PACT
PARTNERSHIP FOR CARBON TRANSPARENCY

Calculating the carbon footprint of your products

A simple how-to guide for those beginning their product carbon footprint journey

PACT, April 2025

Powered by WBCSD World Business Council for Sustainable Development

This guide is meant to help you begin your Product Carbon Footprint (PCF) journey

This guide in brief

Why? Getting started with product-level carbon accounting can seem daunting – this guide hopes to answer common questions and make users feel empowered to get started

What? This guide is a simple introduction to PCF calculation in accordance with the PACT Methodology and how it can be used

For whom? Any company wanting to calculate PCFs for the first time but unsure how to get started

How to use this guide

This guide has **three sections**:

1. **Introduction:** introduces the key concepts around PCFs and contextualizes them
2. **The PCF Journey:** main section – describes step-by-step approach to calculating a PCF from scratch
3. **Levelling Up:** explains how you can take your PCF to the next level and unlock its full potential

Throughout the guide you will find **deep-dives and exercises** so you can learn more about specific concepts and test your newly acquired knowledge.

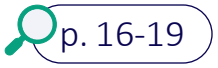
You can jump back and forth between sections to review concepts at any point

Note: How-to-guide content will be updated accordingly once updated versions of the PACT Methodology are released or when additional clarity is needed based on users' feedback. A *table* in the updated versions of the PACT Methodology will be available to understand what changed from previous versions.

This guide assumes no prior knowledge of the PACT Methodology or PCFs – however, more advanced users might still find it valuable

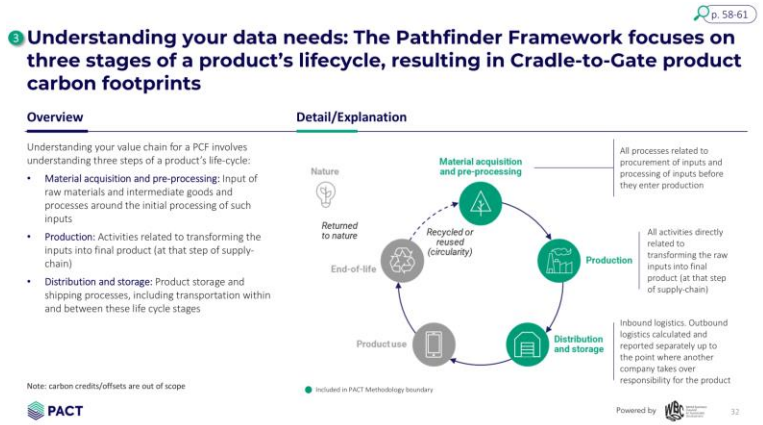
If you are…	…this guide can help you	Start with…
Beginning: You have never calculated a product carbon footprint before, and are not familiar with the PACT Methodology	**Understand:** Understand the key concepts and steps needed during a PCF calculation	Introduction
Intermediate: You have started calculating PCFs using the PACT Methodology but may still have specific questions	**Review:** Review specific methodological questions that frequently come up	The PCF journey
Advanced: You have already calculated many PCFs and know the PACT Methodology inside-out	**Find inspiration:** Find inspiration on how you can leverage PCFs to unlock value for your organization	Levelling Up

Structure of the document

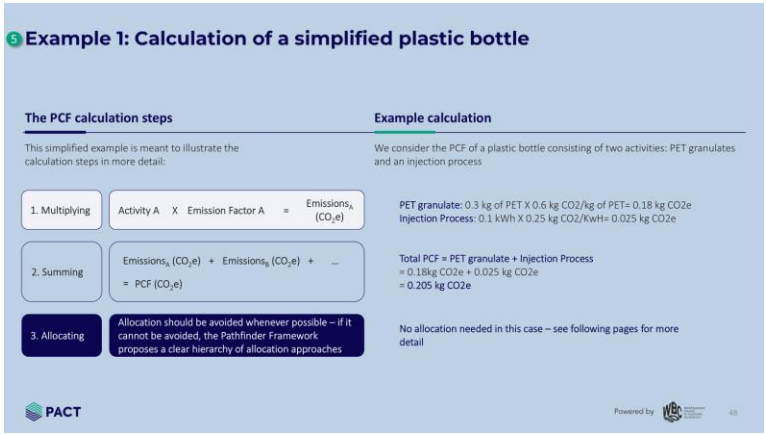
Part 1: Introduction	Understanding the why, what, and how of Product Carbon Footprints
Part 2: The PCF Journey	A step-by-step guide to calculating a PACT Methodology-PCFs from scratch
Part 3: Levelling up	Taking your PCF journey to the next level
Glossary	Useful definitions
	When this logo appears, it means that the item is a specific PACT requirement
	This will give you relevant pages in the PACT Methodology

Overview of page types throughout the document

Methodology pages



Example pages



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Part 1: Introduction

Understanding the why, what, and how of Product Carbon Footprints

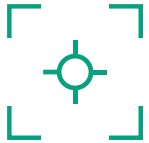
Jump to

Part 1: Introduction
Part 2: The PCF Journey
Part 3: Levelling Up

To empower you and your value chain to make smart, carbon-informed business decisions to reach net zero, carbon emission data must be

Accurate

Reflecting real emissions incurred based on primary and verified data



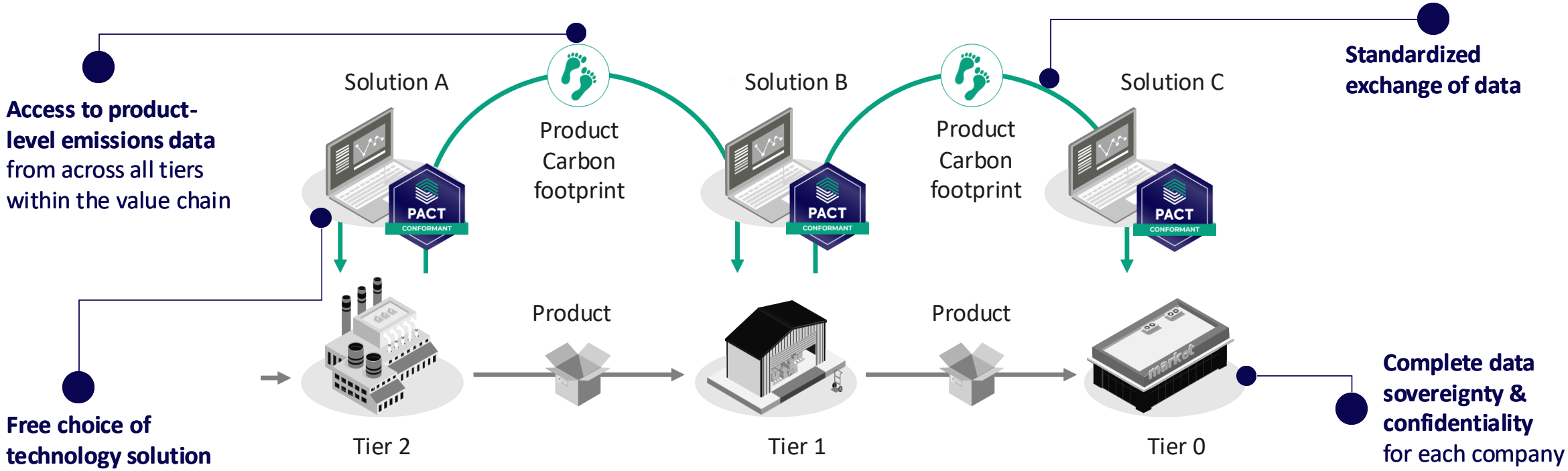
Granular

Linked to individual products (rather than aggregated corporate data)

Comparable

Based on one standard approach for calculation and exchange

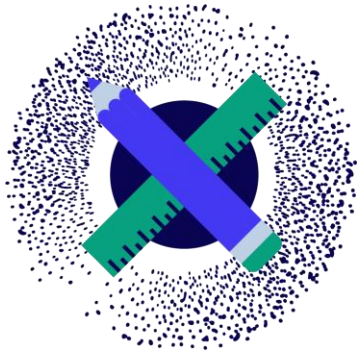
By having granular transparency, each company is able to take carbon-informed decisions…



...across various functions within the business

Procurement

- **Select suppliers** based on product carbon intensity
- Collaborate with suppliers to **drive lower-carbon innovation**



Product design

- **Reformulate products and ingredients** to lower emission
- Focus your Research & Development efforts on **designing lower-carbon products**

Sales

- **Introduce transparent carbon labels and tags** to promote low carbon products
- **Implement premium pricing** for low- to zero-carbon products

Disclosure & Reporting

- **Conduct annual product-level carbon baselining** to report progress toward climate commitments
- **Harmonize disclosure mechanisms** reducing "survey fatigue"

Curious already? Check out this section for more information on how a PCF can generate value for your organization and for your customers

To achieve granular emissions data, companies need to measure GHG emissions associated to purchased products, also known as PCFs

What is PCF

A Product Carbon Footprint (PCF)

- Measures the **total GHG emissions** of a product in CO_2e
- Includes emissions generated during **different life cycle stages** of a product
- Can be **calculated for any product** – no matter how complex the product is

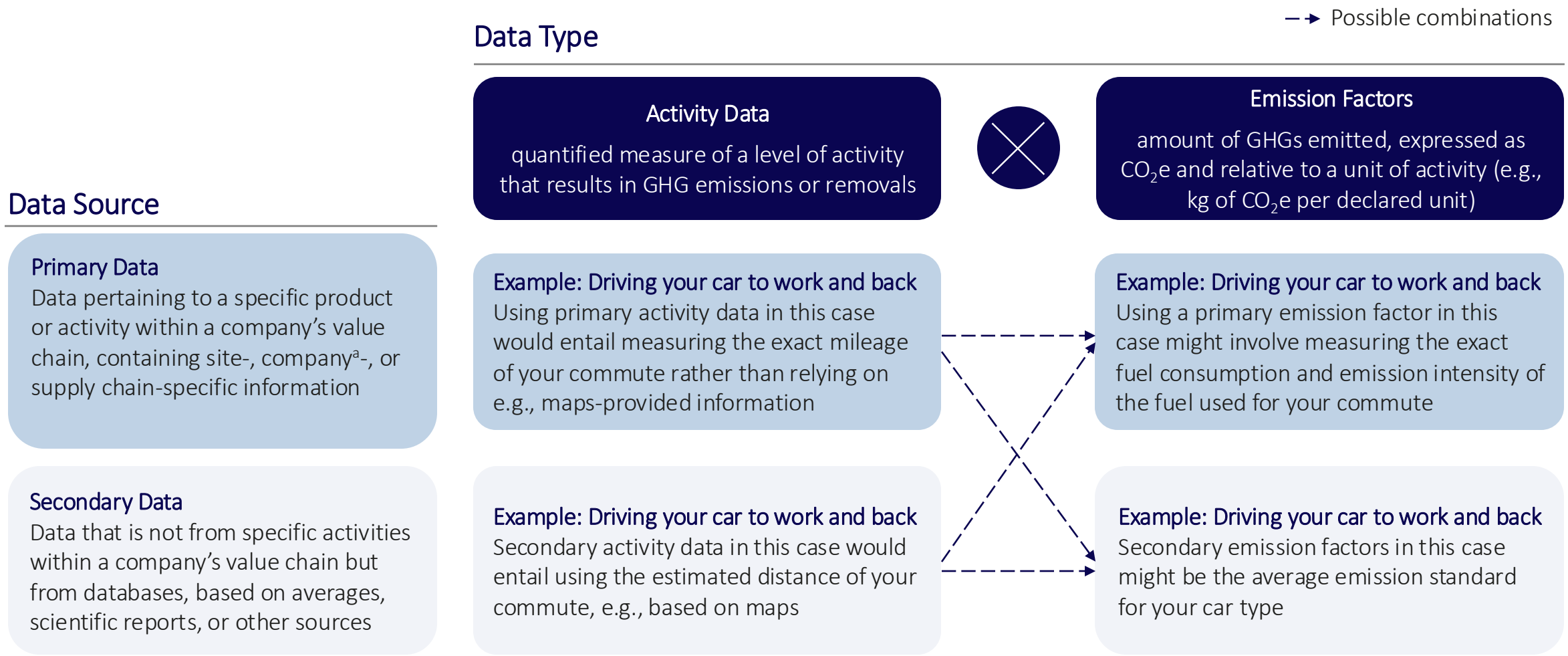
Common characteristics of a PCF

Relative metric: PCFs reflect the emissions intensity of any given product – a PCF is thus expressed as kg CO_2e per declared unit of the product

Targeted scope: A PCF focuses on GHG emissions – it is therefore less comprehensive and more targeted than a full life-cycle assessment (LCA)

Multiple uses: A PCF can be used for many purposes – these include tracking decarbonization measures as well as marketing

A PCF has two main “ingredients” – activity data and emission factors – both of which can be collected from primary or secondary sources



a. If there are multiple sites for the same product

PCFs can have several different boundaries depending on the activities related to the product manufacturing included by the company

Possible boundaries for a PCF

Gate-to-gate:

- A gate-to-gate PCF includes only the emissions resulting from activities within a reporting company's own facilities, not their value-chain

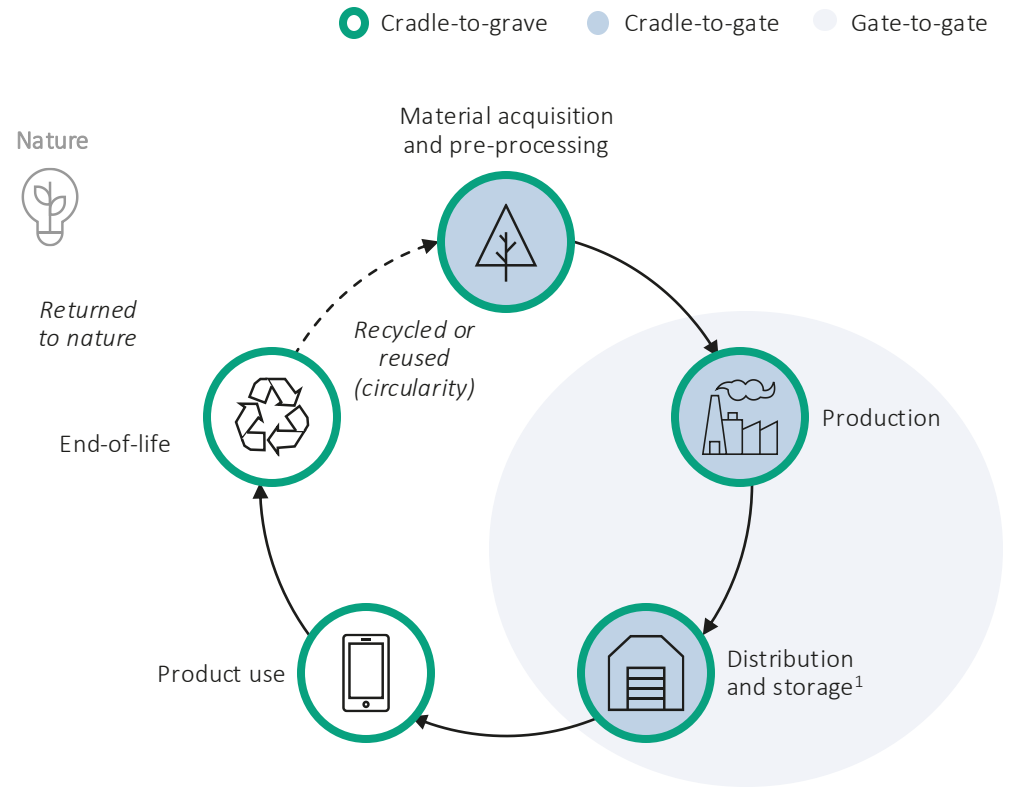
Cradle-to-gate:

- A cradle-to-gate PCF includes all emissions resulting from activities upstream of the reporting company as well as within the company. PACT conformant PCFs are cradle-to-gate PCFs (highlighted in green on the right)

Cradle-to-Grave:

- A cradle-to-grave PCF includes emissions from all processes associated with the product, including downstream processes (e.g., use and end-of life), after the product has left the company's control

Lifecycle stages and boundaries



1. Contains product storage and shipping processes, including transportation within and between these life cycle stages. Outbound transportation and storage should be calculated and reported separately up to the point where another company takes over responsibility for the product (i.e., owns or pays for outbound logistics).

Deep-Dive: Understanding the definition of a “gate”

Context

There are **different ways** to define the “gate” in “cradle-to-gate”

In particular, you may have three questions:

- **Whose gate** is the gate in question?
- To what extent are **steps after** a product leaves the company’s gate included?
- To what extent may the definition of a gate **vary by context** (e.g., industry)?

Explanation

Whose gate?

The gate refers to the **exit gate of the reporting company,** i.e., the gate as the product leaves the reporting company’s direct control.

It does **not refer** to the customer’s gate.

Are any steps included after the product leaves the company’s gates?

