalities of carbon accounting and to gain their perspectives on the key areas identified from the standards and guidance.

To contextualise how carbon accounting is currently performed, the research process involved gaining insight into the challenges operators face. A summary of these challenges is provided below:

- Understanding the link between, and applying the principles of, carbon accounting approaches and standards to a circular initiative or use case.
- Aligning with industry peers to establish a unified basis for circularity calculations and methodological considerations.
- Managing internal resource constraints when designing data collection and calculation procedures for circular initiatives, considering that the proportion of refurbished products as a percentage of total products sold can be as low as 1 to 2%.
- Sourcing high quality data for refurbished or repaired products, as granular, readily available data is not yet commonplace for circular products, and measurement is often based on spend-based (economic activity data) methods and/or the use of proxies.

From these challenges, four key criteria were developed for assessing the suitability of different carbon accounting options for circular goods:

Figure 3 **Criteria to Assess Carbon Accounting Approaches**

Simplicity

As circular products are often not dominant within an operator's Scope 3 inventory, complex carbon accounting exercises for circularity don't make sense.

Pragmatism

The approach should be consistent with, and applicable with existing inventory approaches (for newly manufactured products) and recognise limited data availability.

Alignment

The approach should be aligned to current literature while clarifying treatment of grey areas. Operators also want to build consensus as an industry.

Incentives

The approach should recognise and incentivise circular behaviour by realising kg CO_2e savings and not punishing circular choices via complex accounting.

Accounting approaches were assessed based on the extent to which they enable simplicity and pragmatism in accounting procedures, enable alignment to standards and across industry, and incentivise circular behaviour by key actors in the value chain.

Although each operator has their own operating model, product mix, and market characteristics, the four criteria reflect commonly shared priorities and so can be considered to represent a consolidated industry view.

It should be noted that for operators, emissions savings are generally not the sole driver behind circularity initiatives. Complimentary environmental drivers include waste reduction, water use reduction and avoided resource extraction. While not the core focus of the paper, an example of how these other environmental benefits materialise for mobile handsets is provided in Annex A: Worked Examples and Typical Savings.

Box 1	**Learnings from Other Industries**

In the interest of completeness, other industries were assessed to understand alternative accounting approaches. These include the built-environment, automotive, textiles, equipment rental and the consumer goods industry. Learnings from these industries will be flagged in the following sections of the paper.

It should be noted that the Telecommunications and ICT sectors were found to be relatively advanced in the sophistication of carbon accounting approaches for circularity, meaning learnings from other industries are limited.

Across industries, there is generally both a desire for an accounting approach that quantifies the carbon savings of circularity and an acknowledgement of the need for further development in this area[7].

[7] For example, within the built environment https://www.arup.com/globalassets/downloads/insights/cirular-economy-in-the-built-environment.pdf page 80

5. Carbon Accounting Approaches

Within the framework of the GHGP standards, two accounting approaches are provided that can be applied to quantify the carbon savings of circularity.

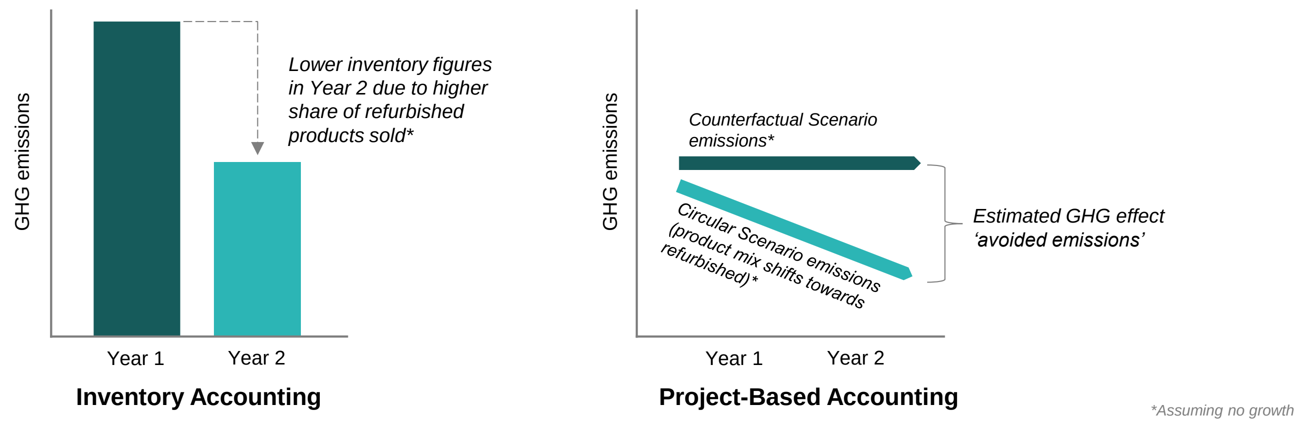
5.1 Scope 1, 2 and 3 Inventory Accounting

Inventory Accounting refers to the comprehensive measurement and reporting of all GHG emissions associated with an organisation's operations over a defined period (typically a one-year reporting period). This is an attributional approach, whereby estimated emission actuals from organisational activities are attributed across Scopes 1, 2 and 3. In the case of circular mobiles, CPE and active network equipment, the selling, leasing or deployment of these products is reported within the relevant Category of Scope 3, or within Scopes 1 and 2 for the energy consumed by equipment used in operations.

5.2 Project-Based Accounting

In contrast, **Project-Based Accounting** is designed to quantify the GHG reductions or avoidance resulting from a specific project or initiative. This approach can be used to compare a circular product's emissions against a defined baseline (the 'Counterfactual Scenario'), estimating the emissions impact that would have occurred in the absence of the circular product. It focuses on the net GHG benefit of the initiative and is often used to calculate the impact of emission reduction projects, sometimes expressed in terms of "avoided emissions".

Figure 4 **Carbon Accounting Approaches**



Adapted from Inventory and Project Accounting: A Comparative Review[8]. Inventory Accounting is based on attributed emissions within a defined period, while Project-Based Accounting demonstrates savings via a hypothetical scenario.

Current GHGP standards permit both types of approaches, however, within the GHGP Scope 3 FAQ on this topic it was clarified that Project-Based Accounting calculations must be reported separately to inventory accounts[9]. The WRI guidance paper on Estimating and Reporting the Comparative Emissions Impacts of Products indicates that Inventory Accounting should be the priority before Project-Based Accounting is used[10].

[8] https://ghgprotocol.org/blog/inventory-and-project-accounting#:~:text=These%20standards%20provide%20two%20methods,emissions%20effects%20of%20a%20project
[9] https://ghgprotocol.org/sites/default/files/2022-12/Scope%203%20Detailed%20FAQ.pdf page 19
[10] https://ghgprotocol.org/sites/default/files/2023-03/18_WP_Comparative-Emissions_final.pdf page 12

6. Inventory Accounting: Scope 1, 2 and 3 Impacts of Circularity

To account for circularity using the Inventory Accounting approach, emissions are allocated in an attributional manner across the three Scopes and, in the case of Scope 3, across the relevant fifteen emissions Categories. This approach creates an emissions "inventory", focusing on estimating and reporting actual emissions generated by organisational activities, that take place in a defined reporting period (typically one year).

It should be recognised that circular initiatives are not free from emission burdens and these should be reflected in the inventory. Even a light cosmetic refurbishment is likely to incur an emissions burden from additional processing and transportation with a 3rd party specialist. The Scope 3 Categories used to capture this burden differ depending on the “ownership-deployment model”[11].

For accuracy, specific characteristics of refurbished products should be considered when developing the emissions inventory. For example, if a refurbished mobile handset that is sold to a customer has a shorter expected use cycle than a newly manufactured one, the Scope 3 Category 11 (Use of Sold Products) emissions calculation should reflect the shorter usage footprint for the refurbished product.

Emissions savings are generally realised through Inventory Accounting as a year-to-year result of an operator’s product mix shifting away from newly manufactured products and towards refurbished ones. This is manifested indirectly, as due to the increased proportion of refurbished products distributed to customers or deployed in operations, or due to the reuse of active network equipment in the reporting year, fewer newly manufactured product purchases are necessary. The majority of the savings are usually within Scope 3 Category 1, which, for the newly manufactured product, includes the cradle-to-gate emissions of the product.[12]

For the refurbished product, Category 1 includes the transportation to the 3rd party for refurbishment and the reprocessing impact of the relevant activities carried out at the refurbishment facility (such as testing, reconditioning, and repackaging). It should be noted that in some cases, the use of refurbished or reused products may lead to increases in emissions in the inventory. Please refer to section 10. Combined Approach: Carbon Savings of Circular Initiatives for a more detailed discussion on the savings of circular products within the emissions inventory.

6.1 Key Considerations When Using Inventory Accounting

To incorporate refurbished products into the inventory, it is necessary to gather data and make calculations around the life cycle emissions of refurbished products.

Depending on available data, operators may adopt different methodological approaches. Emission factors may be selected at product, supplier or industry-average levels, or a hybrid of these, and may use either physical activity data or economic activity data (spend-based methods) (see Appendix B.3 Adjusting a Spend-Based Method in the Absence of Specific Emissions Factors).

[11] “Ownership-deployment model” is a new term created in the course of developing this paper in order to refer to the way in which products are sourced and deployed in an organisation’s own operations, or sold or leased to customers.

[12] For products sourced and deployed in own operations, such as active network equipment, Category 1 would typically include all distribution emissions as suppliers are typically responsible for product distribution to the operator. For Mobiles and CPE, Category 1 may not include the full transportation impact, some or all of which may be allocated to Category 4.

The below table illustrates these options for Category 1. As a general rule, the data selected should follow the GHGP principles of Relevance, Completeness, Consistency, Transparency, and Accuracy[13].

Table 1 **Emissions Data and Data Sources for Refurbished Products (Category 1)**

Method	Emission Data	Data Sources (Refurbished Products)
Product-Level (Physical Activity Data)	Product-level emissions factor for each product (kg CO_2e/kg or kg CO_2e/piece)	Product carbon footprints (PCFs) or Life Cycle Assessments (LCAs) for the refurbished product *In the absence of specific refurbished product data, proxy factors can be developed based proportionally scaled footprints from newly manufactured products*
Supplier-Level (Physical Activity Data)	Supplier's Scope 1, 2 and 3 (Category 1 to 8) emissions data per quantities or units of product (kg CO_2e/kg or kg CO_2e/piece)	Refurbishment partner's per-unit (product) emission data, based on organisational emissions and units produced *In the absence of specific refurbishment partner data, proxy factors can be developed based proportionally scaled footprints from newly manufactured products*
Supplier-Level (Economic Activity Data)	Supplier's Scope 1, 2 and 3 (Category 1 to 8) emissions data per unit of economic value (kg CO_2e/$ of revenue)	Refurbishment partner's per-unit ($) emission data, based on organisational emissions and total revenue *In the absence of specific refurbishment partner data, proxy factors can be developed based proportionally scaled footprints from newly manufactured products*
Industry-Average (Physical Activity Data)	Representative emissions factor for each type of purchased product (kg CO_2e/kg or kg CO_2e/piece)	Industry per-unit (product) emissions factor for the product category *In the absence of specific industry repair or refurbishment factors, proxy factors can be developed based proportionally scaled footprints from newly manufactured products*
Industry-Average (Economic Activity Data)	Environmentally extended input output (EEIO) emissions factor for each type of purchased product per unit of economic value (kg CO_2e/$)	Industry per-unit ($) emissions factor for the product category *In the absence of specific industry repair or refurbishment factors, proxy factors can be developed based proportionally scaled footprints from newly manufactured products.*

Adapted from Scope 3 Guidance for Telecommunication Operators[14]

This table uses Category 1 as the example for Data Sources for Refurbished Products. Category 1 typically realises the most significant emissions savings when the product mix shifts toward a higher proportion of refurbished products.

