PRODUCT CARBON FOOTPRINT TOOLKIT

Partnering to increase transparency and enable decarbonization

Check out our other sustainability toolkits at:
sigmaaldrich.com/sustainabilitytoolkits

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The materials in this toolkit are intended to serve as general guidance and background information only.

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Supplier Expectations

- Calculate product or service carbon footprints for items sold to us
- Request carbon footprints from your own supply chain to improve data quality
- Identify innovations and process improvements that reduce carbon footprints over time

We set supplier expectations across a variety of impact areas. Click here to view them all.

What You'll Find

The **Product Carbon Footprint Toolkit** will help you understand how to develop transparent, credible **Product Carbon Footprints (PCFs)**.

It provides practical guidance aligned with recognized standards, including **ISO 14067**, the **Together for Sustainability (TfS) PCF Guideline**, and the **Greenhouse Gas (GHG) Protocol**.

Review the Glossary to have a better understanding of the concepts discussed in this toolkit

Learn more about our sustainability strategy and goals here.

WHY DO PRODUCT CARBON FOOTPRINTS MATTER?

Carbon footprints translate climate science into a practical metric for action.

They quantify greenhouse gas emissions caused by an activity or product, making an invisible problem visible. By turning emissions into numbers, **we can track, compare, and improve carbon footprints to help prioritize our focus** to reduce climate impact.

Product Carbon Footprint Transparency

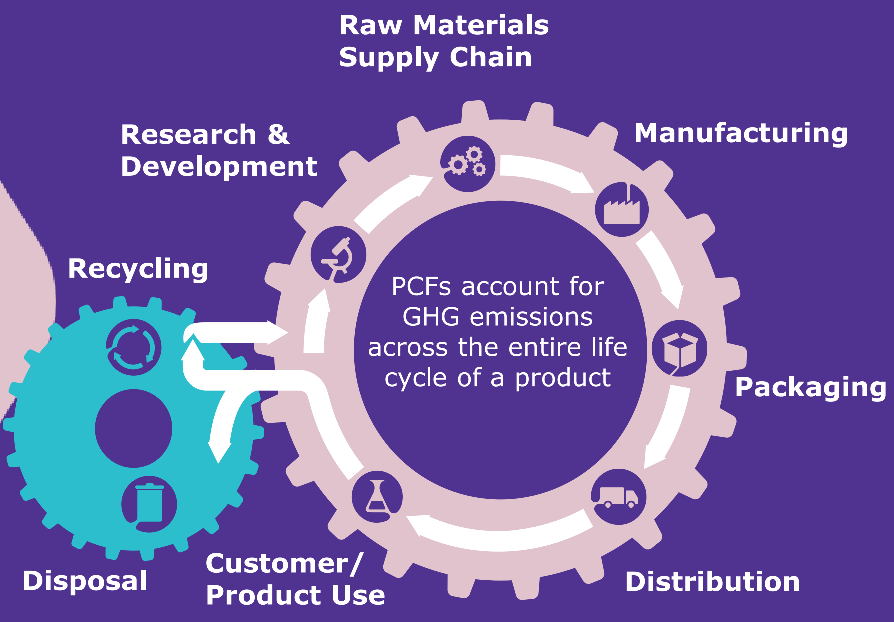
Sustainability is a strong driver for our business, and understanding product carbon footprint (PCF) data is crucial for guiding sustainable practices and supporting emission reduction targets. With purchased goods and services representing a significant portion of our overall emissions, **we urge suppliers to share their emission data**. This exchange of information is fundamental for building robust and sustainable business relationships.

Enhanced Decision Making

PCFs turn portfolio-wide climate impacts into quantifiable values, helping you prioritize where redesign and investment can have the greatest effect. By breaking emissions down across the life cycle, PCFs identify hotspots in materials, manufacturing, energy, logistics, use, and end-of-life. This helps teams focus improvement efforts where they can reduce emissions most effectively.

Supply Chain Context

For many companies, the majority of their GHG emissions—often **70%–90%**—lie outside their own operations, coming from the supply chain (Scope 3 upstream). Because Scope 3 emissions are often estimated using industry averages, supplier-specific PCFs can provide more precise emissions data and support more accurate reporting.



GET STARTED

1. Introduction

This toolkit offers comprehensive guidance on how to start calculating PCFs, emphasizing the importance of primary data in our collaborative efforts to meet our sustainability goals.

PCFs should be calculated using recognized standards & guidance:

- GHG Protocol
- ISO 14067
- Sector-specific guidance (TfS PCF Guideline)
- Cross-industry methodology (PACT Framework)

Using standardized guidance ensures that results are consistent, transparent, and decision-grade which builds trust with stakeholders and supports effective target setting, tracking, and reporting over time.

Have you started your Environmental Accounting Journey?

Before you calculate a PCF, it's essential to establish a robust foundation in carbon accounting. Developing a comprehensive inventory across all scopes of emissions is a **critical step toward creating verifiable** PCFs.

Review our Environmental Accounting Toolkit for more guidance in this process!

Our Supplier Code of Conduct

Emphasizes our expectation that suppliers develop a comprehensive greenhouse gas (GHG) inventory, actively monitor emissions, and provide emission data upon request. Click here for further information

Organizational Carbon Footprint (OCF):

- **Scope 1**
- **Scope 2**
- **Scope 3.1, 3.3, 3.4, 3.5, 3.6, 3.9**
- **Revenue** of same year as emission data

Not yet able to calculate PCFs?

To bridge the gap until product or service-specific carbon footprints are available, suppliers should provide Corporate Level emission data in form of an Organizational Carbon Footprint (OCF).