If a reporting company **directly transports and stores a product at its own facility or pays a 3rd Party to do so**, this transportation and storage is calculated and reported separately from the cradle-to-gate PCF (see visual explanation here)

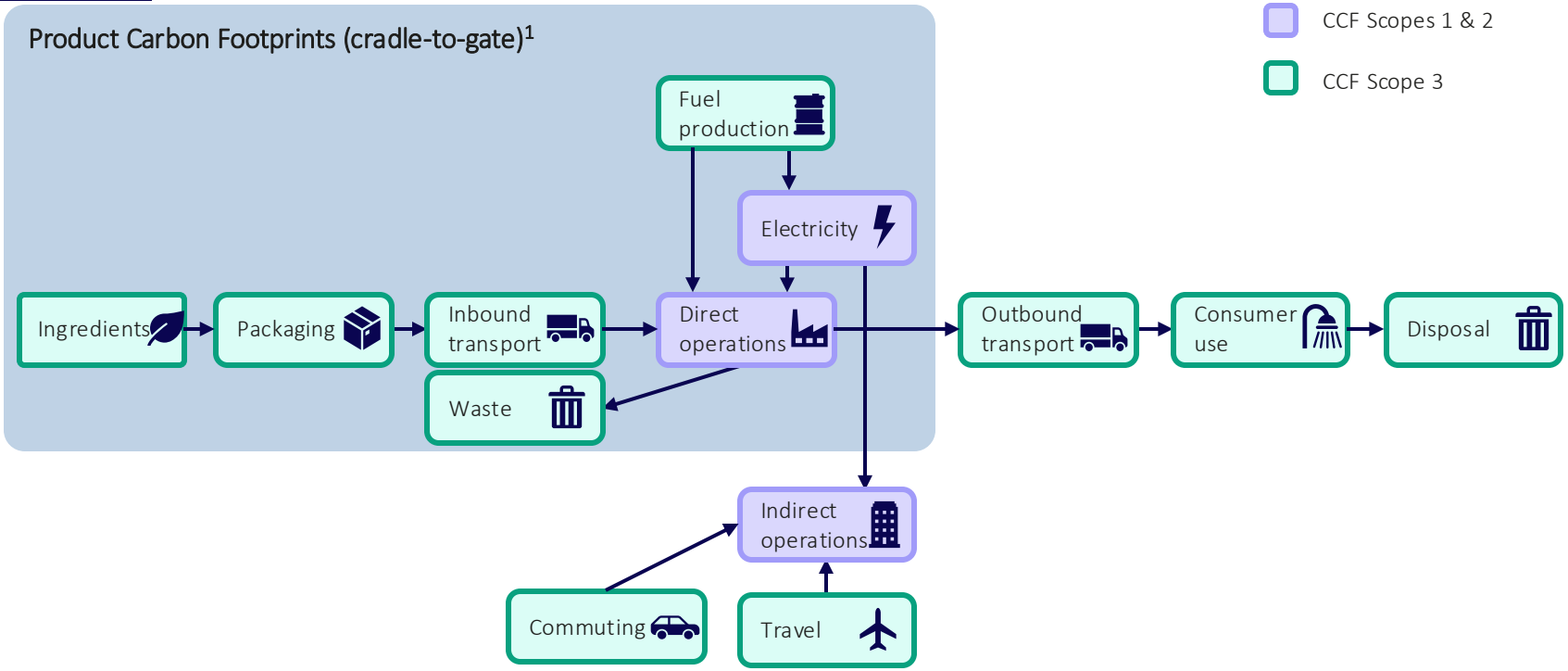
If another company manages transportation and storage, it is not calculated and reported by the reporting company.

Does the definition of gate depend on context?

Depending on the industry and business model of the company, it may be that **specific steps should be included** in a cradle-to-gate PCF even after a product has left the company’s gate.

Although PCFs and Corporate Carbon Footprints differ in the scope and categorization of GHGs, PCFs can be incorporated into corporate footprints to bring greater accuracy

Differences & interconnections between Corporate Carbon Footprints (CCFs) and PCFs



Conclusion

- Supplier-specific PCFs can be leveraged by companies to **improve the granularity of their corporate inventory**
- Greater granularity will also enable companies to **better track any decarbonization action** they may wish to implement in collaboration with suppliers or in relation with a given product

1. PCFs may also be cradle-to-grave, in which case their coverage would extend to outbound transport, consumer use and disposal

The PACT Methodology is PACT's industry-agnostic emissions accounting methodology, which was launched in April 2025 (v3)

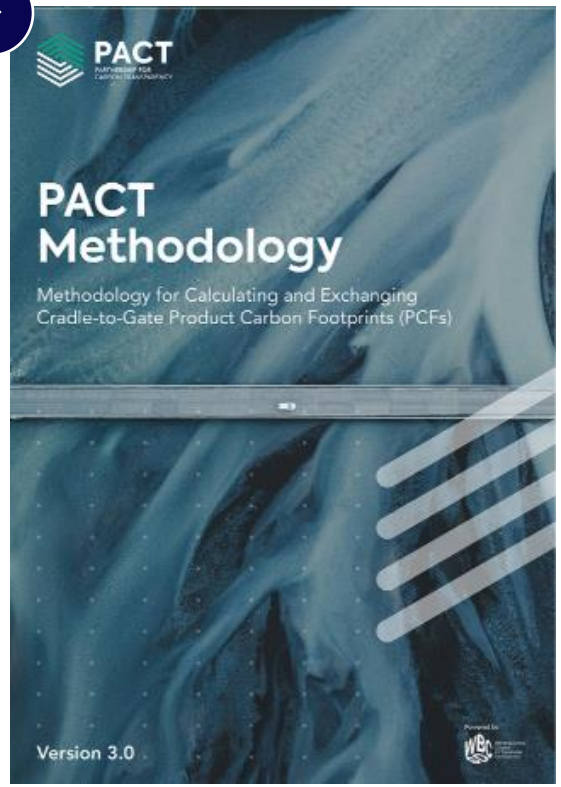
Context

Why?

Harmonization: diverse and diverging approaches to product-level accounting

Consistency: too much flexibility in current accounting methodologies

Ambition: Encouraging companies to get started and providing pathways to improve



Building blocks

Emissions accounting

- Existing methods and standards
- Scope and boundary
- Calculating PCFs

Data integrity

- Data sources and hierarchy
- Primary data share calculation
- Data quality assessment

Verification

- Verification roadmap

Data Exchange

- Data attributes for data exchange
- Integrating PCFs into Scope 3 inventories

Download the PACT Methodology here

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Part 2: The PCF journey

A step-by-step guide to calculating a PACT Methodology-aligned PCFs from scratch

Jump to

Part 1: Introduction | Part 2: The PCF Journey | Part 3: Levelling Up

Moving to product level can seem challenging – which is why starting with key material products and suppliers is essential

Key challenges

- **Large product portfolios** making it difficult to calculate individual PCFs for all of them
- **Data gaps** meaning not all relevant information will be easily available
- **Significant resources required** to get started, and even more to scale product-level carbon accounting
- **Reliance on external stakeholders** when working with supply-chains emissions – a company cannot calculate a PCF on its own

Our proposed approach

- **Top-Down:** As you begin your PCF journey, focus on most material purchased products
- **Strategic:** Improve data quality and availability where it matters most
- **Iterative:** Begin small (i.e., key material products and suppliers) to learn by doing and establish processes
- **Collaborative:** Invite suppliers to be part of the journey, upskill, and share knowledge with each other

Your PCF-journey, from start to finish, involves 8 steps

1 Selecting a product

Overview: Choosing a product to calculate the PCF to get the most value out of the data

2 Choosing a calculation basis

Overview: Picking the calculation standard best suited to your products and requirements

3 Understanding your data needs

Overview: Mapping the value chain of your product enables you to gather the right data

4 Collecting data

Overview: Gathering activity & emissions data for all activities associated with your product

5 Calculating the PCF

Overview: Calculating the PCF and taking additional steps as needed, e.g., allocation, biogenic emissions

6 Assessing data reliability

Overview: Assessing data reliability using quantitative and qualitative metrics

7 Verifying your PCF

Overview: Ensuring data reliability through third-party verification

8 Exchanging your data

Overview: Consolidating all information around your PCF and sharing it with other stakeholders

Each step includes **key explanations, content deep-dives, examples and exercises** for you to test your understanding

Meet Chocolate Corp.! Throughout this guide, we will follow (fictional) Chocolate Corp. on its PCF journey, and see how they implement each step of the journey

Context

Chocolate Corp. is a Swiss chocolate manufacturer, selling their chocolate products on all continents

Their product portfolio consists of **100+ delicious chocolate products**

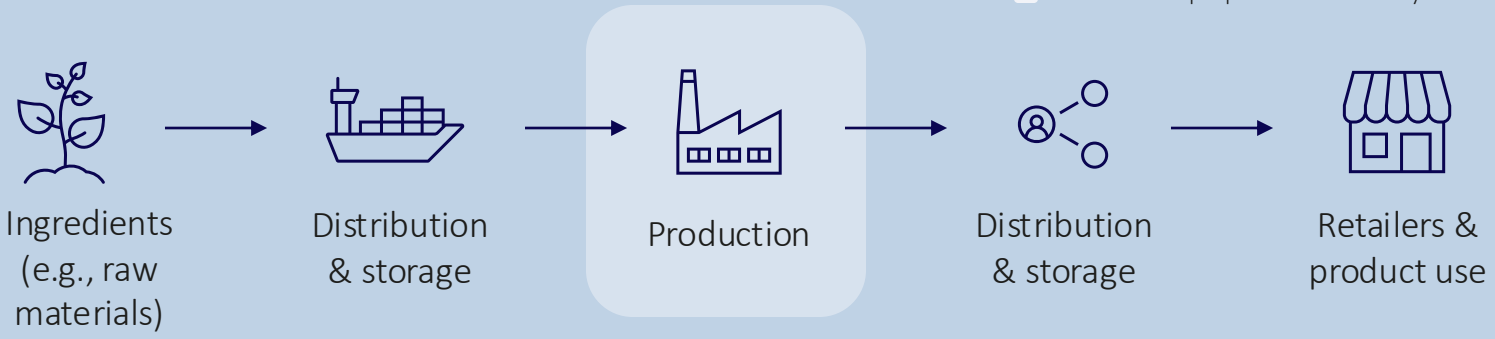
Chocolate Corp. is **committed to decarbonization** and has set ambitious targets

Situation

Chocolate Corp. has decided it needs more granular emissions data – both **to achieve its sustainability targets and to meet increasing regulatory and customer demands**

Chocolate Corp. has a solid **corporate-level emissions baseline** but has never implemented product-level carbon accounting to improve Scope 3 accuracy before.

Position in the value chain



Please note: this example is entirely fictional and has been simplified for illustrative purposes

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1 Selecting a product: Choosing the right data inputs can increase the value of your PCF Calculation - three considerations for strategic product selection

Overview

Before deciding which products to focus on, you should consider these three dimensions:

- **Stakeholders:** Have key stakeholders (e.g., a customer) requested this information?
- **Capability:** Which internal and supplier capabilities can be leveraged to obtain a PCF?
- **Strategy:** Which PCF data will be most important in your strategy?

Detail/Explanation

By considering these three aspects in a **materiality assessment**, you can compile a **list of prioritized products** to obtain PCFs from:

Focusing on products that meet the **reporting needs of key stakeholders**, e.g., customers, regulators or investors

Focusing on products for which the **greatest capabilities already exist**, e.g., due to past LCA or in depth understanding of product

Focusing on products which are **strategically** the most important, e.g., from a financial, decarbonization, climate related risk or branding perspective

1 Example: Ranking products based on likely priority for PCF calculation - representative product selection

TBC

Exercise: Read through the descriptions of the different products and choose five products you think should be prioritized for a PCF calculation, from highest to lowest priority. You can create the ranking simply by dragging products up and down.

Chocolate Corp. Product Overview (ranked by revenue)

Product	Revenue (% total)	Emissions (% of Scope 3)*	Customer Demand	Regulatory Demand	Previous PCF or LCA	Representative Product
1 – Dark Chocolate Bar	30%	20%	No	No	No	Yes
2 – Dark Chocolate Coating	20%	20%	Yes	No	No	Yes
3 – Milk Chocolate	15%	30%	Yes	No	No	Yes
4 – Cocoa Powder	10%	10%	Yes	Yes	Yes	No
5 – White Chocolate	10%	10%	No	No	No	No
6 – Chocolate Spread	5%	5%	No	No	No	No
7 – Vegan Chocolate	1%	5%	Yes	No	No	Yes

*Based on initial scope 3 calculation using secondary databases

Prioritized Products

1. Dark Chocolate Coating
2. Dark Chocolate Bar
3. Milk Chocolate
4. Cocoa Powder
5. Vegan Chocolate

1 Example: Chocolate Corp. decides to focus its initial PCF calculations on five products, both to meet stakeholder expectations and to set a foundation for the future

Chocolate Corp. Approach

Chocolate Corp. begins by mapping products against the three categories to identify potential overlaps or synergies:

Stakeholder Focus

- Key downstream customer has asked for emissions data on **chocolate coating** products
- New regulation demands granular emissions data for **cocoa powder**

Capability Focus

- **Pre-existing LCA capabilities** only available for cocoa powder for any particular products
- However, capability building most important for key processes – e.g., milk chocolate as a key ingredient for many products in the portfolio

Strategy Focus

- **30% of revenue** generated from simple dark chocolate bar, exposed to greater climate risks due to location of source
- However, **30% of emissions** related to milk chocolate bar due to higher emission intensity
- **Vegan chocolate** strategic product to open up new markets

Prioritized Products

- **Cocoa powder and dark chocolate coating** to meet stakeholder demands
- **Dark chocolate** as a revenue driver
- **Milk chocolate** as a strategic product in the portfolio to build PCF capabilities and reduce emissions
- **Vegan chocolate** to position the brand as a low-carbon alternative

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2 Choosing a calculation basis: Your chosen calculation standard will determine how you approach the calculation – it should fulfill three criteria

p. 21-24

Overview

In the context of PCFs, calculation standards provide guidance regarding boundary of a PCF, calculation steps and data requirements as well as data quality considerations. Standards seek to achieve consistency and comparability of PCFs.

Detail/Explanation

When choosing a calculation standard, you should consider these three criteria to determine whether a standard is suitable for your PCF:

Granular: Your chosen calculation standard needs to be on the appropriate level of granularity for a PCF, i.e., the product-level

Specific: Your chosen calculation standard ideally is specific to your particular product – this will give you more guidance when conducting the calculation

Aligned: Your chosen calculation standard should be aligned with the PACT Methodology, industry expectations and regulatory requirements

2 Deep-Dive Calculation Standards: What do we mean by calculation standards?

p. 22

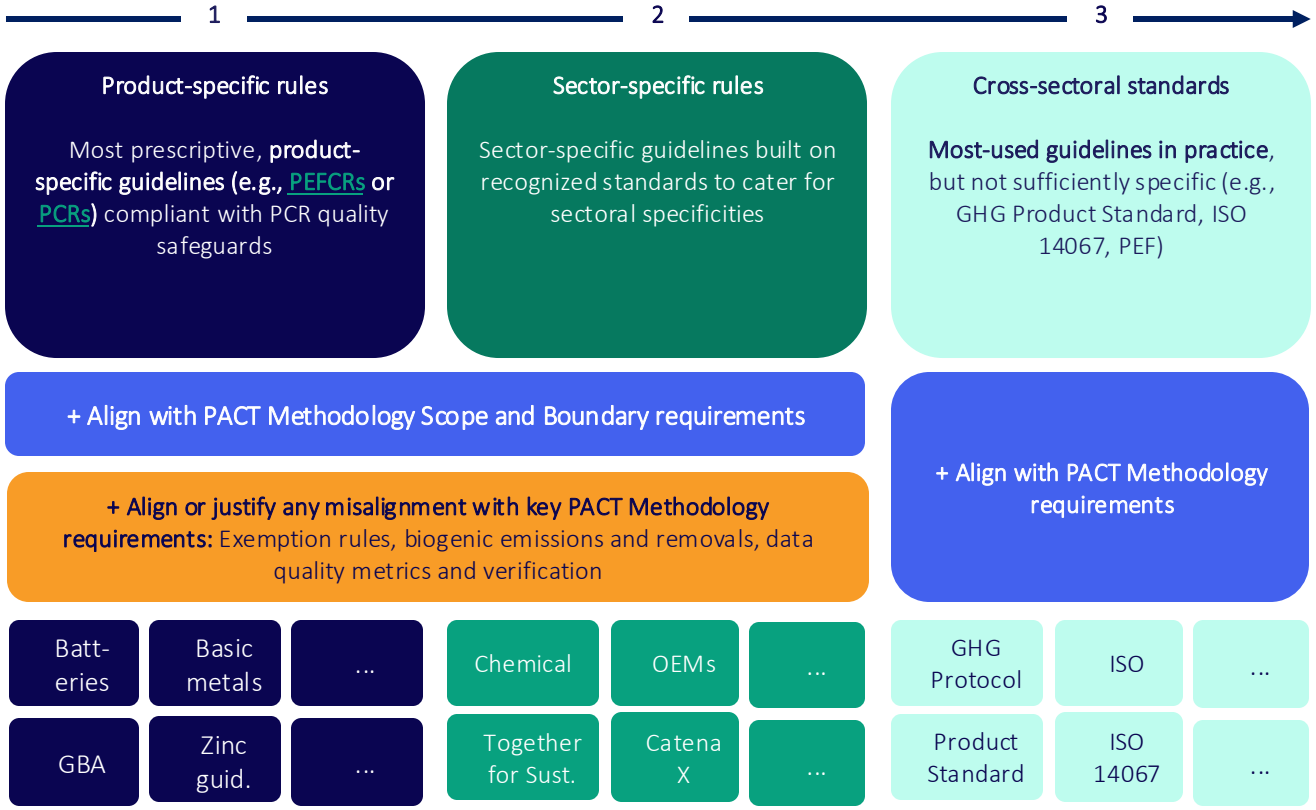
What are calculation standards?

