

REQUIREMENTS

Product carbon footprints

Requirements for assurance – Part 1: Technical

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1 Process flowchart

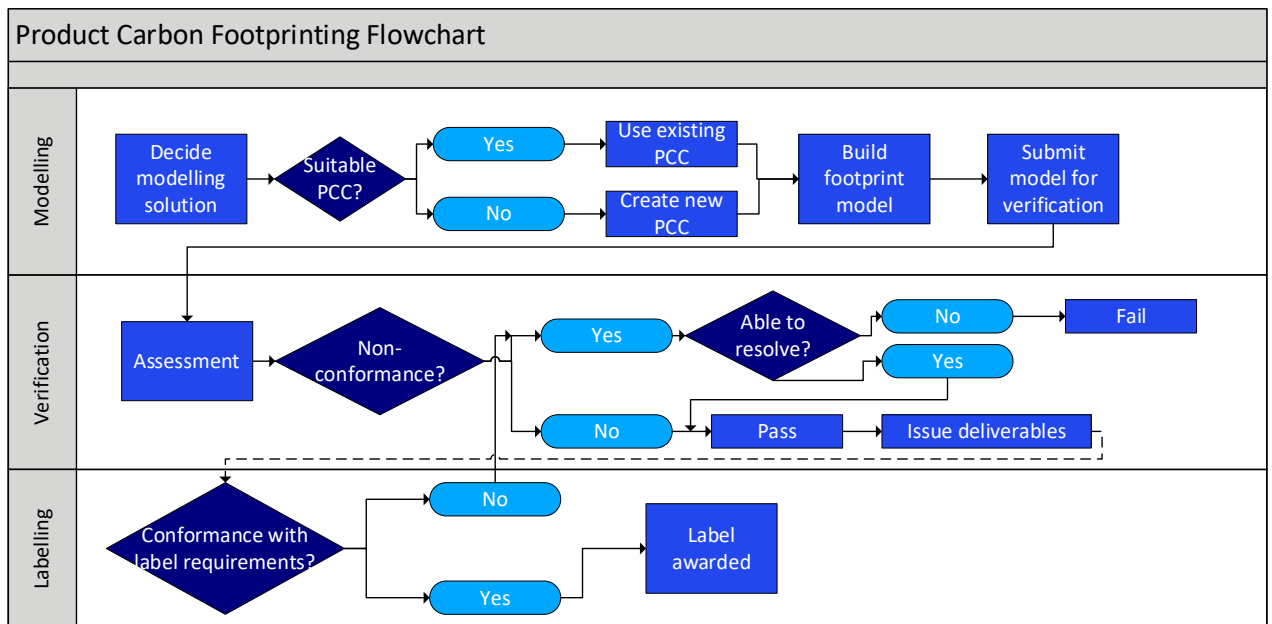


Figure 1. Process flowchart for single product carbon footprint verification project.

2 Scope

- This document defines the requirements to be conformed to by organisations who wish to verify the carbon footprint of their product(s), principally for the purposes of external communication, with or without the use of a Product Footprint Label.
- This document's use is for both the Carbon Trust and external parties.
- The Carbon Trust provides verification of product footprint claims, including calculated carbon footprint results and conformity to the selected standard(s), that supply documentation and calculations, demonstrating conformity with any of the following standards plus the requirements in this document:
 - PAS 2050: 2011 – Specification for the assessment of the life cycle greenhouse gas emissions of goods and services (PAS 2050)
 - The Greenhouse Gas Protocol Product Life Cycle Accounting and Reporting Standard (GHGPPS)
 - ISO 14067: 2018 – Greenhouse gases – Carbon footprint of products: requirements and guidelines for quantification (ISO 14067)
- Additional requirements, beyond the basic requirements outlined in the standards listed, are included below, and are intended to maximise consistency in the results. The below requirements encompass the above standards but there may be instances the standards listed will be required for additional information.
- Successful verification qualifies the footprinted product(s) to carry the Carbon Trust Product Footprint Label, subject to a separate Label Licence.
- Depending on the specific type of communication claim to be applied, additional requirements apply as set out in 'Requirements for assurance – Part 2'.
- The Carbon Trust reserves the right to amend and update this requirements document as deemed necessary. Organisations using this document for purposes of obtaining verification/application of a Product Footprint Label shall ensure that they are using the latest version available when the contract has been signed.

3 Terms and definitions

For the purposes of this document the following terms and definitions apply:

Terminology

Activity data	A quantitative measure of a level of activity that results in greenhouse gas (GHG) emissions.
Allocation	The partitioning of inputs or emissions to a product level, e.g., between two or more products resulting from the same process or product system.
Allocation key	A mechanism for allocation. Used to allocate data from the level of granularity available to a product level. Should be clearly defined and justified. Can include production number, mass, volume, or floor area. Allocation keys may differ between inputs.
Applicant product	The product under assessment when applying for a comparison label.
Approved footprinting tool	A footprinting tool which provides built-in compliance with requirements in this document.
Attributable	Directly related to the product.
Avoided carbon/Avoided emissions	Avoided emissions are emissions reductions that occur outside of a product's life cycle or value chain, but as a result of the use of that product. Examples of products that avoid emissions include low-temperature detergents, fuel-saving tires, energy-efficient ball-bearings, and teleconferencing services.
Biogenic carbon	Carbon (including CO ₂) derived from (non-fossil) biological processes.
Carbon dioxide equivalent (CO₂e)	CO ₂ e shows the combined GHG impact of all applicable greenhouse gasses if all the emissions derived from CO ₂ , by using GWPs for conversion.
Claim period	The time period for which the claim of verification is valid for.
Comparator product	The product(s) being compared to the applicant product, when applying for a comparator label.
Co-product	Any of two or more products resulting from the same process or product system which cannot be produced without the other being produced, and which have a market value.
Customer	May refer to a consumer or a company.
Data period	The time period where data is taken from to create a product carbon footprint. This can be a period outside the footprint period as it is representative of the footprint period.
Data Quality Indicator (DQI)	An assigned indicator of the data quality of each activity data and each emissions factor.
Declared unit	The unit of analysis for a cradle-to-gate boundary.
Direct land-use change (dLUC)	Emissions (primarily from carbon stock losses) due to recent (previous 20 years or more) land conversion directly on the area of land that a company owns/controls or on specific lands in the company's value chain.
Error	An accidental mistake e.g., an incorrect emission factor used.
Established product	Any existing, identifiable product that has been on the market for at least a year.
Footprint period	The time period for which the product carbon footprint (PCF) is representative. Can be used when referring to a previous assessment period.
Fossil carbon	Carbon (including CO ₂) which is derived from fossilised material, in particular fossil fuels such as coal, oil, natural gas, and peat (with regards to combustion).

Functional unit/Final reference flow	The performance characteristics and services delivered by the product being footprinted, used as the unit of analysis for a cradle-to-grave boundary. This can include the function or service a product provides and the duration or service life.
Global warming potential (GWP)	Factor used to describe the radiative forcing of a greenhouse gas relative to that of carbon dioxide (CO ₂).
Greenhouse gases (GHGs)	Gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the earth's surface, the atmosphere, and clouds.
Greenhouse gas statement	Factual and objective declaration that provides the subject matter for the verification or validation.
Gross footprint emissions	A measure of the product carbon footprint excluding biogenic emissions and biogenic removals.
Input allocation	Allocation of inputs (incl. materials, energy, etc.) to a product level.
Mass balance	Checking all the inputs to a process equal all the outputs (main product, co-products, wastes).
Mass-balance approach	Chain of custody model (within a supply chain or organisation's internal processes) in which materials or products with a set of specified characteristics are mixed according to defined criteria with materials or products without that set of characteristics.
Materially correct	The concept of individual misstatements or the aggregation of misstatements that could influence the decision.
Materiality	The % of the total footprint that any individual element has and is central to footprinting as guidance is to change footprinting approaches depending on materiality, to focus efforts of granularity, specificity, and accuracy on the most material parts of a footprint, and to loosen these as the materiality decreases.
May	Used to indicate an option that is allowable or permissible.
Misstatement	Errors, omissions, misreporting or misrepresentations in a GHG statement.
NC	Non-conformity. An element of the footprint inventory or supporting documentation that does not meet the requirements set out in this guidance.
Net footprint	An intensity measure of the total product carbon footprint including fossil emissions, biogenic emissions, and biogenic removals.
New-to-world product	Recently (or soon-to-be) launched product with limited production data.
New product with no direct predecessor	Recently (or soon-to-be) launched products with limited production data. The data available shall be representative of the product.
New product within established product line or product family	Recently (or soon-to-be) launched products with limited production data within an established product line or family.
OFI	Opportunity for improvement. An area in which any element of the footprint inventory or supporting documentation could be improved.
Omission	An emission source, which is either unintentionally or intentionally not included in the calculated PCF where it is required to either be included or justifiably excluded.
Organisation (The)	Any entity, public or private, such as a business, corporation, government agency non-profit organisations, institution, local authority, etc. that wishes to use this document.
Output allocation	Allocation of emissions from all life cycle stages up to this point between multiple outputs, such as co-product allocation.

Primary data	Data collected from specific processes in the studied product's life cycle. Primary data can be process activity data (physical measures of a process that results in GHG emissions or removals), direct emissions data (determined through direct monitoring, stoichiometry, mass balance, or similar methods) from a specific site, or data that is averaged across all sites that contain the specific process. Primary data can be measured or modelled, as long as the result is specific to the process in the product's life cycle.
Product	A good or a service.
Product carbon footprint (PCF)	The sum of greenhouse gas emissions and removals related to a product. This may represent the footprint of not only one SKU, but of a group of SKUs if they satisfy the criteria in Section 5.5.1.
Product change	A product undergoing incremental change.
Product Consistency Criteria (PCC)	Set of specific requirements and guidelines for quantification of and communication on the carbon footprint for one or more product categories, required by the Carbon Trust for verification and labelling purposes to ensure comparison.
Product Emissions Report (PER)	A report summarising the results of the product carbon footprint. An alternative term is Emissions Inventory Report (used in the GHG Protocol's Product Standard).
Product footprint label	Certification mark to be placed on a product identifying its product carbon footprint and/or the achievement of one or more of the sets of labelling requirements in this document.
Product replacement	A new product that specifically replaced an old one.
Prototype	New products not yet in full production.
Recycling allocation	Allocation of the benefits of recycling between products using recycled materials and products that are recycled to provide those materials.
Reference flow	The inputs to or outputs from processes in a product system, that are required for the product to fulfil its function defined in its functional unit.
Secondary data	Data that is not from specific processes in the studied product's life cycle. Direct emission data and process activity data that do not meet the definition of primary data can be classified as secondary. Financial activity data cannot be used to meet the primary data collection requirement and therefore is always classified as secondary. E.g., industry-average kg of material input into a process.
Shall	Used to indicate what is required for a product carbon footprint to be in conformance with the guidance outlined in this document.
Short life-span product	Products that are replaced quickly (e.g., in less than two years).
Should	Used to indicate a recommendation, but not a requirement of this guidance.
Statistical land-use change (sLUC)	Emissions (primarily from carbon stock losses) due to recent (previous 20 years or more) land conversion within a landscape or jurisdiction. sLUC can serve as a proxy for dLUC where specific sourcing lands are unknown or when there is no information on the previous states of the sourcing land.
Stock keeping unit (SKU)	A distinct sales unit consisting of relevant characteristics of a product (e.g., product type, material, size, packaging, etc.).
Unit of analysis	The basis on which the inventory results are calculated for the product (e.g., kgCO _{2e} /kg of product). This is the declared unit for a cradle-to-gate boundary and functional unit for a cradle-to-grave boundary.

Validation Process for evaluating the reasonableness of the assumptions, limitations and methods that support a statement about the outcome of future activities and conforms to criteria outlined in Section 5.

Verification Process for evaluating a statement of historical data and information to determine if the statement is materially correct and conforms to the criteria outlined in Section 5.

Note: Hereafter the term verification will be used unless specified to relate only to validations. The below requirements are also applicable to validations.

4 Pre-engagement requirements

4.1 Confirmation of assessment parameters

- Before the formal verification or validation can take place, the following activities shall take place:
- The organisation needs to have determined and confirmed the following to the Carbon Trust:
 - The definition of the product and product groupings (where applicable) to be verified/validated and labelled where applicable.
 - The geographical area of sales/use.
 - The SKUs (stock keeping units) and geographical areas of sales/use that fall under the definition of the product.
 - The unit of analysis (functional unit) of the footprint.
 - The end-point boundary of the footprint calculation.
 - Footprint period.
 - Which standard(s) the verification is to take place against.
 - What communication claim they wish to use and summarise marketing/label support expectations.
 - The footprinting tool used/to be used (where known).