CASE STUDY

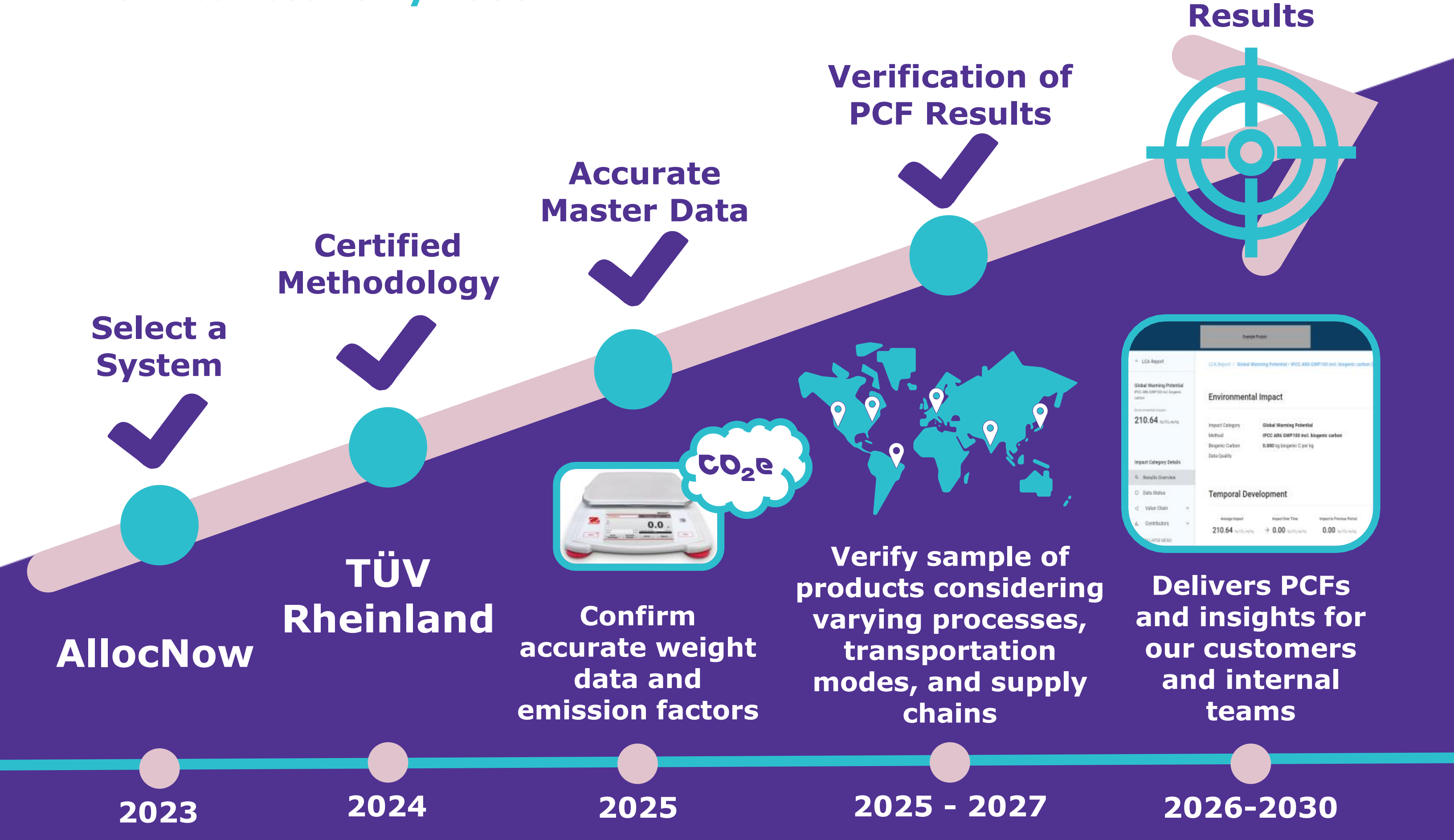
Our PCF Journey

In 2023, we decided to take a portfolio approach to calculating carbon footprints. We provide over 300,000 products, so calculating PCFs individually was not feasible. We selected a system which had the capability to calculate PCFs for all products in our portfolio.

We selected AllocNow, due to their ability to integrate with our Enterprise Resource Planning (ERP) systems as well as our carbon accounting software.

We calculated PCFs for all products in 2024 and began verifying data for the various ERPs in our ecosystem. In parallel, we have worked to verify weight and emission factor data for many of our products to produce trusted results that we can share with our customers.

We started communicating PCFs in 2026 and aim to have 100% of our portfolio calculated with verified results by 2030.