A standard details **requirements, specifications, guidelines or characteristics** which can be used to create consistent output.

In the context of PCFs, standards provide guidance regarding **boundary** of a PCF, the **calculation steps, data requirements as well as data quality** considerations.

Standards enable the **consistency and comparability** of PCFs.

PACT Hierarchy requirements and examples of calculation standards



2 Specificity & Alignment: Companies can conduct a screening exercise to determine which standard or PCR is the most relevant for their context

p. 22

Screening order →

Screening Criteria	Product-specific rules	Sector-specific rules	Cross-sectoral standards
	Example: PCRs for basic chemicals	*Example: Guidance by TfS*	*Example: ISO14067 in conjunction with PACT Methodology*
Regulation	Does any **applicable regulation** mandate the use of a particular PCR? (e.g., upcoming EU Battery Regulation)	Does any **applicable regulation** mandate the use of a particular industry standard?	Does any **applicable regulation** mandate the use of a particular standard?
Acceptance by industry	Does an industry body **maintain a list of accepted PCRs?**	Is the standard **accepted across the industry** or are the divergent standards?	Is the standard **accepted by the industry** of the underlying product?
Geography	Are there any PCRs accepted specifically for the **geography of production or marketing?**	Is the standard **accepted in the region** of the production and marketing of the product?	Is the standard **accepted in the region** of the production and marketing of the product?
Acceptance globally	Are there any PCRs that are **widely used globally?**	Is the standard **widely used globally?**	Is the standard **widely used globally?**

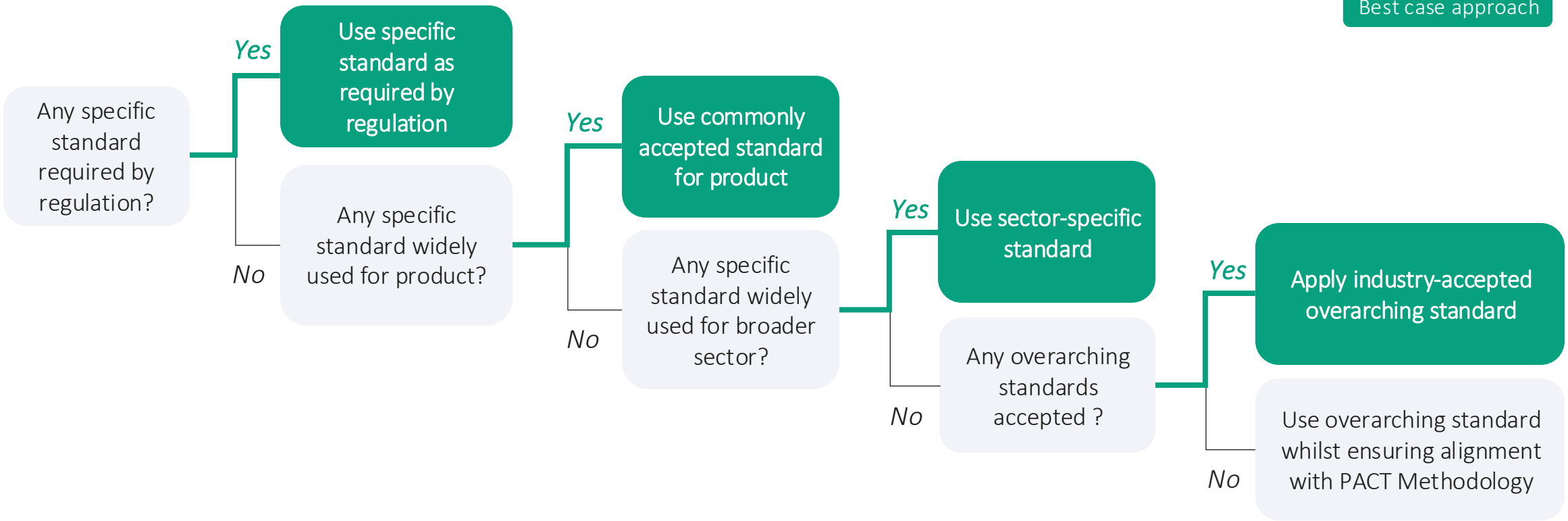
Criteria order ↓

Note: screening order represents desired level for specificity, but ultimate choice will depend on company's strategy and needs

2 Specificity & Alignment: Companies should always aim to use the most specific standards for their products, as these will increase consistency and granularity of PCFs

Use regulation driven product-specific rules → Use product category rules → Use industry-accepted standard → Use accepted overarching standards

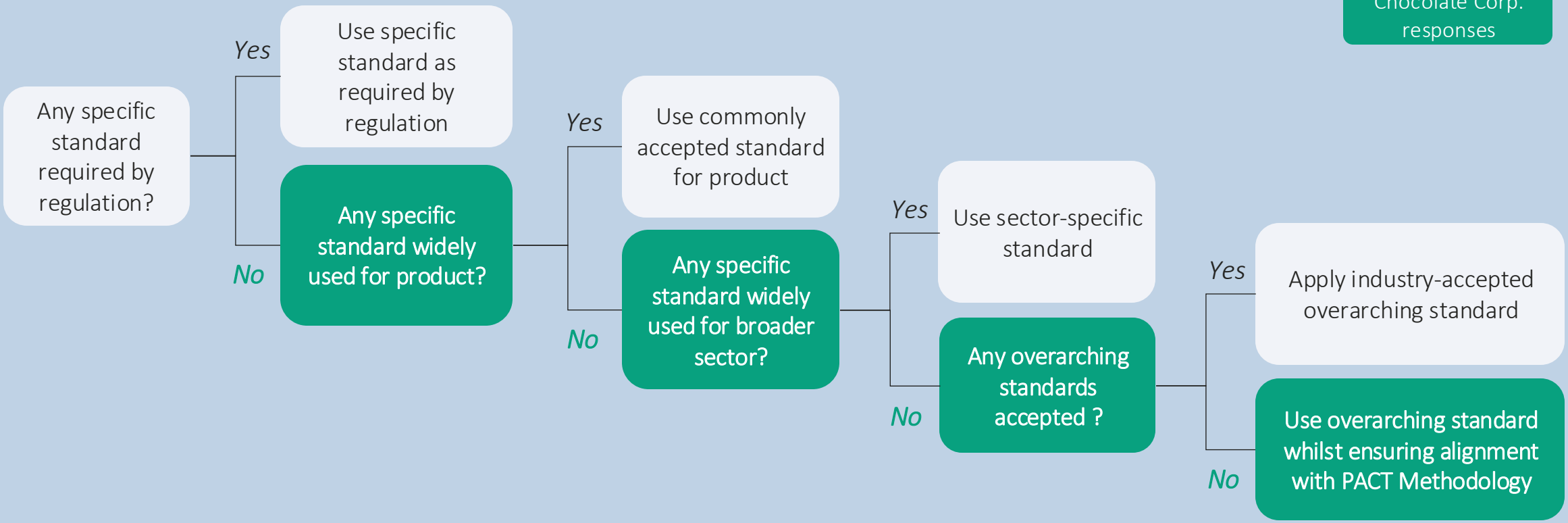
Best case approach



2 Example: Chocolate Corp. conducts a screening exercise to identify the most relevant calculation guidance for calculating a PCF for its milk chocolate bar

Use regulation driven product-specific rules → Use product category rules → Use industry-accepted standard → Use accepted overarching standards

Chocolate Corp. responses



2 Example: Classifying standards, and choosing the most relevant one

Exercise: Classify the following standards based on their level of specificity and choose a standard for different use-cases.

Level 1	Level 2	Level 3	Level 4
Classify the following standards based on whether they are on the product or on the corporate level **Example**: GHG Protocol Corporate Standard vs. European Union PEF	Classify the following standards based on whether they are overarching or industry-specific standards **Example**: PACT Methodology vs. TfS Guidelines	Classify the following standards based on whether they are industry-specific or product specific **Example**: Catena-X vs. Product Category Rules	Choose an appropriate standard based on different scenarios and use-cases **Example**: You are a chemicals player looking to calculate a Scope 3 baseline You are a metals producer looking to calculate a PCF for your steel

Standards to include (not exhaustive)

PAS 2050

PAS 2060

OEF

PEF

Corporate Standard

PACT Methodology

ISO 14040/14044
ISO 14067

Product Category Rules

ISO 14064

Product Carbon Footprint Rulebook

Product Standard

PCF Guideline

Steel Emissions Reporting Guide

GLEC Framework

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3 Understanding your data needs: The PACT Methodology focuses on three stages of a product's lifecycle, resulting in cradle-to-gate product carbon footprints

p. 24-27

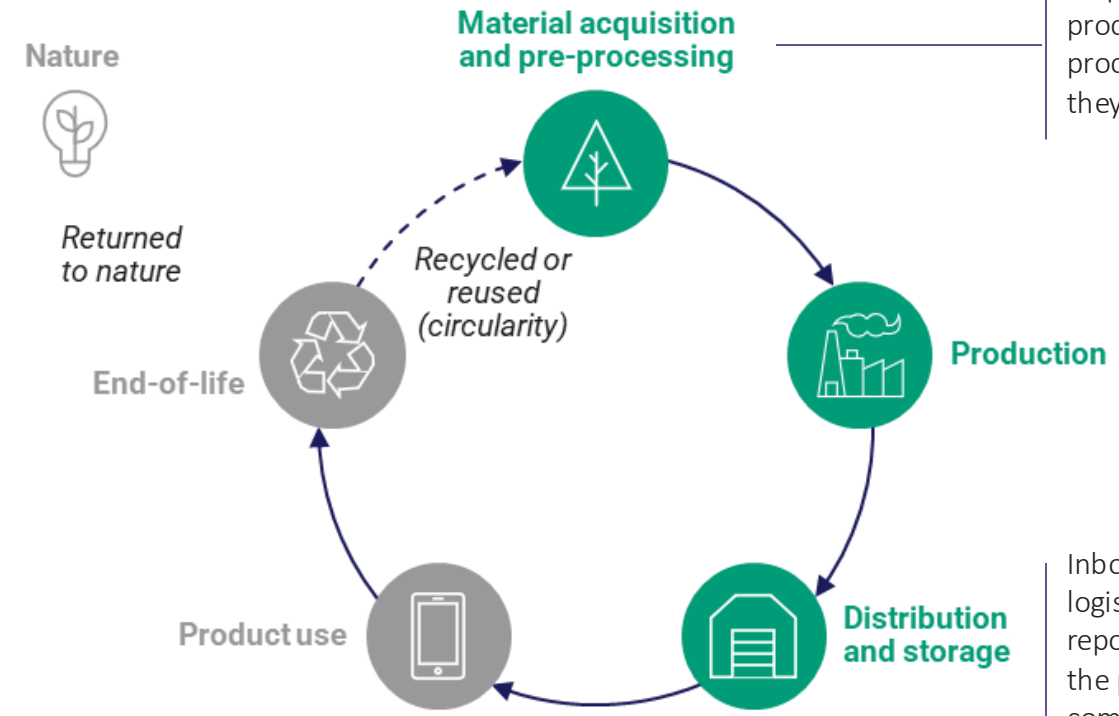
Overview

Understanding your value chain for a PCF involves understanding three steps of a product's life-cycle:

- Material acquisition and pre-processing: Input of raw materials and intermediate goods and processes around the initial processing of such inputs
- Production: Activities related to transforming the inputs into final product (at that step of supply-chain)
- Distribution and storage: Product storage and shipping processes, including transportation within and between these life cycle stages

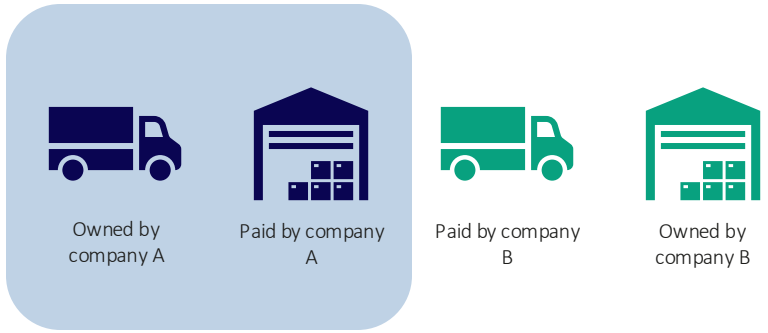
Note: carbon credits/offsets are out of scope

Detail/Explanation

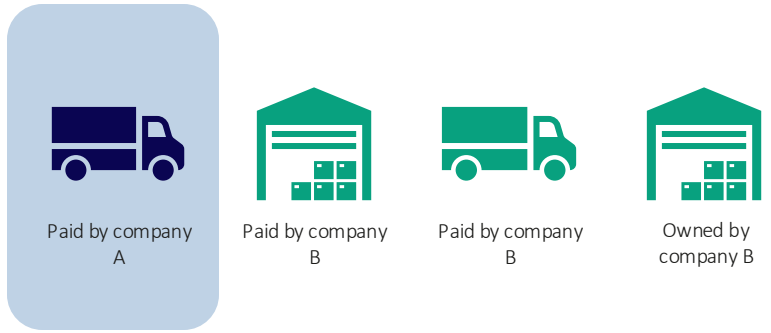


3 Deep-Dive: Transportation to and storage are calculated and separately reported up to the point where another company takes over responsibility for the product

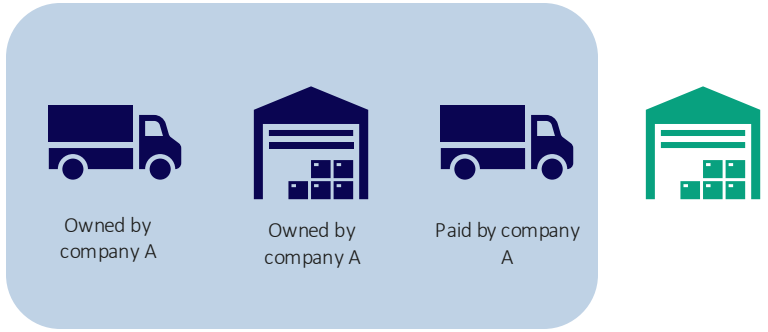
Scenario 1



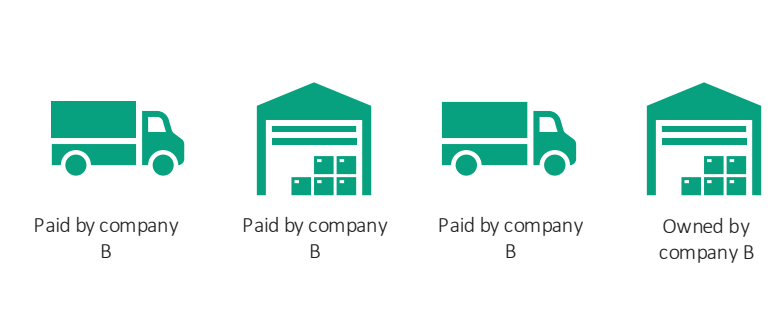
Scenario 2



Scenario 3



Scenario 4



Transportation and storage

Owned, managed or paid for by Company A

Owned, managed or paid for by Company B

Calculated and separately reported by Company A

Assumptions:

- Company A produces a product supplied to Company B
- Start of transport from Company A “production” gate

3 Deep-Dive: Recycling and energy recovery follow the “recycled content” or cut-off method

p. 42-45

What is the “recycled content” or cut-off method and why it is recommended?