Note 1: Any footprinting tool may be used to achieve verification.

Note 2: The choice of footprinting tool may, however, have implications on time/costs for all parties during footprinting and verification. When selecting the footprinting tool, it is recommended to consider the following:

- *Footprint Expert™ is an 'approved footprinting tool, which supports compliance with relevant requirements (including those in this document) through its structure and calculators.¹*
- *In some cases, it may be preferable to take elements such as the calculators and data from Footprint Expert™ but to implement a different modelling approach.*
- *In some cases, other third-party footprinting tools may be preferable.*

Note 3: See Section 4.5 for additional requirements on use of third-party tools.

- The organisation should be satisfied that their resultant product carbon footprint inventory does or will be able to demonstrate conformity with the requirements in this document and any relevant Product Consistency Criteria (see 4.2 below) required by the Carbon Trust.
- Sign an agreement with the Carbon Trust for the verification, including a licence for the footprinting tool if applicable.

¹ <https://www.carbontrust.com/resources/carbon-footprinting-software>

4.2 Product Consistency Criteria (PCC)

- A PCC is a document which provides specific information outside of these requirements needed to develop a product carbon footprint for a particular product or product type, including as a minimum:
 - Product categories the PCC is relevant for
 - Relevant existing Product Category Rules (PCR)

Note: The goal of a PCC is not to (re)create a PCR, as they are often too specific. PCCs can use parts of relevant existing PCR(s) that align with the general requirements (see Section 5 below) and allow for the PCC to cover as broad a range of products as possible.

- Unit of analysis
 - Allocation rules
 - Use-phase rules and complementary products
 - Fugitive and process emissions rules
 - Other PCC's this is in reference to
 - Additional comments
- A PCC should cover as broad a range of products as possible, whilst remaining realistically applicable.
 - The organisation should possess an approved PCC before footprinting. If this is not possible, the organisation should submit their draft PCC to the Carbon Trust to approve as much of the methodology as possible before footprinting.
 - The Carbon Trust and the organisation will work together to finalise all components and produce an approved PCC.
 - The PCC should be submitted to the Carbon Trust by the organisation before footprinting begins.
 - In all instances, the organisation suggests the product grouping. The Carbon Trust is responsible for giving approval or feedback.
 - The Carbon Trust is responsible for providing PCCs for its partnerships.
 - Where a PCC for the relevant product already exists, the Carbon Trust shall provide the organisation with the PCC.
 - Where a PCC for the relevant product does not already exist the organisation and/or their representatives shall be responsible for drafting a PCC to suit their product. The Carbon Trust shall send the organisation a template and a guidance document to facilitate this.
 - In all instances, the organisation shall review and confirm whether the PCC is appropriate for their product. Where the organisation believes the PCC is not suitable for their product or requires updating, they shall provide relevant feedback to the Carbon Trust.
 - The Carbon Trust shall review for approval purposes all newly created or amended PCCs prior to use, providing feedback as necessary. Thereafter, the Carbon Trust will review PCCs on a regular basis to confirm ongoing suitability.
 - Once a PCC has been approved by the Carbon Trust, it shall be made available by the Carbon Trust to interested parties for purposes of transparency and ensuring consistency between organisations producing product carbon footprints of related products/product categories.

4.3 Verification submission

- The organisation shall submit the product footprint inventory to the Carbon Trust, a PER, supporting documentation in support of their claim of conformity and, in order to obtain verification that the inventory, and the resulting footprint within it, conform to the relevant standard, the requirements set out in this document, and the relevant PCC.
- Organisations shall present evidence to demonstrate compliance with each requirement in this document.

4.4 Using the Carbon Trust Product Footprint Label

- Following achieving verification, and subject to a separate agreement and additional assessment, an organisation may be licenced a Product Footprint Label.
- To be licenced the use of a Product Footprint Label, the organisation shall first:

- Agree with the Carbon Trust Client Manager the verification scope and complete a submission which, following assessment by the Carbon Trust (see Section 6) meets the requirements for verification (see Section 5).
- Agree the claim (if chosen) to use in association with the Label (see Part 2).
- Sign the appropriate Label Licence Agreement and pay the relevant fee to the Carbon Trust.
- On completion of the verification, the organisation shall:
 - Use the Footprint Label in conformity with all of the labelling requirements, including those in the Label Licence Agreement (see Part 2).
 - Prepare the product footprint for re-verification and labelling ahead of the Footprint Label expiry date.
 - Inform the Carbon Trust Client Manager if products are discontinued.
 - Inform the Carbon Trust Client Manager if products are replaced with an updated version, or if new additional variants are launched – having made an assessment as to whether the footprinting and communications requirements are believed to cover these new products.
 - Inform the Carbon Trust Client Manager if the organisation is planning to remove the Footprint Label.

4.5 Client use of third-party tools

- These are tools where choices may be made, usually to consistently calculate footprints where some data is not known in advance. For example, where a range of suppliers are being asked to provide similar information and the tool calculates an emission factor for each supplier.
- Where the organisation uses carbon footprint tools designed and maintained by third-party providers (i.e., not the Carbon Trust), whether used internally within or externally to the organisation, the tool shall meet the following criteria to be considered eligible for verification by the Carbon Trust:
 - The tool methodology and results shall demonstrably conform to at least one of the following: GHG Protocol Product Standard, PAS 2050 and/or ISO 14067.
 - The tool shall have achieved third-party verification of its conformity to the above standards – if this is not the case then the tool and its methodology shall be sufficiently accessible for the Carbon Trust to verify the tool.
 - The client should prioritise providing access to the tool. If this is not possible (e.g., due to legal concerns), screensharing sessions along with screenshots shall be provided by the client to demonstrate the usability of the tool along with the inputs, processes, and outputs. A methodology document may be provided by the client relating to the tool.
 - The tool shall separately calculate and report each source of biogenic emissions and removals.
 - The tool shall allow for traceable data sources in order to adequately verify the outputs.

5 General requirements

5.1 To achieve verification, the organisation shall provide sufficient information and evidence to demonstrate to the satisfaction of the Carbon Trust that:

- The organisation has calculated the carbon footprint of the product, conforming to at least one of the standards listed in Section 2 above and the additional requirements contained in this document. It may be required to review and comply with some clauses in the standard(s).
- The product carbon footprint shall include all greenhouse gasses converted to CO₂ equivalent emissions (CO₂e), using a 100-year global warming potential (GWP).
- The latest Intergovernmental Panel on Climate Change (IPCC) GWP values should be used by preference, but previous IPCC values may be used if necessary.
- The product carbon footprint shall separately calculate and report each source of biogenic emissions and removals.

5.2 Conforming to the Product Consistency Criteria (PCC)

- The inventory shall conform to the relevant PCC determined in the pre-engagement activities (see 4.2 above).

5.3 Emission factors

- Approved emission factor sources include, but are not limited to:

Table 1. Approved emission factor sources.

UK government GHG conversion factors for company reporting	IEA	EcolInvent
ICE	GaBi	

Note: If a product footprint uses supplier-specific emissions factors, methodology is needed to compare against the data quality framework

5.3.1 Supplier-specific emission factors

- The organisation should provide evidence of third-party verification of any supplier-specific emission factor used.
 - The third-party verifier should be a reputable and recognised verification body.
- If third-party verification of supplier-specific emission factors has not been completed, the organisation shall provide the methodology and supporting calculations.
 - The Carbon Trust shall review the methodology and supporting calculations as part of the verification process.
 - This shall be disclosed to the Carbon Trust ahead of project scoping and pricing. If this has not been disclosed, this shall be scoped as a variation of scope to allow for sufficient time to review and approve the emission factor.
 - This shall not be considered a verification of the emission factor but a first review to ensure there are no material errors, omissions, or misstatements.

5.4 Ownership and control of the product

- The organisation shall have sufficient ownership and/or control of the product's manufacture, design, and branding. The organisation shall own or control the transformation of incoming materials into the final product. *

Note: Where the organisation does not own or control the transformation of incoming materials into the final product, the organisation may either:

- *Ask the supplier who manufactures the product to obtain a verified cradle-to-gate footprint; or*
- *Work together with the supplier to complete the footprint of this product by interpreting 'owns, operates, controls' to include both their own operations and those of the supplier. ***

** Transformation may entail, for example: assembly, injection moulding, agricultural processing, chemical processing, and mixing. Packaging and branding a product manufactured by another organisation shall not be sufficient. For services, this requires control of how the service is provided.*

*** i.e., include primary data from the organisation's own operations, and of the supplier's operations.*

- At least 10% of the footprint shall be from primary data.
- Site-specific activity data shall be collected for individual processes where the organisation has financial or operational control. The data shall be selected based on the sampling plan (see Section 5.19).
 - The choice of emissions factor shall be reviewed against activity data.

5.5 The product system to be studied and its system boundary

- Clarity on 'What is this the footprint of?' is essential for a labelling scheme. When someone reads the label, there needs to be no ambiguity about what this information is telling them.
- Organisations shall have clearly defined for each product:
 - Which SKUs (stock keeping units) and geographical areas of sales/use that fall under the definition of this product (see 5.5.1)

- Geographical area of sales/use (see 5.5.2)
- The unit of analysis (functional unit) of the footprint (see 5.5.3)
- The reference flow (see 5.5.4)
- The end-point boundary of the footprint calculation (see 5.5.5)
- Footprint period (see 5.5.6)

Note: In instances where the organisation manufactures the same products/SKUs at different factories and where the geographical area of sale/use are the same these may be grouped and emissions shall be reflective of how much product is produced at each site, this may result in a difference in upstream emissions of >5%.

5.5.1 Grouping SKUs within one product footprint

- One product footprint may include one or many SKUs in a specific geographic area of sales/use (see 5.5.2 below)
- To optionally group SKUs/areas into one product footprint, all of the below requirements shall be met:
 - All SKUs have an equivalent function – i.e., the same functional unit (or declared unit if cradle-to-gate).
 - All SKUs are under an equivalent level of control by the organisation.

Example 1: A branded SKU and a retailer's own brand SKU shall not be combined.

- All SKUs within a defined geographic region have materially similar supply chains and manufacture/service provision, i.e., variations up to the point where the product leaves the organisation's gate vary the total footprint by less than 5%.

Example 2: Often colours or added flavouring vary footprints by <5%.

Example 3: There are five SKUs with the same content, with the same functional unit of 'per 20 ml serving', which vary only by size of packaging – if the packaging varies the footprint by <5% they may be combined.

- All SKUs within a defined geographical area have materially similar downstream footprints, i.e., downstream footprint varies by less than 5%.

Example 4: Two cars meet the first 3 requirements; however, one has an engine which emits 140 g CO₂e/km whilst the other emits 200 g CO₂e/km – as such these shall not be combined.

Note 1: The grouped SKUs/areas shall support the intended communications. Where the SKUs/areas cannot be grouped as a result of the above SKU/area grouping rules but the packaging for the different regions is required to be the same then the on-packaging communication shall not include an average footprint and shall instead include either the separate footprints of all relevant regions or reference to a separate location (e.g., a website) where these can be located.

Note 2: Where organisations would like to group SKUs, this may require additional assessment activities to determine whether the grouping complies with the above and below requirements depending on the level of grouping.

5.5.2 Geographical area of sales/use

- The organisation shall define each geographical area for which a footprint (which may constitute one or more SKUs as defined in Section 5.5.1) is required.
- The footprint inventory shall produce a separate result for each product sold within a geographical area, each of which shall be verified.
- The geographical area may be an individual country, a region, or a group of countries, or represent a global or rest of world average. Depending on the nature of the geographic region chosen, the following requirements are applicable:
 - Individual countries:
 - The calculated PCF result shall be reflective of the emissions in the specified country.
 - Regions/Groups of countries:
 - The stated region/group of countries' calculated PCF result shall be reflective of the emissions in the specified area, region, or group of countries, for example 'Europe', 'North America' or 'USA and Canada'.
 - Where the specified region or group of countries has a particular meaning, e.g., 'Europe', 'North America', etc., then the stated region/group of countries PCF shall include all the countries commonly understood to be included in that region/group.