Based on a review of the literature and research papers, product-level methods (for example product carbon footprints "PCFs" or Global Warming Potential (GWP) impact measures from Life Cycle Assessments "LCAs") and physical activity data are generally preferred to give an accurate view of the emissions burdens from refurbishment initiatives.

- Product-level factors are generally preferred over industry or supplier-level factors as they account for specific product characteristics and avoid the averaging or apportionment effects of other methods.
- Specific factors are generally preferred over generic factors, as they more closely represent the actual emissions impacts. It is recognised that this may create situations where

[13] https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf page 21
[14] https://www.gsma.com/solutions-and-impact/connectivity-for-good/external-affairs/wp-content/uploads/2023/07/Scope-3-Guidance-2023.pdf page 23

inconsistent methods are used between newly manufactured products and refurbished products. For example, although product-specific LCA measures may be in use for newly manufactured products, there may be no LCA data available for refurbished equivalents. In this case, supplier-specific data from the specific refurbishment partner, apportioned to the specific product or operator, may be more accurate than data proportionally scaled from a new product LCA, or a proxy measure taken from industry averages of refurbished products.

- Physical activity data is generally preferred over economic activity data as tying physical quantities to emissions factors avoids market variabilities/abnormalities.

If specific data for the refurbished product is not available but is available for the newly manufactured version of the refurbished product, operators can approximate refurbished product emissions using proportional scaling. This is a “proxy data” approach as described in the GHGP: *"If data of sufficient quality are not available, companies may use proxy data to fill data gaps. Proxy data is data from a similar activity that is used as a stand-in for the given activity. Proxy data can be extrapolated, scaled up, or customised to be more representative of the given activity."*[15]

Using this method, operators can take a percentage of the newly manufactured product’s production impact as an estimation of the reprocessing impacts in Category 1 (these could be based on typical industry savings or based on savings estimates from comparable products, for more information see the accompanying **Excel Model**).

To complete the full picture of the value chain impacts of refurbished products across the lifecycle, transportation and use-phase emissions can be calculated to reflect the logistical characteristics and expected duration of use of the refurbished product. In this way, proportional scaling can be incorporated to develop data proxies to fill data gaps when accounting for circular products.

While a specific product-level method using physical activity data is preferred for refurbished products, there is recognition that attaining widespread coverage of product-level factors is a journey. *The Scope 3 Guidance for Telecommunication Operators* prioritises methods that allow for hot spotting and emissions mitigation, acknowledging that data quality can be improved over time[16]. When a spend-based method is used, it should ideally be based on specific data from refurbishment and reverse logistics partners. Options to manage a spend-based method when specific factors are lacking are presented in Appendix B.3 Adjusting a Spend-Based Method in the Absence of Specific Emissions Factors.

Once the impacts of circular products are calculated, data should be incorporated into inventory accounts according to established accounting procedures specific to the relevant “ownership-deployment” model of the product. This process is demonstrated in the following figure.

The “ownership-deployment model” is a term created for use in this paper to represent how a product is sourced (purchased or leased from a supplier) and then deployed in operations or leased to customers or sold on by the business. The importance of the ownership-deployment model is visualised in Figure 5, indicating how operators typically allocate emissions across different Scopes and Categories depending on the applicable ownership-deployment model.

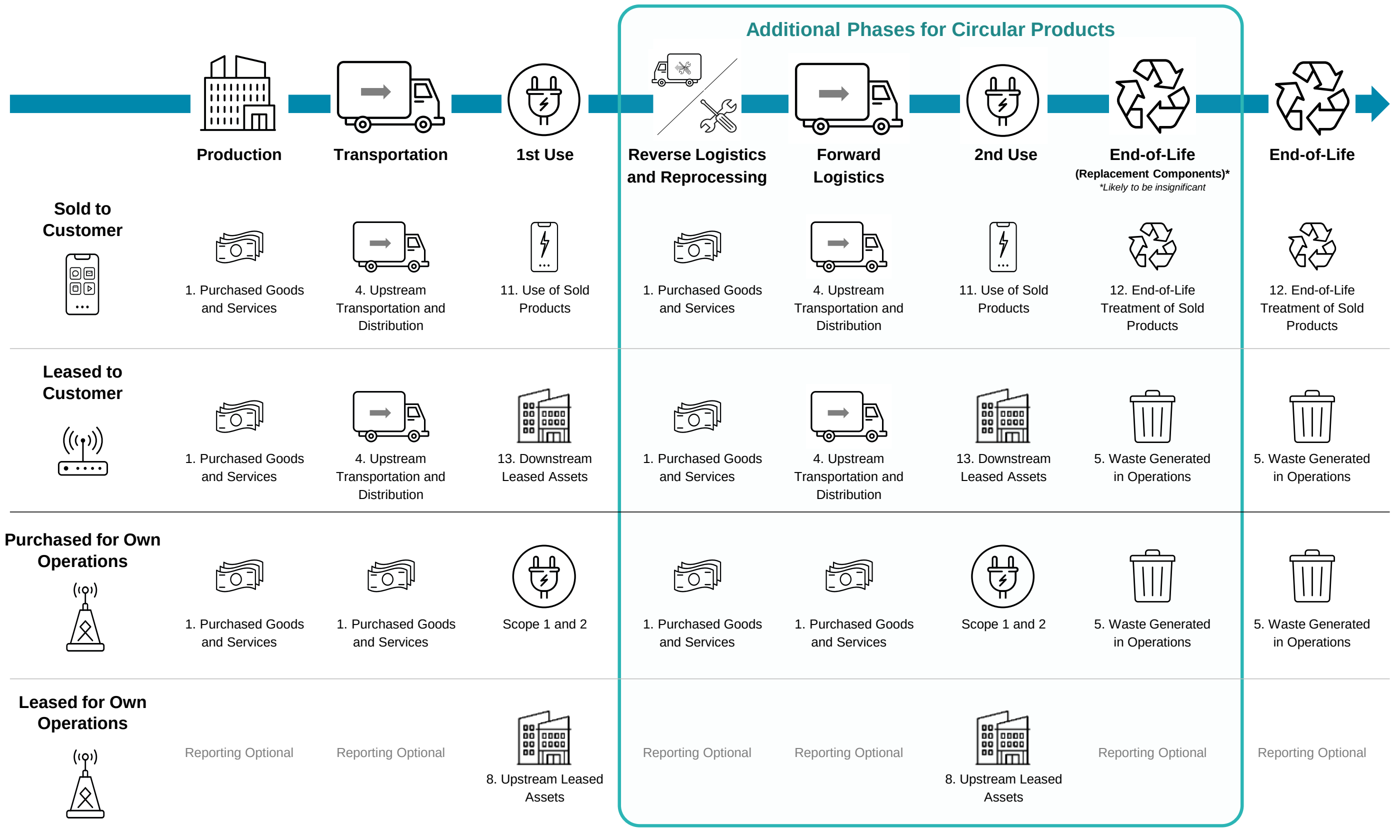
---

[15] https://ghgprotocol.org/scope-3-calculation-guidance-2 page 18

[16] https://www.gsma.com/solutions-and-impact/connectivity-for-good/external-affairs/wp-content/uploads/2023/07/Scope-3-Guidance-2023.pdf page 11

It should also be noted that the ownership-deployment model applied to a product can materially change the volume of emissions reported within the annual inventory. Certain emissions categories may not apply under different ownership-deployment models, and temporal reporting requirements can vary with each model (see Appendix B.4 Ownership-Deployment Model and Inventory Accounting Results for more information).

Figure 5 **Product Life Cycle Stages and Inventory Accounting**



The results of product life cycle assessments are allocated across Scope 1 and 2, and seven Scope 3 Categories depending on the ownership-deployment model.

6.2 Practical Application of Inventory Accounting

The following section summarises findings regarding operator use of the Inventory Accounting approach for circular initiatives. It also provides some insight into how operators are handling the issue of embodied emission allocation between product lives, although this issue is explored in more detail within 9. Allocating Embodied Emissions Across Product Use Cycles. Please note that, as all operators studied were using the Operational Control approach, the below findings all relate to accounting within Operational Control boundaries.

6.2.1 Mobile Refurbishment

During interviews, both “leased product” and “sold product” ownership-deployment models were observed for mobiles, though selling devices is currently more prevalent.

Inventory approaches and data sources can vary between operators, but Table 2 represents how sold mobiles are commonly accounted for within the emissions inventory.

Table 2 **Operator Inventory Accounting for Mobile Phone Refurbishment**

Scope 3 Category	Mobile Phones	
	Newly Manufactured	**Refurbished**
1. Purchased Goods and Services	Product-level method (specific): LCA, PER (product environmental report), EcoRating GWP data Product-level method (proxy): Proxy data/weighted averages used when specific data/LCAs not available Supplier specific allocated spend-based method. Hybrid approach may be applied in Category 1 data gaps for Mobiles suppliers may be filled by industry-average factors	Product-level method (proxy): Proportionally scaled percentage of newly manufactured product LCA based on ADEME study. Supplier specific allocated spend-based method (applied to emissions from refurbishment partner and, if separate, reverse logistics provider). Hybrid approach may be applied in Category 1 data gaps for Mobiles suppliers may be filled by industry-average factors *Includes both reprocessing (manufacturing) emissions and reverse logistics emissions*
4. Upstream Transportation and Distribution	Product-level method (specific): LCA or proxy data relating to the Distribution stage Physical activity data (weight x distance) based on transport assumptions Supplier specific allocated spend-based method covering forward logistics to customer *Note upstream transport between supplier and distribution hub was allocated to either Cat 1 or 4.*	*No international distribution accounted for due to local refurbishment* Supplier specific allocated spend-based method to account for forward logistics to customer. May be reported within Category 1.
5. Waste Generated in Operations	*Generally, mobiles are treated as "sold products".* *May be used where operators retain ownership in Device as a Service (DaaS) scenarios.*	*Same treatment as newly manufactured mobiles (left).*
9. Downstream Transportation and Distribution	*Category 9 was occasionally used by operators instead of Category 4, with the same principles as Category 4 applied.*	*Same treatment as newly manufactured mobiles (left).*
11. Use of Sold Products	Use-phase CO_2e for full expected lifetime based LCA use phase footprint Physical activity data (typical kWh usage from device report/proxy) multiplied by an expected lifetime applied to country of sales grid factor (lifetime is typically a standardised corporate assumption of product life, often 3 years).	*Same methods as newly manufactured product are typically applied* The same use phase impact as newly manufactured device may be assumed, or a proportionally scaled usage based on shorter lifetime, per proxy from ADEME report, typically a 2-year lifetime used in lieu of 3 years.
12. End-of-Life Treatment of Sold Products	LCA EoLT impacts may be used. Physical activity data (weight and operator specific assumptions) may be used. *Sometimes excluded based on low significance/materiality.*	*EoLT for replacement components typically excluded as deemed not material, but may be captured within Category 1 when operators apply the supplier specific spend method.* *Retained components of newly manufactured mobiles are generally excluded from the refurbished footprint, per allocation procedure Cut off B (see 9. Allocating Embodied Emissions Across Product Use Cycles).*
13. Downstream Leased Assets	*Generally, mobiles are treated as "sold products", however category 13 may be used where operators retain ownership in DaaS scenarios.*	*Same treatment as newly manufactured mobiles (left).*

6.2.2 CPE Refurbishment

While both "leased product" and "sold product" ownership-deployment models are used within the industry for CPE, in most cases CPE is leased to customers. It is worth noting that, in some cases, CPE follows a leasing-type business model but operators opt to account for emissions under sold product Categories within the Scope 3 inventory, for simplicity of reporting. Table 3 represents typical inventory categorisation methods used by operators to account for CPE within the emissions inventory.