GET STARTED

2. Software Selection

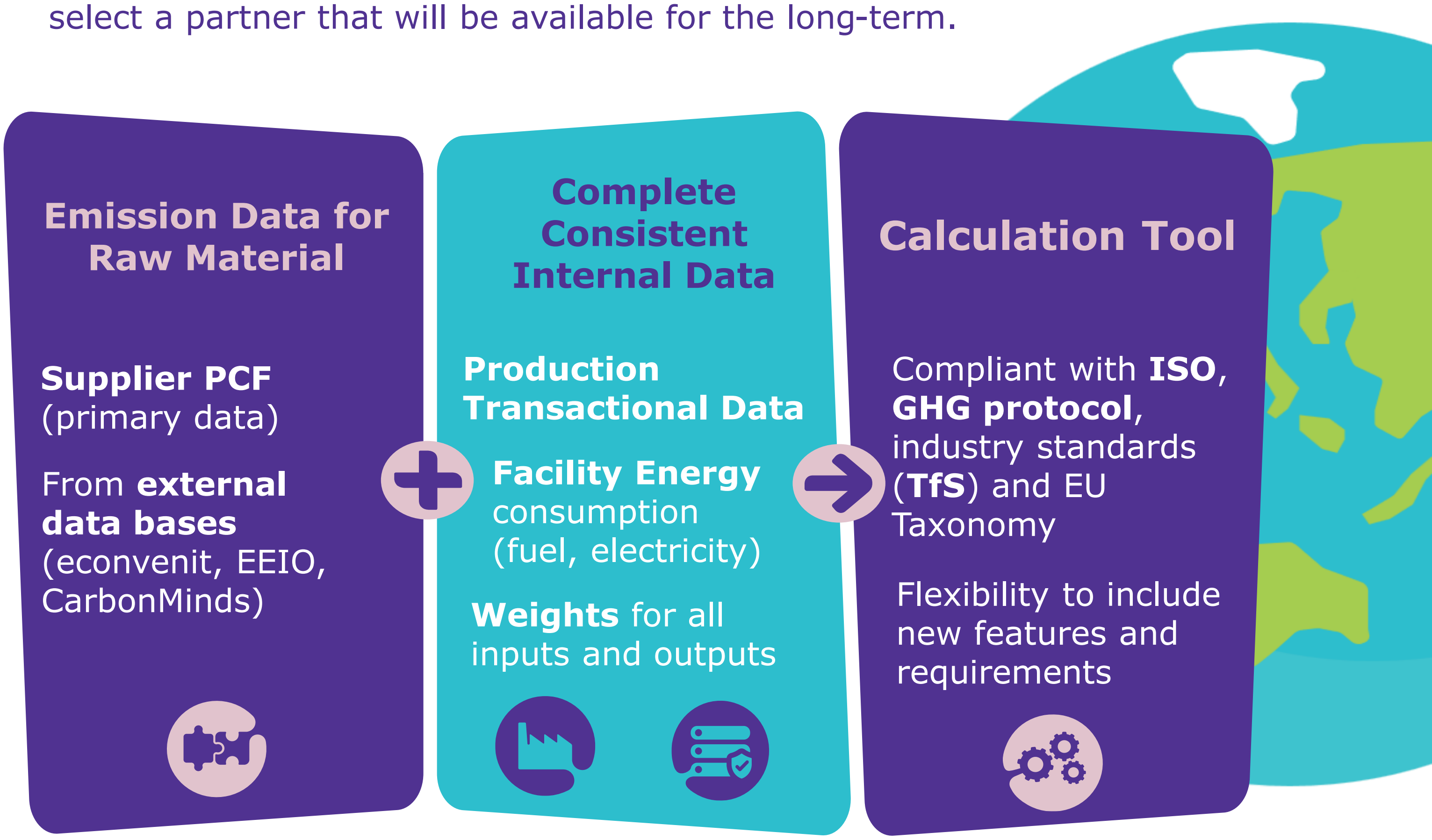
Using a commercially available PCF software offers multiple benefits over in-house solutions:

- Streamline data ingestion, emission factor management, allocation rules, and audit trails.
- Support repeatability and comparability across products and sites.

Whether you calculate PCFs for your entire portfolio or a subset will influence the best-fit calculation system for your strategy.

When selecting a solution, prioritize strong integration with your corporate data (especially ERPs and environmental accounting systems), evidence of sector adoption with peer references, and the ability to export machine-readable outputs in formats your customers accept.

Vendors typically provide up-to-date standards, governance features, audit logs, and verification support to speed customer acceptance. Assess a vendor's strategic roadmap and support during selection to ensure you select a partner that will be available for the long-term.



GET STARTED

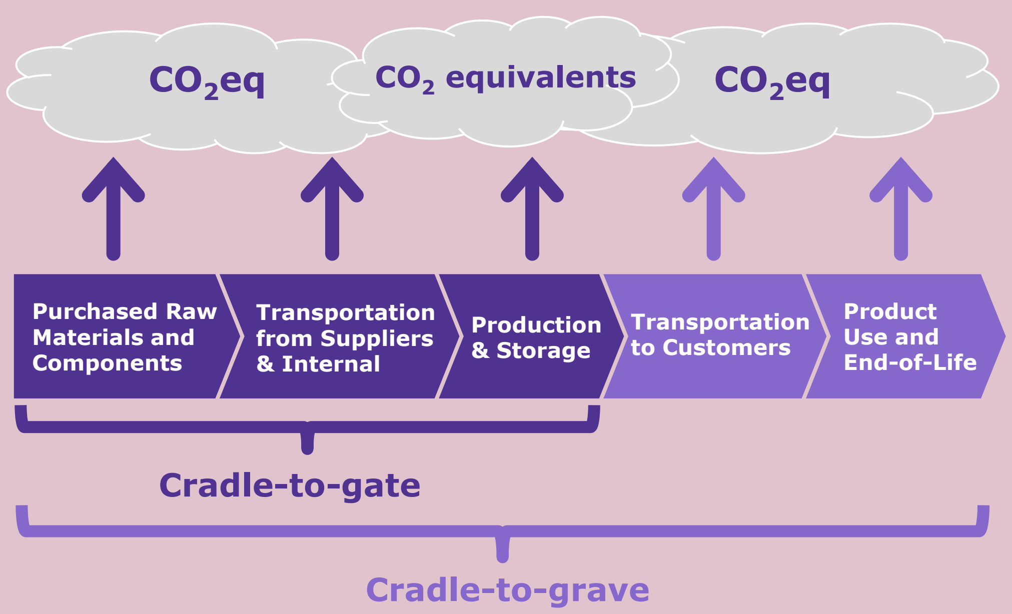
3. Understand Key Concepts

LCA vs. PCF?

Life Cycle Assessment (LCA) is a broader method that can cover multiple impact categories, while a PCF focuses on climate impact (GHG emissions). A PCF can be produced as a stand-alone figure or as the Global Warming Potential component of an LCA.

Cradle to gate vs. cradle to grave

Cradle-to-gate covers emissions up to the point the product leaves your facility; **cradle-to-grave** also includes emissions from product use and end-of-life. Select the scope that aligns with customer needs and your scope of control of emissions.