Example 1: 'Europe' shall represent all countries in Europe and shall not be used to describe only a select number of European countries.

- The stated region/group of countries calculated PCF result shall be within 5% of what the calculated PCF result would be for each and every individual country in the region/group of countries.

Note 1: It may be suitable to demonstrate conformity to the above 5% requirement by testing expected extremes.

Note 2: Please refer to Section 5.5.1 if downstream is material, it may be suitable to analyse the downstream impacts per country of sale to determine if the variation is over the 5% threshold.

- The organisation shall demonstrate the overall downstream footprint (e.g., distribution, use-phase, and end-of-life) does not differ by more than 5% between the furthest and highest electricity/use-phase country to the closest and lowest electricity/use-phase country.
- Global:
 - The calculated global PCF result shall be reflective of the emissions of all countries in the world. The calculated global PCF result shall be within 5% of what the calculated PCF result would be for each and every individual country.
 - The organisation shall demonstrate the overall downstream footprint (e.g., distribution, use-phase, and end-of-life) does not differ by more than 5%. This shall be evidenced between the highest emissions point downstream, and the lowest emissions point downstream.

Note 2: It may be suitable to demonstrate conformity to the above 5% requirement by testing expected extremes.

Note 3: Products with significant downstream emissions which vary from country to country (especially electricity-related use-phase emissions) are therefore unlikely to be suitable for a global PCF.

Example 2: A global PCF may be appropriate to represent emissions for products where country of sale is not known e.g., the client sells to a distributor who sells the product into countries outside of the client's control/influence/knowledge, or for direct online sales where the client cannot control the location into which the product is sold. It is important the organisation can demonstrate downstream distribution, use-phase and end-of-life would be <5% different from the lowest option to the highest option.

- Rest of world:
 - Where 95% or more of the estimated total annual carbon footprint of a product is represented by calculated PCF results representing one or more specified countries, then the remaining 5% or less of emissions in other countries may be represented by a 'rest of world' calculated PCF result.

Example 3: A 'rest of world' PCF may be used to represent emissions for products where country of sale is not known e.g., the client sells to a distributor who sells the product into countries outside of the client's control/influence/knowledge, or for direct online sales where the client cannot control the location into which the product is sold.
 - A 'rest of world' PCF value may be used for purposes of achieving the Carbon Trust Product Footprint Label, however, as a 'rest of world'-calculated PCF result may not be reflective of the emissions in the constituent countries, the calculated PCF result itself shall not be disclosed externally to ensure it is not used for comparative purposes.
- Average (weighted):
 - Where two or more suitable calculated PCF results have been calculated for a product, the client may additionally calculate a weighted average of those calculated PCF results for internal information purposes only.
 - As a weighted average calculated PCF result may not be reflective of the emissions in the constituent countries, the weighted average calculated PCF result itself shall not be disclosed externally to ensure it is not used for comparative purposes.

5.5.3 Unit of analysis – Functional unit or declared unit

- The unit of analysis:
 - For a finished product (cradle-to-grave), shall be the functional unit.
 - For an intermediate product (cradle-to-gate), shall be the declared unit.
- A well-defined functional unit should consist of three general parameters: the magnitude of the function or service; the duration or service life of that function or service; and the expected level of quality (see Appendix 7 for services requirements.)
 - A functional unit should be a quantified description of the performance requirements a product fulfils. This is followed to ensure a range of different products which fulfil a similar/the same function can still be compared side-by-side. This is important when a customer is comparing environmental information to make a purchasing decision.

- A well-defined declared unit should describe the quantity (e.g., mass, volume) of a product.
 - A declared unit does not consider the use or function of a product as the boundary ends at the factory gate. Therefore, its performance requirements are not relevant.

Note 1: PCCs may define additional product performance information which shall be reported to enable comparability decisions by business customers, e.g., products with a large use-phase (such as electric motors) shall report information enabling the use-phase to be calculated.

Note 2: The Product Footprint Labels enable products to be compared. It is therefore essential that this comparison is based upon a fair and valid unit of analysis for comparison.

Note 3: There are circumstances where a product can have multiple units of analysis (e.g., electronics). In these cases, the unit of analysis defined in the PCC or PEFCR shall be used. Where unavailable, a functional unit should be defined early, and a PCC submitted.

5.5.4 Reference flow

- After choosing a functional unit or declared unit, the reference flow(s) shall be defined.
 - The reference flow(s) defines the inputs or outputs of a product life cycle stage that enable it to perform its function, to be determined. Each life cycle stage may have the same reference flow or may have different reference flow(s).

5.5.5 End-point of boundary of the footprint calculation (cradle-to-gate or cradle-to-grave)

- Products sold to consumers shall be footprinted cradle-to-grave, including the following life cycle phases as detailed below.
- Products sold to business customers which are the final user of the product, rather than transforming it into another product, shall be footprinted cradle-to-grave.
- Products sold to business customers which are then branded and sold to consumers of the product, rather than transforming it into another product, shall be footprinted cradle-to-gate.
- Products sold to business customers which transform it into another product, shall be footprinted cradle-to-gate.
- Life cycle stages for cradle-to-grave and cradle-to-gate footprints are as follows:

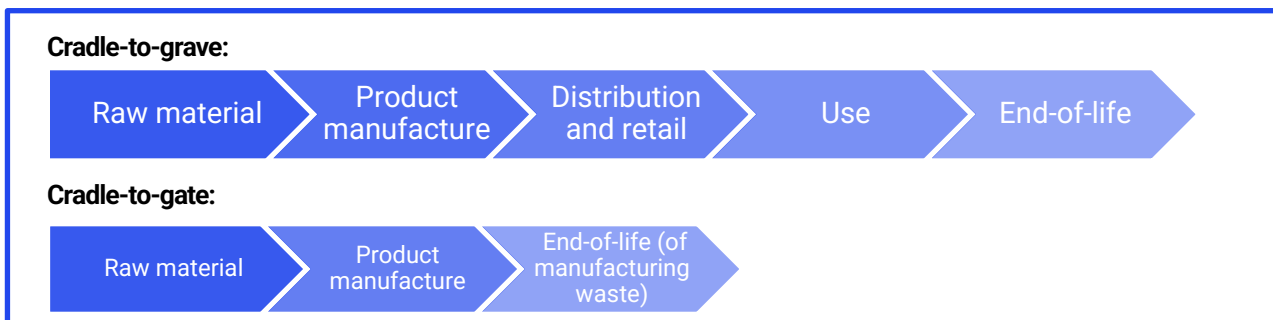


Figure 2. Life cycle stages for cradle-to-grave and cradle-to-gate footprints.

- For cradle-to-gate footprints:
 - The footprint shall always be calculated for the final packaged product to the outbound factory gate of the organisation. This is the footprint that should be used on any communication claims.
 - Where the organisation also owns, operates, or controls outbound transport, a second footprint may be calculated including this, and both footprints verified.

Further requirements on this topic may be defined in an applicable PCC.

- For cradle-to-grave footprints:
 - The footprint/Footprint Label should include relevant cradle-to-grave information that may influence the decision of end-users/consumers e.g., biogenic carbon, land-use change, deforestation. Further requirements on this topic may be defined in an applicable PCC.

5.5.6 Footprint period

- All footprint inventories shall use historical primary data to represent a stated historical footprint period OR shall forecast an estimated footprint for a future footprint period for validation.
- The footprint period shall correspond or be representative of the data period for the organisation's final manufacture or service delivery of the product.
- Primary data collection:
 - Shall be representative of a 12-month period to avoid seasonality impacts. * Where there is less than 12 months of actual data, the organisation shall demonstrate the data is representative of a 12-month period.
 - May start in any month.
 - May start in different months for different suppliers.

Note: Agricultural data is best measured over one continuous growing season (i.e., not start in the middle of one growing season), which is often different to manufacturing time periods.

- Data periods shall be clearly documented for all primary data.
- If seeking use of the label footprint periods shall end no more than 15 months before the contract signing.
 - If seeking verification only the time period may be from any year of sale.

Note: If the project does not start as planned due to client delays, the client shall make sure the end date is then within 15 months of the project start.

- Where a production cycle takes more than 12 months, a 12-month primary data collection period shall still be used, and it shall be ensured that the data is representative of the different stages of production over the 12 months.
- *Exceptions to the 12-month requirement for primary data are:
 - Where seasonal impacts can be proven to be immaterial, a minimum data period of six months may be used.
 - Agricultural products may measure a rolling average footprint up to a data period of five years (requirements for which may be defined in PCCs).
 - Where a product is seasonal, or not produced on a continual basis, the data period associated with the production of the product shall be used.

5.6 Process mapping

- A process map shall be submitted which describes the life cycle process flows of the product in sufficient detail that the Carbon Trust assessor team has context behind the footprint inventory.

Note 1: This may be created by any method, e.g., any software package, or drawn by hand and scanned.

Note 2: PCCs may include a generic process map, to save organisations time, which should be amended if required.

- As a minimum, the process map shall:
 - Give the key processes in the life cycle, including the inputs and outputs of these processes.
 - Include inputs with smaller materiality combined into groups, as they will be modelled. *
 - Include downstream processes for cradle-to-grave footprints.
 - Highlight anything to be excluded from the footprint.
 - Highlight processes owned, operated, or controlled by the organisation (see 5.3 above).
 - Highlight processes owned, operated, or controlled by the organisation's suppliers if included (see 5.3 above).
- The outputs of each process shall be defined as:
 - Products: final products being footprinted;
 - Interim products: outputs which become an input to another process;
 - Co-products: outputs which are sold into other value chains; ** or
 - Wastes: outputs with no value.
 - Processes shall be assigned to life cycle stages. ***

**E.g.: Where there are many inputs which have a small percentage contribution to the total footprint, these similar inputs may be grouped into a single representative input, to reduce the number of calculations (see 5.17 below).*

Note: It is important not to over-simplify too early in the modelling process. Materiality should be considered when combining input groups. It is recommended that original data prior to grouping is retained for reference.

***And hence carry some environmental impact with them.*

****Life cycle stages may be 'raw materials', 'manufacturing', 'distribution', 'use-phase', 'end-of-life'.*

5.6.1 Simplifying the number of processes

- The organisation should seek to minimise the number of processes without significantly impacting how materials and utilities are assigned to each product; nor how the impacts of co-products and fugitive emissions affect each product footprint.
- Processes which simply continue to transform the single interim product output of the prior process, should be investigated to assess whether these two processes may be combined.

Example 1: If input materials or utilities enter both processes, can the processes be combined and still ensure the right quantities of inputs are assigned to each product? If not, do not combine.

Example 2: If significant wastes, co-products, or fugitive emissions leave either process, can the processes be combined and still ensure the impacts are assigned to each product? If not, do not combine.

5.6.2 Process exclusions

- All non-attributable emissions shall be excluded from the footprint inventory, unless required by a PCC or seeking PCF+ (see Appendix 6).
- Non-attributable emissions include processes, services, materials, and energy that are not directly part of the life cycle of the studied product. For example, marketing spending for goods or farmland that isn't directly used to produce a crop.

5.7 Use-phase

- A cradle-to-grave footprint shall clearly and sufficiently* and accurately calculate a representative use-phase. This could be direct and/or indirect depending on the use-profile of the product.
 - Indirect may also include complementary products for reporting purposes. **

**Materiality needs to be taken into account and modelling should ensure minimum data quality requirements are met (see 5.23 below).*

***A complementary product is a product that may be consumed or used with the product that is being product carbon footprinted. As such, it may potentially form part of the use-phase of the PCF.*

5.8 End-of-life stage

- If unapproved footprinting tool used » End-of-life emissions shall be calculated in compliance with the standard.
- If approved footprinting tool used » The end-of-life calculator shall be used to meet these requirements.
- For clarification:
 - Where waste is re-used in manufacturing phases, the footprint shall include the processes to enable this re-use (e.g., re-smelting).
 - Default data specific to a product category as defined in the PCC shall be used as directed in the PCC.

Example: Incineration with energy recovery should have a boundary at the point at which the waste material enters the energy recovery process – after which it is feedstock for energy generation, a new product. Some methodologies clients use give a credit for avoided grid electricity due to incineration. This does not align with our definition of attributable emissions.

5.9 Allocation

- Allocation is required in three areas, which shall be assessed independently:
 - Allocating an input between multiple products (see 5.9.1).
 - Allocating carbon impact between the product and co-products (see 5.9.2).
 - Allocation associated with recycling (see 5.9.3).