Table 3 **Operator Inventory Accounting for CPE Refurbishment**

Scope 3 Category	Customer Premises Equipment	
	Newly Manufactured	**Refurbished**
1. Purchased Goods and Services	Product-level method (specific): LCA/PCF GWP data received from CPE suppliers Supplier specific allocated spend-based method. Hybrid approach may be applied in Category 1 so data gaps for CPE suppliers may be filled by industry-average factors	Supplier specific allocated spend-based method (applied to emissions from refurbishment partner and, if separate, reverse logistics provider). Hybrid approach may be applied in Category 1 so data gaps for CPE suppliers may be filled by industry-average factors *Includes both reprocessing (manufacturing) emissions and reverse logistics emissions*
4. Upstream Transportation and Distribution	Product-level method (specific): LCA/PCF Distribution data received from CPE suppliers Physical activity data (weight x distance) based on transport assumptions Supplier specific allocated spend-based method covering forward logistics to customer. *Note upstream transport between supplier and distribution hub allocated to either Cat 1 or 4.*	*No international distribution accounted for due to local refurbishment* Supplier specific allocated spend-based method to account for forward logistics to customer. May be reported within Category 1 as part of aggregated forward logistics spend
5. Waste Generated in Operations	Physical activity data (weight and operator specific assumptions). *Sometimes excluded due to insignificance*	*Same treatment as newly manufactured CPE (left)*
9. Downstream Transportation and Distribution	*Category 9 was occasionally used by operators instead of Category 4, with the same principles as Category 4 applied.*	*Same treatment as newly manufactured CPE (left)*
11. Use of Sold Products	Physical activity data (typical kWh usage from device report/proxy) multiplied by an expected lifetime applied to country of sales grid factor (lifetime is typically a standardised corporate assumption of product life, often 5 years).	Excluded as it is generally considered to have been accounted for when the virgin product was sold. *As refurbishment is built into the CPE operating model, the initial sale has already accounted for all use cycles of the sold product over the overall expected lifetime.*
12. End-of-Life Treatment of Sold Products	LCA. Physical activity data (weight and operator specific assumptions). *Sometimes deemed not material.* *May be reported within Category 1.*	*EoLT for replacement components typically excluded as deemed not material but may be captured within Cat. 1 when applying the supplier specific spend method.* *Retained components of newly manufactured CPE are generally excluded from the refurbished footprint, per allocation procedure Cut off B (see 9. Allocating Embodied Emissions Across Product Use Cycles).*
13. Downstream Leased Assets	Physical activity data for use-phase CO_2e reported for 1 year based on annual 'snapshot' of typical kWh usage from unit report/proxy) multiplied by country average grid factor(s). *Sometimes leased product usage is reported upfront in full in Cat. 11 based on expected life.*	*Same treatment as newly manufactured CPE (left)*

Purple text = Products **leased** to customers. Blue text = Products **sold** to customers

6.2.3 Active Network Equipment Refurbishment

Active network equipment can be purchased by operators (this approach is more common) or leased from vendors for use in network operations. Currently, purchases of network equipment are predominantly newly manufactured goods but, in some instances, refurbished equipment is purchased. Some operators also reuse decommissioned equipment from one part of their business elsewhere within the network (sometimes in a different operating country), and on some occasions may sell decommissioned equipment to a third party vendor or marketplace, or directly to another operator.

Table 4 represents typical Inventory Accounting approaches used for the purchasing and leasing of active network equipment.

Table 4 **Operator Inventory Accounting for Active Network Equipment Refurbishment**

Emissions Category	Active Network Equipment	
	Newly Manufactured	**Refurbished**
Scope 3 **1. Purchased Goods and Services**	Supplier specific allocated spend-based method. Hybrid approach may be applied in Category 1 so data gaps for Equipment suppliers may be filled by industry-average factors. *Includes both manufacturing emissions and distribution (supplier to telco transport) emissions* This category is optional for leased equipment and is not always reported.[17]	Supplier specific allocated spend-based method (applied to emissions from refurbishment partner and, if separate, reverse logistics provider). Hybrid approach may be applied in Category 1 so data gaps for Equipment suppliers may be filled by industry-average factors. *Includes both reprocessing (manufacturing) emissions, reverse logistics, and forward distribution (supplier to telco transport) emissions*
Scope 3 **4. Upstream Transport and Distribution**	*Generally, all product transport is reported within Category 1*	*Same treatment as newly manufactured equipment (left)*
Scope 3 **5. Waste Generated in Operations**	Physical activity data (weight and operator specific assumptions). *Reporting product EoLT emissions for leased equipment is optional and is not always reported, but may be reported under Category 8*	*Same treatment as newly manufactured equipment (left)*
Scope 3 **8. Upstream Leased Assets**	Physical activity data (use-phase CO_2e reported for 1 year based on annual 'snapshot') *Note: If the operator is considered to have "operational control" of the asset, usage emissions are reported within Scope 1 and 2*	*Same treatment as newly manufactured equipment (left)*
Scope 1 Stationary Combustion **Scope 2 Purchased Electricity**	Accounted in Scope 1 and 2 inventories, as part of annual electricity usage (kWh) or fuel burnt in generators.	*Same treatment as newly manufactured equipment (left)*

Red text = Products **leased** for use in own operations. Green text = Products **purchased** for use in own operations

[17] The optionality of reporting of Scope 3 Category 1 and 5 for leased equipment was noted in the Scope 3 Guidance for Telecommunication Operators https://www.gsma.com/solutions-and-impact/connectivity-for-good/external-affairs/wp-content/uploads/2023/07/Scope-3-Guidance-2023.pdf p47

Box 2 **Resale of Active Network Equipment**

Reselling active network equipment could, in theory, incur a “Use of Sold Products” (Category 11) burden from the second user. This could be the case even if the equipment is first sold on to a 3rd party refurbishment partner. However, there are provisions within the literature that may exclude this activity from Scope 3 reporting (see Appendix B.5 Resold Active Network Equipment). In interviews, no instances of Scope 3 Category 11 reporting were observed for resold active network equipment. Overall, operators viewed this type of accounting as counterproductive as it could disincentivise circular operator behaviours.

6.2.4 Device Repair Services

As outlined in 3. Defining Circularity in the Context of Carbon Accounting, in the case of Device Repair Services, the customer brings their device to the operator who will have it repaired, often via a 3rd party repair partner, before it is returned to the customer. In this instance, ownership generally does not pass from the customer to the operator, and consequently, there is no “sold product” impact within the emissions inventory, nor is a “leased product” relationship established.

The direct impacts for Inventory Accounting, in this case, are therefore limited to the operator’s spend with a 3rd party repair partner, which is accounted for through regular accounting procedures under Scope 3 Category 1, typically covering any transportation and reprocessing emissions burdens associated with the repair. From an operator’s perspective, this case was generally not seen as significant enough to warrant detailed Inventory Accounting (for example based on a product-level method), due to its low impact within the overall inventory. Instead, it is typically accounted for using supplier-level or industry-average spend-based methods.

However, as the repair of a device may be considered to extend the lifetime of the device in use by the customer and therefore delay the purchase of a newly manufactured device, there is a theoretical societal benefit from repair in terms of “avoided” emissions. An “avoided emissions” calculation via the Project-Based Accounting approach has greater applicability to this case and will be further explored in section 7.2.2 Device Repair Services.

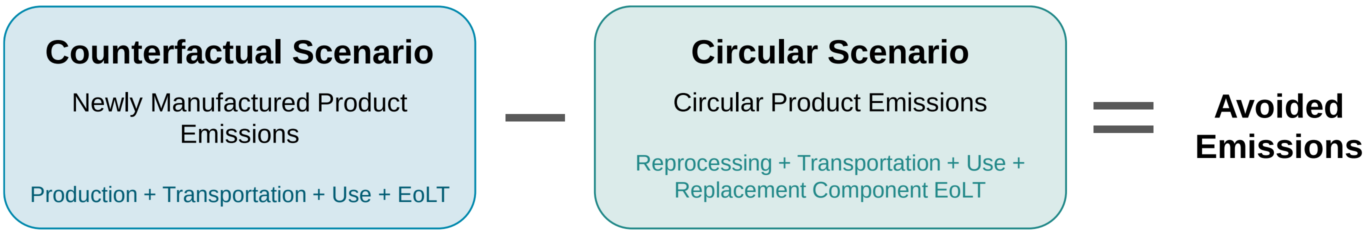
In the case of repairs performed as a service outside of warranty, the societal emissions avoided by reducing the production of new devices are not directly reflected in an operator’s emissions inventory. However, repairs performed within warranty may have a second order impact on the operator’s emissions inventory by reducing the need for replacement devices. Providing a replacement typically requires the operator to procure an additional new or refurbished device to replace the non-functional device, and this carries an associated inventory impact. When replacements involve newly manufactured devices, the emissions savings from successful repairs can therefore be substantial versus replacement with a new device. On the other hand, if warranty replacements are fulfilled using refurbished devices, the carbon savings are likely negligible, as the emissions associated with repair and refurbishment are generally comparable.

7. Project-Based Accounting: Avoided Emissions of Circularity

Alongside the Inventory Accounting approach, a second, complementary approach is outlined in the literature that is highly relevant when quantifying the carbon impacts of circularity. This is Project-Based Accounting, also known as consequential accounting or intervention accounting.

Under this approach, refurbished or repaired products can be considered to partially or fully substitute newly manufactured ones, enabling the calculation of emissions reductions, so-called “avoided emissions”. The avoided emissions figure is based on a comparison between two scenarios: a Counterfactual Scenario (which consists of the products most likely selected if the circular option were unavailable[18]) and a Circular Scenario (which consists of refurbished or repaired products).

Figure 6 **Project-Based Accounting**



EoLT: end of life treatment

As displayed in this graphic, the premise of this accounting approach is the principle that, to some extent, circular products are substituting newly manufactured, counterfactual products.

The Project-Based Accounting approach generally has two use cases within the industry:

1. External Claims: For customer facing sustainability claims that report on the “avoided emissions” impact of historical initiatives.
2. Internal Appraisals: For internal “carbon business cases” calculating the actual or potential benefits of emissions reduction initiatives.

As previously stated, any reporting using this approach must be disclosed separately from Inventory Accounting.[19] This is because the two are using different and non-comparable approaches.[20] The Inventory Accounting approach reflects attributed emissions actuals, while Project-Based Accounting is a consequential approach, using hypothetical scenarios. Due to a reliance on these hypothetical displacement scenarios, the GHGP has received feedback that Project-Based Accounting is not as robust as Inventory Accounting.[21] However, when used for internal assessments, it may be beneficial to link the Project-Based calculations back to the emissions inventory. This connection can be used to model the potential impact of the circular initiative on future inventory numbers, which are often connected to science-based reduction

[18] Climate-Avoided-Emissions-guidance_WBCSD.pdf page 48
[19] https://ghgprotocol.org/sites/default/files/2022-12/Scope%203%20Detailed%20FAQ.pdf page 19
[20] https://ghgprotocol.org/sites/default/files/2023-03/18_WP_Comparative-Emissions_final.pdf page 7
[21] https://ghgprotocol.org/sites/default/files/2024-03/Scope-3-Survey-Summary-Draft.pdf page 68

targets and organisational climate transition plans. This is covered in more depth in 10. Combined Approach: Carbon Savings of Circular Initiatives.