WHAT

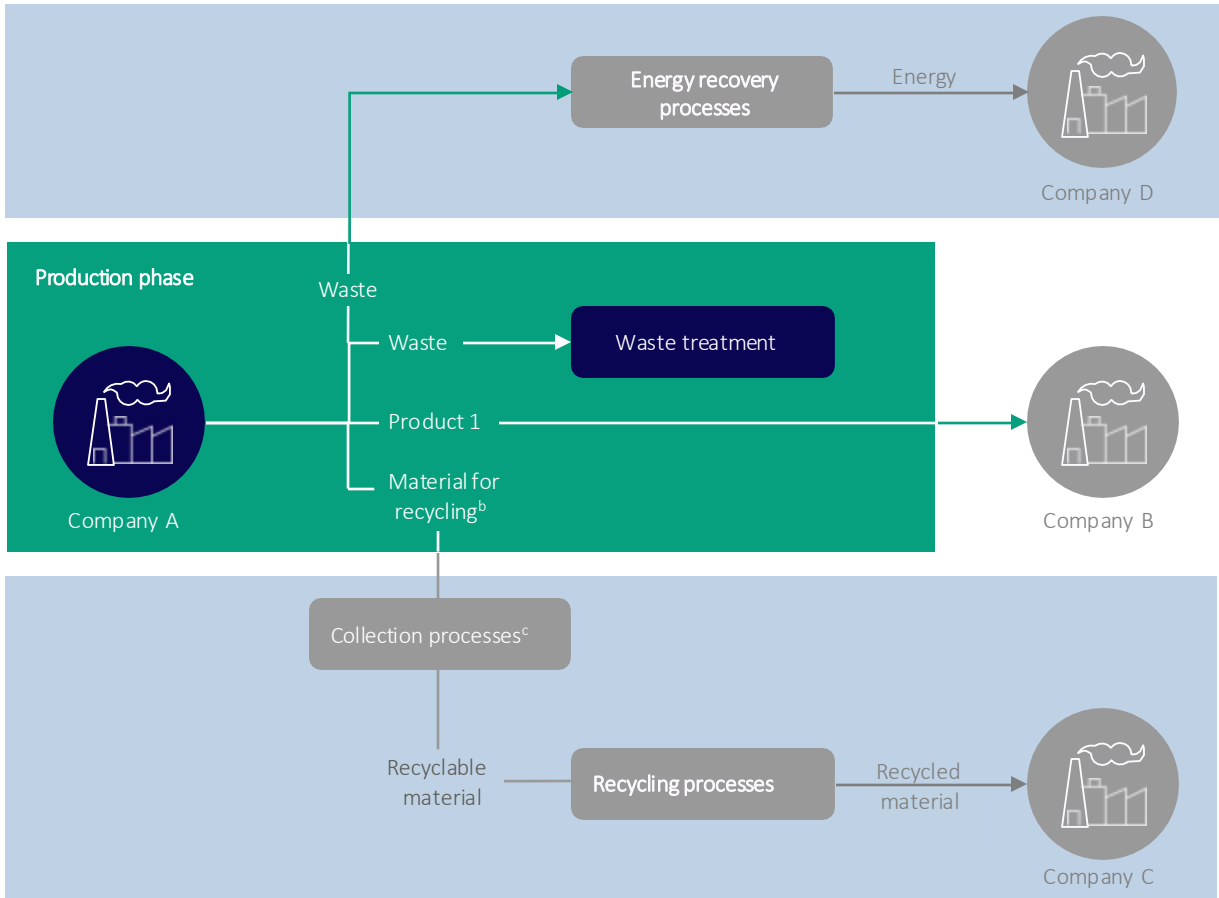
- Method stipulates that **companies using recycled material** as an input in their production **shall account for the emissions from the recycling stage as well as any collection, sorting and pre-processing (e.g., shredding),** and not for initial production emissions

WHY

- **Cradle-to-gate scope**, i.e., not including the end-of-life stage

Note: carbon credits/offsets are out of scope

Detail/Explanation

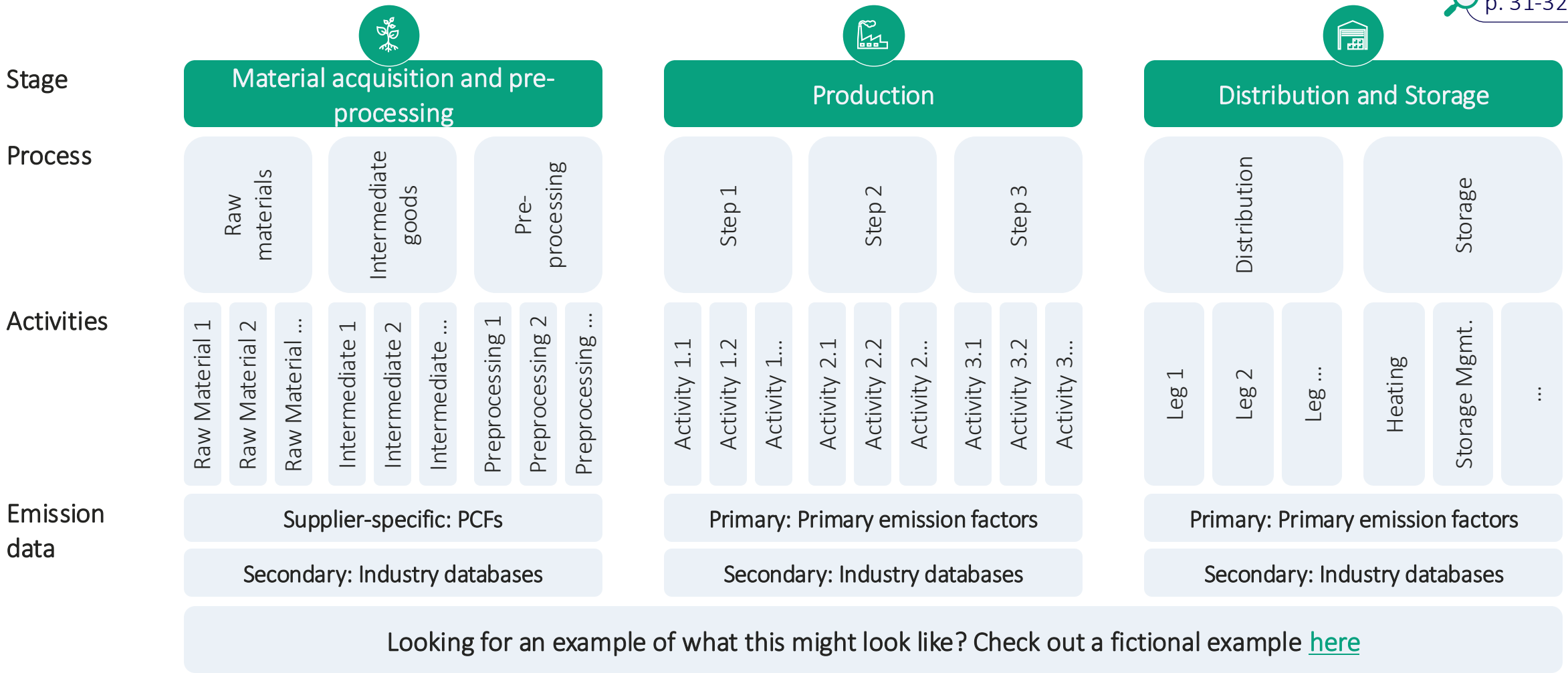


- Emissions from material flows within production phase included in PCF of Product 1[a]
- Emissions included in subsequent life cycle stage

a. Waste and recyclable material streams are not burdened by production impacts (exit burden-free). Direct emissions should be only allocated to main products and by-products (Product 1).
b. Material that would otherwise have been considered waste.
c. Can include collection, sorting and preprocessing.

3 Deep-Dive: Putting together the three stages provides a full "map" of all attributable processes to the products, and the kinds of activity data needed for each of them

p. 31-32



Looking for an example of what this might look like? Check out a fictional example here

3 Example: Organizing activities and processes into the three buckets, and deciding which processes to exclude

TBC

Exercise: Classify the following processes and activities based on their stage in the product's lifecycle and determine whether they should be included in the product's PCF. Multiple selections are possible!

Activities (not exhaustive)	Material acquisition and pre-processing	Production	Distribution and Storage	Not included
Cocoa Pods	Cocoa Pods			
Consumption of Chocolate				Consumption of Chocolate
Heating		Heating		
Milk Powder	Milk Powder			
Stirring		Stirring		
Package Waste Treatment				Package Waste Treatment
Packaging		Packaging		
Vanilla extract	Vanilla extract			
Sugar	Sugar			
Whipping of cocoa mass		Whipping of cocoa mass		
Transport to retailer				Transport to retailer
Lecithin	Lecithin			
Roasting of beans		Roasting of beans		
Grinding of nibs		Grinding of nibs		
Shaping		Shaping		
Transportation to prod. site	Transportation to prod. site			
Temporary storage			Temporary storage	
Cooling		Cooling		

3 Deep-Dive: Activities can be excluded from a PCF conformant to the PACT Methodology based on two criteria

p. 33-34

1 Boundary-based exclusion

Activities that do not fall within the cradle-to-gate boundaries for the reporting company need to be excluded.

For example, since Chocolate Corp. is a chocolate manufacturer, emissions resulting from the consumption of chocolate are not included since the PACT Methodology's boundary is cradle-to-gate.

Other examples might include end-of-life treatment of the product, or transportation to retailers (if paid for by customer).

Note: carbon credits/offsets are out of scope

2 Our proposed approach

The **total exclusion of individual processes cannot exceed 3% of the overall PCF**.

For Chocolate Corp., this might include activities such as specific ingredients needed in very small quantities.

Example: Case study demonstrating a justified exclusion

Consider a process for which no primary or secondary data is available on material inputs X and Y. The company estimates that even if materials X and Y have the highest possible GHG intensities based on conservative proxy data, their aggregate impact, based on the total amount present in the product, does not exceed 3% of the total product carbon emissions impact. Therefore, the material inputs X and Y are justified exclusions. If, in aggregate, their emissions resulted in more than 3% of the total PCF, companies shall ensure at least one of the materials is assessed and included to avoid surpassing the 3% exemption rule. .

3 Example: Chocolate Corp. maps out all its activities included in the first stage of the milk chocolate's bar lifecycle – material acquisition and pre-processing

Processes and activities

Emission data

Output and notes

Process	Activities	Activity Data	Primary & supplier-specific	Secondary
Raw material acquisition	Cocoa Pods	Tons of cocoa pod	PCF from supplier	Emission factor from secondary database
	Oil & Gas	m^3 of natural gas	PCF from supplier	
	Milk Powder	Tons of milk pow.	PCF from supplier	
	…	…	…	
Intermediary inputs acquisition	Vanilla extract	Tons of extract	PCF from supplier	Emission factor from secondary database
	Sugar	Tons of sugar	PCF from supplier	
	Lecithin	L of lecithin	PCF from supplier	
	…	…	…	
Pre-processing	Roasting of beans	kWh for roasting	Primary emission factor	Emission factor from secondary database
	Grinding of nibs	kWh for grinding	Primary emission factor	
	…	…	Primary emission factor	
	…	…	…	

- Includes all material inputs **between resource extraction from nature to when materials enter the company's gates**
- May also include **transportation** to or within facility

3 Example: In a second step, Chocolate Corp. maps out all activities occurring during the Production stage of the milk chocolate bar

Processes and activities		Emission data		Output/further comments
Process	Activities	Activity Data	Primary	Secondary
Production Step 1: Mixing	Heating	m^3 of natural gas	Primary emission factor	**Emission factor from secondary database**
	Stirring	kWh used	Primary emission factor	
	…	…	Primary emission factor	
	…	…	…	
Production Step 2: Whipping	Stage 1	kWh used	Primary emission factor	**Emission factor from secondary database**
	Stage 2	kWh used	Primary emission factor	
	Stage 3	kWh used	Primary emission factor	
	…	…	…	
Production Step 3: Tempering	Stirring	kWh used	Primary emission factor	**Emission factor from secondary database**
	Shaping	kWh used	Primary emission factor	
	Cooling	kWh used	Primary emission factor	
	…	…	…	

- Production stage starts when **product components enter the manufacturing site and ends when finished studied product leaves the manufacturing gate**
- Companies **should not include processes not directly connected** to the studied product
- May also include **transportation** to or within facility

PACT

EXAMPLE ONLY

Your PCF-journey, from start to finish, involves 8 steps

Focus of the following pages

1 Selecting a product

Overview: Choosing a product to calculate the PCF to get the most value out of the data

2 Choosing a calculation basis

Overview: Picking the calculation standard best suited to your products and requirements

3 Understanding your data needs

Overview: Mapping the value chain of your product enables you to gather the right data

4 Collecting data

Overview: Gathering activity & emissions data for all activities associated with your product

5 Calculating the PCF

Overview: Calculating the PCF and taking additional steps as needed, e.g., allocation, biogenic emissions

6 Assessing data reliability

Overview: Assessing data reliability using quantitative and qualitative metrics

7 Verifying your PCF

Overview: Ensuring data reliability through third-party verification

8 Exchanging your data

Overview: Consolidating all information around your PCF and sharing it with other stakeholders

Each step includes **key explanations, content deep-dives, examples and exercises** for you to test your understanding

4 Collecting data: Collecting data is informed by the process maps of the previous steps, as well as the calculation guidance used

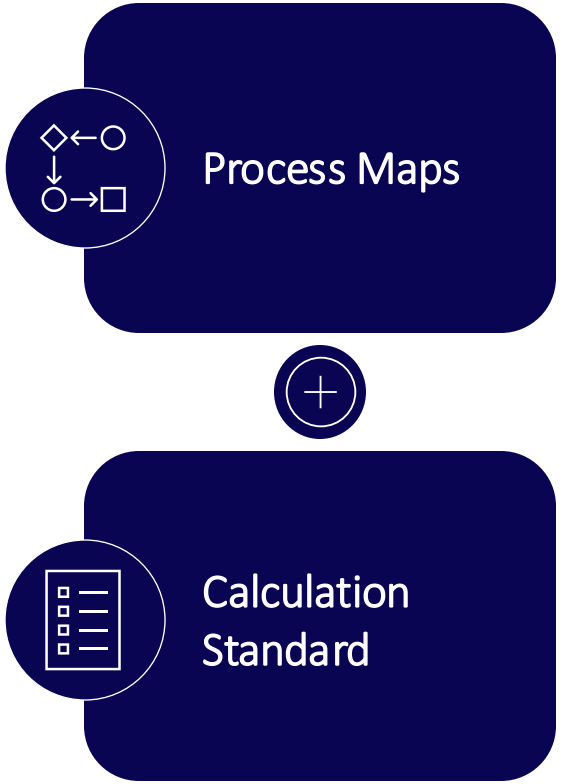
Overview

Gathering data is a central process of any PCF calculation

The process involves three steps:

1. Create full list of attributable processes and data points linked to them
2. Add data sources and data owner to each data point
3. Make a data collection plan with clear responsibilities and timelines

Data collection should be guided by two components



- Understand all **attributable processes** that need to be included in the calculation
- Understand all **underlying data linked to the processes** and **break down each process into the most strategic granular data point**

- Understand all **specific requirements around which processes** need to be included and how
- Understand which **data sources are permissible** under the Methodology (e.g. primary vs. secondary)

4 Data points: Before data collection, it is helpful to have a full understanding of all required data points to conduct the calculations to avoid duplicating efforts

Stages, processes and activities

Data points

Stage	Process	Activities	Activity Data		Emission Data	
Material acquisition and pre-processing	Material acquisition	Cocoa beans	Tons of beans	Split by origin	Emission intensity by geography	
		Oil & Gas	m^3 of natural gas	L of oil	CO_2e/ m^3 of NG	CO_2e/ l of oil
		Milk Powder	Tons of powder	…	PCF of milk pow.	…
		…	…	…	…	…
	Pre-processing	Roasting of beans	Temperature	Duration	CO_2e/ m^3 of NG burnt for heating	
		Grinding of nibs	kWh used	Cycles	Emission intensity of national grid	
		…	…	…	…	
		…	…	…	…	…
Prod-uction	Tempering	Cooling	kWh/ ton	Tons of choc.	CO_2e/ kWh used for cooling	
		Shaping	kWh/ ton	Tons of choc.	Emission intensity per kWh used	
		…	…	…	…	…
Dist. & St.	Storage	Cooling	Average temp.	Average days	Site-specific emission intensity for heat	
		…	…	…	…	…

4 Data Sources: Once all data points have been defined, the next step involves identifying data sources for each data point

Data points

Data sources

Notes

Type	Data Point	Primary	Secondary (examples)	Potential Data Owner
Activity Data	Tons of beans	Procurement data	**Not allowed** under PACT Methodology – spend-based approaches only as last resort	Procure-ment
	m^3 of natural gas	Procurement data		
	kWh used	Energy usage data		
	Average temp.	Operations data		
	Average days	Operations data		
	…	…		
Emission Data	CO_2e/ m^3 of NG	Gas-supplier specific int.	Ecoinvent emission factor	LCA team
	PCF of chemical	PCF from supplier	Sphera emission factor	
	Av. CO_2e/ t.km	Supplier's emission int.	GLEC database	
	CO_2e/ kWh used	Site-specific emission int.	National emission factors	
	CO_2e/ day heating	Site-specific emission int.	National emission factors	
	…	…	…	

- **Primary activity data is required** by the PACT Methodology
- **Priority** should be given to **primary emissions data**
- Data availability may be challenging – data collection should be seen as **iterative process**, where clear plans are established to **progressively improve data**

PACT

EXAMPLE ONLY

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4 Data Collection Plan: In a final step, companies can identify how to best collect the data, and divide responsibilities

Data sources

Collection Plan

Notes

Type	Data Points	Data Owner	Responsible	Timeline
Procurement data	Tons of beans	Procurement	Person A	1 month
	m^3 of natural gas		Person A	1 month
Operations data	Average temp.	Storage function	Person B	1 month
	Average stor. days		Person B	1 month
PCF Data	Milk Powder	Procurement	Person A	6 months
	Lecithin		Person A	3 months
Secondary databases	CO_2e/ kWh	LCA team	Person C	2 weeks
	CO_2e/ m^3 of NG		Person C	2 weeks
Site-specific EF	CO_2e/ kWh used	Storage function	Person B	1 month
	CO_2e/ day heating		Person B	1 month
...	...	...	...	...
	...		...	...