5.9.1 Input allocation

- Many inputs, especially utilities, are not sub-metered and hence require allocation. This requires 'allocation keys' to allocate data from the level of granularity at which values are available down to a product level.

- For each allocation of an input, an allocation key shall be clearly defined and justified.
 - Select an allocation key which most fairly allocates emissions between products, e.g., by number of products, by mass of products (kg), by volume of products (m³), area of production (m²), etc.
 - Allocation keys are required for the same purpose in finance systems, so use these if applicable.
 - Allocation keys may be defined in PCCs.
 - Different inputs may use different allocation keys.
 - Allocation may require more than one step.

E.g., Step 1, allocate between plastic injection and assembly; Step 2a, allocate plastic injection energy between parts; Step 2b, allocate assembly energy between finished products – this example requires three different allocation keys.

5.9.2 Output allocation (between products and co-products)

- Where a process produces two or more outputs, which cannot be produced without the other being produced, and which have a market value, these shall be considered products and co-products.

Note 1: Outputs with no value are considered 'waste'.

Note 2: With reference to the definition of outputs in the process-map (see 5.6 above), this allocation may be required between any combination of the final product, interim products, and sold co-products.

- Allocation is required between these co-products.
- The data and method used to allocate between outputs shall be clear and justified.
 - The allocation approach defined in the PCC shall be used (see Section 4.2).
 - 'System expansion' shall not be considered practicable unless defined within a PCC.

Note 3: This is due to the quantity of data, research complexities and sector-wide agreements required.

- If using economic allocation:
 - The economic values used for products and co-products shall be those applicable at the point at which the co-products are first created (i.e., their value prior to any further processing).
- If the PCC defines economic values or sources of values, or methods for allocation » Then these shall be used. Otherwise »
 - Commercial market values, not internal transfer pricing, shall be used.
 - A reputable source shall be used.
 - Average pricing over a three-year period shall be used to avoid fluctuations.
 - A mechanism shall be put in place to review these values.

5.9.3 Recycling allocation

- Recycling allocation allows products to use the generally lower, recycled material emissions factor, rather than exclusively using virgin material emissions factors, for a portion of some input materials – thereby reflecting the benefits of recycling in reducing GHG emissions. The methodology used balances how much benefit is attributed to products that use recycled input materials and how much is attributed to products that are recycled and provided these materials.
- Where a Product Footprint Label is to be used all input materials which comprise a material contribution to the overall footprint shall (and other input materials may) apply EU-PEF recycling allocation requirements, in order to ensure comparability for all products under the labelling scheme.
- Organisations do not need to consider these requirements under the below situations, and where not considered, and will simply use virgin emission factors for the input material:
 - The input material has no recycle content and the input material is not recycled at end-of-life.
 - Information is not available on % of recycled input material or % end-of-life recycling rates.
 - The organisation has chosen on materiality basis not to apply the recycling allocation methodology to this input material.
- The EU Product Environmental Footprint (PEF) Circular Footprint Formula (CFF) shall be applied in the following ways to modify the emissions factor used for materials, as follows:

Note: The below approach should be used in most instances and where the organisation believes it is not suitable, this shall be justified, and a suitable alternative approach agreed upon with the Carbon Trust and defined in the PCC.

- Factor 'A' shall be used to allocate the burdens and benefits from recycling between the 'material supplier' and 'material user' based on the market situation of the product.
- A material is classed as a waste when the holder has no further use, and when it is discarded or is released to the environment. This should be defined as when the material has not been sold therefore, determined as waste.
- A 'used or reused' material shall follow one of three accounting methods depending on its situation:

Table 2. Guide for application of Factor 'A' from the EU Product Environmental Footprint (PEF) Circular Footprint Formula (CFF) based on market situation of the product.

A	Applied when	Materials
0.2	Demand for high-quality secondary material is higher than the amount produced, and the market price for secondary material is similar to primary material.	Metals Glass Paper and cardboard (general)
0.5	Market situation is more balanced or unknown.	Plastics Paper (graphic/tissue)
0.8	Demand for secondary material is low and market price of secondary material is considerably lower than primary material.	Textiles

- The recycling process shall account for material quality loss during recycling, which is pre-defined for most materials by the EU PEF CFF method.

Table 3. Guide for application of material quality loss from the EU PEF CFF.

Material quality loss default value (MQL)	Materials
1	Metals/Glass
1	Paper/Cardboard (applied when the 'secondary material input' emission factor <u>does</u> include quality loss from recycling)
1	PET (SSP recycling)
0.9	PP, HDPE, PET (mechanical recycling)
0.85	Paper/Cardboard (applied when the 'secondary material input' emission factor <u>doesn't</u> include quality loss from recycling)
0.75	LDPE film

Note 1: Where the price of recycled material is higher than the primary material, the quality loss ratio should be set to 1.

Note 2: These are used for Q_{sin}/Q_p and Q_{sout}/Q_p in the PEF CFF formula.

- For each input material where EU PEF CFF recycling allocation is to be used, the following two factors are required:
 - R1 = the recycled content of the input material (%)
 - R2 = the recycling rate of that material at the end of the products life (%)
- Two emissions factors shall be used:
 - Ev = the impact of virgin material (kgCO₂e/kg)
 - Er = the impact of recycled material (kgCO₂e/kg)
- The following formula shall be used to determine the emissions factor to be used for input materials following this method:
 - First calculate what portion of the emissions factor can use Er:
 - $Pr = R2 \times (1-A) \times MQL + R1 \times A$
 - Then calculate the emissions factor for input material:

- $EF = Pr \times Er + (1-Pr) \times Ev$

Note: This is derived from PEF CFF formula, less energy recovery and landfill emissions portions which are accounted for separately in end-of-life (see Section 5.8).

5.10 Treatment of electricity

- Average grid mix emissions factors for the full life cycle of electricity shall be used unless the criteria specified in Appendix 2 are met.

Important: Do not use the combustion-only emissions factors used in organisational carbon footprinting.

- If unapproved footprinting tool used » Electricity emission factors shall account for emissions arising across the full life cycle of the electricity supply system.
- If approved footprinting tool used » Data is included that meets these requirements.

5.10.1 On-site electricity generation

- When energy is generated from a source other than the national or regional energy supply network, source-specific factors corresponding to the generation method and fuel used shall be applied.

5.11 Avoided carbon

- Avoided emissions shall not be included in this footprint.

5.12 Treatment of fossil and biogenic carbon

- Each source of biogenic removals and emissions (CO₂e [CO₂ and CH₄]) shall be calculated separately. The total gross biogenic removals and emissions (CO₂e [CO₂ and CH₄]) as well as the net amount shall be reported separately from fossil emissions and removals in the inventory and PER.
- Biogenic removals and emissions shall be allocated between separate products (see 5.9.1), between the product and co-products (see 5.9.2) and in association with recycling (see 5.9.3).
- For cradle-to-grave footprints:
 - Biogenic removals and emissions (across the whole life cycle) shall be calculated as if released or removed at the beginning of the footprint period, therefore all removals will effectively be re-emitted. *
 - Biogenic carbon content should be reported when the product is being recycled or reused at end-of-life.

**Assuming there will be an end-of-life biogenic emission e.g., there will be no end-of-life biogenic emission for a diamond.*

- For cradle-to-gate footprints:
 - Biogenic removals and emissions (within the defined boundary) shall be calculated as if released or removed at the beginning of the footprint period.
 - Biogenic carbon content of the product shall be reported.
- If unapproved footprinting tool used » The inventory shall separate biogenic and fossil emissions.
- If approved footprinting tool used » These requirements are inherently met.
- Tracing in-product biogenic carbon and land-based removals through its life cycle shall follow mass allocation if allocation is required.

5.12.1 End-of-life

- Claims of carbon removed or captured due to a product being sent to landfill are not allowed. An end-of-life emission shall be accounted for.
- For all other end-of-life destinations, the biogenic emission shall be included. *

**Assuming there will be an emission e.g., there will be no end-of-life emission for a diamond.*

5.12.2 On-site electricity generation

- When energy is generated from a source other than the national or regional energy supply network, source-specific factors corresponding to the generation method and fuel used shall be applied.

5.13 Land-use change

- Where relevant the organisation shall calculate either statistical land-use change (sLUC) or direct land-use change (dLUC).

- The land-use change approach shall follow either a linear or equal discounting approach.
- If unapproved footprinting tool used » The inventory shall meet the requirements of the standard for calculating direct land-use change.
- If approved footprinting tool used » Data is included that meets these requirements.
- Indirect land-use change is not presently included but will be reviewed.
- The accounting approach shall follow guidance from the current 'WRI Land Sector and Removals Guidance'.

5.13.1 Soil carbon change

- This is not presently included but will be reviewed.
- The final published version of 'WRI Land Sector and Removals Guidance' is expected to be released at the end of 2023. Once the final guidance has been published, soil carbon change associated with product carbon footprints will be reviewed in detail.

5.14 Fugitive emissions from processes, livestock, manure, and soils

- Emissions of greenhouse gasses directly from processes, such as chemical reactions or refrigerant losses, shall be included in the footprint if significant or estimated.
- CO₂, N₂O and CH₄ emissions arising from livestock, manure and soils shall be included in the footprint if significant. These shall be calculated using IPCC's 'Guidelines for National Greenhouse Gas Inventories'.
- If the PCC defines requirements for fugitive emissions from processes, livestock, manure, and soils » Then these shall be used.

5.15 Aircraft emissions

- Radiative forcing for all air transport (passenger and freight) may be included in the footprint.

Note 1: It is recommended that radiative forcing is included in the footprint but not mandated.

Note 2: Radiative forcing is not mandated by any standards, so the organisation may choose to exclude it. They should, however, disclose that they have done so with an explanation alongside – such as 'chosen source emission factors do not include it', 'science is uncertain', etc.

5.16 Data and calculation traceability: supporting verification and maintenance

- The organisation is responsible for providing documentation adequate for demonstrating compliance with this scheme. The documentation shall be sufficiently clear and transparent to enable verification decision-making.
- The organisation shall:
 - Disclose the source of all primary data; the data period it relates to; and a contact person.

Note 1: This is most effectively done by groups of data from the same source, not for every data point.

- Where secondary data is not in the footprinting tool's database, the organisation may obtain data. In this case, the organisation shall disclose the source of the data, reference where it can be found, version numbers, exact name of the data point, and how the Data Quality Indicator (DQI) (see 5.23 below) was assigned.
- Disclose units of measurement.

Note 2: Organisations should ensure sufficient attention is given to correct disclosure of units of measurement as this is one of the most common sources of error (e.g., reporting in kg instead of tonnes or the other way around).

- Specify if activity data is calculated or assumed rather than measured.
- Provide access to or demonstration of data calculations.
- Document all assumptions made and include a written justification for these assumptions and indicate the sources with sufficient detail to provide enough supporting evidence to the assessor team to ensure the team are confident.

Note 3: The source may be the name of an expert.

- Provide primary data to the assessor team in its original form from the source of the data and ensure the way in which data is processed (formulae and sources) is clear to the assessor team.
- Disclose all allocation keys required to process the data.

Note 4: Hard-coding allocation into calculations is a common source of errors and makes verification difficult or impossible.

- If pre-processing of data has been required in a separate spreadsheet prior to entry into the template/footprinting tool, then this spreadsheet shall also be submitted to the assessor team.

Note 5: If the organisation pre-processes the data and fails to disclose how the resulting data was created (and hence the validity of that data), the assessor team cannot be certain that an error has not been introduced.

Note 6: Good traceability of where data comes from, how it is manipulated, and why decisions have been made; help to make the inventory easier to maintain/update and more easily adapted to assist with reduction.

5.17 Materiality: significance or cut-off criteria

- The organisation should understand the materiality of each element of the footprint as a percentage of the total.
- Elements of the footprint with:
 - High materiality and sensitivity should be modelled with high quality data, i.e., measured.
 - Low materiality and sensitivity may be modelled with lower data quality, i.e., estimated, proxies.
 - Low-quality data is always preferable to excluding an element.

Note: Materiality = contribution to the total footprint. Sensitivity = extent the footprint changes with different data choices.

5.18 Activity data

5.18.1 Upstream (supply chain)

- Primary data collection from suppliers shall only be required if needed to meet the minimum data quality requirement as per Section 5.23 in this document.