7.1 Key Considerations When Using Project-Based Accounting

Carbon savings within Project-Based Accounting largely depend on the Counterfactual Scenario selected and the extent to which the circular product is assumed to be a substitute for the newly manufactured product used in the counterfactual scenario.

7.1.1 Selecting a Counterfactual Product

The counterfactual product should be chosen carefully to develop considered avoided emissions estimations. In some cases, the counterfactual may be the same as the virgin unit baseline, which represents a newly manufactured version of the same model as the refurbished product. In other cases, if a newer model would logically have been selected in the absence of the refurbished option, the counterfactual product selected may be a different model from the refurbished comparator. The following table clarifies this terminology with product examples.

Table 5 **Product Terminology and Project-Based Accounting**

Terminology	Definition	Mobile Phone	CPE	Active Network Equipment
Virgin Unit Baseline	A newly manufactured version of the circular product (same model).	Newly manufactured iPhone 14 128GB	Newly manufactured Wi-Fi 6 router	Newly manufactured v1 server
Circular Product	A refurbished or repaired version of the virgin unit baseline (same model).	Refurbished iPhone 14 128GB	Refurbished Wi-Fi 6 router	Refurbished v1 server
Counterfactual Product	The product most likely selected in the absence of the circular product.	Newly manufactured iPhone 15 256GB	Newly manufactured Wi-Fi 7 router	Newly manufactured v2 server

The *ISO 14064-3* principle of “Conservativeness” should be considered when selecting counterfactual products. The standard defines this principle as using a selection that is “cautiously moderate” when assessing comparable alternatives[22]. Here, choosing a conservative counterfactual product will depend on the ownership-deployment model, which life cycle stage is dominant for the product, and the availability of lower-emission, more advanced alternative products. For example:

- Comparing the footprint of a refurbished *iPhone 14 128GB* to the latest *iPhone 16 Plus 512GB* might overstate benefits, as it assumes a customer would have otherwise selected a newer, more powerful, model with a relatively high embodied footprint, versus a more adjacent model such as an *iPhone 15*, or simply a new version of the same *iPhone 14*.
- On the other hand, for active network equipment, comparing a refurbished model to its virgin unit baseline might be misleading if the counterfactual product is not a newer, more capable model. This is because with, the pace of technological innovation, older models are

[22] ISO 14064-3 (2019-04) Part 3: Specification with guidance for the verification and validation of greenhouse gas statements page 8

quickly replaced by newer models with better energy efficiency. Assuming an operator would have purchased an older model rather than a newer one in the absence of the refurbished product may thus understate the negative usage phase impacts of the refurbished product.

7.1.2 Deciding on a Substitution Rate

Once an appropriate counterfactual product has been selected, the concept of substitution becomes particularly important. The "substitution rate" is defined in research papers as the extent to which the purchase of a used item replaces the purchase of a newly manufactured item[23]. To support a claim for fully avoided emissions, a circular product must be assumed to be a 1-to-1 substitute of the comparator product. This is deemed a "perfect substitution", and means the circular product has the same expected duration of use and provides the equivalent function of the counterfactual. When a product does not provide full equivalency, it is deemed an "imperfect substitute".

In the case of an imperfect substitution, and to adopt a conservative approach, the number of refurbished product units required may be scaled so the comparison is equivalent. In practice, this is typically based on the duration of use differential between the counterfactual and circular product. For example, if a newly manufactured mobile handset is expected to last 3 years, but the circular one lasts 2 years, the circular product only replaces two-thirds of the counterfactual product due to its duration of use. In this case, the emissions impact of 1.5 circular products should be used to make an equivalent comparison with 1 counterfactual product.

Depending on the goal and purpose of the calculation, a different approach may be taken, and the principle of conservativeness is viewed differently. For example, if the intention is to create an internal business case for the impacts of savings on the inventory, it is more practical to align the calculation approach with that used in Inventory Accounting. In this case, the substitution rate may not be applied for a sold product (see 10. Combined Approach: Carbon Savings of Circular Initiatives for more information). If the calculation is used for external claims, such as "Avoided emissions" claims, taking a conservative and justifiable approach to the quantum of the claim normally takes precedence over aligning with Inventory Accounting procedures.

7.2 Practical Application of Project-Based Accounting

The following section outlines findings relating to operator approaches to Project-Based Accounting for circular initiatives.

7.2.1 Product Refurbishment

Project-Based Accounting was found to be relatively popular with operators researched. Around one-third of assessed operators were found to be making some type of "avoided" or "saved" emissions claim relating to their refurbishment activities. A list of example claims is available in Appendix B.6 Within-industry Project-Based Accounting. Avoided emission claims are made across product categories, but the exact methodology underpinning the claims is rarely publicly disclosed.

[23] Calculating the Environmental Benefit of Reuse Platforms

Box 3 **Avoided Emissions and CPE**

In the context of refurbishment, an "avoided emissions claim" is based on the idea that a newly manufactured, counterfactual product (to some extent) has been substituted and displaced, creating a societal benefit. This is a relatively simple assertion for sold products, such as mobiles, as within the business model of the product category it is generally reasonable to assume that in the absence of a refurbished alternative, the operator would have sold a newly manufactured product.

With leased CPE business models, however, the basis of a claim can become more complex, as it could be argued that an aspect of circularity (light refurbishment) is embedded into the core CPE business model and has become an "industry norm". Depending on the purpose of the avoided emissions claim, and the level of assurance being applied, operators **may** want to consider the conservativeness of their CPE claims, as, while *ISO 14064-2* has relatively simple additionality requirements, others such as the *VCS assurance standard* may apply a stricter requirement called the "common practice test" to assess whether the activity is standard across the industry. In this CPE scenario, the assurance test may conclude that purchasing newly manufactured CPE is not a valid Counterfactual Scenario for comparing with the collection and refurbishment of CPE that was designed and deployed with the intention of continuous use and reuse. Discussions with operators reveal an alignment that avoided emissions claims are generally more robust for CPE if:

1. CPE is sold (rather than leased) to customers, and ownership is recovered through an operator initiative before it is refurbished and redistributed.
2. Leased CPE, after its 5-year life, undergoes more intensive remanufacturing for an additional use cycle, which may involve upgraded technical specifications.
3. Rates of recovery of leased CPE are increased, and this results in the avoidance of newly manufactured product purchases. For example, collection rates of routers are increased from 80% to 90% versus last year.

Regardless of the type of claim made, the standards require transparent disclosure and justification of the Counterfactual Scenario used, alongside the claim.

7.2.2 Device Repair Services

Currently, there is limited evidence of avoided emissions claims being made across the industry for Device Repair Services, although a handful of instances were observed for mobiles:

"Finding and utilising good repair services and infrastructure that makes repairs simpler can be more appealing than replacements and can also make a big impact on your company's net zero journey. By adding one year to the life of a smartphone, we could save the same volume of carbon emissions by 2030 as taking 4.7 million cars off the road"[24]

As outlined in section 6.2.4 Device Repair Services, repairing a customer device could in theory postpone the purchase of a newly manufactured one, resulting in reduced demand for the

24 https://www.vodafone.co.uk/business/insights-articles/circular-economy-acceleration-to-net-zero

production of newly manufactured devices, and therefore lower societal emissions. On a global level, therefore, avoided emissions from repair can generally be considered a positive societal impact, as they help to delay or avoid the emissions associated with newly manufactured devices. Savings estimates from this case are explored further in Annex A.3 CPE Refurbishment.

However, while avoided emissions from device repairs are generally regarded as positive impacts on a societal-level, operators should be cautious of directly attributing these savings to their own operations. When repairs are performed as a service, outside a warranty structure, the uncertainty surrounding whether a customer would have purchased a replacement device directly from the same operator makes it more appropriate to associate such emissions “savings” with broader society-level impacts. For instance, linking an increase in device repairs to a projected reduction in Scope 3 Category 1 emissions—stemming from fewer newly manufactured mobiles being sold—likely represents a tenuous and speculative connection. As discussed in 6.2.4 Device Repair Services, in the case of warranty repairs, savings could reasonably be tied back to the operator.

7.2.3 Other Industries and Project-Based Accounting

The popularity of Project-Based Accounting and avoided emissions claims is mirrored across non-ICT industries. These types of claims were found to be the primary way (according to publicly available information) companies in other industries are demonstrating the carbon benefits of circularity initiatives. Claims are commonplace and, in some cases, accompanying avoided-emissions targets have been instituted (for example BMW have announced a target of avoiding over 200 million tonnes of CO_2 emissions by 2030[25]).

[25] https://www.press.bmwgroup.com/global/article/detail/T0332273EN/over-200-million-tonnes:-bmw-group-sets-ambitious-goal-to-reduce-co2-emissions-by-2030?language=en#:~:text=The%20BMW%20Group%20is%20underpinning,tonnes%20of%20CO2%20by%202030.

8. Setting Boundaries When Calculating Savings

8.1 Standards and Guidance on Boundary Setting

For both the Inventory and the Project-Based Accounting approaches, consistent boundaries are required to account for circular and newly manufactured products in a uniform manner. This section will explore the importance of boundary selection when quantifying the carbon savings of circularity.

At the product unit-level, the system boundary, as defined by *ISO 14044*, determines which processes are included in the product system[26]. This is important when assessing circular versus counterfactual products. Critically, the comparison should be made on an equal basis; if a life cycle stage is included in one scenario, the equivalent activities (or "unit processes") should be included in the other, provided they are assessed as significant[27].

The *ITU-T L.1410* standard discourages excluding (or "cutting off") life cycle stages or unit processes where this can be avoided. If a unit process is excluded, due to, for example, the environmental impacts being deemed insignificant, the criteria must be explicitly stated and consistently applied within the life cycle assessment study[28].

8.2 Setting Boundaries within Circular Scenarios

In the case of Product Refurbishment and Device Repair Services, the EoLT of replacement components installed in refurbished products could be considered for exclusion based on insignificance. Since only a small fraction of components are typically replaced during refurbishment or repair, and considering the relatively low significance of the EoLT stage emissions for replacement components compared to the rest of the circular product life cycle stages, emissions from this process are minimal and tend not to meet materiality thresholds, so can generally be excluded.