The reference unit to which the product's carbon footprint is calculated (1 kg of material, 1 component, 1 finished product). All activity data and emissions must be expressed per this unit.

What are your "Products"?

Service, Product, or Both? We expect suppliers of services and/or products to share **cradle-to-gate carbon footprints.**

GET STARTED

3. Understand Key Concepts

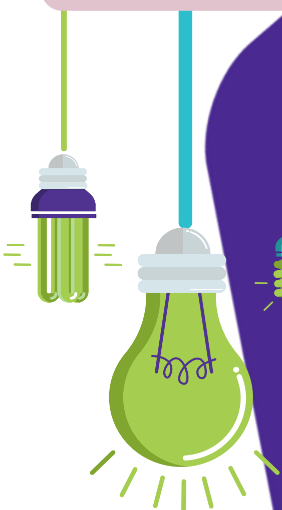
Primary data
Data measured directly at the production site, such as energy consumption, material inputs, waste amounts, or transport distances. This is the most accurate and preferred data source.

Secondary data
Data from literature, industry averages, or LCA datasets (e.g., ecoinvent). Used when primary data is not available.

CO_2 Equivalent (CO_2e)
A common unit of measure that expresses the combined effect of different greenhouse gases (e.g., CO_2, CH_4, N_2O) as if they were all CO_2. This ensures emissions are comparable.

Emission Factor
Climate impact per unit of activity (e.g., kg CO_2e/kWh, kg CO_2e/kg material), already converted using GWP and ready to use in PCF calculations.

Global Warming Potential (GWP100)
A factor showing how much warming a greenhouse gas causes over 100 years compared to CO_2. GWP100 is the mandatory timeframe required by ISO 14067, GHG Protocol, and TfS. Often represented as kg CO_2e/kg



TOGETHER FOR SUSTAINABILITY

We recommend to use the TfS PCF Guideline!

The Together for Sustainability (TfS) Product Carbon Footprint Guideline offers detailed calculation instructions for "cradle-to-gate" PCFs. While it was developed for the chemical industry, its principles can be effectively applied across various other sectors as well!

We’re also a member of TfS. Our suppliers have access to training materials at no cost, including PCF guidance. Build your skills with the TfS Academy.

GET STARTED

3. Understand Key Concepts

Biogenic vs. Fossil Carbon: accounting framework

Biogenic carbon
Carbon from recently living biological materials (e.g., wood, crops). Must be reported separately from fossil carbon.

Fossil Carbon
Carbon originating from non-renewable fossil sources. All emissions from fossil fuels count as fossil CO_2e.

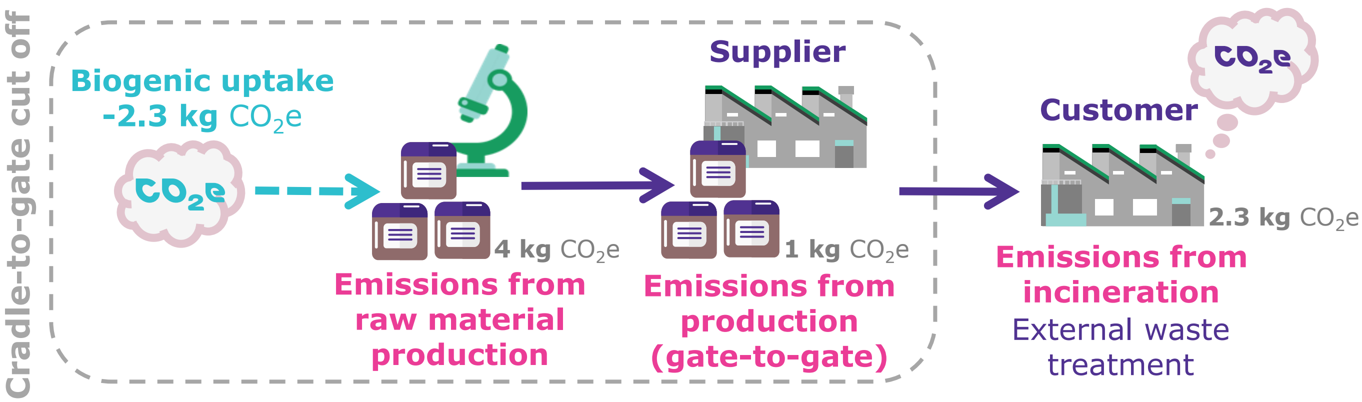
Bio-based products contain carbon that originally came from the atmosphere, absorbed by plants during photosynthesis. **This creates a short carbon cycle**, unlike fossil carbon, which adds "new" CO_2e to the atmosphere.

Biogenic carbon is important because it affects

- **PCF results** (bio-based products often have lower fossil emissions)
- **Carbon storage** claims (carbon remains stored in the product for a defined period)
- **End-of-life emissions** (biogenic CO_2e is treated differently from fossil CO_2e because it is part of a closed, short-cycle carbon loop, but it is still released back to the atmosphere)
- **Transparency** (avoiding misleading "carbon neutral" claims by clearly separating biogenic and fossil carbon flows)

Major standards require separate accounting of biogenic carbon. The PCF guidelines (TfS, ISO 14067, and the GHG Protocol) require reporting two values: **one PCF including biogenic removals and one excluding them**.

Example of biogenic solvent (carbon uptake) vs. fossil solvent



Solvent Source	Fossil	Bio-based
Raw Material Emissions (CO_2e)	4	4
Biogenic Uptake (CO_2e)		-2.3
Production Emissions (CO_2e)	1	1
PCF - cradle to gate (CO_2e)	5	2.7
PCF - cradle to grave (CO_2e)	7.3	5

PCF FRAMEWORK

The ISO 14067 standard consists *of four* iterative phases adopted from the ISO 14040/44 Life Cycle Assessment standard.