5.18.2 Own operations

- Primary data shall be collected for stages in the life cycle which the organisation owns, operates, or controls.

Note 1: As per Section 5.3 above organisations shall have sufficient ownership and control of the product.

Note 2: As per Section 5.3 above, where PAS 2050 is selected as part of the verification criteria, at least 10% of the footprint shall be from primary data.

5.18.3 Downstream (if cradle-to-grave)

- Sufficient primary data (such as data collected from test procedures and consumer research) shall be collected to meet the minimum data quality requirement (see 5.23 below) although secondary activity data is often sufficient for downstream activities, especially when:
 - Relevant secondary data has been collected already by a reputable source and is of reasonable or good data quality.
 - It is defined in PCCs or held within an approved footprinting tool's templates/calculators. *
- If approved footprinting tool used » Primary data shall be collected to enter into templates/calculators used to model downstream processes, appropriate to materiality.
- If unapproved footprinting tool used » Primary data shall be collected to model downstream processes, appropriate to materiality. The organisation shall clearly show how the calculations to model each downstream stage meet the requirements of the standard and the impact upon data quality.

Note: Primary activity data may be collected by means of sampling, extrapolating or use of proxies (see 5.18.4).

**Much downstream activity data takes this form.*

5.18.4 Traceability for biogenic removals and emissions

- Removals may be accounted for in a product carbon footprint upstream, own operations and/or downstream.
 - In terms of removals, third-party verifications for 'chain of custody' and own operations shall be adequately evidenced in terms of traceability rather than seeking to verify it through the product footprint verification.
 - The organisation shall apply an appropriately conservative approach to land-use change.
 - If using a mass-balance approach, sufficient processes and evidence shall be in place to prevent the double-counting of biogenic carbon upstream and/or within an organisation. In addition, both the biogenic and the fossil equivalent material that is not displaced shall share equivalent end-of-life fates

such that physical biogenic CH₄ and CO₂ emissions will match the amounts included in the inventory, regardless of which end-of-life stream the physical carbon follows.

5.19 Multiple sites: Sampling, extrapolating or use of proxies

- When collecting data for a multi-site operation (e.g., many similar farms or retail shops) techniques may be used to be efficient and avoid the need to collect data from every site, i.e., for finding the most efficient method to achieve the minimum data quality requirement (see 5.23). The selected technique needs to ensure sufficient representativeness of the wider population and hence sufficient data quality of the result.
 - If sampling is defined in the PCC » This shall be followed.
 - If sampling is not defined in a PCC » Select, disclose, and justify techniques from below.
1. **Extrapolation or use of proxies for low materiality sites**
 - Sites with low materiality may be accounted for via extrapolation or use of proxies from other sites where data is collected. The resultant impact upon data quality shall be evaluated.
 2. **Sampling level**
 - One of the below shall be selected:
 - a) **Data collected from each site**
 - Finding an effective way of collecting data from every site is always the preferred option.
 - ‘No sampling’ shall be used when <20 sites.
 - The footprint of product X is a weighted average † of product X’s footprint from each site ‡ .
 - b) **Random sampling**
 - This is the default sampling method; and the simplest.
 - A minimum number of sites shall be sampled as below (interpolating between the points given).

Table 4. Number of sites sampled when applying random sampling methodology.

Total number of sites	20	30	40	50	70	100	150	200	300	400	500	1000
Sites to be sampled	20	23	28	33	41	49	59	65	73	78	81	88
Sampling rate (%)	100%	77%	70%	66%	59%	49%	39%	33%	24%	20%	16%	9%

- Where sites are of similar size[†], pure random sampling shall be used. However, where a limited number of sites are significantly larger[†] than average, the organisation shall ensure the sample includes sufficient number of these larger sites to be representative of the total supply of product.
 - The footprint of product X is a weighted average[†] of product X’s footprint from each sampled site.
- c) **Sampling based on grouping by key attributes**
 - If the organisation has further information about key attributes contributing to the footprint between different sites, then the population may be divided into groups to reduce sample rates.
 - Firstly, group the sites by key attributes into four groups. The basis for grouping sites shall be clearly justified, demonstrating the key attributes considered for grouping.
 - Collect data from two of the larger † sites from each group, plus a further sample of \sqrt{N} (where N is the total population) from across all the groups.

Table 5. Number of sites sampled when applying sampling based on grouping by key attributes.

Total number of sites	20	30	40	50	70	100	150	200	300	400	500	1000
Sites to be sampled	12	13	14	15	16	18	20	22	25	28	30	40
Sampling rate (%)	62%	45%	36%	30%	23%	18%	13%	11%	8%	7%	6%	4%

- The footprint of product X is a weighted-average † of product X’s footprint from each group, where this group average footprint is a weighted-average † of product X’s footprint from each sampled site.

- Where a limited number of sites are significantly larger † than average, the organisation shall ensure the sample includes sufficient of these larger sites to be representative of the total supply of product.

d) Alternative sampling methods

- Methods A to C are preferred. However, where it can be justified that these methods are not appropriate, alternative sampling methods shall be used based on quantitative statistical principles. The sampling strategy and supporting rationale shall be clearly documented.

† An appropriate measure such as sales volume or revenue shall be used.

‡ Accounting for extrapolation and use of proxies outlined in Point 1 above.

5.20 New products

- New SKUs that fall under existing grouping within a verification may be considered as part of that existing grouping for verification and labelling purposes.
 - The new product shall be <5% different in emissions to existing products.
 - The new product shall be <5% of total sales volume of the existing products.
- A new product is a recently (or soon-to-be) launched product with limited available data.
 - The product shall have available projected country of sales following the launch of the new product.
 - The product shall have six months or more manufacturing data OR the product launched is sufficiently similar to established products (to use as proxy) OR manufacturing can be estimated as a proxy based on the grounds of materiality.
 - If manufacturing can be justifiably estimated the new product should have justifiable calculations for the material parts of the footprint e.g., use-phase.
 - Footprint inventories for new products which share supply chains, manufacturing locations, and downstream processes with established products may be considered representative through extrapolation of current product data.
- A new product or calculating a projected product carbon would be classified as a **validation** rather than verification. Requirements as detailed in Section 5 in the 'Requirements for assurance – Part 2' apply, but the Label Licence would only be valid for **one year** after which a review and update would be necessary to rebaseline, reconcile and **verify** based on actual 12 months of data.

5.21 Prototypes, and product changes

- Activity data shall be representative of the product as it would be sold on the market.
- Primary data from prototypes shall not be considered representative.

5.22 Secondary data

- Secondary data, including emission factors, shall be selected in this order of preference:
 - Those held within an approved footprinting tool's database.
 - Another reputable source.
- Where data is selected from 'another reputable source', this choice shall be justified.
- Where a choice between multiple potentially valid secondary emissions factor is required, this choice shall be justified.
- Determining the most appropriate data point requires a decision to be made as to which emission factor best represents this specific input into the product footprint, alongside the desire for highest quality data.

5.23 Minimum data quality requirement

The organisation shall conform to the manual data quality requirements (5.23.2), presenting calculations clearly for verification.

- Data Quality Indicators (DQIs) shall be assigned by the organisation to data points generating CO₂e values, to support either method (5.23.1). This shall be completed by the team who have completed the footprint.
- If Footprint Expert™ templates used » Automated data quality calculation is embedded into the tool.
- If any other footprinting tool used » Data quality shall be determined using the manual method.
- Minimum data quality requirements:

- The cumulative contribution to final footprint shall be made up of emissions where:
- At least 70% of the total footprint is classified as having 'good' data quality.
- At least 95% of the total footprint is classified as having 'good' or 'medium' data quality.
- No more than 5% of the total footprint may be classified as having 'poor' data quality.

Note 2: The data quality of an overall footprint is the sum of the data quality of each data point in the inventory factored by its contribution to the overall footprint. Each data point is the product of activity data and selected emission factor. This is a very important but also complex area of product footprinting. For this reason, two alternative requirements are defined for data quality.

5.23.1 Assigning Data Quality Indicators (DQIs)

- Please see Appendix 4 for a more detailed description on Data Quality Indicators.
- The data quality of each data point is a combination of both the data quality of the activity data and of the emissions factor used to calculate the CO_{2e} value.
- All primary activity data shall be assigned a DQI.

Note: It may be more efficient to assign the same DQI to a range of similar primary activity data rather than assessing each data separately.

- All secondary data in the database of an approved footprinting tool or defined in a PCC will have a DQI already assigned to it.
- All other secondary data used shall be assigned a DQI.

5.23.2 Data quality requirement

- Calculation method:
 - The organisation shall demonstrate that the minimum data quality level has been achieved.
 - To an appropriate level of granularity, the emission sources should have an 'application' DQI calculated, as the combination of activity and emission factor DQI.
 - The overall 'application' DQI of each data point is summarised by the Table below. It is these values that should be ranked according to cumulative contribution in order to check compliance with the minimum data quality level.

Table 6. Overall Data Quality Indicators when applying the manual data quality requirement.

		Activity data		
		Data Quality Indicator	Good	Medium
Emission Factor Indicator	Good	Good	Good	Medium
	Medium	Good	Medium	Poor
	Poor	Medium	Poor	Poor

Note: It may be useful to compile a reasonably complete inventory before attempting too much manual data quality assessment, to ensure that this effort is focussed on the most material emissions and removals. However, the process will always be somewhat iterative.

- DQI assessment method:
 - The below describes a scoring system that is used at Carbon Trust Advisory.
 - Using the scoring criteria in Appendix 4, a high-level description is provided below, assign each emissions source a Data Quality Indicator score, the level of granularity of the assessed emissions source should be to an appropriate level. The framework below sets out how to translate a numerical overall DQI score to a qualitative description.

Table 7. Data Quality Indicator scoring system used at Carbon Trust Advisory.

Data quality description	Overall DQI score
Good	≥ 0.70
Medium	$0.40 \leq x < 0.70$
Poor	> 0.40

- Activity data DQI shall be assessed using the below Table:

Table 8. Criteria used to assess Activity Data Quality.

	Comments	Example options
Data source	The source of activity data	Volumetric in terms of kWh, tonnes or spend based in terms of £\$€ per unit
Completeness	How completely does the data represent the emission boundary	To what extent is there any sampling, proxy data, estimation, or partial representation
Technology	Describe the technology involved in providing the material or service. Linked to selection of emission factor	The type of energy source or technology required (or assumed) to make a material
Location	Which facility, supplier (or raw material source) location or broader geographical location	Facility location, supplier's raw material source location (specific or more generally by country or region)
Age	The age of the data, relative to the inventory year	Normally the inventory year

- Any new emission factor DQIs shall be assessed using the below Table:

Table 9. Criteria used to assess new emission factor Data Quality Indicators.

	Comments	Example options
Data source	The emission factor source	Supplier-specific, published life cycle assessment (LCA), national database, EEIO etc.
Completeness	How completely does the emission factor represent the intended emission boundary	To what extent is there any sampling, proxy data, estimation, or partial representation
Technology	Representation of the core technology used in the process(es) modelled by the emission factor	This may be dealt with in a range of ways, such as 'modern vs obsolete', 'large scale vs small scale' or just document the specific technology (e.g., 'large-scale, modern sugar refinery with natural gas CHP')
Location	Region the emission factor represents	Varying levels of geographical detail, bearing in mind that few emission factors currently represent data more detailed than per country and for some (e.g., agri-forest related) climactic or other physical considerations may be more important
Age	Related to one or both of the publication and data representation date	A database may be published in 2020 but include emission factors representing 2010

5.23.3 Use-phase DQI

- The methods outlined in 5.23.2 do not apply directly to the use-phase.
- An assessment shall be made to assign a DQI to the use-phase as a whole, based upon the same general principles and rating mechanism as used in 5.23.2.

5.23.4 Reporting data quality

- A summary of data quality per process (at least) must be included in the Product Emissions Report.

5.24 Sensitivity analysis

- For this scheme the process of meeting the minimum data quality requirement (see 5.23) shall be deemed to meet the requirements relating to sensitivity analysis of the final result.

5.25 Assessing uncertainty

- For this scheme the process of meeting the minimum data quality requirement (see 5.23 above) shall be deemed to meet the requirements relating to assessing uncertainty.

5.26 Life cycle interpretation

- All relevant requirements of life cycle interpretation have already covered in other sections of this document.