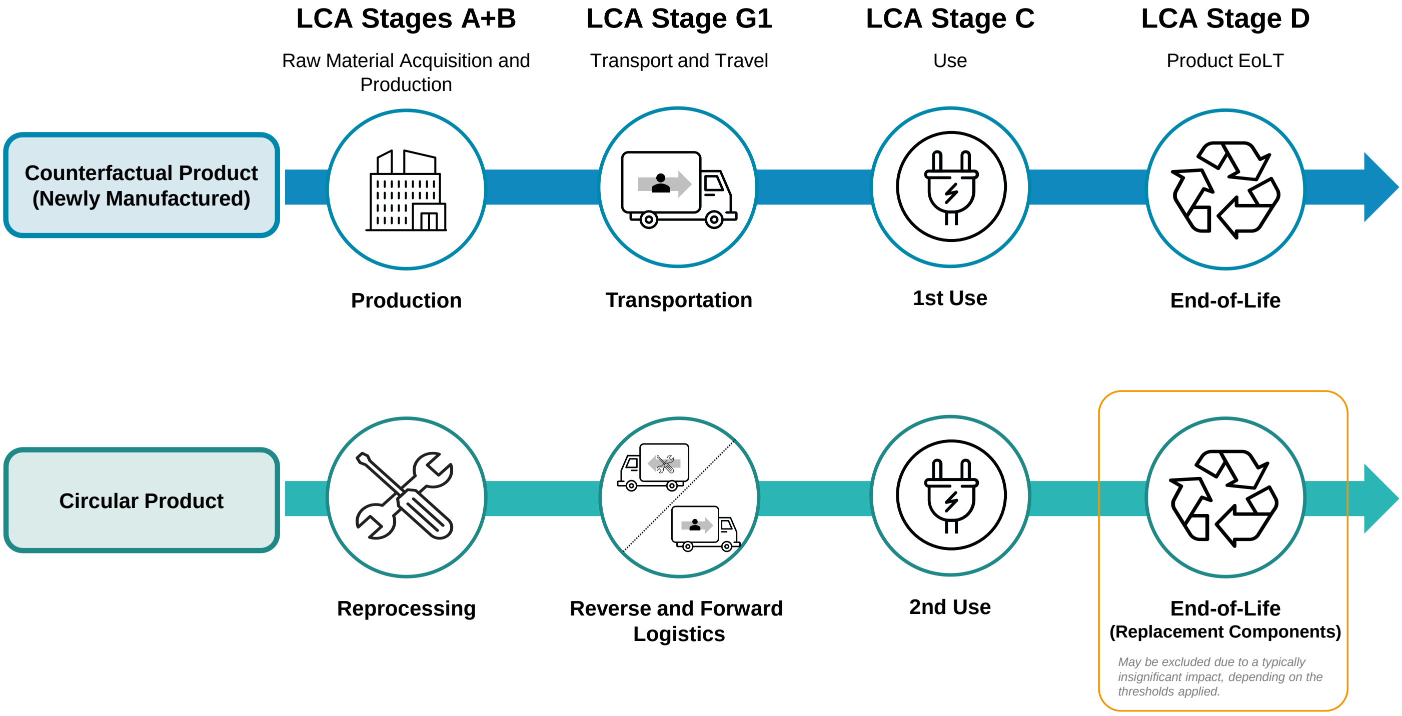
Taking into account that the EoLT process impact can be excluded for the second use cycle of a typical circular product, the following graphic provides an example of a cradle-to-grave system boundary at the unit-level. This displays the life cycle stages that would typically be considered for newly manufactured and circular products, ensuring that boundaries are consistently applied across both scenario

[26] ISO 14044 (2006-07-01) Environmental management — Life cycle assessment — Requirements and guidelines page 5

[27] Insignificance can be determined by "Estimating the process's emissions using data with upper limit assumptions to determine whether, in the most conservative case, the process is insignificant based on either mass, energy, or volume, as well as GHG relevance criteria. To determine whether an estimate is insignificant or not, a company needs to establish a definition of insignificance which may include a rule of thumb threshold. For example, a rule of thumb for insignificance may be material or energy flows that contribute less than one percent of the mass, energy, or volume and estimated GHG significance over a process, life cycle stage, or total inventory." https://ghgprotocol.org/sites/default/files/standards/Product-Life-Cycle-Accounting-Reporting-Standard_041613.pdf page 42

[28] "By invoking a cut-off, the assessment can be simplified by excluding processes that will not significantly change the overall conclusions of the study, as long as the intended application is met…Cut-offs shall be avoided as far as possible" ITU-T L.1410 (12/2014) Methodology for environmental life cycle assessments of information and communication technology goods, networks and services page 33

Figure 7 **System Boundaries at a Unit Level**



The LCA stage notations in this graphic are based on ITU-T L.1410[29]. This graphic illustrates a system boundary covering cradle-to-grave processes for counterfactual (newly manufactured) and circular products. In general, if an LCA stage is included within the system boundary, the processes for both products in the comparative assessment should be included. The exception is if a process does not meet a materiality threshold.

When setting boundaries for emissions calculations, the next key consideration is how embodied emissions should be allocated across multiple use cycles. This is an issue of allocation, which will be explored in greater detail in the following section.

[29] ITU-T L.1410 (12/2014) Methodology for environmental life cycle assessments of information and communication technology goods, networks and services page 105, 119

9. Allocating Embodied Emissions Across Product Use Cycles

In the context of emission accounting for circularity, the question of allocation is if, how, and to what extent, embodied emission impacts should be shared between product use cycles.

Emissions allocation is an important question for circular product accounting, as it dictates how product emissions flow into inventory accounts, and can also alter the proportion of emissions attributed to the circular scenario, which changes the overall savings result.

The *Scope 3 Guidance for Telecommunication Operators* provides some clarification on the issue of allocation in the context of reused, refurbished or repaired goods. This guidance states that:

> "*The emissions from purchased goods previously used should not include the emissions that arose from their extraction from raw materials, production and transportation associated with their original manufacture. Emissions that arise from any further extraction, production and transportation associated with such goods shall be accounted for by the telecommunication operator for the reporting year in which they purchased or acquired them.*"[30]

This is a logical and pragmatic allocation approach, though some feedback received from survey respondents during the GHGP update process has included calls to explore sharing embodied emissions across use cycles, enabling more balanced and impartial accounting, and so this is an area where GHGP standards may change in future.[31]

Embodied emissions allocation in the context of circularity remains an evolving area; much of the current literature on allocation focuses on recycling and co-products[32]. There are, however, principles within the standards and guidance that inform the discussion of allocation within the context of this paper.

9.1 Potential Allocation Approaches

From the literature and research papers, four potential allocation approaches are identified for circular practices. These share embodied emissions across product lives in the following ways (note for the purposes of the following figures, the EoLT of replacement components is excluded, as discussed in 8. Setting Boundaries When Calculating Savings).

---

[30] https://www.gsma.com/solutions-and-impact/connectivity-for-good/external-affairs/wp-content/uploads/2023/07/Scope-3-Guidance-2023.pdf page 15
[31] https://ghgprotocol.org/sites/default/files/2024-03/Scope-3-Survey-Summary-Draft.pdf page 60
[32] ITU-T L.1410 (12/2014) Methodology for environmental life cycle assessments of information and communication technology goods, networks and services page 42, 43

Table 6 **Comparison of Potential Allocation Approaches**

Approach	Life Cycle Phase				
	Production & Transportation	1st Use	Reverse Logistics, Reprocessing & Forward Logistics	2nd Use	Ultimate EoLT
Cut-off Variant A Embodied emissions are not shared between use cycles, and the second use cycle takes responsibility for the full EoLT. *Adapted from ITU-T L.1410*[33]	●	●	○	○	○
Cut-off Variant B Embodied emissions are not shared between use cycles, and the first use cycle takes responsibility for the full EoLT. *Adapted from ADEME*[34]	●	●	○	○	●
Split Emission All embodied emissions are shared equally between use cycles. *Adapted from the Waste and Resources Action Programme (WRAP)* [35]	◐	●	◐	○	◐
Depreciation Embodied emissions are depreciated across product use cycles. *Adapted from the International Journal of Lifecycle Assessment*[36]	◐	●	◐	○	◐

● = Allocation to Use Cycle 1. ○ = Allocation to Use Cycle 2.

Note: EoLT = end-of-life treatment.

Source: Visual concept based on Fraunhofer IZM (2022)[37].

9.2 Assessment of Allocation Approaches

The assessment criteria of Simplicity, Pragmatism, Alignment and Incentives (outlined in 4. Industry Challenges in Carbon Accounting for Circularity) were applied to the potential approaches. Each of the potential allocation approaches has unique advantages and drawbacks, for a full assessment of the four allocation approaches, please refer to Appendix B.7 Assessment of Allocation Approaches. The testing process yielded the following results:

[33] ITU-T L.1410 (12/2014) Methodology for environmental life cycle assessments of information and communication technology goods, networks and services page 43

[34] https://librairie.ademe.fr/dechets-economie-circulaire/5833-assessment-of-the-environmental-impact-of-a-set-of-refurbished-products.html page 20

[35] https://www.wrap.ngo/sites/default/files/2020-09/WRAP-Final-Reuse-Method.pdf page 12

[36] The search for an appropriate end-of-life formula for the purpose of the European Commission Environmental Footprint initiative.

[37] https://www.izm.fraunhofer.de/content/dam/izm/de/documents/Abteilungen/Environmental_Reliability_Engineering/Projekte/Carbon%20savings%20reuse%20of%20ICT%20equipment%20November_2022.pdf page 15

Table 7 **Operator Preferences for Allocation Approach**

Approach	Simplicity	Pragmatism	Alignment	Incentives
Cut-off Variant A	Good	Good	Excellent	Good
Cut-off Variant B	Excellent	Excellent	Good	Good
Split Emission	Fair	Fair	Fair	Excellent
Depreciation	Poor	Poor	Poor	Excellent

● = Excellent. ● = Good. ● = Fair. ● = Poor.

While Split Emissions and Depreciation approaches scored highly in terms of accurately reflecting emissions savings, they did not meet operator requirements of Simplicity and Pragmatism.

Allocation approaches that involved splitting embodied emissions across use cycles (Split Emissions and Depreciation approaches) were seen as problematic from Simplicity and Pragmatism perspectives. Current inventory methodologies do not easily allow for this type of allocation as they can require complex assumptions or retroactive accounting practices.

Cut-off "Variant B" (whereby the EoLT is assigned to the first use cycle) was assessed as the preferred allocation procedure. This approach is in line with current GHGP literature and scores well across all criteria, particularly in its ability to enable simple and pragmatic accounting procedures. It was deemed superior to Variant A as the EoLT phase treatment was considered more easily applicable for inventory accounting for sold products.

Adoption of *Cut-off "Variant B"*, has two major implications:

- Within Inventory Accounting, if an operator is selling a refurbished product under this approach, they would generally only account for the additional reprocessing and transportation burden of refurbishment, plus the additional use-phase. EoLT impacts would be excluded (the EoLT of the newly manufactured product is allocated 100% to the newly manufactured product, while the EoLT of the replacement components is generally considered insignificant).
- Within Project-Based Accounting, the Circular Scenario would consist only of the additional reprocessing and transportation burden, and the additional use-phase, meaning calculations made for internal use are likely to broadly translate to inventory reductions.

It should also be noted that the preference for this type of cut-off approach to allocation is currently mirrored across industries. It is frequently viewed as the most pragmatic approach to sharing emissions across product use cycles. Within the built environment, standards *EN 15978 (2011)* and *EN 15804 (2012)* use a type of cut-off approach where the impacts from virgin material production and EoLT are attributed to the first use.[38] In ICT, HPE reference a cut-off type approach when estimating emissions from circular practices within their circular economy report.[39]

[38] Development of a life cycle assessment allocation approach for circular economy in the built environment page 3
[39] https://www.hpe.com/psnow/doc/a00117985enw?from=app&section=search&isFutureVersion=true page 11

10. Combined Approach: Carbon Savings of Circular Initiatives

For operators seeking to understand how increases in adoption of refurbished products may impact their organisational emissions footprint, a combination of the Inventory Accounting and Project-Based Accounting approaches can be used to calculate associated inventory reductions.

This method can be used for internal "carbon business cases" to appraise the potential sustainability benefits of a proposed refurbishment initiative, to identify what savings can be made to contribute towards science-based emissions reduction targets or to support climate transition planning.