- Data collected should represent the **average of a period** (e.g., 1 - 3 years)
- Different data items are likely to have **different timelines**
- Different data items also have **different data owners** so recommend splitting up and empowering data owner to reduce need for back-and-forth
- It is essential to **get started early** to ensure data collection is timely and improves over time

PACT

EXAMPLE ONLY

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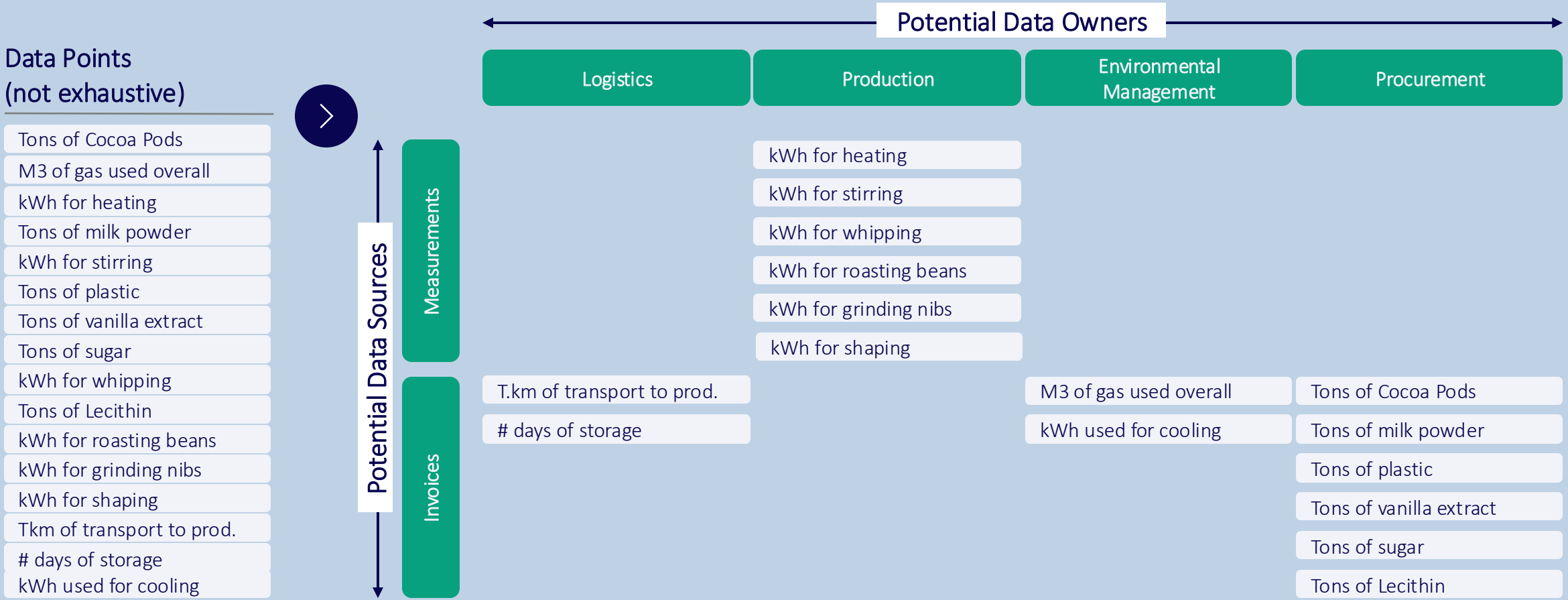
4 Example: Sorting data points to processes and potential data sources/ owners

Exercise: Match the data points on the left with the potential data sources and data owners on the right!



Your PCF-journey, from start to finish, involves 8 steps

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5 Calculating the PCF: A PCF calculation involves three steps

p. 31-34

Overview

Once all data has been gathered, the PCF calculation involves three steps:

1. **Multiplying** each activity with the relevant emission factor
2. **Summing** emissions from all processes attributable to the product
3. **Allocating** emissions which are split between products

The PCF calculation steps

The actual PCF calculation is oftentimes simple and requires no specific expertise:

The emissions for each activity A are…	Activity A X Emission Factor A = $Emissions_A$ (CO_2e)
The total PCF for a product containing components A, B and C is…	$Emissions_A$ (CO_2e) + $Emissions_B$ (CO_2e) + $Emissions_C$ (CO_2e) = PCF (CO_2e)
Allocation of emissions depends on the specific product	Allocation should be avoided whenever possible – if it cannot be avoided, the PACT Methodology proposes a clear hierarchy of allocation approaches

5 Example: Calculation of a simplified plastic bottle

The PCF calculation steps

This simplified example is meant to illustrate the calculation steps in more detail:

1. Multiplying	Activity A X Emission Factor A = $Emissions_A$ (CO_2e)
2. Summing	$Emissions_A$ (CO_2e) + $Emissions_B$ (CO_2e) + … = PCF (CO_2e)
3. Allocating	Allocation should be avoided whenever possible – if it cannot be avoided, the PACT Methodology proposes a clear hierarchy of allocation approaches

Example calculation

We consider the PCF of a plastic bottle consisting of two activities: PET granulates and an injection process

PET granulate: 0.3 kg of PET X 0.6 kg CO2/kg of PET= 0.18 kg CO2e
Injection Process: 0.1 kWh X 0.25 kg CO2/KwH= 0.025 kg CO2e

Total PCF = PET granulate + Injection Process
= 0.18kg CO2e + 0.025 kg CO2e
= **0.205 kg CO2e**

No allocation needed in this case – see following pages for more detail

5 Example: Calculating a simple PCF based on existing data

Exercise: Match the activity data and emission factors. Then, determine whether the data needs to be transformed before calculating your first PCF!

Level 1

Match the activity data with the relevant emission factor

Implementation: Table below is initially unordered, and users have to drag items up and down to match the activity with the right emission factor

Activity	Emission Factor
14g/ bar, milk powder	10.1 kg CO2e/kg
100g/ bar, cocoa beans	2.2 kg CO2e/kg
14g/ bar of sugar	0.55 kg CO2e/ kg
100g/ bar of transportation	0.22 kg CO2e/kg
100g/ bar of roasting	0.0 (Ren. Energy)
0.050 kWh/ bar	104 g C02e/ kWh
0.036 kWh/ bar	104 g CO2e/kWh

Level 2

Determine whether we need to transform the data before we can multiply the activity data with the emission factor

Implementation: Mark each item in the table with whether a transformation is needed – if you choose incorrectly, it will highlight what needs to be transformed. If you choose correctly, it will do the transformation automatically

Activity	Transformation
Milk powder	Yes – g and kg
Cocoa beans	Yes – g and kg
…	…

Level 3

Multiply each item in the table, and determine whether we need to adjust the results before we can aggregate each activity into a final PCF

Implementation: Mark each emission result based on whether it needs to be adjusted before we can aggregate it. If you choose correctly, it will do any adjustments automatically, resulting in a final table of activities and associated emissions

Activity	Transformation
Heating	Yes – result in g rather than kg
Storage	Yes – result in g rather than kg
…	…

Level 4

Sum the emissions from all activities to calculate your first PCF!

Implementation: Mark all cells in the final table that need to be summed to calculate the final PCF

Activity	Emissions
Milk Powder	0.14 kg CO2e
Cocoa beans	0.22 kg CO2e
Sugar	0.008 kg CO2e
Transport to site	0.022 kg CO2e
Roasting of nibs	0.0 kg CO2e
Heating	0.005 kg CO2e
Stirring	0.0037 kg CO2e
…	….

5 Example: Chocolate Corp. has gathered all required data and can now calculate its first simple PCF for a 100g bar of milk chocolate (without packaging)

Inventory Data

Stage	Activity	Activity value	Emission factor
Material Acquisition & Preprocessing	Milk Powder	14g/ bar	10.1 kg CO2 e/kg
	Cocoa beans	100g/ bar	2.2 kg CO2e/kg
	Sugar	14g/ bar	0.55 kg CO2e/ kg
	Transport to site	100g/ bar	0.22 kg CO2e/kg
	Roasting of nibs	100g/ bar	0.0 (Ren. Energy)
Production	Heating	0.050 kWh/ bar	104 g C02e/ kWh
	Stirring	0.036 kWh/ bar	104 g CO2e/kWh
	Whipping	0.059 kWh/ bar	20 g CO2e/ kWh
	Tempering	0.038 kWh/ bar	20 g CO2e/ kWh
Transportation & Storage	Temporary Storage	0.01 kWh/ bar	500 g/ kWh

PCF calculation

Stage	Activity	Emissions
Material Acquisition & Preprocessing	Milk Powder	0.14 kg CO2e
	Cocoa beans	0.22 kg CO2e
	Sugar	0.008 kg CO2e
	Transport to site	0.022 kg CO2e
	Roasting of nibs	0.0 kg CO2e
Production	Heating	0.005 kg CO2e
	Stirring	0.0037 kg CO2e
	Whipping	0.001 kg CO2e
	Tempering	0.001 kg CO2e
Transportation & Storage	Temporary Storage	0.005 kg CO2e

Total: 407g CO2e / kg chocolate bar

Note: This example is illustrative only – important activities were excluded for illustration purposes!

5 Deep Dive: Allocating emissions might be necessary when emissions are shared between outputs of a particular process

p. 35-40

What is allocation

Allocation refers splitting multi-input/output processes into single output unit processes by using physical, economic, or other criteria to partition the emissions between the product system being studied (also known as the studied product) and one or more other product systems (also known as co-products[1]).

Allocation is **not usually the preferred approach** but is oftentimes **unavoidable.**

When choosing an allocation approach, you should **prioritize sector-specific guidance** which is oftentimes able to provide more granular guidance on how to conduct an allocation

How does the PACT Methodology implement allocation?

The PACT Methodology builds on existing hierarchies of allocation approaches to develop a decision-making tree that will ensure consistent allocation approaches across suppliers:

Avoiding allocation: Whenever possible, try to avoid allocation by using process sub-division or system expansion

Physical allocation: Allocating the inputs and emissions of the system based on an underlying physical relationship between product quantities

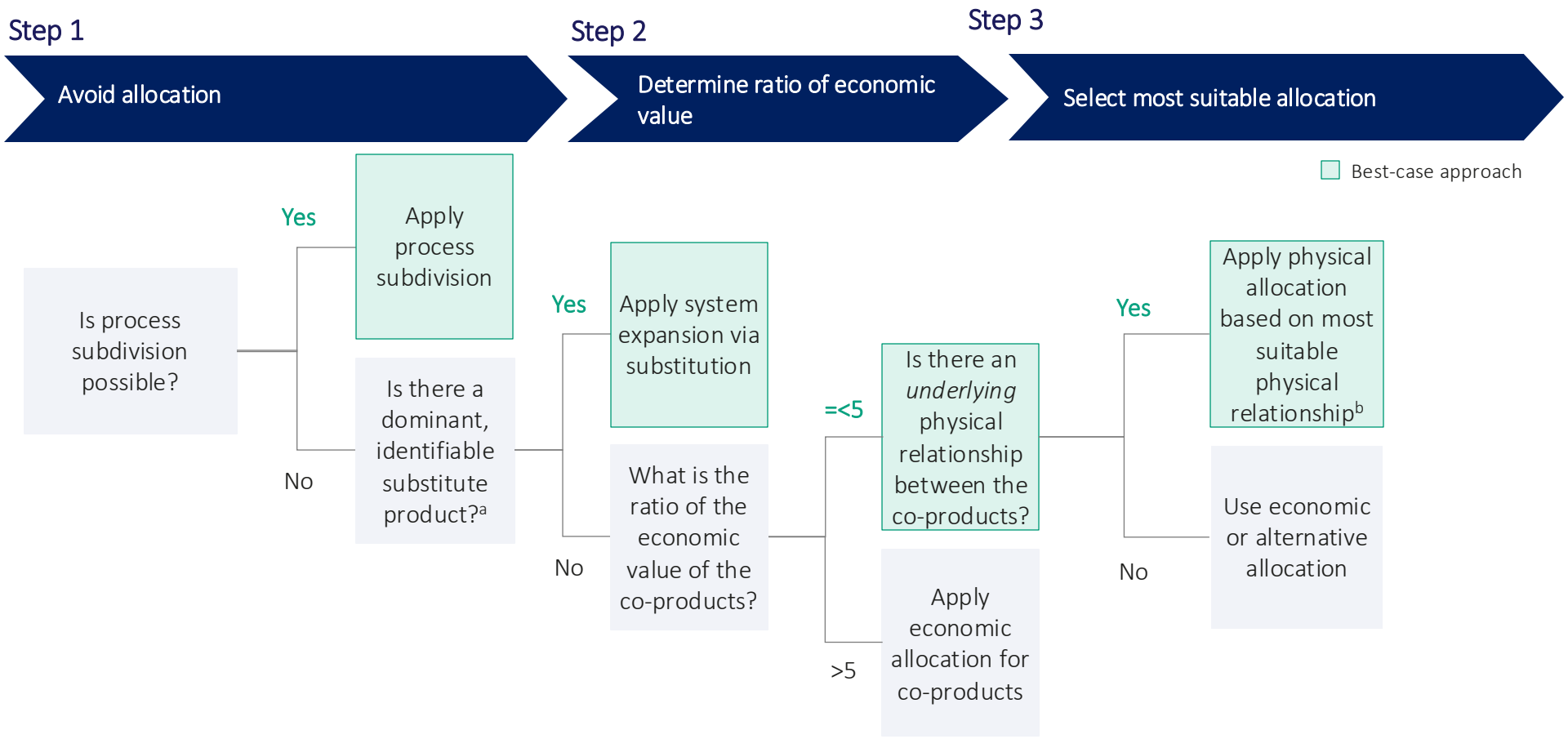
Economic allocation: Allocating the inputs and emissions to the product and co-product(s) based on the market value of each when exiting the common process

Other relationships: Using other underlying relationships between products and co-products to allocate emissions

1. To determine if the output of the process is a co-product or a waste, please follow the EU Waste Directive 2008/98/EC

5 Deep Dive: When considering allocation approaches, you should follow this best-practice hierarchy of approaches

p. 37

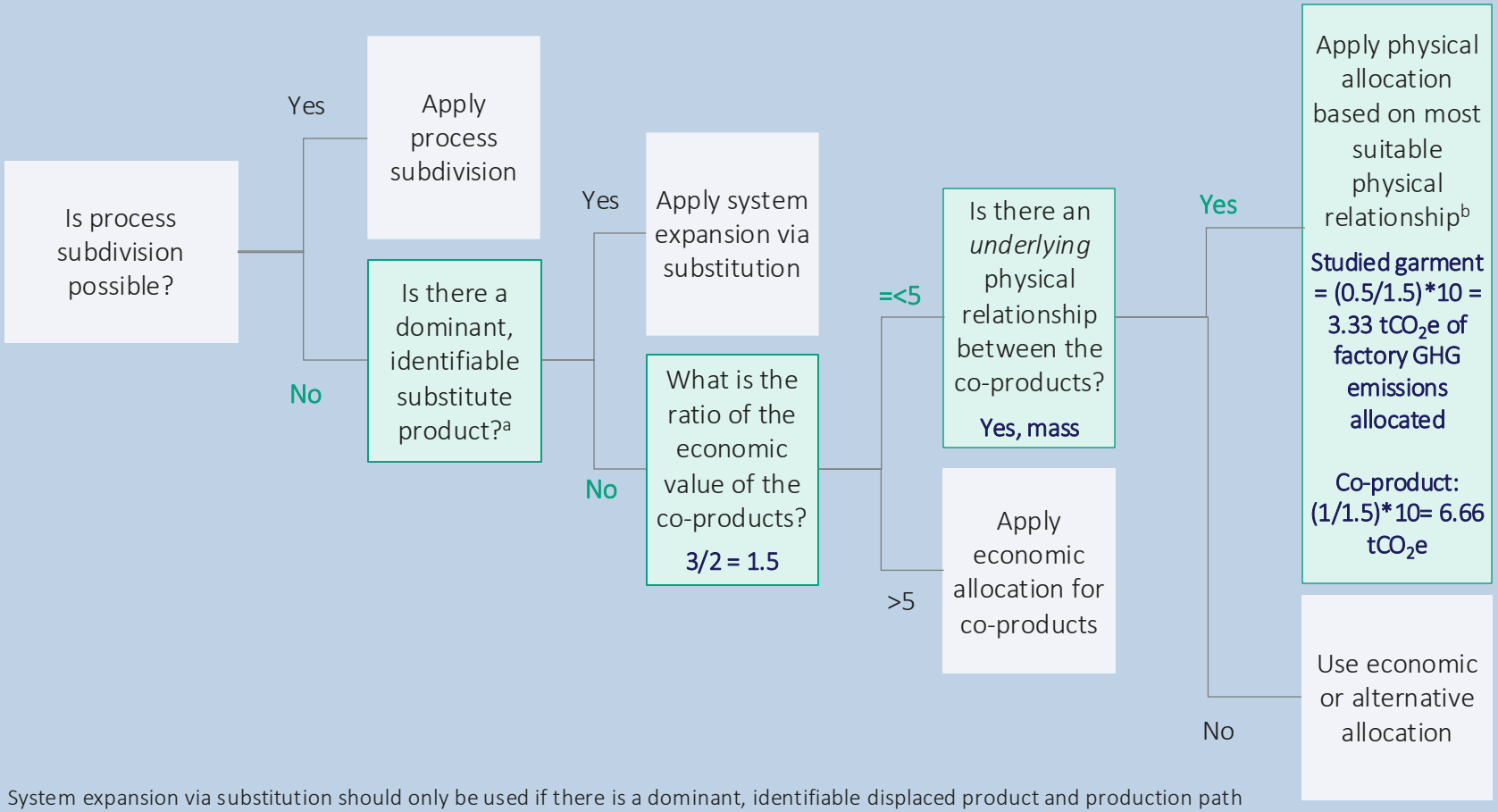


a. System expansion via substitution should only be used if there is a dominant, identifiable displaced product and production path for the displaced product based on sector consensus.

b. In doubt, mass allocation should be prioritized, but there are instances where other allocation factors may be more suitable (e.g., liters for liquids, energy content for energy).