1. **Goal & Scope** establishes the purpose of the calculation, the intended use, the functional unit, system boundaries, and the assumptions and data quality requirements.

2. **Life Cycle Inventory** (LCI) then gathers and models all relevant material, energy, and emission data using reliable and verifiable GHG information.

3. **Life Cycle Impact Assessment** (LCIA) data is converted into CO_2 equivalent results based on recognized global warming potentials.

4. **Interpretation** evaluates completeness data quality, identifies hotspots, and assesses sensitivity to verify the results align with original Goal & Scope.

The phases interact continuously. Insights from Interpretation may require revisiting earlier phases to improve accuracy and transparency, ensuring a robust and credible PCF.

This framework provides a **structured**, **transparent**, and **repeatable** method for calculating and validating PCFs, enabling comparability, traceability, and confidence in product-level carbon results.

PCF Framework (ISO 14067 – aligned with ISO 14040/44 LCA standard)

STEP 1: Goal & Scope Definition

- Goal & intended use
- System boundaries
- Functional or declared unit
- Limitations and assumptions

STEP 2: Life Cycle Inventory (LCI)

- Data collection
- Data quality assmt.
- Mass & energy balance
- Applied methodological choices

STEP 3: Life Cycle Impact Assessment (LCIA)

Calculate the impacts on Climate Change (Global Warming Potential)

STEP 4: Interpretation

- Hotspot & sensitivity analysis
- Data quality check
- PCF results & communication

PCF FRAMEWORK

STEP 1: Goal & Scope Definition

This first step defines the purpose of the PCF calculation and sets the methodological rules and boundaries for how the PCF is calculated.

GOAL OF THE Calculation	Describe why you're conducting the PCF calculation and what business question it aims to answer. State the target audience and whether the PCF will be used internally or externally.
INTENDED USE	Describe how the PCF results will be used, such as customer disclosure, hotspot identification, improvement tracking, claims, etc. The intended use determines required precision, level of documentation, and review needs.
SYSTEM BOUNDARIES	Define what is included in the PCF calculation, such as product or variant covered, technical specifications and markets, geographic scope, reference time period, life-cycle boundary (cradle-to-gate or cradle-to-grave).
FUNCTIONAL OR DECLARED UNIT	Define the unit in which the PCF will be expressed (e.g. 1 kg, 1 piece, 1 liter). For cradle-to-gate studies, use a declared unit if the full function cannot be defined. Include relevant performance characteristics so results are meaningful and comparable.
LIMITATIONS & ASSUMPTIONS	Define the methodological rules and constraints, such as allocation approaches, cut-off rules, exclusions or proxy data, representativeness limitations (time, geography, technology), and known data gaps. Include data quality requirements such as completeness and consistency, precision and uncertainty considerations and data source hierarchy (primary vs. secondary). Clear documentation ensures transparency, reproducibility, and appropriate interpretation.

PCF FRAMEWORK

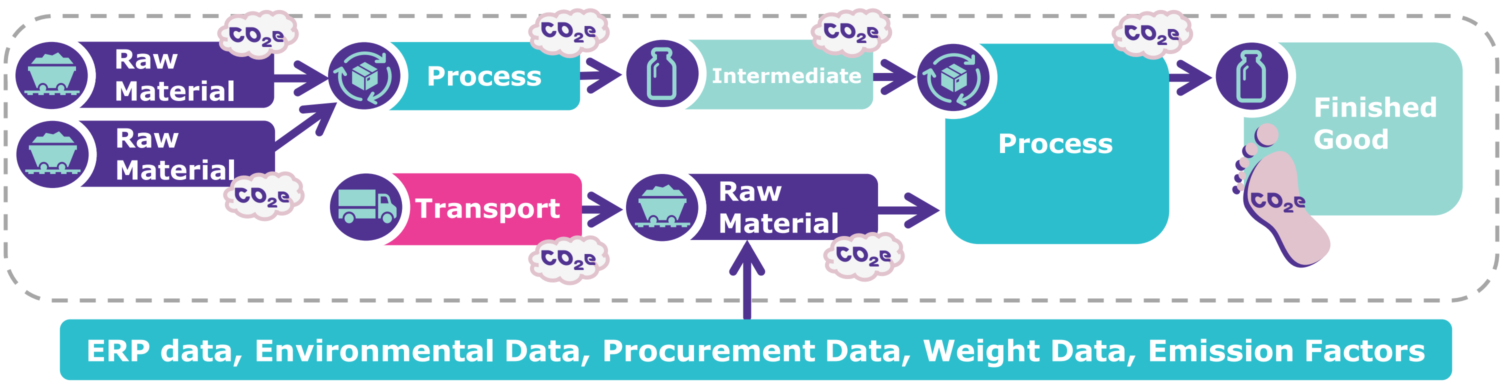
STEP 2: Life Cycle Inventory (LCI)

Identify and compile required datasets

Once the PCF strategy and goal/scope are defined, the next step is to collect, review, and prioritize the data needed to model the product system. **Typical datasets include:**

- **Operational emissions:** energy use and on-site process emissions (e.g., fuel combustion, steam, compressed air, direct process emissions)
- **Production transaction or Bill-of-Materials (BOM) Data:** product composition, material inputs, co-products, intermediates, and manufacturing steps.
- **Weight or mass data:** quantities needed to normalize results to the declared/functional unit (e.g., kg CO_2e per kg of product) and ensure correct scaling of inputs and outputs
- **Raw material emission factors (EFs):**
    - **Primary data:** Supplier-specific PCFs (preferred per TfS, ISO 14067 and GHG Protocol).
    - **Secondary data**: Reputable LCA databases used when primary data is unavailable.