To perform this analysis, operators would begin with a Project-Based approach to quantify the expected inventory impacts of a refurbished product versus a counterfactual newly manufactured product. Operators can then scale these up to reflect full scale Circular vs Counterfactual scenario, before categorising the two in line with Inventory Accounting procedures, to show the hypothetical savings impacts on the Scope 1, 2 and 3 inventory. A step-by-step description of the calculation method is outlined below.

10.1 Calculating Inventory Reductions from Circular Initiatives

Operators should apply four key steps when calculating the carbon savings of circular initiatives:

A. Defining the Project Boundary

The boundary should encompass all activities associated with the refurbishment initiative, including:

- Collection, transportation, and reprocessing of used products (Circular Scenario).
- Avoided production, transportation and end-of-life treatment of new products (Counterfactual Scenario)
- The use phase impacts of each scenario. These may be different depending on the relative energy efficiency of the products selected and the substitution rates applied, based on the expected duration of use.

B. Quantifying Circular Scenario Emissions

In this step, operators calculate the emissions impacts from the circular initiative, including the emissions from the refurbishment operation and the use of the refurbished product during their second use cycle. Data requirements are typically:

- Emissions factors for refurbished products, including:
    - GHG impacts of refurbishment processes (e.g., cleaning, repairs, testing).
    - Transport of goods to and from refurbishment facilities.

  - Packaging and redistribution to customers.
- Expected duration of use of the circular product (e.g. 2 years for a refurbished mobile).
- Typical energy consumption of the refurbished product per year (in kWh).
- Average in-use energy emissions factor (kg CO_2e/kWh).

Depending on available data, emissions factors may use different methods:

- Product-level method: such as the GWP impacts from the relevant lifecycle stages taken from an LCA or PCF of the specific refurbished product.
- Supplier-level allocation method: such as the Scope 1, 2 and upstream Scope 3 emissions of the refurbishment provider allocated to the in-scope product via physical or economic activity data. Data for transportation partners may also need to be added if transportation is not handled by the refurbishment provider.
- Industry-average method: such as an industry average factor for electronics repair and refurbishment.

For the purposes of this calculation, practitioners should mirror the data sources used in the emissions inventory. For example, if emissions relating to reprocessing appear as spend-based supplier-level emissions in Category 1, operators should use this data in order to give a faithful representation of inventory savings as they appear in the inventory.

C. Quantifying Counterfactual Scenario Emissions

The Counterfactual Scenario represents what emissions would have occurred without the refurbishment initiative (e.g. purchasing and selling newly manufactured mobiles). Data requirements are typically:

- Emissions factors for the full lifecycle of a newly manufactured product, including:
  - Production (including raw material extraction)
  - Transportation
  - Use
  - End-of-life treatment.
- Expected lifetime of the counterfactual product (e.g. 3 years for a newly manufactured mobile)
- Typical energy consumption of the refurbished product per year (in kWh)
- Average in-use energy emissions factor (kg CO_2e/kWh).

For the purposes of this calculation, practitioners should mirror the data sources as they would have been used in the emissions inventory. For example, if emissions relating to production appear as product-level PCF-based emissions in Category 1, operators should use this data in order to provide a faithful representation of how counterfactual impacts would have appeared in the inventory.

Box 4 **Matching Project-Based Calculations to Inventory Procedures**

It should be noted that in some cases, the methods used for the Counterfactual Scenario may differ from those used for the Circular Scenario. For example, some operators account for newly manufactured CPE based on product LCAs, using the product-level method, but account for emissions from their refurbishment partner based on economic activity with the supplier, using a supplier-level allocation method. This is often a decision made during the Inventory Accounting process to maximise the data quality of the inventory.

In this case, it is recommended to reflect the inventory procedures within the Project-Based calculation for the purposes of this specific exercise, to faithfully reflect the impact of circular initiatives as they would appear within the inventory.

If data is available, practitioners may wish to carry out a parallel, secondary calculation showing the results based on more specific data. Where this gives a more accurate result, changes to the overall inventory procedure can be considered based on this evidence, and if these changes are applied to the organisation's inventory accounting procedures, these can then be reflected in the primary calculation provided to stakeholders regarding the inventory reductions from the circularity initiative.

D. Simulating Inventory Savings

Once project-level scenarios are defined, relative savings can be quantified within the context of the company's overall GHG inventory. Generally, savings follow the below principle:

Inventory Savings = Counterfactual Scenario Emissions (based on inventory methods) – Circular Scenario Emissions (based on inventory methods)

However, when comparing inventory impacts of circular versus counterfactual products, overall volumes must be considered. This raises the concept of substitution within the context of inventory accounting. When simulating inventory savings, substitution rates may be factored in differently depending on the ownership-deployment model of the product in question, and the temporal boundaries of the analysis.

For sold products, such as mobile handsets, it may be assumed that a refurbished handset is a perfect substitution for a newly manufactured mobile in the emissions inventory because the operator has sold a refurbished mobile instead of a newly manufactured one. The fact that the expected duration of use may be 2 years versus 3 years for the newly manufactured mobile could be disregarded, as there is no guarantee that after 3 years the operator would sell 50% more mobiles as customers return to replace their refurbished mobile with an increased cadence.

For active network equipment deployed in own operations, however, it is more problematic to disregard the substitution rate of a shorter expected duration of use. This is because if a server is expected to last 5 years when purchased as newly manufactured, but only 3 years when purchased as refurbished, it is reasonable to assume that the operator will need to purchase 1.7 refurbished units to meet its needs over the next 5 years. This would lead to Category 1 impacts of x1.7 reprocessing and transportation emissions, versus Category 1 impacts of x1 newly manufactured unit production and distribution emissions.

Inventory savings reported should therefore be adjusted accordingly, based on the unique scenario, the ownership-deployment model and the associated inventory procedures, and the temporal boundaries of the analysis.

Once the overall emissions of each scenario have been scaled appropriately, based on expected unit volumes adjusted for any relevant substitution impacts, the resulting emissions can be allocated to the appropriate emissions inventory Scopes and Categories. The emissions savings should be allocated based on Inventory Accounting procedures for each ownership-deployment model. For example, for mobile handsets sold to customers, production and upstream transportation impacts are typically allocated to Category 1, forward logistics to Category 4, expected duration of use to Category 11, and EoLT to Category 12. For active network equipment, production and upstream transportation impacts are typically allocated to Category 1, EoLT impacts in Category 5, and usage impacts are reflected within Scope 1 and 2.

In this way, expected emissions from each scenario and the associated savings can be presented in terms of their simulated impact on each emissions Scope and Category within the inventory. Please refer to section 6. Inventory Accounting: Scope 1, 2 and 3 Impacts of Circularity for more detailed discussion of inventory allocation procedures in the context of circular initiatives.

10.2 Reporting Inventory Savings from Circular Initiatives

Once allocated, the overall analysis can be presented to stakeholders to support decision-making, appraisals and planning activities related to the role of circular initiatives in reducing an operator's overall carbon footprint.

In practice, although past GSMA analysis has shown that mobile refurbishment could make a 7% contribution to operators' near-term reduction targets, the overall savings operators can expect from product lifetime extension via circular initiatives will vary depending on the types and quantities of product refurbished, the emissions intensity of the refurbishment operation, the usage intensity of the refurbished product, the extent to which refurbished products substitute newly manufactured products (the level of equivalence), and the specific measurement and allocation procedures applied to account for products within the emissions inventory.

Operators can refer to the simplified **Excel Model** accompanying this paper to perform a practical application of this analysis for their specific products.

Annex A: Worked Examples and Typical Savings

Introduction and Overview

In this annex, the recommendations outlined in the guidance (including the recommended boundaries and allocation procedure) are applied to circular initiatives within mobiles, CPE and active network equipment, to display indicative savings per product category.

Results are displayed across Inventory Accounting and Project-Based Accounting approaches and key influencing factors are highlighted. The intent is to provide a general understanding of the level of savings that could be expected from refurbishment and repair initiatives.

This is supported by an accompanying **Excel Model**, which is likewise based on the principles covered in this guidance. The Excel model structures user inputs and generates indicative emissions savings. The savings generated by the model are then translated into the Inventory and Project-Based Accounting approaches, as well as Simulated Inventory Savings. This model can be leveraged if users want to further understand the recommended calculation methods, create specific scenarios, model savings in a granular way (for example, by LCA stage) to make detailed estimations, or develop a set of results for different product lines that can be combined to model forward inventory reductions.

A.1 Mobile Handset Refurbishment

A.1.1 Mobile Refurbishment Case

From interviews with operators and desk-based research, currently, a newly manufactured mobile handset is typically estimated to have an average use duration of 3 years,[40] and a refurbished handset a duration of 2 years.[41] The refurbishment burden used in studies is an average of observed reprocessing procedures; in some cases, a clean is all that is needed, in others, a screen and battery replacement takes place. Refurbishment generally happens locally; products are typically not sent back to the Original Equipment Manufacturer (OEM). For the purposes of the savings calculation, we assume the mobiles are sold and the use-phase is based on an average European regional grid factor.

A.1.2 Typical Carbon Impacts from Mobile Refurbishment

Inventory Accounting (sold products):

- **1 x Newly manufactured product** = approx. 73 kg CO_2e across Scope 3 Categories 1, 4, 11 and 12.
- **1 x Refurbished product** = approx. 8 kg CO_2e across Scope 3 Categories 1, 4, 11 and 12.

[40] https://eeb.org/revealed-the-climate-cost-of-disposable-smartphones/
[41] https://librairie.ademe.fr/dechets-economie-circulaire/5833-assessment-of-the-environmental-impact-of-a-set-of-refurbished-products.html page 27

Project-Based Accounting:

- Due to the refurbished product's duration of use, it is only replacing 2/3 (two-thirds) of a newly manufactured product. A substitution rate multiplier of x1.5 is applied to the refurbished product's emissions to make the comparison equivalent.
- For Project-Based Accounting, the virgin unit baseline is used as the counterfactual product. This may be adjusted depending on how operators apply the principle of conservativeness.
- **Total emissions savings** = approx. **80%** from selling a refurbished mobile versus selling a newly manufactured mobile across all stages of the lifecycle including usage.
- **Embodied emissions savings** = approx. **85%** from reprocessing, transporting and disposing a refurbished mobile handset versus producing, distributing and disposing of a newly manufactured handset.

As the use-phase constitutes a small percentage (approx. **5%**) of total emissions for newly manufactured mobiles, total emissions savings for mobile handsets are similar to embodied savings in this case.

A.1.3 Key Factors That Influence Savings

- Level of refurbishment reprocessing
- Distance and mode of transport (truck, rail, sea or air freight) for reverse and forward logistics.

Mobile handset refurbishment calculations are based on 2023 transport[42] and grid factors[43], and adjusted ADEME[44] and Apple data[45].

Box 5 **Mobile Refurbishment: Other Environmental Savings**

Here, a continuation of the logic used previously in Project-Based Accounting is applied to other key environmental impact characteristics. Due to the refurbished product's duration of use, it is only replacing 2/3 (two-thirds) of a newly manufactured product, therefore a multiplier of x1.5 is applied to the refurbished product impacts to make the comparison equivalent.

Note: this analysis is inclusive of all LCA stages.