5 Example: Defining the right allocation approach for two co-products

Factory produces two different clothing garments on equal measure but is unable to perform process subdivision. No PCRs exist. Our studied garment weighs 0.5kg and has an economic value of 2$, while the co-product weighs 1kg, and has economic value of 3$. There are 10 tCO_{2e} to be allocated.

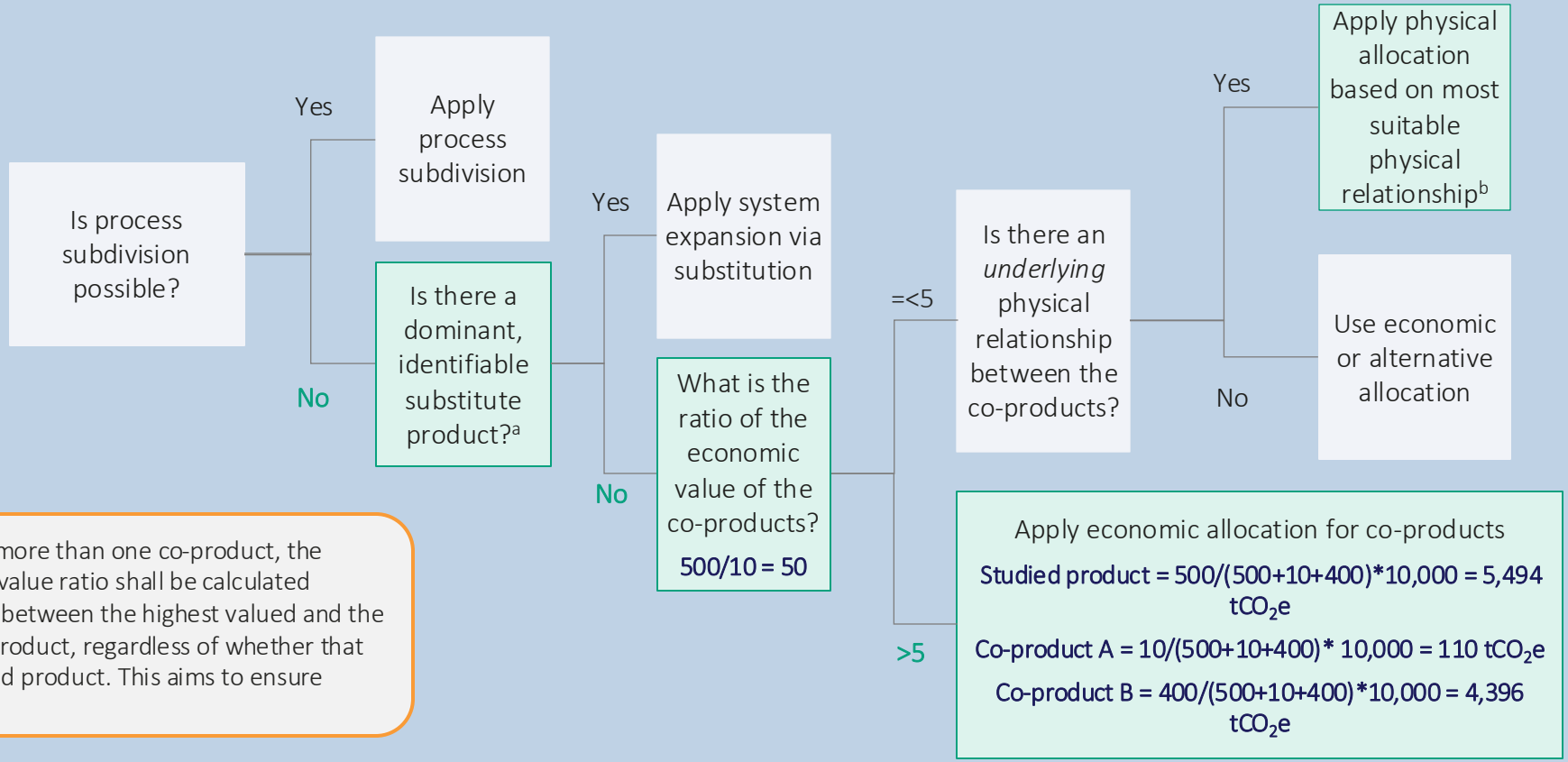


a. System expansion via substitution should only be used if there is a dominant, identifiable displaced product and production path for the displaced product based on sector consensus.

b. In doubt, mass allocation should be prioritized, but there are instances where other allocation factors may be more suitable (e.g., liters for liquids, energy content for energy).

5 Example: Defining the right allocation approach for multiple co-products

Mining company extracts and sells three products from a single mine. Process subdivision is not possible, and no PCRs are available. Studied product's economic value is $500 M/t and has a mass of 1.5t; it has two co-products with values of $10 M/t and 30 t (co-product A) and $400 M/t and 0.5 t (co-product B), respectively. There are 10,000 tCO_2e to be allocated.



If there is more than one co-product, the economic value ratio shall be calculated based on the ratio between the highest valued and the lowest valued co-product, regardless of whether that includes the studied product. This aims to ensure consistency.

a. System expansion via substitution should only be used if there is a dominant, identifiable displaced product and production path for the displaced product based on sector consensus.

b. In doubt, mass allocation should be prioritized, but there are instances where other allocation factors may be more suitable (e.g., liters for liquids, energy content for energy).

5 Example: Chocolate Corp. needs to determine an allocation approach for cocoa shells which are further used in a separate process

Exercise: Cocoa shells can be processed to extract further cocoa and for other applications. Chocolate Corp. therefore sells its cocoa shells to another company, making cocoa shells a **co-product** rather than waste. Accordingly, Chocolate Corp. needs to find an allocation approach to determine how to allocate the emissions related to cocoa shells. Help Chocolate Corp. determine the right allocation approach by going through the decision tree!

Question 1	Question 2	Question 3	Question 4	Question 5
Question: Is avoiding allocation possible by using process sub-division for cocoa shells?	**Question**: Are there sector-specific or product-category rules which provide guidance on how to allocate cocoa shell emissions?	**Question**: Is there a dominant identifiable substitute product which could be used to avoid allocation?	**Question:** Is the ratio in economic value greater than 5? **Hint:** Cocoa liquor sells for around 100 times the price of cocoa shells	**Question:** Should Chocolate Corp. apply economic allocation in this case?
Yes: Incorrect. The process by which cocoa shells are produced is the same as the process by which cocoa beans are produced. The two process cannot easily be divided.	**Yes:** Incorrect. For example, the EPD System does not list any PCRs around cocoa products.	**Yes:** Incorrect. There is unlikely to be a product comparable to cocoa shells in the context of chocolate manufacturing.	**Yes:** Correct. The ratio in economic value greatly exceeds 5, indicating that cocoa shells are unlikely to be produced independently of cocoa liquor.	**Yes:** Correct. In cases where the value of a coproduct is much lower than for the main product, economic allocation should be applied to ensure consistency.
No: Correct. The process by which cocoa shells are produced is the same as the process by which cocoa beans are produced. The two processes cannot easily be divided.	**No:** Correct. There does not seem to be a commonly used allocation approach for cocoa products. The EPD system, for example, does not list any PCRs on cocoa.	**No:** Correct. Cocoa shells are likely to have unique characteristics in this specific value chain and context.	**No:** Incorrect. The economic ratio by far exceeds 5 – cocoa shells are not produced independently of cocoa liquor but are clearly a by-product.	**No:** Incorrect. Economic allocation is the most consistent approach when the value of a co-product is clearly driven by the value of a main product.

5 Example: Chocolate Corp. uses economic allocation to allocate emissions from cocoa shells

Step		Description	Results
1	Establish PCF baseline	Chocolate Corp. has already calculated an initial PCF in a previous step, using this result as the baseline for its 100g milk chocolate bar	407g CO2e / bar
2	Identify potential allocation need	Chocolate Corp. has noticed that the cocoa shells resulting from the production of cocoa liquor are sold and used in further processes	Cocoa Shells
3	Identify allocation approach	Chocolate Corp. follows the allocation decision tree and has determined economic allocation as the correct allocation approach	Economic allocation
4	Implement allocation approach	Chocolate Corp. calculates the ratio of economic value of cocoa shells and chocolate liquor, using average market prices	Ratio: 100:1
5	Refine PCF using allocation	Chocolate Corp. allocates 99% of emissions resulting from the cocoa beans to its chocolate bar, and 1% to the cocoa shells. Applying this ratio to its original PCF corrects the estimate of the emissions resulting from cocoa beans slightly, and lowers the overall PCF slightly as well	Cocoa Beans: 0.218 kg CO2e instead of 0.22kg
			Overall PCF: 403 g CO2e/ bar

5 Deep-dive: Calculation of biogenic and land sector related emissions is mandatory

p. 47-55

Overview

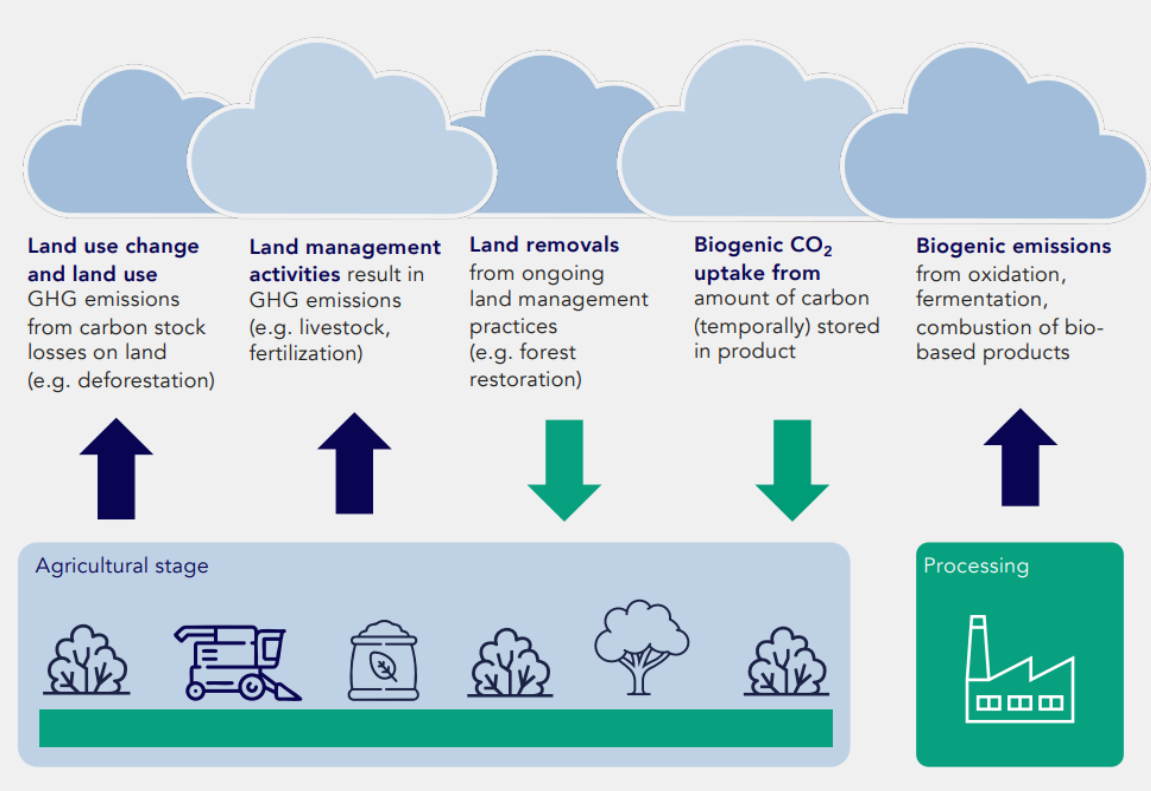
- Land sector emissions (including agriculture, forestry and other land use) are responsible of approximately 22% of global annual net GHG emissions[1]

- Biogenic and land sector related emissions mandatory for calculation
  - Can only be excluded if:
    - Biogenic carbon content of product <5%

    OR

    - Biogenic and land related emissions are below <3% contribution to total cradle-to-gate PCF

Included emissions and removals



[1]IPCC, 2023. Climate Change 2023: Synthesis Report (Summary for Policymakers).

5 Deep dive: Overview of required biogenic and land related indicators

p. 47-49

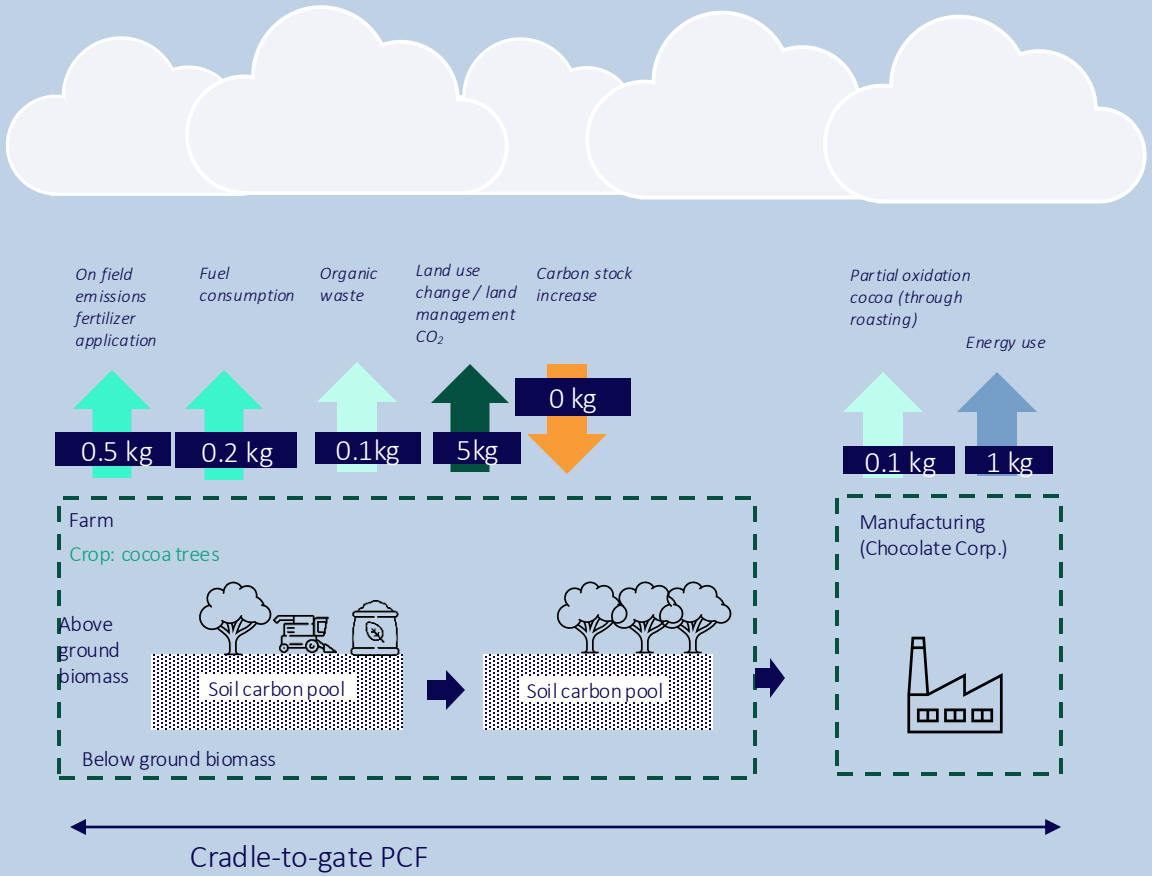
	Sub-category	Unit	Shall/Should /May	Part of PCF	Short description	Examples
A. Land use and land use change emissions	LUC emissions	kgCO_2e	Shall	Yes	GHG emissions due to change in land use type	GHG and biogenic CO2 emissions due to conversion of forest to cropland (deforestation)
	Land management CO_2 emissions	kgCO_2e	Shall-2027	Yes	Biogenic CO_2 emissions due to recurring management actions on land in the same land use category	Biogenic CO2 emissions from carbon stock losses due to management practices such as fertilization, pest control and fire
B. Biogenic Non-CO_2 emissions	Biogenic Non-CO_2 emissions	kgCO_2e	Shall	Yes	CH_4 emissions from land management practices and the oxidation and transformation or degradation of biomass.	Livestock CH_4 emissions, manure, CH_4 emissions, CH_4 emissions from rice cultivation
C. Fossil emissions	Fossil emissions – total	kgCO_2e	Shall	Yes	Fossil emissions resulting from stationary/mobile combustion, industrial processes and fugitive emissions. Includes land management and all other industrial emissions.	CO_2 from combustion of fossil fuels from industrial processes
	Fossil emissions – land management	kgCO_2e	Shall-2027	Yes	Separately reported Fossil CO_2 and N_2O emissions due to land management practices. These values are also reported in Fossil emissions – total.	CO_2 and N_2O emissions from fertilization and liming
D. Land removals	Land management CO_2 removals	kgCO_2e	May	Yes	CO_2 removals from a net increase in carbon stored in land-based carbon pools. Subject to reporting requirements	Soil carbon sequestration, reforestation, afforestation
E. Biogenic product CO_2 uptake	Biogenic product CO_2 uptake	kgCO_2e	Shall	Yes/No[1]	Net biogenic CO_2 uptake of biomass in the product	Biogenic CO_2 uptake from photosynthesis in wood product
	Biogenic carbon content	kgC	Shall	No	The amount of biogenic carbon contained within the product	Amount of biogenic carbon in bio-plastic
F. Land tracking	Land occupation	$m^2.a$	Should	No	Amount of agricultural land occupied in a land use category	Amount of cropland occupied by wheat