MODELING OF PCF DATA



PCFs trace data from raw materials to finished goods. Each stage adds its own emissions, accumulating along the chain.

Emissions come from the footprint of raw materials and from energy and processes within the production system. Calculating these contributions requires data such as ERP data, energy and environmental data, procurement data, material weights, and emission factors from recognized LCA databases.

PCF FRAMEWORK

STEP 2: Life Cycle Inventory (LCI)

Plan & collect data

Data collection is usually the most time-consuming part of a PCF. Because collecting "perfect" data for every minor process is often impossible or too expensive, the LCI phase requires a structured and iterative approach:

- **Prioritize**
  Focus your effort on those parts of the life cycle or emissions categories that are most important for the overall impact.
- **Identify Sources**
  For each life cycle stage or unit process, specify the necessary *data source* (e.g. reactor operation) and *type* (e.g. measured, calculated) required.
- **Develop a Data Collection Landscape**
  Map all needed data sources, documenting location of data, data attributes, and any identified gaps.
- **Data Quality Check**
  Clearly state if you used *primary data* **–** your actual measures is preferred – or *secondary data* such as, industry averages or database values.
- **Completeness**
  If you omit something (like a specific component), state it and explain why.
- **Mass & Energy Balance**
  Double-check that the total materials and energy entering your system roughly match what leaves as product, scrap, or waste.

When supplier PCFs are unavailable for raw materials, obtain emission factors from secondary databases. Maintain a factors register (source, version, geography, year) for traceability and align these factors with corporate Scope 3 Category 1 reporting.

Click here to see our Environmental Accounting Toolkit for guidance.

Commonly used databases:

High-accuracy, activity-based data

- Ecoinvent
- CarbonMinds
- Sphera

Lower accuracy due to higher uncertainty

- EEIO: Spend based data

PCF FRAMEWORK

STEP 3: Life Cycle Impact Assessment (LCIA)

Once you've collected your inventory data, the next step is to translate those numbers into actual climate impact. The Life Cycle Impact Assessment (LCIA) phase converts raw inventory data such as material mass, energy consumption, and transports into environmental impact results, specifically quantifying the PCFs.

1. CORE CALCULATION FORMULAS

Depending on the type of data available, use one of the two standard formulas below.

Formula 1: Activity-based emissions

Used when you have consumption data (e.g., electricity bills or material weight).

$$\text{kg } CO_2e = \text{Activity data} \times \text{Emission factor}$$

Activity data: *amount of activity (e.g., kg of material, kWh of electricity)*
Emission factor: *kg CO_2eq per unit of activity*

Formula 2: *Direct emissions*

Used when you have the specific mass of a released gas (e.g., release of CH4).

$$\text{kg } CO_2e = \text{Direct emission} \times \text{GWP}$$

Direct emission: *quantity of gas released (in kg)*
GWP: *emission factor converting the quantity of gas released into kg CO_2e*

2. METHODOLOGICAL STANDARDS

Depending on the type of data available, use one of the two standard formulas below.

The 100-year GWP characterization factors (GWP100y) according to the Intergovernmental Panel on Climate Change (IPCC) shall be used in the PCF calculations, based on the IPCC’s Sixth Assessment Report (AR6).

Source: adapted from TfS Guideline, 2024

PCF FRAMEWORK

STEP 3: Life Cycle Impact Assessment (LCIA)

The below example outlines the cradle-to-gate process data for the Chlor-alkali electrolysis. The weighted average of selected material and energy inputs and outputs are shown per kg chlorine.

Fig1. Chlor-alkali electrolysis cradle-to-gate process data of data for PCF calculation

ACTIVITY DATA	DEVELOPING EMISSIONS INVENTORY PER ACTIVITY	CALCULATION OF EMISSION INVENTORY WITH ACTIVITY DATA	EMISSION FACTOR PER GHG	LIFE CYCLE IMPACT ASSESSMENT WITH GLOBAL WARMING POTENTIAL (GWP)-FACTORS	GHG EMISSION FACTORS / PCF DATA	
Using grid electricity	Calculation of GHG emission based on data from grid: GHG LCI / kWh	X 2.36 kWh	CO_2 0.395 kg CO_2 / kWh	CO_2 1 kg CO_2e / kg CO_2	CO_2 0.93 kg CO_2e / kg	
Purchase of salt	Dataset from supplier (TfS) cradle-to-gate PCF: PCF / kg oil	X 2.15 kg salt	CO_2 0.2 kg CO_2 / kg	CO_2 1 kg CO_2e / kg CO_2	CO_2 0.43 kg CO_2e / kg	CO_2 1.4 kg CO_2e / kg
Purchase of sulphuric acid	Dataset from LCA database cradle-to-gate LCI: GHG LCI / kg	X 0.01 kg sulphuric acid	CO_2 0.14 kg CO_2 / kg	CO_2 1 kg CO_2e / kg CO_2	CO_2 0.001 kg CO_2e / kg	
List of activities within system boundary to produce the product	Different sources for emission factors are available	Per declared unit 1 kg Chlorine	Inventory of GHG emission per impact contribution	GWP-factors translate individual GHG into the common unit CO_2e	Aggregated GHG emissions in CO_2e per declared unit	

The PCF calculation consists of the sum of each GHG released and removed from the product system.

 Source: TfS Guideline, 2024

PCF FRAMEWORK

STEP 4: Interpretation

The Interpretation phase is the final step of calculating a PCF. The goal is to understand what is driving your product's carbon footprint, check the quality of your data, and turn your findings into concrete next steps. This phase helps deliver a PCF that is meaningful, transparent, and ready for customer communication.

During this phase you should:

1. **Identify the main contributors (hotspots)**
   Determine which inputs, processes, or materials have the largest impact on the PCF (i.e. high-impact raw materials, energy-intensive steps, transport distances).