Note 1: This scheme has an explicit goal of meeting the requirements for the label. If all requirements of this document and the relevant PCC are conformed to, there will be no significant issues or limitations.

Note 2: All footprinting involves some limitations in its approach, calculations, and results. Under this scheme these limitations are managed in a standardised way, and processes put in place to ensure that they are not significant for the specified goal if verification is achieved.

5.27 Preparing the Product Emissions Report

- A draft Product Emissions Report shall be produced by the client prior to the verification process, including as a minimum the information shown in Appendix 1.
- At this stage the verification section is left blank, until public disclosure (see 5.29).

5.28 Verification: Presenting results, conformity, and materiality

- The verification process may raise major and minor non-conformities.
- Prior to the granting of the verification statement:
 - Corrective action shall be required for all major non-conformities.
 - However, a corrective action shall be required for sufficient minor non-conformities, to ensure that the aggregate highest reasonable estimate of the impact of all non-conformities justified as minor does not exceed 5% of the footprint.

**Minor non-conformities have a non-material impact on the final footprint (see Sections 5.17, 6.2).*

5.29 Public disclosure (after verification)

- The Product Emissions Report should be made available in the public domain, as shown in Appendix 1.
- Where the 'Greenhouse Gas (GHG) Product Life Cycle Accounting and Reporting Standard' is chosen as the reporting criteria, the organisation shall publicly report the Product Emissions Report (PER) and shall report information contained within Section 13.2 of the GHG Standard.
- Where ISO 14067 is chosen as the reporting criteria, the organisation may report the PER. Where the PER is reported publicly, the organisation shall conform to 9.1.2, 9.1.3, 9.1.4 or 9.1.5 as relevant.
- Where PAS 2050 is chosen as the reporting criteria, the organisation may publicly report the PER. Where the PER is reported publicly, the organisation shall conform to 10.2 and 10.3 of PAS 2050.
- When communicating the verified PCF result to a consumer, the rounding rules found in Appendix 5 shall be followed.

Note 1: Rounding rules shall be used in any place a customer may view the PCF results, for example in the PER, on product packaging, or on the company website.

Note 2: Rounding rules may also apply to the communication of reduction results, providing that the reductions were calculated using the original raw footprints.

6 Assessment

6.1 General assessment requirements

- The Carbon Trust shall undertake an assessment of the information and evidence provided by the organisation for the purposes of demonstrating how they have met the verification requirements described in Section 5 (including the requirements of the relevant PCC) and any relevant additional Product Footprint Label requirements in 'Requirements for assurance – Part 2'.
- Where the Carbon Trust identifies areas of concern, gaps in the evidence provided, areas where the evidence demonstrates nonconformity with the requirements, or any other need for further information or evidence, these shall be notified to the organisation in the form of a Query and Evidence Request.
- Upon receipt of the Query and Evidence Request the organisation shall provide a response by taking any additional action required and providing within a reasonable timeframe sufficient additional information and/or evidence to address the identified queries, gaps, and nonconformities.
- The Carbon Trust commits to two rounds of Query and Evidence Request and Response, where necessary, as a minimum. Where the initial responses to the Query and Evidence Request provided by the organisation are not sufficient one further round of Query and Evidence Request and response may be undertaken at the sole discretion of the Carbon Trust. Provision for further rounds of Query and Evidence Request and Response is not typically included within the scope of service.
- Where the information and evidence provided is sufficient for Carbon Trust to be satisfied that the organisation has met the verification requirements described in Section 5 and any relevant additional claims and labelling requirements in Part 2, the Carbon Trust shall provide verification and labelling in line with Section 7.
- Where the organisation is unable to provide suitable information and evidence to demonstrate that they have met the verification requirements described in Section 5 and/or any relevant additional labelling requirements in Part 2 within the agreed upon timescales for the service, the Carbon Trust reserves the right to terminate the service upon written notice.

6.2 Materiality in assessment

Table 10. Errors, omission and misstatement default thresholds and result on assurance process.

Error, omission, and misstatement (EOM) situation An individual EOM is known/estimated* to be:	EOM represents	Finding type Non-conformity (NC) type	Where the audit finding is not closed during the course of the project, the following applies:
Greater than or equal to the materiality threshold for the total footprint (>=5%)	<ul style="list-style-type: none"> • >=5% total footprint 	<ul style="list-style-type: none"> • Major NC 	<ul style="list-style-type: none"> • Project is completed with an adverse opinion. • Footprint is <u>not</u> verified. • Use of applicable Product Footprint Label <u>not</u> granted.
Greater than or equal to 5% (>=5%) per product life cycle stage AND below than the materiality threshold for the total footprint (<5%)	<ul style="list-style-type: none"> • >=5% per product life cycle stage • <5% total footprint 	<ul style="list-style-type: none"> • Minor NC 	<ul style="list-style-type: none"> • Project is completed with a Modified Opinion highlighting the weakness related to the Minor NC. • Footprint is verified. • Use of the Product Footprint Label may be granted as applicable. • The Minor NC is open and requires correcting before the next verification as a minimum.

<p>Greater than or equal to the materiality threshold per product life cycle stage ($\geq 1\%$) AND below 5% ($< 5\%$) per scope AND below the materiality threshold for the total footprint ($< 5\%$)</p>	<ul style="list-style-type: none"> • $\geq 1\%$ but $< 5\%$ per product life cycle stage • $< 5\%$ total footprint 	<ul style="list-style-type: none"> • Minor NC 	<ul style="list-style-type: none"> • Project is completed with an unmodified opinion. • Footprint is verified. • Use of Product Footprint Label may be granted as applicable. • The Minor NC is open and requires correcting before the next verification as a minimum.
<p>Greater than 0% ($> 0\%$) per life cycle stage AND below the materiality threshold per scope ($< 1\%$), AND below the materiality threshold for the total footprint ($< 5\%$)</p>	<ul style="list-style-type: none"> • $> 0\%$ per emission source • $< 1\%$ per scope • $< 5\%$ total footprint 	<ul style="list-style-type: none"> • Opportunity for improvement (OFI) 	<ul style="list-style-type: none"> • Project is completed with an unmodified opinion. • Footprint is verified. • Use of Product Footprint Label may be granted as applicable. • The OFI is open. Taking action to close the OFI is optional. • If the EOM is close to the threshold the organisation should be made aware that if the footprint changes it might represent a Minor NC next time.

- Where the EOM (in particular an omission) has been estimated to be below but close to exceeding a materiality threshold, it may be necessary to complete the project and issue the deliverables as indicated but with a caveat that the organisation needs to obtain further data to confirm the exact extent of the EOM within a suitable timescale (e.g., within six months). Should the organisation be unable to do this, or further data confirms that the EOM was in fact above the threshold, then appropriate, further action in line with the Table above should be taken. The Carbon Trust may withdraw the previously issued deliverables.

Note: The EOM materiality thresholds provided above are the default thresholds. However, the organisation may request to use more stringent thresholds for their project, in which case the more stringent thresholds should be used.

- Non-material contributors may be excluded if the highest reasonable estimate does not exceed 0.1% of the total footprint. Aggregate exclusions shall not exceed 1% of the total footprint.
 - The organisation shall document a simple justification for these exclusions.
 - It is preferable to include all emissions sources but with proxies, extrapolation, or increasingly lower quality data for smaller elements of the footprint rather than excluding non-material contributors.

Note: The organisation should expect this to follow an iterative approach as the materiality of each element is gradually better understood.

7 Verification and the Carbon Trust Product Footprint Label

- Where the requirements in Section 5 (including the requirements of the relevant PCC) have been satisfactorily met, the Carbon Trust shall provide verification in the form of the following:
 - A letter of assurance, detailing the parameters of the assessment, assessment outcome and (if applicable) conditions of the Product Footprint Label.
 - A certificate of assurance, verifying that the products have been assessed and found as having met the relevant requirements criteria (including the requirements of this document) and that the calculated footprint results have been calculated correctly and are valid for communication for either 12 or 24 months (depending on intended usage).
- Where the additional labelling requirements in Part 2 have been satisfactorily met, the Carbon Trust shall license the use of a Product Footprint Label in the form of the following:

- The Carbon Trust Product Footprint Label Licence, valid for either 12 or 24 months (depending on intended usage).

8 Verification maintenance requirements

8.1 Changes to the sale of products

- The organisation shall ensure products only use the Verified Label in compliance with the Label Licence Agreement and all relevant requirements in this document. This is most critical when products change.
- When a product is discontinued the organisation shall:
 - Inform their Carbon Trust Client Manager.
- Where a new SKU is created that meets the requirements to be included within an existing product verification as defined in Sections 4.1 and 5.20 above the organisation shall:
 - Inform their Carbon Trust Client Manager.

8.2 Changes to the product inventory

- The organisation shall ensure products only use the Verified Label in compliance with the Label Licence Agreement and all relevant requirements in this document. This is most critical when products change.
- When a product is replaced with an updated version or where significant changes are made to processes, materials, components or use of that product, the organisation shall:
 - Document the key input values which have changes (before and after values).
 - Update the inventory with these changes.
 - Inform their Carbon Trust Client Manager to discuss right to use the label.
- When a product has changed due to factors outside of the organisation's control:
 - Inform their Carbon Trust Client Manager.
 - If the change is related to the actions taken to reduce the footprint of the product, this change will be reviewed during re-verification.
- The overall results of each product carbon footprint may have changed if the change is more than 10%:
 - If not, the letter of assurance and certificate of assurance are still valid, and the Label may be used until the expiry date of that verification.
 - If changes exceeding 10% are due to factors outside the organisation's control, the letter of assurance and certificate of assurance are still valid, and the Footprint Label may be used until the expiry date of that verification.
- If a new letter of assurance and certificate of assurance will be required, the organisation shall submit the documentation of key input value changes and the before and after inventories for assessment. Once a new letter of assurance and certificate of assurance are issued application may be made for a new label.

8.3 Misuse of the Carbon Trust Footprint Label

- Ongoing surveillance is conducted by the Carbon Trust to check for adherence to the Carbon Trust Product Footprint Label requirements. Failure to adhere to these labelling requirements may result in any of the following actions being taken dependent upon severity:
 - The removal of the Licence of the Verified Label for the product in question.
 - The removal of all Label Licence for the organisation.
 - A period of time when the organisation may not apply for any new Verified Labels.
- The Carbon Trust reserves the right to use the full extent of the law to take all appropriate actions to ensure these labelling requirements are enforced to uphold the integrity of the scheme/label.

9 Re-verification assessment

9.1 Assessment activities for re-verifications

- Where an organisation wishes to re-verify, i.e., obtain a subsequent verification of a product that has been previously verified, then in addition to the assessment activities described in Section 7, the following re-verification assessment activities shall take place:
 - The Carbon Trust shall compare the current and previous footprints to confirm consistency. The organisation shall be able to provide explanation of any changes between the footprints.
 - The Carbon Trust shall review action taken by the organisation to address any suspended minor non-conformities. The organisation shall be able to provide evidence action taken to address suspended minor non-conformities as appropriate. Where sufficient action to suitably address and close off a suspended minor non-conformity have not been taken the Carbon Trust reserves the right to escalate the matter to a major non-conformity if appropriate.

9.2 Rebaselining

- In most instances a rebaselining exercise may not be necessary. The below detail the instances where a rebaseline will be necessary in order to accurately compare the two footprints for a reduction assessment:
 - If secondary data quality representing the original footprint period has significantly improved, it shall be updated.
 - If data quality has increased or decreased, the newer data shall be used in the re-baselined footprint (ensuring comparable data quality is used to record changes).
 - The methodology applied in both the inventories should be identical. If the methodology changes for any reason the previously verified footprint shall be rebaselined to align to the new methodology.

Note 1: The drive to create comparable results that enable meaningful reduction comparisons is in conflict with the common principle within product footprint standards of data quality improvement. For example, if new better-quality data is used to calculate future footprints and improve the relevance of organisation's information, this may not be comparable to the original data using poorer quality data. Care should be taken when managing this tension as it may remove options to demonstrate quantified reductions.

Note 2: Banked emission reductions (Part 2) may apply over multiple footprint periods, and it may therefore be necessary to re-baseline more than one footprint calculation.

9.3 Label claim transition

- Where an organisation has previously achieved one claim e.g., carbon neutral, they may transition to a new claim to suit their marketing needs.
- The footprint period shall be the same as previously verified and labelled.
- The organisation shall notify their Client Manager at least six months prior to the verification expiry date.
- The organisation shall inform the Client Manager of the label they would like to transition to.
- The process to do so will be outline by marketing and the Client Manager.
- The products shall meet the relevant labelling claim section of the new claim they would like to publish.