- In total 8 **biogenic and land related indicators**
- 5 of those are **mandatory for reporting** and two of those are mandatory from 2027 onwards[2]
- **All these indicators are** calculated and exchanged besides the final PCF

[1] Biogenic product CO_2 uptake is excluded in PCF – excl. biogenic CO_2 uptake and included in PCF - incl. biogenic CO_2 uptake

[2] While companies should calculate and report this information, it is only required by end of 2027 (i.e., 31.12.2027)

5 Example: Biogenic and land related emissions of cocoa supplier and Chocolate Corp. manufacturer



Cradle to gate PCF of 1 kg of cocoa beans (fictive numbers)

Reporting categories in PACT	Value ($kgCO_2eq$)	Comment
Land use change emissions	5	LUC emissions from forest clearing
Land management CO_2 emissions	0	
Fossil emissions – land management	0.5 + 0.2	Direct field emissions and GHG from production of fertilizer, use of agricultural machinery
Fossil emissions – non-land management	1	Energy consumption cellulose manufacturing
Biogenic non-CO_2 emissions	0.1 + 0.1	Methane from organic waste/ pruning Methane from oxidation of product
Land management net CO_2 removal	0	
Biogenic CO_2 uptake	-0.5	Conversion of final biogenic carbon in product into CO_2 uptake
Total PCF - excl biogenic CO_2 uptake	5 + 0.5 + 0.2 + 1 + 0.1 + 0.1 = 6.9 kg CO_2e	
Total PCF - incl. biogenic CO_2 uptake	5+ 0.5 + 0.2 + 1 + 0.1 + 0.1 – 0.5 = 6.4 kg CO_2e	

Your PCF-journey, from start to finish, involves 8 steps

Focus of the following pages

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Overview: Choosing a product to calculate the PCF to get the most value out of the data

2 Choosing a calculation basis

Overview: Picking the calculation standard best suited to your products and requirements

3 Understanding your data needs

Overview: Mapping the value chain of your product enables you to gather the right data

4 Collecting data

Overview: Gathering activity & emissions data for all activities associated with your product

5 Calculating the PCF

Overview: Calculating the PCF and taking additional steps as needed, e.g., allocation, biogenic emissions

6 Assessing data reliability

Overview: Assessing data reliability using quantitative and qualitative metrics

7 Verifying your PCF

Overview: Ensuring data reliability through third-party verification

8 Exchanging your data

Overview: Consolidating all information around your PCF and sharing it with other stakeholders

Each step includes **key explanations, content deep-dives, examples and exercises** for you to test your understanding

6 Assessing data reliability: There are two ways to assess and monitor data reliability after a PCF has been calculated

p. 62-68

Overview

Assessing data reliability is a central component of the PACT Methodology.

Data reliability is implemented through two metrics in the PACT Methodology:

- Primary Data Share assess the extent of primary data in the PCF calculation
- Data Quality Indicators assess the quality of the underlying data regarding several characteristics

The two data reliability metrics in the PACT Methodology

1

Primary Data Share (PDS)

Percentage of PCF emissions that were **calculated** using **primary** activity and emissions **data**

Can be used to gradually **increase use of primary data**

2

Data quality ratings (DQRs)

Quantitative score for three **data quality** indicators based on data quality matrix

Can be used to monitor and understand **data quality hotspots**

The PACT Methodology requires companies to **calculate and report PDS along a PCF**, while companies should calculate and report **DQRs, it is only required by end of 2027** (i.e., 31.12.2027)

Notes:
- PDS and DQRs are assessed based on the absolute PCF excluding biogenic CO_2 uptake
- If PDS not available, assume 0% (worse case); if DQRs not available, assume 5 (worse case)

6 Deep-Dive: Assessing data reliability unlocks several use-cases central to achieving carbon transparency

Assessing

The data reliability metrics can be used to **internally assess how reliable a PCF result** is likely to be, creating a **basis for decision-making** how PCF accuracy could be improved

Communicating

Data reliability metrics are **central to transparently communicating with data users** – data users want to know what kind of data they are looking at, and how reliable the data is likely to be

Improving

Data reliability metrics provide KPIs that can be used to steer improvements of PCF processes

In particular, the metrics can be used to **gradually increase the use of primary data** in PCF calculations

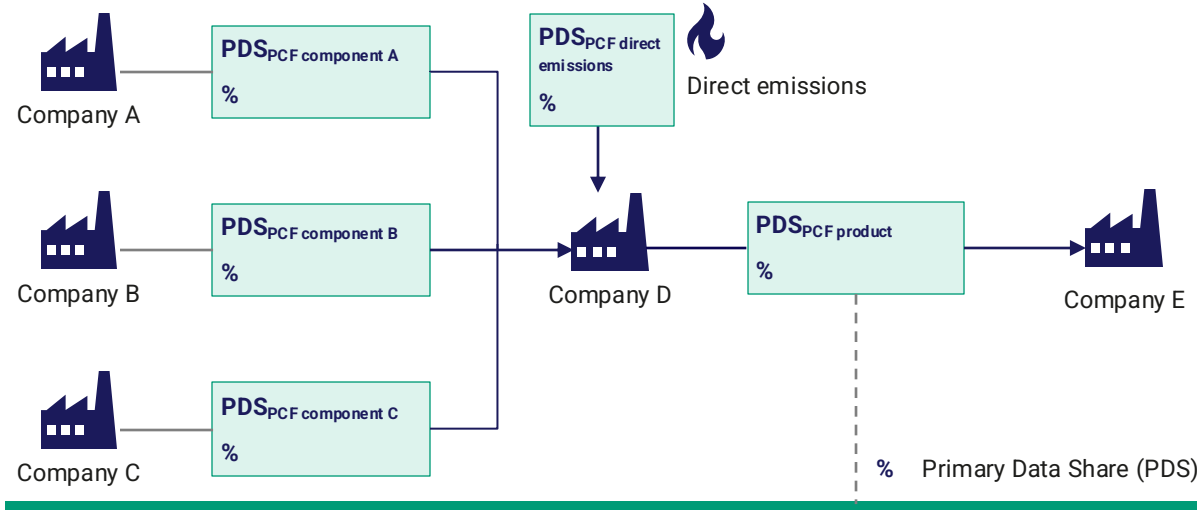
6 Deep-Dive: The Primary Data Share (PDS) can be used to track the percentage of a PCF that is based on primary data

p. 62-64

What is the PDS?

The PDS is a **weighted average** of the primary data shares of the components of the PCF calculation (**both activity and emission factors**), i.e., the percentage of PCF emissions that were calculated using **primary activity and primary emissions data**.

The weights are given by a **component's contribution** to the overall PCF



Formula to calculate $PDS_{PCF\ product}$

$$\frac{|PCF_{component\ A}| * PDSc_{component\ A} + |PCF_{component\ B}| * PDSc_{component\ B} + |PCF_{component\ C}| * PDSc_{component\ C} + |PCF_{direct\ emissions}| * PDSd_{irect\ emissions}}{|PCF_{component\ A}| + |PCF_{component\ B}| + |PCF_{component\ C}| + |PCF_{direct\ emissions}|}$$

How is the PDS calculated?

Component	Data input	Activity data source	Emission factor	Emission factor source	$\lvert PCF_i \rvert$ $kgCO_2e$	% PCF	PDS_i	Total PDS
$PDS_{PCF\ component\ A}$	1,000 kg	Primary	0.8	Primary & Secondary	800	19%	36%	7%
$PDS_{PCF\ component\ B}$	2,000 kg	Secondary	1.2	Primary & Secondary	2,400	56%	0%	0%
$PDS_{PCF\ component\ C}$	500 kWh	Primary	0.18	Secondary	90	2%	0%	0%
$PDS_{PCF\ direct\ emissions}$	5,000 GJ	Primary	0.2	Primary	1000	23%	100%	23%
				$\lvert PCF_{product} \rvert$	4,290	$PDS_{PCF\ product}$		30%

Note: For the purpose of this example, please note that direct emissions are considered to have a PDS of 100%, since both the activity data and emission factor data come from primary sources, while component B and C are considered to have a PDS of 0%, since activity data and emission factors data respectively come from secondary sources.

6 Deep-dive: The Data Quality Ratings (DQRs) track qualitative dimensions of data quality through a quantitative score

p. 65-68

What are the DQRs?

Data quality ratings are **quantitative indicators measuring 3 data quality indicators (DQIs).**

Each of the 3 dimensions is assessed against a **common matrix** defining data quality (from 1 (best score) to 5 (worst score)), and include:

- **Technological representativeness**
- **Geographical representativeness**
- **Temporal / Time representativeness**

An overall DQR for a PCF is a **weighted average** of data quality indicators for a particular component, where the weight is given by **component's contribution** to the overall PCF.

DQRs assess emission factors and direct emissions data.

How are the DQRs calculated?

Formula:

$$DQR_{indicator\ PCF\ product} = \Sigma\frac{(|PCF_i| * DQR_{indicator\ i})}{\Sigma|PCF_i|}$$

Example calculation:

Data Quality Indicators (DQIs)	Component 1	Component 2	Component 3	Total DQR
GHG contribution to absolute PCF	**25%**	**30%**	**45%**	**100%**
Technological representativeness	2	2	1	1.55
Geographical representativeness	2	2	3	2.45
Temporal / Time representativeness	1	5	2	2.65

Example of calculation

Total Technological representativeness DQR: a weighted average based on each component's emissions contribution to the absolute PCF

= 2 * 0.25 + 2 * 0.30 + 1 * 0.45 = 1.55

6 Deep-Dive:The three dimensions of data quality are meant to provide an indication of how likely the data represent the actual activity and associated processes

p. 65-66

Technological representativeness

1	2	3	4	5
The dataset has been created based on data reflecting the exact technology employed (i.e. plant specific process/equipment data for the plant/equipment where the product has been manufactured) Note: this quality score can be achieved only in case of use of primary data	The dataset has been created based on data reflecting the company-specific and same technology to the one employed for the actual manufacturing (i.e. same technology, the company/site specific but not necessarily plant specific – it could be an average if several company/site specific data are available) Note: can only be achieved using primary data	The dataset has been created based on data reflecting an average for an equivalent technology to the one employed for the actual manufacturing (i.e. same technology, but not company specific) Note: this is the maximum score achievable with secondary data	The dataset has been created based on data reflecting a technological proxy (i.e. similar but not same technology, irrespectively if based on averages or supplier specific data)	The dataset has been created based on different or unknown technology vs technology actually employed

Geographical representativeness

1	2	3	4	5
The dataset has been created based on data reflecting the country subdivision (if applicable) or country in which the product has been manufactured Country subdivision list: States in the USA, Provinces in Canada, Federative units in Brazil, Provinces in Argentina, States in Mexico, Republics in Russia, States in India, Provinces in China, States in Australia	The dataset has been created based on data pertaining the country, in which the product has been manufactured. The area where the dataset is generated is valid for the geographical area where the site is located *Example: The site is in California and the dataset is a US average*	The dataset has been created based on data pertaining to the geographical region (e.g. Europe, Asia, North America), in which the product has been manufactured The area where the dataset is generated is valid for the geographical area where the site is located *Example: The site is in Spain and the dataset is a European average*	The dataset has been created based on global averages *Example: The site is in Japan and the dataset is a global average*	The dataset has been created based on data with a geographical scope which is either unknown or pertaining a country, or region not including the site in which the product has been manufactured *Example: In absence of a global average, the dataset geographical applicability is unknown.*

Temporal / Time representativeness

1	2	3	4	5
The difference between "Reference Period End" of the dataset and "Reference Period End" of the PCF is ≤1 year (i.e., 366d (to count for leap year))	The difference between "Reference Period End" of the dataset and "Reference Period End" of the PCF is >1 year and ≤2 years (i.e., 731d)	The difference between "Reference Period End" of the dataset and "Reference Period End" of the PCF >2 years and ≤3 years (i.e., 1096d)	The difference between "Reference Period End" of the dataset and "Reference Period End" of the PCF is >3 years and ≤4 years (i.e., 1461d)	The difference between "Reference Period End" of the dataset and "Reference Period End" of the PCF is >4 years or unknown

DQIs definitions:

- **Technological representativeness:** The degree to which the data reflects the actual technology / technologies used in the process
- **Geographical representativeness:** The degree to which the data reflects the actual geographic location of the processes within the inventory boundary (e.g., country or region)
- **Temporal / Time representativeness:** The degree to which the data reflects the actual time (e.g., year) or age of the process.

6 Example: Help Chocolate Corp. calculates its first Primary Data Share (PDS) with the input of PDS from some of its suppliers

Exercise: Help Chocolate Corp. calculate its first PDS by filling in the marked column with the percentage of the overall PCF based on primary data for each activity!

Activity	Activity Data	Emission Factor source	% Primary Data?	Share of emissions, %	PDS Contribution	Solution
Milk Powder	Primary Data	Supplier-Specific	64%	36.1%		23.1%
Cocoa beans	Primary Data	Industry Database	0%	50.2%		0%
Sugar	Primary Data	Industry Database	0%	2.2%		0%
Transport to site	Primary Data	Supplier-Specific	Unknown	5.8%		0%
Roasting of nibs	Primary Data	Site-Specific	100%	0.1%		0%
Heating	Primary Data	Industry Database	0%	1.4%		0%
Stirring	Primary Data	Industry Database	0%	1.1%		0%
Whipping	Primary Data	Site-Specific	100%	0.6%		0.3%
Tempering	Primary Data	Site-Specific	100%	0.4%		0.2%
Temporary Storage	Primary Data	Avrg. Grid Emission Factor	0%	2.1%		0%
				Total: 100%		PDS: 24.1%

Remember: For an element to be considered primary data, both activity and emissions data needs to be from primary sources! And if a supplier is unable to share % of primary data, then it shall be considered 0%!

6 Example: In the next year, Chocolate Corp. receives PDS data from additional suppliers, allowing it to refine its PDS calculation

Exercise: Help Chocolate Corp. update its PDS by incorporating the PDS received from suppliers in the marked column!

Activity	Activity Data	Emission Factor	Primary Data?	PDS from supplier	Share of emissions, %	PDS Contribution	Solution
Milk Powder	Primary Data	Supplier-Specific	Yes	64%	36.1%		23.1%
Cocoa beans	Primary Data	Supplier-Specific	Yes	72%	50.2%		36.1%
Sugar	Primary Data	Industry Database	No	-	2.2%		0%
Transport to site	Primary Data	Supplier-Specific	Yes	100%	5.8%		5.8%
Roasting of nibs	Primary Data	Site-Specific	Yes	n/a	0.1%		0.1%
Heating	Primary Data	Industry Database	No	-	1.4%		0%
Stirring	Primary Data	Industry Database	No	-	1.1%		0%
Whipping	Primary Data	Site-Specific	Yes	n/a	0.6%		0.6%
Tempering	Primary Data	Site-Specific	Yes	n/a	0.4%		0.4%
Temporary Storage	Primary Data	Supplier-Specific	Yes	38%	2.1%		0.8%
					Total: 100%		PDS: 66%

Remember: For an element to be considered primary data, both activity and emissions data needs to be from primary sources! And if a supplier is unable to share % of primary data, then it shall be considered 0%!

6 Example: Help Chocolate Corp. calculate a DQR for the "Geographical Representativeness" dimension

Exercise: Help Chocolate Corp. calculate the DQR for "Geographical Representativeness" by first assigning ratings for each activity, and then calculating the final DQR!

Activity	Share of Emissions, %	Underlying Information on geographic accuracy of input	Your ratings	Correct Ratings	DQR Contribution	DQR Solution
Milk Powder	36.1%	Supplier-specific PCF provided based on information specific to the producing country		1		0.36
Cocoa beans	50.2%	Supplier provides only global average data due to different production location		4		2.01
Sugar	2.2%	Industry database provides information on sugar by region		3		0.07
Transport to site	5.8%	Logistics provider disaggregates data based on region		3		0.17
Roasting of nibs	0.1%	Nibs are roasted in one specific location for which information is available		1		0.001
Heating	1.4%	On-site heating system provides almost real-time data		1		0.014
Stirring	1.1%	Information can only be estimated based on regional averages		3		0.033
Whipping	0.6%	Information can only be estimated based on regional averages		3		0.018
Tempering	0.4%	In-house solution for tempering specific to the site		1		0.004
Temporary Storage	2.1%	Only generic industry averages for Europe are available		3		0.063

Result: DQR: 2.74

6 Example: Chocolate Corp. calculates its Data Quality Rating for all the five dimensions after evaluating each activity

Activity	Share of Emissions, %	Data Quality Ratings		
		Technological Representativeness	Geographical Representativeness	Temporal/Time Representativeness
Milk Powder	36.1%	1	1	2
Cocoa beans	50.2%	2	4	4
Sugar	2.2%	2	3	1
Transport to site	5.8%	2	3	1
Roasting of nibs	0.1%	1	1	1
Heating	1.4%	2	1	2
Stirring	1.1%	4	3	2
Whipping	0.6%	2	3	2
Tempering	0.4%	1	1	1
Temporary Storage	2.1%	5	3	3
Results:		**DQR: 1.72**	**DQR: 2.74**	**DQR: 2.94**

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Overview: Consolidating all information around your PCF and sharing it with other stakeholders

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7 Verifying your PCF: Verification ensure data integrity through the external validation of PCF results

p. 69-77

Overview

Verification:

Entails **evaluation** that the PCF conforms to a given standard.