Category	Newly manufactured	Refurbished	% Savings
Waste (WEEE grams)	200	33	approx. **85%**
Water usage (m^3eq)	90	20	approx. **80%**
Raw material extraction (kg)	270	38	approx. **85%**

[42] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023
[43] https://ember-energy.org/data/electricity-data-explorer
[44] https://librairie.ademe.fr/dechets-economie-circulaire/5833-assessment-of-the-environmental-impact-of-a-set-of-refurbished-products.html
[45] https://www.apple.com/environment/pdf/products/iphone/iPhone_11_Pro_PER_sept2019.pdf

A.2 Mobile Handset Repair

A.2.1 Mobile Repair Services Case

From desk-based research, it is estimated that the average duration of use for a “repaired” mobile is less than that of a “refurbished” mobile, considering that repair of a customer mobile generally focuses on a single defective component rather than a general reconditioning. An estimate based on research on this topic is that a repaired mobile might last on average an additional approx. 1 year[46]. Repair is likely to take place locally to the customer. For the purposes of the saving calculation, the use-phase is based on an average European grid factor.

A.2.2 Typical Carbon Impacts from Mobile Repair Services

Inventory Accounting:

- Low direct impact on the Scope 1, 2 or 3 inventory, possible negative impact via increased spend with a 3rd party repair provider

Project-Based Accounting:

- Newly manufactured product = approx. 73 kg CO_2e
- Repaired product = approx. 7 kg CO_2e
- Due to the circular product’s use duration, it is only replacing 1/3 (one-third) of a newly manufactured product. A multiplier of x3 is therefore applied to the circular product’s emissions to make the comparison equivalent.
- For Project-Based Accounting, the virgin unit baseline is used as the counterfactual product. This may be adjusted depending on how operators apply the principle of conservativeness (for example, if modelling warranty replacements, a refurbished handset may be chosen as the counterfactual product)
- **Total emissions savings** = approx. **70%** from repairing a mobile and using it for an additional year versus the incremental impact of producing, distributing, using and disposing of a newly manufactured mobile 1 year earlier.
- **Embodied emissions savings** = approx. **75%** from repairing a mobile to extend its life for an additional year versus the incremental impact of producing, distributing and disposing of a newly manufactured mobile 1 year earlier.

As the use-phase constitutes a small percentage (approx. **5%**) of total emissions for newly manufactured mobiles, total emissions savings are similar to embodied savings in this case.

A.2.3 Key Factors That Influence Savings

- Type of repair procedures, for example, screen vs battery vs charging port replacement.

Mobile handset repair calculations are based on 2023 transport[47] and grid factors[48], and adjusted ADEME[49] and Apple data[50]

[46] Modelling of different circular end-of-use scenarios for smartphones
[47] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023
[48] https://ember-energy.org/data/electricity-data-explorer
[49] https://librairie.ademe.fr/dechets-economie-circulaire/5833-assessment-of-the-environmental-impact-of-a-set-of-refurbished-products.html
[50] https://www.apple.com/environment/pdf/products/iphone/iPhone_11_Pro_PER_sept2019.pdf

A.3 CPE Refurbishment

A.3.1 CPE Refurbishment Case

Interviews with operators and equipment providers suggest that typically, newly manufactured CPE currently has a total lifespan of 5 years. At least one refurbishment process is considered to be designed into the operating model for leased CPE, but products may be refurbished between 1-3 times over their lifetime. This process is usually light touch, involving testing, cosmetic treatment and repackaging. Refurbishment is likely to be carried out locally, minimising transportation impacts. For the purposes of the savings calculation, we assume the CPE is a sold router with 5 years as the duration of use for the newly manufactured router, and 3 years as the duration of use for the refurbished router. The use-phase is based on an average European grid factor.[51]

A.3.2 Typical Carbon Impacts from CPE Refurbishment

Inventory Accounting (sold products):

- 1 x Newly manufactured product = approx. 115 kg CO_2e across Scope 3 Categories 1, 4, 11 and 12.
- 1 x Refurbished product = approx. 50 kg CO_2e across Scope 3 Categories 1, 4, 11 and 12.

Project-Based Accounting:

- Due to the refurbished product's use duration, it is only replacing approx. 2/3 (two-thirds) of a newly manufactured product. A multiplier of x1.67 is applied to the refurbished product's emissions to make the comparison equivalent.
- For Project-Based Accounting, the virgin unit baseline is used as the counterfactual product. This may be adjusted depending on how operators apply the principle of conservativeness.
- **Total emissions savings** = approx. **30%** from selling a refurbished router versus selling a newly manufactured router.
- **Embodied emissions savings** = approx. **80%** from reprocessing, distributing and disposing of a refurbished router versus producing, distributing and disposing of a newly manufactured router.

As the use-phase constitutes a significant percentage (approx. **65%**) of total emissions for newly manufactured routers, total emissions savings are noticeably different to embodied savings.

A.3.3 Key Factors That Influence Savings

- Use-phase is significant for CPE. Total emissions savings are dependent on grid factors, a cleaner/dirtier grid can change percentages.
- Distance and mode of transport (truck, rail, sea or air freight) for reverse and forward logistics.

CPE refurbishment calculations are based on 2023 transport[52] and grid factors[53], interviews, LCA data from OEMs, and publicly available Sagemcom studies[54] [55].

---

[52] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023
[53] https://ember-energy.org/data/electricity-data-explorer
[54] https://www.sagemcom.com/sites/default/files/2020-01/Ecodesign-Rapport%20RSE%20EN.pdf
[55] https://www.sagemcom.com/sites/default/files/Sustainability-of-the-home-LAN_June-2023.pdf

GSMA

A.4 Active Network Equipment Refurbishment

A.4.1 Active Network Equipment Refurbishment Case

Through interviews with equipment providers, newly manufactured active network equipment is assumed to be used for 10 years. Active network equipment for products older than 3 years is generally not considered for refurbishment due to energy efficiency reasons and the advancement of technology. For this reason, refurbished active network equipment is assumed to be used for 7 years. Reprocessing burdens can vary from simple testing and reissue to repair of non-functional components via remanufacturing or via cannibalisation of other collected products, and so "refurbishment" should be based on an average of these processes. Refurbishment via 3rd party vendors is likely to be local.

Although some OEMs do offer equipment recertification programmes, some of which may involve more extensive transportation and remanufacturing impacts, this is currently less common than the local refurbishment via so called "grey market" 3rd party providers. For the purposes of the saving calculation, we assume the active network equipment is an active antenna and that it is purchased. The use-phase is based on an average European grid factor.[56]

A.4.2 Typical Carbon Impacts from Active Network Equipment Refurbishment

Inventory Accounting (products purchased and used in network operations):

- 1 x Newly manufactured product = approx. 18,500 kg CO_2e across Scope 1 and 2, and Scope 3 Categories 1, 4 and 5.
- 1 x Refurbished product = approx. 12,500 kg CO_2e across Scope 1 and 2, and Scope 3 Categories 1, 4 and 5.

Project-Based Accounting:

- Due to the refurbished product's use duration, it is only replacing approx. 2/3 (two-thirds) of a newly manufactured product. A multiplier of x1.43 is applied to the refurbished product's emissions to make the comparison equivalent.
- For Project-Based Accounting, the virgin unit baseline is used as the counterfactual product. This may be adjusted depending on how operators apply the principle of conservativeness.
- **Total emissions savings** = approx. **5%** from selling a refurbished antenna versus selling a newly manufactured antenna.
- **Embodied emissions savings** = approx. **80%** from reprocessing, distributing and disposing of a refurbished antenna versus producing, distributing and disposing of a newly manufactured antenna.

As the use-phase is dominant (approx. **90%**) of total emissions for newly manufactured antennas, total emissions savings are markedly different to embodied savings.

A.4.3 Key Factors That Influence Savings

- Use-phase is dominant for active network equipment. Total emissions savings are heavily dependent on grid factors, a cleaner/dirtier grid can substantially change percentages.

- Distance and mode of transport (truck, rail, sea or air freight) for reverse and forward logistics.

Active Network Equipment refurbishment calculations are based on 2023 transport[57] and grid factors[58], interviews, and LCA data provided by OEMs

[57] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023
[58] https://ember-energy.org/data/electricity-data-explorer

Annex B: Appendices

B.1 Relevant GHGP Survey Feedback for Circular Product Carbon Accounting

Starting in 2022, GHGP surveyed over 350 respondents. The following feedback and suggestions were raised, which if addressed in the update of the GHGP Scope 2 and 3 standard (expected in 2025) could have an impact on current carbon accounting standards with regard to circularity[59]:

- **Accounting:**
  - Temporal aspects: Reporting emissions up-front for circular products can misrepresent their benefits. Reporting these emissions annually could give a better representation.[60]
  - Allocation: Request for GHGP to clarify and give direction on how to distribute emissions between use cycles for circular products.[61]
- **Data Challenges:**
  - Gathering accurate supplier-level emissions data is a significant challenge.[62]
  - There are concerns around the accuracy of the spend-based method, which raised calls for assurance requirements to be strengthened.[63]
- **Avoided Emissions:**
  - More guidance is needed on accounting for avoided emissions and what differentiates these from emissions captured within Scopes 1/2/3.[64]
  - Calls to keep avoided emissions reporting separate from inventory reporting.[65]

[59] https://ghgprotocol.org/sites/default/files/2023-05/Topline%20Findings%20from%20Scope%202%20Feedback%20Webinar_GHG%20Protocol_05.02.2023.pdf page 17
[60] https://ghgprotocol.org/sites/default/files/2024-03/Scope-3-Survey-Summary-Draft.pdf page 58
[61] https://ghgprotocol.org/sites/default/files/2024-03/Scope-3-Survey-Summary-Draft.pdf page 60
[62] https://ghgprotocol.org/sites/default/files/2024-03/Scope-3-Survey-Summary-Draft.pdf page 4
[63] https://ghgprotocol.org/sites/default/files/2024-03/Scope-3-Survey-Summary-Draft.pdf page 5
[64] https://ghgprotocol.org/sites/default/files/2024-03/Scope-3-Survey-Summary-Draft.pdf page 69
[65] https://ghgprotocol.org/sites/default/files/2024-03/Scope-3-Survey-Summary-Draft.pdf page 68

B.2 Reprocessing Definitions within Literature

Table 8 **Reprocessing Definitions Within the Literature**

Circular Terminology	Scope 3 Guidance for Telecommunication Operators	ITU-T L.1024 (see footnotes for works cited)	ETSI TR 103 476 (see footnotes for works cited)
Remanufacturing		Return a used product [or component] to at least its original performance with a warranty that is equivalent or better than that of the newly manufactured product [66]	Process in which one or more part(s) are reworked to compose a new part/good
Refurbishing (including reconditioning)	Reused, refurbished and repaired goods constitute items of property that were previously owned by another company and restored to a usable condition prior to the purchase where necessary by the telecommunication operator	Reconditioning; Refurbishing: Return a used product to a satisfactory working condition by rebuilding or repairing major components that are close to failure, even where there are no reported or apparent faults in those components [67]	Processing hardware and/or software of an ICT good, a plug-in unit or system module of a used ICT good for reuse through e.g. testing, cleaning and repair
Reuse		Process by which a product or its parts, having reached the end of their first use, are used for the same purpose for which they were conceived [68]	Any operation by which component parts of end-of-life products are used for the same purpose for which they were conceived [69]
Preparing for reuse		Checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be reused [70]	
Repair			Restore to working order

[66] Accounting for the environmental benefits of remanufactured products: Method and application
[67] Accounting for the environmental benefits of remanufactured products: Method and application
[68] EN 45554:2020, General methods for the assessment of the ability to repair, reuse and upgrade energy-related products.
[69] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives.
[70] Accounting for the environmental benefits of remanufactured products: Method and application

B.3 Adjusting a Spend-Based Method in the Absence of Specific Emissions Factors

While physical activity data is generally preferred within the literature and research papers for accuracy reasons, a key observation from interviews is the prevalence of spend-based methods for Inventory Accounting.