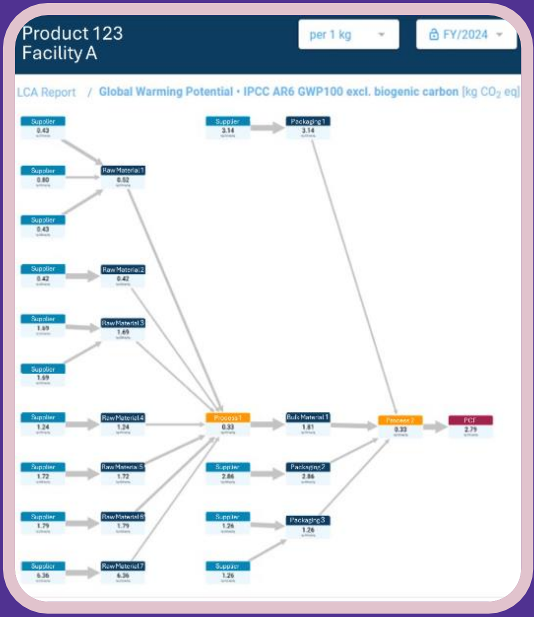
2. **Check data quality and consistency**
   Review the inputs and assumptions to ensure they align with the Goal & Scope.
   - Is activity data complete and representative?
   - Are emission factors up to date?
   - Is the modelling aligned with the defined system boundaries?

   This step increases the robustness and credibility of the results.

3. **Assess uncertainties, limitations and sensitivity analysis**
   Evaluate how much the results might change if different data or assumptions were used (sensitivity analysis) and acknowledge any limitations in the data.

4. **Verify results support the Goal & Scope**
   Confirm that the results answer the questions or objectives defined at the start of the project (Goal & Scope).

5. **Draw conclusions & recommendations**
   Convert the analysis into insights: opportunities to reduce emissions, processes to optimize, materials or suppliers to consider, points to monitor for future improvements



QUALITY AND VERIFICATION

5. Quality Assurance and Verification

A carbon footprint is an estimate of impact, not a fixed product attribute, and may change as data quality improves. Customers often expect or require third-party verification of your methodology.

Establish controls for data capture, transformation, and approval. Use dashboards to flag missing data, outliers, and unit errors. Assign clear data owner and reviewer roles.

Results depend on input quality—prioritize high-impact data like weights, emission factors, and energy use.

Improve data quality with internal programs and backend checks, including routine reconciliations (mass/energy balance) and automated validations. Benchmark emission factors and intensities against peers or databases to detect anomalies.

Implement calculations that follow ISO, TfS or GHG guidelines and undergo third-party verification. Specify standards and versions used, plus any company-specific rules when communicating PCFs. Consider limited assurance for initial disclosures and higher assurance for official claims or labels.

Third-Party Verification

Third-party verification provides your company and customers assurance that the PCF calculation methodology meets standards expectations and will produce results that can be trusted

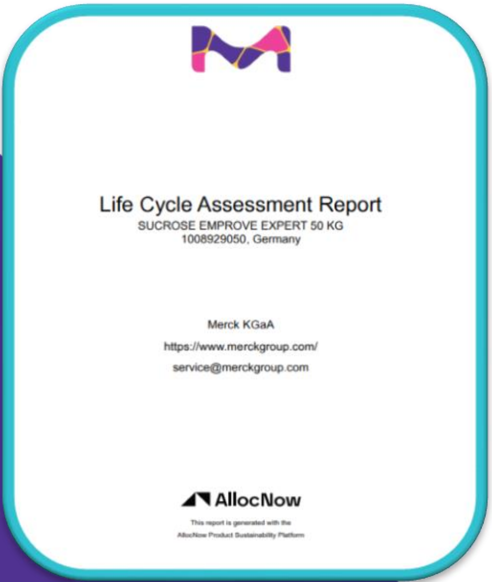
- Limited Assurance audits will confirm that the methodology is correct, but will not give confidence that specific PCF results are accurate
- Higher Assurance audits will look deeper into the input data sources and provide assurances that individual PCF results are accurate

DISCLOSE AND ACT

6. Disclose, Monitor, and Reduce Footprints

After calculating and verifying PCFs, decide how to communicate results. Align with customers on communication channels (e.g., direct sharing, portals, data platforms) and formats (machine-readable plus summary report).

Be ready to meet technical & governance requirements, such as those on PCF sharing platforms like Mattermaps (formerly SiGREEN). Assign an owner for managing PCF requests and always maintain a single source of truth.


Life Cycle Assessment Report
SUCROSE EMPROVE EXPERT 50 KG
1008929050, Germany

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AllocNow

Use your PCF results to identify reduction opportunities and capture improvements in updates. Communicate progress to customers.

- Review our other [Sustainability Toolkits](#) to see decarbonization strategies proven to work!

Reduction strategies include:

- Sourcing lower-emission materials or working with decarbonized suppliers
- Local sourcing to shorten transport and choose efficient modes
- Using renewables and cutting energy consumption
- Reducing waste, improving yields, and minimizing scrap or rework through continuous monitoring

Our Lessons Learned

- Start data clean ups (weights or emission factors) as soon as possible
- Gain program buy-in from senior leaders in all organizations that will participate in developing or sharing PCF data
- Identify stakeholders for all stages of PCF development
  - Commercial teams for PCF communications
  - Supply Chain teams for data verification
- Don't underestimate the time required to verify results
- Start data clean ups (weights or emission factors) as soon as possible

RESOURCES

Explore additional resources to enhance environmental accounting strategy and take further action.