10 Communications

- Communications relating to the product carbon footprint verification and any associated labelling shall be in line with the Carbon Trust's usage guidelines for the Product Footprint Label.

Appendices

Appendix 1: Product Emissions Report outline

Background information
Organisation name
Organisation contact information
Product name
Boundary
Standards, specifications and/or other documents against which the organisation has been assessed for conformity
Name of the independent, third-party verifier
Level of assurance achieved
Date of verification
Functional unit/Final reference flow
Footprint period
Product Consistency Criteria
Scope and boundary
Scope
Boundary:
Raw materials
Manufacturing
Transport
Storage and use
End of life
Non-attributable processes
Excluded attributable processes
Methodology
Methodological choices
Assumptions
Allocation – Input, outputs, and recycling
Grouping
Methodological changes since previous report
Data requirements
Data collection and validation
Data quality assessment
Results

Appendix 2: Product Consistency Criteria template

Product Consistency Criteria form for (PRODUCT/PRODUCT GROUP)

REQUIREMENTS

PCC covers the following product(s):	
Relevant existing PCR(s)	
Unit of analysis	
Allocation rules	
Use-phase rules	
Fugitive and process emission rules	
Other	

GUIDANCE

Grouping rules	
Other guidance	

VALIDITY

Approval date:

Valid until: [five years from approval date]

Author:

Appendix 3: Electricity emission factors

3.1 Introduction

- This appendix provides an explanation regarding electricity emissions factors and why those used in product footprinting differ from those used in organisational footprinting.
- This is an area which causes much confusion, particularly for those familiar with organisational footprinting, but for whom product footprinting is relatively new.

3.2 Summary

- The emissions which arise from electricity generation can be placed into the following four categories*:
 1. Upstream emissions of fuels used for electricity generation
 2. Generation (i.e., combustion)
 3. Transmission and distribution losses
 4. Further downstream emissions arising from electricity generation
- Standards for organisational footprinting or national accounting require electricity emissions factors which account for only Item 2 from this list, which align with the boundary principles applied for such footprinting. i.e., a Scope 1 and 2 view, ignoring upstream impacts.
- All countries produce a national figure to be used for such footprinting.
- Standards for product footprinting, or Scope 3 organisational footprinting require electricity emissions factors which account for all categories 1-4 from this list, which align with the boundary principles applied for such footprinting. i.e., a full life cycle principle.
- Countries in the EU, and others such as Japan and the US, publish a national figure to be used for such footprinting.

3.3 Therefore, the following are included in approved footprinting tools:

- For product footprinting:
 - If a national published figure exists, these are used.
 - Where no national published full life cycle electricity figure exists, a representative extra portion of emissions is added (of approximately 10%) to create a number which will be included within the footprinting tool.
 - This is updated annually.
 - If a supplier-specific electricity factor can be obtained that is reliable, it too may be used (see below). However, it shall be a full life cycle figure. If it doesn't include the upstream emissions (which is likely), then similar additions shall be made to this supplier-specific factor as have made to the national factor.

3.4 Further explanation of life cycle emission factor requirements

Treatment of electricity

- The GHG emissions associated with the use of electricity shall include, where relevant, GHG emissions arising from the life cycle of the electricity supply system, including but not restricted to:
 - The GHG emissions arising from the generation of electricity, e.g., combustion of fuels.
 - The GHG emissions arising from the generation of electricity lost in transmission and distribution in the grid.
 - Upstream GHG emissions (e.g., the mining and transport of fuel to the electricity generator or the growing and processing of biomass for use as a fuel).
 - Downstream GHG emissions (e.g., the treatment of waste arising from the operation of nuclear electricity generators or treatment of ashes from coal-fired electricity plants).

- GHG emissions related to construction, maintenance and decommission of the electricity supply system. When electricity is internally (e.g., on-site generated electricity) produced and consumed for a product under study, life cycle data for that electricity shall be used for that product.
- When a supplier of grid electricity can deliver a specific electricity product with specific life cycle data and guarantee that the electricity sale and the associated GHG emissions are not double counted, life cycle data for that electricity product shall be used. When the supplier of electricity does not provide specific GHG data for the specific electricity product, the GHG emissions associated with the national grid where the life cycle stage occurs shall be used.
- Where a country does not have a national grid but has several unconnected grids or several countries share a common grid, GHG emissions associated with the relevant grid from which the electricity is obtained shall be used.
- If specific life cycle data on a process within the electricity supply system are difficult to access, data from recognised databases may be used.

Appendix 4: Data quality scoring

- There must be an assessment of the data quality of the activity data and of the emission factor used for each emission source. The level of detail in the assessment may be linked to materiality of the emission source. The appropriateness of the emission factor used, given the activity data context, should also be assessed. For both the activity data and the emission factor, the following scoring criteria for assessment should be followed. An alternative approach must be fully documented and justified.
- The rules on materiality and sufficient data quality set out in Section 5.23 must be referred to when scoring and interpreting data quality.
- The overall Data Quality Indicator (DQI) score is a combination of activity data (Activity Data Quality, ADQ), emissions factor (Emission Factor Intrinsic Quality, EFIQ) and the appropriateness of the matching. The scores against quality criteria for both the activity data and emission factor can have different weightings. It may be necessary to treat scoring of goods differently from services, as the sources and functional units differ.
- The following Tables provide example decision-making tools and scoring options.

Data Quality Indicator example:

Table 11. Data quality assessment scoring.

Data quality description	Overall DQI score
Very good	0.85
Good	0.70
Fair	0.40
Poor	0.20
Very poor	0.10

Table 12. Activity data (Activity Data Quality, ADQ).

ADQ score	Source (Goods)	Source (Services)	Location	Age	Technology	Completeness
1	Excellent – Direct volumetric consumption data, e.g., bill of materials by SKU AND facility.	Services: Excellent – Entirely spend (by supplier and facility) for services where spend is the best activity data, e.g., legal, prof services etc.	Excellent – Data used is at sub-facility level, e.g., manufacturing line or fleet fuel use per vehicle group.	Excellent – Data is from of the inventory year.	Excellent – Data represents all key factors that drive emissions, e.g., ‘steel grade XY, made from blast oxygen furnace’ or ‘aluminium extruded and anodised’ or ‘animated online ad agency’ or ‘Car/Van/HGV model X’.	Excellent –Data complete for reporting footprint period; no missing data/extrapolation.
0.875			Very good – Data used is at facility level, e.g., manufacturing plant but product-specific; no allocation needed.		Very good – Data represents most (but not all key) factors that can determine emissions, e.g., ‘steel made by BOF’ or ‘alu extruded’ or ‘online ad agency’ or ‘first class flight’ or ‘17t rigid HGV’.	

0.75	Good – Direct volumetric consumption data, e.g., bill of materials by SKU OR facility.	Services: Good – Spend by supplier OR facility.	Good – Data used is at facility level, e.g., manufacturing plant but allocation needed.	Good – Some other years' data used (up to a year's difference to inventory year) but a reasonable representation of inventory activity, e.g., relatively constant activity year-on-year.	Good – Activity data is well described, at a high level, e.g., 'steel' or 'aluminium' or 'ad agency' or 'flight' or 'HGV' (Class 4).	Good – Mostly complete data. Minimal missing data/extrapolation; very good representation of reporting footprint period.
0.6			Acceptable – E.g., data used is national (allocation needed)		Acceptable – Activity has been summarised into a mix; e.g., 'metals' or 'marketing' or 'overland travel' or 'freight' (Class 3)	Acceptable – Some estimates/proxies/background calcs used, but still a good representation; e.g., only nine months data available, extrapolated from several years' seasonal patterns of data
0.4	Poor – Secondary data.	Services: Poor – Spend on services not by supplier or facility.	Poor – Data used is regional (e.g., Europe).	Poor – Data up to up to three years out from the inventory year, possibly not a reasonable representation of inventory year.	Poor – Quite generic, unspecific descriptions, e.g., 'parts', 'components'; 'consulting' (Class 2).	Poor – Significant estimates/proxies/background calcs used, and the result is likely a poor representation of reporting footprint period. E.g., only three months data available with uncertain annual variability or secondary data used.
0.2	Very poor – Spend data.		Very poor – No break down of location, i.e., global,	Very poor – Data is more than three years out from the inventory year and definitely	Very poor – Very generic descriptions, e.g., 'goods' or 'services' (Class 1).	Very Poor – Significant estimates, proxy, assumptions in the background calcs etc., unlikely representative or not known. E.g., the Carbon Trust's calc assumptions unconfirmed

				not representative (or this is unknown).		with client; significant guesses made.
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Table 13. Emission factor (Emission Factor Intrinsic Quality, EFIQ).

EFIQ score	Source (Physical)	Source (S)	Location	Age	Technology	Completeness
1	Excellent – Published product LCA/Supplier product-specific/Use r process calc/FPX calculator.		Excellent – Data used is facility specific or sub-regional (US state, Scotland vs England).	Excellent – EFs published/updated in latest CMDB version year. Or published previously but robust adjustments to latest CMDB version year,	Excellent – Data is specified by all key technologies that drive emissions, e.g., ‘steel grade XY, made from blast oxygen furnace’ or ‘carmaker/OEM’s LCA’ (- CMDB: Class 4++).	Excellent – Complete representation.
0.875					V good – Data used has good specificity of technology, e.g., ‘steel grade XY’ or ‘first class flight’ or ‘17t rigid HGV’ (- CMDB: Class 4+)	
0.75	Good – General database (e.g., EcoInvent, BEIS, IEA) – based upon a pre-defined	EEIO: Good – EEIO EF for a service (e.g., legal services) from a well-managed EEIO DB; e.g., the Carbon	Good – National.	Good – Less than three years of difference.	Good – Data used is based on industry average technology, e.g., ‘steel’ or ‘flight’ or ‘HGV’ (- CMDB: Class 4).	Good – Mostly complete (some, but not material sampling, proxy, extrapolation etc. applied, e.g., PCF missing some life cycle stages: transport/manufa

	'approved' list.	Trust's EEIO EFs.				cturing energy etc.)
0.6		EEIO: Acceptable – Mix, more 'good' than 'very poor'.	Acceptable – Regional (e.g., Europe if technically driven or bioregion if agriculture driven).	Acceptable – Less than six years of difference.	Acceptable – General type has been used, e.g., 'metals' or 'marketing' or 'travel' or 'freight' (- CMDB: Class 3).	
0.4	Poor Estimates/extrapolation /expert opinion or supplier average, e.g., average across all products sold.	EEIO: Poor – Mix, more 'very poor' than 'good'.		Poor – More than six years of difference or age is unknown.	Poor – High-level type has been used, e.g., 'base material' (- CMDB: Class 2).	Poor – Approximate (significant sampling, proxy, extrapolation etc.; e.g., PCF missing some large life cycle stages - key materials etc.)
0.2	Very poor – EEIO.	EEIO: Very poor – EEIO EF for a physical good/activity where volumetric EFs should be available, e.g., EF/\$ on business travel, transport, physical goods, etc.	Very poor – Global.	Very poor – More than ten years of difference or age is unknown.	Very poor – A highly generic guess has been used, e.g., 'goods' (- CMDB: Class 1).	

Appendix 5: Rounding rules

- Presenting simple, quantified environmental information in any public arena should be done with care. A single footprint number relies on a great deal of background information that itself cannot effectively be communicated at the point of sale. Any assumptions and commentary regarding the footprint shall be available upon request, so that consumers may understand issues around (amongst others) precision and uncertainty.
- In order to manage precision and uncertainty in a straightforward manner, final footprints for public use shall be rounded according to the list in below table. The rules generate up to an approximate +/- 5% rounding impact.

Table 14. Rounding rules.

Life cycle GHG emissions (CO ₂ e) per functional or reference unit	Round to nearest:
> 10 g, <= 20 g	1 g
> 20 g, <= 40 g	2 g
> 40 g, <= 100 g	5 g
> 100 g, <= 200 g	10 g
> 200 g, <= 400 g	20 g
> 400 g, <= 1.0 kg	50 g
> 1.0 kg, <= 2.0 kg	100 g
> 2.0 kg, <= 4.0 kg	200 g
> 4.0 kg, <= 10.0 kg	500 g
etc.	etc.