The use of spend-based methods when accounting for circularity is in keeping with operator priorities of Simplicity and Pragmatism and is often useful to facilitate hot spotting and targeted emissions mitigation. However, spend-based methods do not always accurately reflect emissions realities, and they can be subject to market distortions.

In the absence of specific emissions factors for refurbished products at a product, supplier, or industry-average level, the operator has three potential options to incorporate and recognise the lower emissions of refurbished spend within the inventory. These are provided below:

1. **Cost-Based Differential Approach:** Using existing emissions factors for newly manufactured products combined with a lower spend on refurbished products will naturally generate lower calculated emissions. Depending on the operator's specific situation, the difference may closely approximate reality, in this case, there will be no need for further adjustments. Note: this should be checked at intervals due to market volatility of pricing.
2. **Emissions Factor Reduction Approach:** If spend on newly manufactured products and refurbished is similar (on a per unit basis), applying a percent reduction to existing emissions factors for newly manufactured products can help operators estimate emissions in a way that closely approximates actual impacts. The key to using this method is to transparently document and justify the process by which the refurbished emissions factor is derived. Note: this should be checked at intervals due to market volatility of pricing
3. **Baseline Price Approach:** This approach is similar to option 2. Here, a percentage reduction is applied to the newly manufactured products emissions factor, but instead of using actual refurbished spend, spend is based on what the products would have cost if purchased new.

Table 9 illustrates each option using an example of a refurbished mobile and a newly manufactured mobile. For the purposes of this example, the refurbished mobile has 20% of the Category 1 emissions of the newly manufactured mobile.

Table 9 **Options to Adjust a Spend-Based Method (Category 1 Example)**

	1. Cost-Based Differential Approach		2. Emissions Factor Reduction Approach		3. Baseline Price Approach	
	Newly Manufactured Mobile	Refurbished Mobile	Newly Manufactured Mobile	Refurbished Mobile	Newly Manufactured Mobile	Refurbished Mobile
Spend (€)	500	300	500	300	500	*Same as new* → **500**
Emissions Factor	0.1	0.1	0.1	*20% of new* → **0.02**	0.1	*20% of new* → **0.02**
kg CO_2e	50	30	50	6	50	10

In this example, the 3 options are presented within the context of a refurbished mobile, which has 20% of the Category 1 emissions compared to a newly manufactured mobile. The Baseline Price Approach accurately reflects savings.

Within the example, the Cost-Based Differential does not adequately capture emissions savings, while the Emissions Factor Reduction approach overstates savings. The Baseline Price approach accurately reflects savings.

Operators should evaluate the relevance of these options based on their specific scenarios, as the applicability of Cost-Based Differentials and Emissions Factor Reductions depend on individual circumstances. The Baseline Price approach is generally applicable across contexts; however, it can be more complex to apply as it requires mapping of refurbished product prices to the price of their newly manufactured equivalents. For typical percentages derived from industry sources, that can be applied within this approach, refer to the **Excel Model** accompanying this guidance.

B.4 Ownership-Deployment Model and Inventory Accounting Results

Temporal Aspects

According to the GHGP Corporate Value Chain (Scope 3) Accounting and Reporting Standard, burdens for each Category may be accounted for “up-front” in full on product purchase, or through an annualised footprint[71]. Within the operational control approach, the use-phase for sold products should be reported in full up-front, while for leased products or goods deployed within own operations, the use-phase reporting is annualised.

- Emissions in Scope 3 Categories 1 (Purchased Goods and Services), 2 (Capital Goods) and 4 (Upstream Transportation and Distribution) are reported in full upon product acquisition.
- Emissions in Scope 3 Categories 11 (Use of Sold Products) and 12 (End-of-Life Treatment of Sold Products) are reported up-front based on expected duration of use and expected EoLT.
- Emissions in Scope 3 Categories 5 (Waste Generated in Operations), 8 (Upstream Leased Assets) and 13 (Downstream Leased Assets) are reported annually based on emissions from the disposal/treatment of waste and the operation of assets that take place in the reporting year.
- Scope 1 and Scope 2 emissions are reported annually based on fuel combustion and electricity used.

Future changes to in-use energy factors only impact leasing models or goods used in own operations, as usage is reported annually for leased products and falls under Scope 1 and 2 for own operations, as goods are within the organisation’s operational control. For sold products, emissions are reported up-front using the most recent grid factor at the time the product is sold[72]. These different methods result in different total emissions, depending on the ownership-deployment model applied to the product.

Mandated Reporting

There is also an additional impact as in some cases emissions reported under one ownership-deployment model need not be reported under another. This is seen when purchasing vs leasing active network equipment, where accounting for embodied emissions may be considered “optional” for leased goods, per the minimum boundary defined in the GHGP Corporate Value Chain (Scope 3) Accounting and Reporting Standard.

Mobiles and CPE: Production, transportation, use and waste footprints are all accounted for in both leased vs sold ownership-deployment models, but under different Categories and with different temporal rules.

Active network equipment: Under the current standards, operators could see a benefit by leasing active network equipment as they would not be mandated to report the production and upstream transportation of leased active network equipment against Scope 3 Category 1, or EoLT against Scope 3 Category 5.

[71] https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf page 33

[72] https://www.gsma.com/solutions-and-impact/connectivity-for-good/external-affairs/wp-content/uploads/2023/07/Scope-3-Guidance-2023.pdf page 63

Box 6 **Leased and Purchased Equipment Used in Own Operations**

The difference highlighted within the above analysis on leased vs purchased network equipment reflects an opportunity to clarify the *Scope 3 Guidance for Telecommunication Operators.*

Currently, reporting the production and upstream transportation emissions of the product is only mandatory if the product is purchased. If leased, it is left to the discretion of the reporting organisation whether to report the embodied emissions associated with the leased products. This can create inconsistencies across the industry, where companies that report emissions have inflated inventories compared to peers who opt not to disclose the embodied carbon of leased products. Making this reporting either mandatory or explicitly excluded would remove ambiguity and ensure consistency.

B.5 Resold Active Network Equipment

In the case of operators selling on used active network equipment to a downstream user, or collecting used mobiles that are then auctioned or sold on, the onward use-phase could be a significant emissions source for the operator initiating the circular process. The literature can be interpreted to require reporting of this energy usage in Category 11 (Use of Sold Products), even if goods are first sold to a third-party refurbisher. The logic from the GHGP for intermediate products can be applied.

> *"When a company sells an intermediate product that directly emits GHGs in its use-phase, it is required to account for direct use-phase emissions of the intermediate product by the end user, (i.e., emissions resulting from: the use of the sold intermediate product that directly consumes fuel or electricity during use; fuels and feedstocks; GHGs released during product use)".* [73]

There is a risk that this practice could disincentivise the supply of products to the secondary market and discourage circular behaviours, as it would generally increase the emissions inventory of companies supplying used products into the circular economy, versus the relative impact of product EoLT via recycling and disposal. Considering the lack of data on downstream sales pathways of products and the inability to track usage, operators may opt to exclude Category 11 emissions related to selling on used active network equipment, with the appropriate disclosures and justifications.[74]

Equally, considering the lack of control or influence over the subsequent usage and treatment of a product supplied to a circular economy marketplace or vendor organisation, it may be considered that this activity no longer meets the Scope 3 relevancy criteria of "Influence", and therefore can be considered outside of the Scope 3 boundary.[75]

[73] https://ghgprotocol.org/sites/default/files/2022-12/Chapter11.pdf page 123

[74] "In some situations, companies may have scope 3 activities, but be unable to estimate emissions due to a lack of data or other limiting factors…Companies are required to disclose and justify any exclusions in the public report" https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf page 60

[75] "Influence: There are potential emissions reductions that could be undertaken or influenced by the company" - Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf page 61

B.6 Within-industry Project-Based Accounting

Table 10 **Within-Industry Project-Based Accounting**

CPE	Mobile Phones	Active Network Equipment	Not Specific
BT: "In 2020, refurbishment of home hubs and set-top boxes avoided 11,400 tonnes of CO_2e."[76]	**Vodafone:** "Purchasing a refurbished smartphone instead of a new device helps to avoid around 50 kg CO_2e of greenhouse gas emissions."[77]	**Vodafone:** "In the last year we avoided nearly 1,500 tonnes CO_2e (carbon dioxide equivalent) by re-using equipment across our UK sites."[78] **MTN:** "The reuse and redeployment of refurbished network equipment… 7911 tCO_2e emissions avoided."[79]	**Proximus:** "12,500 tons of CO_2 saved due to in-house repair & refurbishment."[80] **AT&T:** "Through the refurbishment and recycling process, we avoided more than 400,000 metric tons (MT) of CO_2 equivalent (CO_2e) of emissions compared to if those devices were new."[81] **Telefonica:** "We reused more than 4.5 million pieces of equipment from operations, offices and customers, 6% more than the previous year, avoiding 366,000 tonnes of CO_2 associated with the manufacture of new products."[82]

[76] https://www.bt.com/bt-plc/assets/documents/digital-impact-and-sustainability/our-report/report-archive/2021/tackling-climate-change-and-environmental-challenges.pdf

[77] https://www.vodafone.com/news/protecting-the-planet/protecting-the-planet-starts-at-the-bottom-of-your-drawer

[78] https://www.vodafone.co.uk/newscentre/planet/refresh-reuse-recycle-how-vodafone-is-promoting-the-circular-economy/

79 https://www.mtn.com/wp-content/uploads/2024/04/MTN_FY23_Sustainability_Report.pdf

80 https://www.proximus.be/en/id_b_cl_net_zero_co2_emissions/companies-and-public-sector/news/news-blog/solution-news/net-zero-co2-emissions.html

81 https://sustainability.att.com/priority-topics/product-life-cycle#:~:text=For%202023%2C%20more%20than%206,if%20those%20devices%20were%20new

82 https://www.telefonica.com/en/sustainability-innovation/environment/circular-economy/#:~:text=Furthermore%2C%20we%20reused%2046%25%20of,the%20manufacture%20of%20new%20products.

B.7 Assessment of Allocation Approaches

Table 11 **Assessment of Allocation Approaches**

Allocation Approach	Pros	Cons
Cut-Off "Variant A"	• Simple. • Incentivises circularity from a first user perspective.	• Allocation of production and EoLT burden is not totally equitable. • Accounting for end-of-life of sold products under 2nd use cycle is problematic in Inventory Accounting, it can require a prediction of how many newly manufactured products will become circular.
Cut-Off "Variant B"	• Simple. • Pragmatic, no adjustment is needed to first user accounting practices. • Incentivises circularity from a second user perspective.	• Allocation of production and EoLT burden is not totally equitable.
Split Emissions	• Incentivises circularity as burdens are shared. • Somewhat more equitable in that embodied emissions are shared between use cycles.	• Problematic to apply as it requires prior knowledge (or assumptions) of a number of use cycles. • A 50/50 split can be seen as arbitrary. • Treatment of Category 1 emissions differs from existing guidance.
Depreciation	• Incentivises continued circularity as burdens are depreciated. • An equitable way to share emissions burdens.	• Problematic to apply as it requires prior knowledge (or assumptions) of a number of use cycles. • Lacks pragmatism, requires complex calculations. • Treatment of Category 1 emissions differs from existing guidance.