Guidelines and Standards	**GHG Protocol Product Life Cycle Accounting and Reporting Standard** **ISO 14067:2018** **Together for Sustainability (TfS) PCF Guideline** **PACT Methodology for Product Carbon Footprints** **GHG Protocol Corporate Standard (Scope 1&2)** **GHG Protocol Scope 2 Guidance** **GHG Protocol Corporate Value Chain Standard (Scope 3)**
Overview of LCA Software	**Common LCA & PCF Software** (neither exhaustive, nor ranked): **AllocNow:** A PCF-focused platform designed for cradle-to-gate calculations, automated data pipelines (ERP, procurement), and TfS-aligned outputs. **GaBi (Sphera):** One of the most widely used LCA software systems globally, with large industrial datasets and strong modelling capabilities. **SimaPro (PRé Sustainability):** A long-established professional LCA platform used in academia and industry, with broad database access (ecoinvent, Agri-footprint, etc.). **OpenLCA (GreenDelta):** Open-source LCA software used for flexible modelling, research, and custom projects; supports multiple database formats.
Example PCF Report	Example PCF Report
Biogenic Carbon Resources	Improving and harmonizing Scope 3 Reporting: Biogenic Carbon

PCF FRAMEWORK

Life Cycle Inventory

Example of a simplified **LCI spreadsheet** with the data need to be collected for subsequent impact assessment. The data must be related to the declared/functional unit.

General description	
Process/product name	Name of the process/product reported
Functional unit or declared unit	e.g. 1 kg of finished product, m2 of treated surface
Date of issue	Date of the data collection
Annual production	e.g. 40.000 kg
Process/product description	General description of the process and technical parameters (e.g. yield, scrap rate, nominal performance)
Process Flow chart/ system boundary	Process chart including the process steps and what is included and not. This helps to understand which process steps are included in the data collection

Inputs per declared unit				
	Amount	**Unit (kg/declared unit)**	**Data origin (measured, calculated, literature)**	**Completeness/ methodological remarks/comments**
Raw materials		kg		% recycled content
Consumables, operating materials		kg		
Energy		kWh, MJ		Electricity, natural gas, diesel
Water		m3, L		Recirculating/pure
Transport		km		Type of transport

Outputs per declared unit				
	Amount	**Unit**	**Data origin**	**Completeness/ methodological remarks**
Reference product		kg		
Co-product (s)		kg		
Emissions to air, water, soil		kg		
Waste, wastewater		m3, L		Specify waste treatment (landfill, recycling, incineration)

GLOSSARY

Allocation: A method used when a process produces multiple products or by-products. Common allocation methods: Mass allocation, Economic allocation, Energy or chemical content–based allocation. Allocation ensures emissions are fairly shared between co-products.

Carbon Accounting: The process of measuring and managing a company's greenhouse gas emissions, often using established protocols and standards to ensure accuracy and consistency.

Carbon Footprint Reduction Strategies: Actions taken to lower greenhouse gas emissions, such as improving energy efficiency, transitioning to renewable energy sources, optimizing supply chain logistics, and enhancing product design.

Carbon Neutrality: Achieving a balance between emitting carbon and absorbing carbon from the atmosphere, often through a combination of reducing emissions and investing in carbon offset projects.

Carbon Offsetting: The process of compensating for carbon emissions by investing in projects that reduce or remove an equivalent amount of carbon dioxide from the atmosphere, such as reforestation or renewable energy projects.

Carbon storage claims: Indicate that part of the carbon is retained in the product or system for a certain time instead of being immediately released to the atmosphere, which may influence how climate impacts are reported

Cut-Off Criteria: Rules for determining which inputs or processes can be excluded from the calculation (e.g., very small contributions). All exclusions must be justified and documented.

Decarbonization: The process of reducing carbon emissions associated with energy use and other activities, often through the adoption of cleaner technologies, renewable energy sources, and improved efficiency.

Emission factor per GHG: The amount of each greenhouse gas released separately (e.g., CO_2, CH_4, N_2O). Used together with GWP factors to calculate CO_2-equivalents.

Hotspot Analysis: A method used to identify the stages in a product's life cycle or specific processes that contribute the most to its carbon footprint, allowing organizations to prioritize reduction efforts.

GLOSSARY

Net-Zero Emissions: The goal of reducing greenhouse gas emissions to as close to zero as possible, with any remaining emissions being balanced by removing an equivalent amount of carbon from the atmosphere.

Product system: a collection of unit processes with their elementary and product flows that together perform one or more defined functions and model the life cycle of a product.

Recycled Content: The proportion of raw materials that come from recycled sources. Can be pre-consumer (industrial scrap) or post-consumer (collected after use).

Scope 1 Emissions: Direct greenhouse gas emissions from owned or controlled sources, such as emissions from fuel combustion in company vehicles or facilities.

Scope 2 Emissions: Indirect greenhouse gas emissions from the generation of purchased electricity, steam, heating, and cooling consumed by the reporting company. These emissions occur at the power plant level.

Scope 3 Emissions: All other indirect emissions that occur in a company's value chain, including both upstream emissions (from suppliers) and downstream emissions (from customers). Scope 3 often represents the largest portion of a company's total emissions.

Short-cycle carbon loop: Carbon absorbed from the atmosphere by biomass is returned as CO_2e over a short time frame (years to decades), unlike fossil carbon which introduces long-stored carbon into the atmosphere.

Supplier Engagement: The process of collaborating with suppliers to improve their sustainability practices and obtain accurate data on their emissions, which is essential for calculating scope 3 emissions.

Sustainability Reporting: The practice of disclosing environmental, social, and governance (ESG) performance and impacts, including carbon emissions, to stakeholders, often following established frameworks like the Global Reporting Initiative (GRI).

Third-Party Verification: An independent assessment of a company's carbon footprint calculations and methodologies to ensure they meet established standards and provide reliable results.

Transparency: The practice of openly sharing information about emissions calculations, methodologies, and results with stakeholders, which builds trust and credibility.