- Disclosure of results directly to another business within a supply chain should be done using the raw, unrounded footprint values.
- A change to a calculated footprint that alters the rounded result is considered to be material.

Appendix 6: PCF+ boundary and rules

- The PCF boundary as standard practice includes raw materials, manufacturing, distribution, use-phase, and end-of-life.
- The **PCF+** boundary includes certain additional categories which are related to the activities associated with the product with result in non-attributable emissions.
- The associated product footprint standards state that non-attributable emissions may be included within the product inventory as long as the scope and boundary have accurately defined that there are additional categories.
- Any materiality or data quality assessment of the attributable emissions or removals should not include non-attributable emissions. However, materiality or data quality assessment of non-attributable emissions or removals shall include both.
- Examples of non-attributable emissions include:
 - Capital goods (e.g., machinery)
 - Other overheads (e.g., marketing, administrative functions)
 - Transport of the product user to retailer
 - Employee transport

- Complementary products
- If suitable, the non-attributable categories **may** be included in the reduction assessment of a PCF+ product. This includes any decreases or increases occurring and the chosen boundary shall be consistent between inventory years. It is not possible to claim a reduction as a consequence of changing the boundary.
- It is acceptable for carbon removals to be accounted within the PCF+ boundary as long as the removals are contractually linked, traceable and verifiable as related to the product.
 - Mass balance approach to allocating upstream removals may be applied in some instances to cradle-to-grave footprints (see Section 5.18.4).
 - The product should not claim removals which are otherwise claimed by another organisation or outside the product scope.

Appendix 7: Services requirements

7.1. Process flowchart

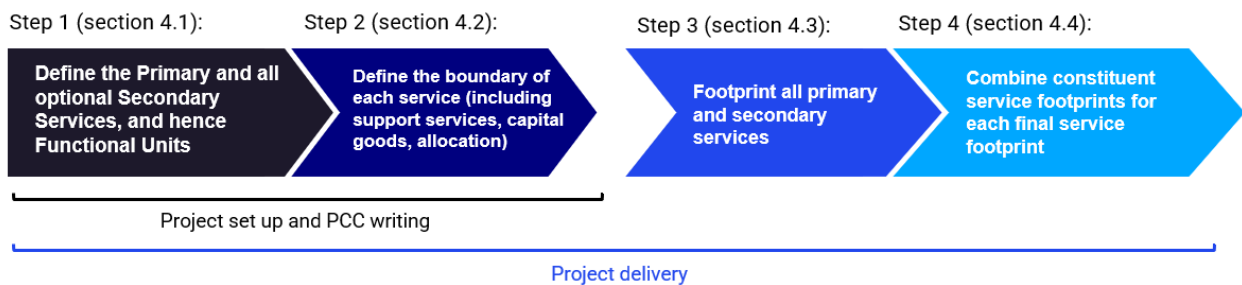


Figure 3. Flowchart of service assurance process.

7.2. Scope

- This section defines the requirements to be conformed to by organisations who wish to verify the carbon footprint of their service(s), principally for the purposes of external communication, with or without the use of a Product Footprint Label.
- This section should be used when interpreting the 'Product Carbon Footprints – Requirements for assurance' above when footprinting or verifying a service.
- Section 5.5 defines the boundaries typically footprinted for the product carbon footprint (PCF) of a good. Beyond a cradle-to-grave and a cradle-to-gate footprint, a gate-to-gate boundary of a good can be footprinted, this is typically the cradle-to-grave of a service PCF.
 - The gate-to-gate footprint of a good is used when companies want to know the PCF of an outsourced operation in their goods manufacture. This can be incorporated into the PCF of the good they make.
 - Example: A publisher wants to calculate the PCF of a book. The publisher buys the paper for the book, and they create content to be printed on it, however printing is outsourced to a printing company. In order to account for the printing, they need a gate-to-gate footprint for the printing of the book or a cradle-to-grave footprint of the printing service. In order to do this and capture the relevant emissions, the requirements in this appendix shall be met.
- The same product can be footprinted as a good or a service, dependent upon how it is sold:
 - If the customer purchases the good outright, this is a good PCF and the footprint shall be cradle-to-grave, covering the whole life cycle.
 - If this same good is leased or rented to multiple customers over its lifetime e.g., a book in a library, then this shall be footprinted as a service PCF, where the footprint is an apportionment of the full life cycle of the good plus additional emissions for leasing. The functional unit shall be related to the time used/leased for, (whereas for a good it is often per unit).

7.3. Terms and definitions

- For the purposes of this appendix the following terms and definitions apply:

Good	A tangible product.
Service	An intangible product. *
Primary service	What a customer receives or keeps as a result of this service PCF. The primary service(s) shall be defined in the functional unit.
Secondary service	Options beyond the Primary Service offered to the client to select from, and often defined in the contract. Included secondary service(s) included shall be defined in the functional unit.
Support service	An additional service (part of a service PCF) that the customer does not see but experiences the effect of and is required to deliver the service being footprinted.

**The service may include a good in the footprint.*

7.4. Service footprinting process

- Important: If a suitable PCC exists for this primary service, then this should be reviewed for applicability and enacted upon, avoiding the need to complete all of Steps 1 and 2 (as set out in Sections 7.4.1 and 7.4.2).

7.4.1. Step 1: Define the primary and secondary services, and functional units

7.4.1.1. Primary and secondary services

- The organisation shall define what a customer always receives from this service (primary service) as well as the options offered to the customers (secondary services). This is Step 1.
- The organisation shall determine how many footprints will be calculated and match these to a clear functional unit of these services.

Note: In general, the service footprint boundary is determined by answering the question 'What does the customer get in return for paying for this service?'

Note: this may be demonstrated in the form of a contract or online user interface.

- Example: in the service footprint of a hire car, the primary service (what a customer always receives) is use of a car for a portion of its lifetime. The secondary services (options offered to the customer) could be a tank of fuel, drop off and pick up, insurance cover options.

7.4.1.2. Functional units

- The PCF of a service shall have a functional unit that defines: the primary service, chosen secondary services and excluded secondary services. This should be linked to the structure of the purchasing arrangement, such as contracts or website selections; and may result in a combination of different PCFs with different functional units. This therefore derives from the output of 7.4.1.1.
- There is more flexibility in the boundary of a service than the boundary of a good, therefore the functional unit shall be specific and prescriptive. The functional unit is important for clear public communication of the service footprint. The consumer must have insight into what has been considered in the footprint of this specific service.
- Where relevant, the functional unit and communication around the footprint shall be clear in defining that the footprint covers the emissions from the transaction of the service rather than the enablement, consequence or emissions avoidance that occurs as a result of the service.
 - Example: The footprint of a provision of a mortgage will not include the emissions from the house purchased.

7.4.2. Step 2: Define the boundary of each service (including support services, capital goods, allocation)

- The organisation shall more clearly define the boundary of each service defined in Section 7.4.1. This is Step 2.
- This involves defining all support services and capital goods relevant to each primary and secondary services, and any allocation principles that should be followed.
- When viewed from a PCC perspective this is to define what should be taken into consideration. When viewed from a specific footprint perspective materiality and other factors will determine inclusion or not.

Note: these may be defined by a process map.

Note: this process map may differ than that of a good e.g., have different life cycle stage names.

7.4.2.1. Support services and capital goods

- The support services and capital goods are not explicitly written in the functional unit, however they necessary in understanding the boundary of the service footprint.
 - Example: In the service footprint of the provision of a bank loan, if the server is run by a third party, then this support service shall be included in the service footprint as this support service is necessary to deliver the primary service of a bank loan.
- If a capital good is instrumental in answering the questions in section, then it shall be included in the footprint.
 - Example: in the service footprint of hiring a tool, the embodied carbon of this capital good shall be apportioned and included in the footprint. In the example of hire car, the embodied carbon of the car shall be apportioned and included in the boundary, this is because this capital good is required to deliver the primary service of hiring a car.

7.4.2.2. Allocation

- Section 5.9 shall be followed when determining allocation for a services PCF. A service PCF has many inputs and will usually require multiple allocation keys. Allocation shall be determined by attributability.
 - Example (if mass allocation is being used) - the number of people directly involved in delivering the service shall be defined, e.g., in the example of the provision of a mortgage, 70% of staff are considered directly involved in the service (e.g., mortgage support advisors), therefore, 70% of shared emissions sources (e.g., electricity in offices), shall be included in the service footprint. The HR and marketing department are not directly involved in delivering the provision of a mortgage; therefore, this share of emissions shall not be included.

7.4.2.3. PCC

- At this point, the Product Consistency Criteria (PCC) shall be written. The PCC shall list everything defined thus far, such as the list of all secondary services to define if they are included or excluded from a footprint.
- A specific service footprint following this PCC will include/exclude different combinations of these secondary services (see Section 7.4.4).

7.4.3. Step 3: Footprint all primary and secondary services

- The organisation shall footprint each primary and secondary service separately. This is Step 3. These shall include the required support services and capital goods relevant to each primary and secondary service.

7.4.4. Step 4: Combine constituent service footprints for each final service footprint

- The organisation shall determine the footprint of each final service that can be purchased. This is Step 4.
- This shall include the primary service and a selected combination of secondary services.
- Each service shall be a process in the footprint of a good. A service footprint may be used as an emission factor of a process within the footprint of a good.

- For interactive online communication (after the user has selected their service options) every combination of final service can be displayed to the user as the calculated footprint, even if there are millions of combinations, and is a preferred option if possible.
 - For static communications this may be impractical in which case grouping may be applied as per Section 5.5.1. If grouping in accordance with 5.5.1, the functional unit may be generalised, in which case the functional unit shall be clear in defining what SKUs equivalent are grouped within the functional unit.
 - Example: Where the service is the provision of a hire car – and the insurance level selection does not change the footprint by more than 5% – the functional unit may be a ‘C-class car, per day, in the UK, including any insurance and one 60 litre tank of diesel fuel, but not including drop-off or pick up.’

7.5. Examples

7.5.1. Car hire service

- Emission sources (categorised by service type) that would be included in the example of a hire car:
 - Primary service – the provision of hiring a C-class car in the UK.
 - A capital good that relates to the primary service is the car. An apportionment of embodied emissions of the hire car based on hire period compared to full lifetime would be included.
 - Note: for EVs in relatively low grid intensity countries the embodied footprint may be the larger part of the footprint
 - Support services that may be required to deliver this primary service are car servicing, car maintenance and car cleaning – but materiality shall be tested here.
 - Secondary services – a 60 litre tank of fuel, drop off and pick up and fully comprehensive insurance. Whether these are included in the footprint depends on whether these are options chosen in the contract or website selection.
- Based on the above, the functional unit could be the hiring of a C-class car, per day, in the UK, including fully comprehensive insurance and one 60 litre tank of diesel fuel, but not including drop-off or pick up.
- There are many potential inclusions to this service footprint that can be shown to be immaterial, but this should not be confused with what is inside and outside of the boundary. Materiality shall be tested.

7.5.2 Provision of a mortgage

- Emission sources (categorised by service type) that would be included in the example of a mortgage provision:
 - Primary service – the provision of a mortgage.
 - The support services required to deliver this primary service could include emissions associated with servers and server room (if not on office site) and an apportionment of the Scope 1 and 2 emissions of the bank’s branches.
 - Secondary service – these could include paper or online correspondence.
 - The support services required to deliver this secondary service could include the postage service to deliver paper updates to customer homes.
- Based on the above, the functional unit could be the provision of a re-mortgage, including physical paper correspondence.

Note: This functional shall be clear that the service footprint covers transactional emissions of the service and not any financed emissions of the mortgage.

VERSION HISTORY

Version	Date	Summary of changes	Author	Approved by
1.0	11 February 2022	Initial version	Multiple	M. Barrow, S. Centty, J. Kazer, I. Catterall
2.0	11 October 2022	Technical changes in relation to requirements for: <ul style="list-style-type: none">• Product Consistency Criteria• Biogenic carbon• Verified Label, CO₂ measured scope• Verified Label, reducing CO₂ scope Further minor technical and editorial changes.	Multiple	M. Barrow, S. Centty, K. Dollery
3.0	24 July 2023	Technical changes in relation to requirements for: <ul style="list-style-type: none">• Data quality criteria• Separation of technical (Part 1) and label/claims (Part 2) Further minor technical and editorial changes.	Multiple	M. Barrow, M. Hockaday, J. Newton

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