On the short-term (2025-2030) companies are, at a minimum, required to verify their PCF Calculation Model: calculation methodology or algorithm used to calculate PCFs

On long- term (2030 onwards) companies are required to verify their PCF Program: system governing how a company generates and manages PCFs

Rationale:

Central element of PACT Methodology, increasing **reliability** of and **trust** in PCFs

Roadmap approach:

Increasingly ambitious verification requirements over time – allowing companies to prepare in advance and improve over time

The PACT Methodology requirements around verification

Dimension	2025-2030	2030 onwards
1 Coverage	PCF Calculation Model	PCF program
2 Conformance to reporting	PCR or sector-specific guidance, if followed, in addition to PACT Methodology	PCR or sector-specific guidance, if followed, in addition to PACT Methodology
3 Boundary	Cradle-to-Gate	Cradle-to-gate
4 Verification Level	Limited Assurance	Certification
5 Provider	Independent Third Party	Independent Third Party
6 Process Cycle	3 years or PCF variance >10%	3 years or PCF variance >10%
7 Companies covered	Phased-in approach for SMEs All requirements above identically apply to SMEs but with a two-year time lag to allow for capacity building	

7 Deep-dive: Getting started on verification requirements involves three steps

p. 69-74

Step		Input	Dimension	Evidence Consolidation Elements
1	**Understanding requirements:** Checking roadmap and understanding verification requirements and choose a to verify PCF Calculation model or certify PCF Program	PACT Verification Roadmap	Data	List of all primary and secondary data sources Data reliability assessments (PDS or DQRs) Inventory of all GHG sources and sites
2	**Gather evidence:** Using Table 14 and Table 15, and Table 16 to meet the verification requirements to start the process	PACT Methodology v3	Method	List of all calculation steps and results List of all standard requirements and assumptions Details of allocation approach followed
3	**Conducting assurance:** Engaging third-party assurance provider to undergo verification process per Step 1	PACT Methodology + Third-Party Assurer	Governance	Map of data governance approach to PCF Risk Management processes Disclosure of internal capacity, expertise and quality control

7 Example: Chocolate Corp. is preparing to verify their PCF Calculation Model

1 Understanding Requirements → 2 Gathering Evidence → 3 Obtaining verification

Chocolate Corp. has reviewed the verification requirements of the PACT Methodology v3 and found the following:

- It currently does not meet the verification requirements
- It is preparing verification of their PCF Calculation Model by gathering evidence on all elements needed for verification, listed in Table 14 and Table 15
- Chocolate Corp. is also reaching out verification bodies that could help verify the PCF Calculation Model

Chocolate Corp. begins to consolidate the required evidence across the required elements to certify the PCF Calculation Model:

- Data: It maintains a registry of all data sources, associated data quality indicators, and data quality checks
- Method: it can trace all calculation steps and assumptions going into the calculations, incl. system boundaries, characterization factors, exempted emissions

Chocolate Corp. has begun reaching to a verification body to understand whether they can verify the PCF Calculation model and have the needed skills and expertise to do so

The verification body will run results test to ensure that the PCF Calculation Model generates correct PCFs, based on a set of test input data

Through its preparation, Chocolate Corp. is well-positioned to understand what is required to obtain PCF Model Verification.

7 Example: Test your understanding of verification requirements!

Exercise: Determine whether each of the six statements on verification is true or false!

	Statement	Response	Correct response	
1	Verification in PACT requires evaluation of accuracy of individual PCFs, and their underlying data	Short-term verification requirements in PACT require the verification of the PCF Calculation Model, not of individually calculated PCFs and its underlying data	True	False
2	The verification requirements are fixed and apply immediately	The verification requirements are contained in a roadmap – stricter requirements are phased in over time to give companies time to prepare	True	False
3	Verification is a required component under the PACT Methodology	Verification is required to be fully PACT conformant	True	False
4	Verification can be undertaken by either a first- or a third-party provider	Verification needs to be conducted by a third-part provider; first-part assurance is not PACT conformant	True	False
5	The verification process needs to be renewed every year	Verification needs to be renewed every 3 years, unless the PCF changes by >10%	True	False
6	Verification requirements apply to SMEs	The requirements equally apply to SMEs; however, they take effect later than for corporates	True	False

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6 Assessing data reliability

Overview: Assessing data reliability using quantitative and qualitative metrics

7 Verifying your PCF

Overview: Ensuring data reliability through third-party verification

8 Exchanging your data

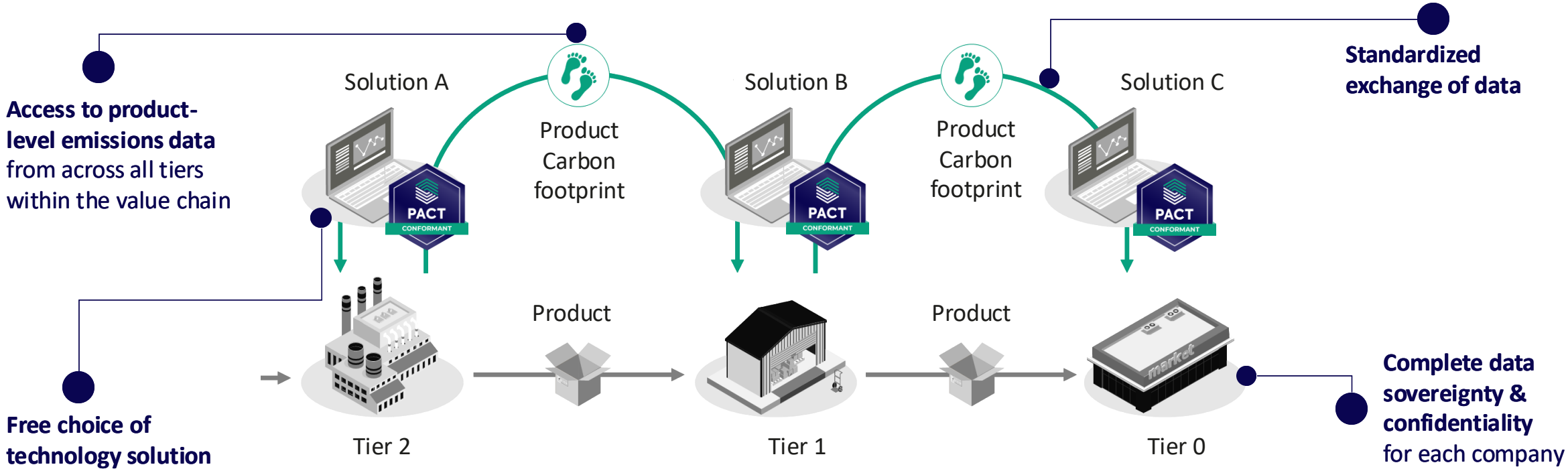
Overview: Share your PCF in a standardized way over the PACT Network.

Each step includes **key explanations, content deep-dives, examples and exercises** for you to test your understanding

8 The PACT Network makes exchanging PCF data between organizations less cumbersome by providing a standardized technical language

Current Situation	Solution
PCF data exchange is highly laborious, using various formats (i.e., excel files shared via email) Suppliers suffer "survey fatigue" from non-standardized requests	The PACT Network enables PCF data exchange in a standardized format across interoperable and secure technology solutions. Solutions implement the PACT Technical Specifications, become PACT Conformant, and can then exchange PCF data across the PACT Network.

8 The PACT Network of interoperable solutions enables standardized PCF data exchange



1	Technical Standard	40+	PACT Conformant Solutions

8 The PACT Network is by design not a platform, but rather a specification that allows technologies to exchange PCF data

Since the network is not a platform, it...

... is more **inclusive**

A central platform implies membership and barriers to become part of it

With the Network, anyone can join

... gives you **control of your data**

A platform requires central management of **data control and sovereignty**, whereas the Network gives users this control

... is designed to **connect**

Platforms are not built by default to connect to other systems, whereas **interoperability is core** to the PACT Network

Platforms built by industry specific initiatives or Solution Providers **can all connect** to the Network

8 Deep dive: The PACT Technical Specifications enable the interoperable exchange of Product Carbon Footprints across PACT Conformant Solutions

p. 78-81

PACT Technical Specifications V3

Technical Specifications for PCF Data Exchange (3.0.0-20250428)

Living Document

Latest published version:
https://docs.carbon-transparency.org/spec/3.0.0/

Previous Versions:
https://docs.carbon-transparency.org/spec/2.3.1/

Feedback:
pact@wbcsd.org with subject line "[data-exchange-protocol] … *message topic* …"
GitHub

Abstract

This document specifies a data model for GHG emission data at product level based on the PACT Methodology (previously Pathfinder Framework) Version 3, and a protocol for interoperable exchange of GHG emission data at product level.

§ 1. Introduction

This document is a work in progress and should not be used for conformance testing. Please refer to the latest stable version of the Technical Specifications for this.

For an overview of changes since the last version (2.3), see the Appendix A: Changelog.

This document contains the necessary technical foundation for the PACT Network, an open and global network for emission data exchange.

The goal of this document is to enable the interoperable exchange of Product Carbon Footprints across conforming host systems.

The methodological foundation of the specification is the PACT Methodology Version 3.0, see [PACT-METHODOLOGY].

Building blocks

Data Model

The data model specifies:

- Set of attributes, attribute definitions, and syntax
- Data model available as an open API schema

API Specification

Specifies a standard technical language for solutions to send, request, and receive PCF information over the internet

8 Overall, the PACT Network vision is to enable an open and global network of interoperable solutions for the secure, peer to peer exchange of accurate, primary and verified data

Open and Global

Data exchange is based on open guidelines and technical specifications that can be used by all organizations globally

Interoperable

Data is exchanged via different solutions that "speak the same language", meaning data formats can be read by any solution

Secure

Data cannot be accessed or manipulated by third parties during exchange and only the minimum necessary amount of data is exchanged

Peer-to-Peer

Data is shared directly between two companies in a decentralized manner, with no need for a central intermediary

An **open and global** network of **interoperable** solutions for the **secure peer-to-peer** exchange of **accurate**, **primary** and **verified product emissions data** – across **all industries** and value chains

Accurate

Data is calculated consistently in accordance with the Pathfinder Framework

Primary

Data is specific to the company exchanging it, rather than based on industry averages

or proxies

Verified

Data is verified either automatically or by third parties, e.g., to check calculation methodology

Product Data

Data has the highest possible granularity and individual products of

a company

All Industries

Data relating to any product can be exchanged – independent of industry or value chain

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Part 3: Levelling Up

Taking your PCF journey to the next level

Jump to

Part 1: Introduction | Part 2: The PCF Journey | Part 3: Levelling Up

From insight to action: what happens after you have calculated and exchanged a PCF

Overview

Congratulations!

Calculating your first PCFs is a great achievement!
With the insights generated from the PCF, you are now ready to connect your PCF back to the bigger picture
This section will highlight which steps you can take to unlock the full value of carbon transparency

What's next?

Leveraging the insights from your PCF across **three dimensions** will help ensure that the accuracy and granularity a PCF provides permeates through the organization:

Management: The PCF can become a management tool used to improve data quality, corporate GHG accounting, procurement decisions and product portfolios

Strategy: The PCF can become a strategy tool used to steer product portfolios, inform R&D and design processes, market entry and sustainability targets

Engagement: The PCF can become an effective tool for engagement, including marketing, supplier engagement, policy advocacy

Deep-Dive: Unlocking the full value of your PCF involves three dimensions – management, strategy and engagement

Management

The PCF can become a management tool used to **track and manage performance**

Examples might include tracking data quality, tracking emissions performance of suppliers, improving corporate accounting or managing climate risk

Strategy

The PCF can become a strategy tool if it is used to **inform strategic decisions**

Such decisions might include product portfolio steering, innovation programs, supply chain decisions, or broader sustainability objectives

Engagement

The PCF can be the basis for **targeted engagement with key stakeholders**

Such stakeholders might include consumers, sustainability-conscious investors, regulators and suppliers

Management: Using PCF data for five management use-cases will generate additional value while accelerating your sustainability journey

Use Case	Description
Improving data quality	The PCF, and its associated data quality metrics, can become KPIs used to assess data quality underlying the PCF calculation – with the goal to improve data quality over time
Improving corporate GHG accounting	By incorporating product-level data into corporate-level carbon accounting, PCFs can be used to improve corporate GHG accounting accuracy
Monitoring sustainability targets	PCFs can provide good indicators for whether sustainability targets are being met or not – monitoring e.g. the most impactful products' PCFs is likely indicative of overall performance
Monitoring supplier performance	PCFs can be used to track supplier performance – by requesting regular updates of PCF data and comparing suppliers, you can track supplier performance over time[a]
Managing climate risk	Product-level emissions data can be used to manage climate risk and identify the highest exposures

a. Please note that even if the suppliers' PCF data is calculated following the same methodology, the use of different secondary data sources (e.g., ecoinvent vs Sphera) or the percentage of primary data share may make the comparison unfair. To limit this, make sure to include the PDS and DQR indicators into consideration when comparing suppliers.

Corporate Accounting Case Study: Chocolate Corp. uses its PCF data to refine estimates of its Scope 3 inventory

Chocolate Corp wants to review its **Scope 3 Category 1 (Purchased Goods & Services) inventory**. Since Chocolate Corp. has received **PCF data** from various suppliers on one of the key inputs – cocoa beans – it refines its Scope 3 baseline using this data:

Baseline: Without PCF data

Chocolate Corp. procures cocoa beans from 3 suppliers from different continents. Without PCF data, Chocolate Corp. applies average global emission intensities to its cocoa beans to calculate its baseline:

Calculation

Total Emissions from cocoa beans =

60,000 tons of cocoa beans x CO_2e/ tons of beans =

60,000 tons x 1.47t CO_2e / ton = **88,200 tons CO_2e**

Refinement: With PCF data

The beans' three suppliers have provided their respective PCFs. Supplier 1 supplies 50% of beans, supplier 2 30%, and supplier 3 20%. Based on the results, Chocolate Corp. considers procuring more from supplier 1 (less intensive), or work with all suppliers to drive reductions across all PCFs:

Calculation

Total Emissions =

(30k tons x 1.1 t CO_2e/ton supplier 1) + (18k x 1.6 t CO_2e/ ton supplier 2) + (12k x 1.5 t CO_2e/ ton supplier 3) =

33,000 t CO_2e + 28,800 t CO_2e + 18,000 t CO_2e = **79,800 t CO_2e**

Strategy: Your PCF can inform strategic decisions, which can be categorized across five use cases

Use Case	Description
Product Portfolio	PCF data can inform which direction to take your overall product portfolio – for example, gradually replacing the highest intensity products might be a significant decarbonization lever
Innovation, R&D and product design	Knowing which products have the highest emissions also informs where innovation and product re-designs might be needed the most, or where the potential for green premia might be greatest
Decarbonization strategy	PCF data can be used to guide a company-wide decarbonization strategy, e.g. which levers to pull at what point in time, and which areas of the business to prioritize
Supply-chain strategy	PCF data can be a valuable input when designing supply-chain strategies – for example, when comparing suppliers, emissions data might become one screening criteria[a]
Marketing strategy	PCF data might be valuable when deciding which markets to enter, and how a product should be marketed – for example, a lower footprint might be a unique value proposition in some geographie

a. Please note that even if the suppliers' PCF data is calculated following the same methodology, the use of different secondary data sources (e.g., ecoinvent vs Sphera) or the percentage of primary data share may make the comparison unfair. To limit this, make sure to include the PDS and DQR indicators into consideration when comparing suppliers.

Marketing Case Study: Chocolate Corp. uses PCF data to market its vegan chocolate as a low-carbon alternative to other types of sweets

Marketing Approach

1. **Leverage PCF data:**
   Chocolate Corp. uses the PCF for its vegan chocolate bar to be able to compare it to potential substitute sweets

2. **Identify value proposition:**
   Chocolate Corp. finds that its vegan chocolate bar has a much lower PCF than other products in its portfolio or on the market – it has a low-carbon value proposition!

3. **Design marketing:**
   Chocolate Corp. has decided to put its PCF on its vegan chocolate bar, creating a campaign around the chocolate's sustainability credentials for sustainability conscious consumers

Engagement: Engaging your stakeholders using PCF data

Use Case	Description
Supplier Engagement	Engaging your suppliers around PCF data not only improves the data quality of your PCFs but might also provide new opportunities towards joint decarbonization progress
Customer Engagement	Engaging your customers around PCF data is a great way to differentiate your product and tap into new commercial opportunities
Compliance Engagement	Highlighting PCF data as part of your sustainability reporting can be a great way to add depth and nuance to your compliance reporting
Industry Engagement	Engaging with your wider industry to scale the PCF practice and foster further alignment will ensure that your organization is regarded as a leader
Regulatory Engagement	Engaging with regulators and regulatory requirements using PCF data enables regulations to be based on the best available data

Supplier Engagement Case Study: Chocolate Corp. uses its Scope 3 “Purchased Goods & Services” baseline to prioritize inputs with high emissions for supplier engagement

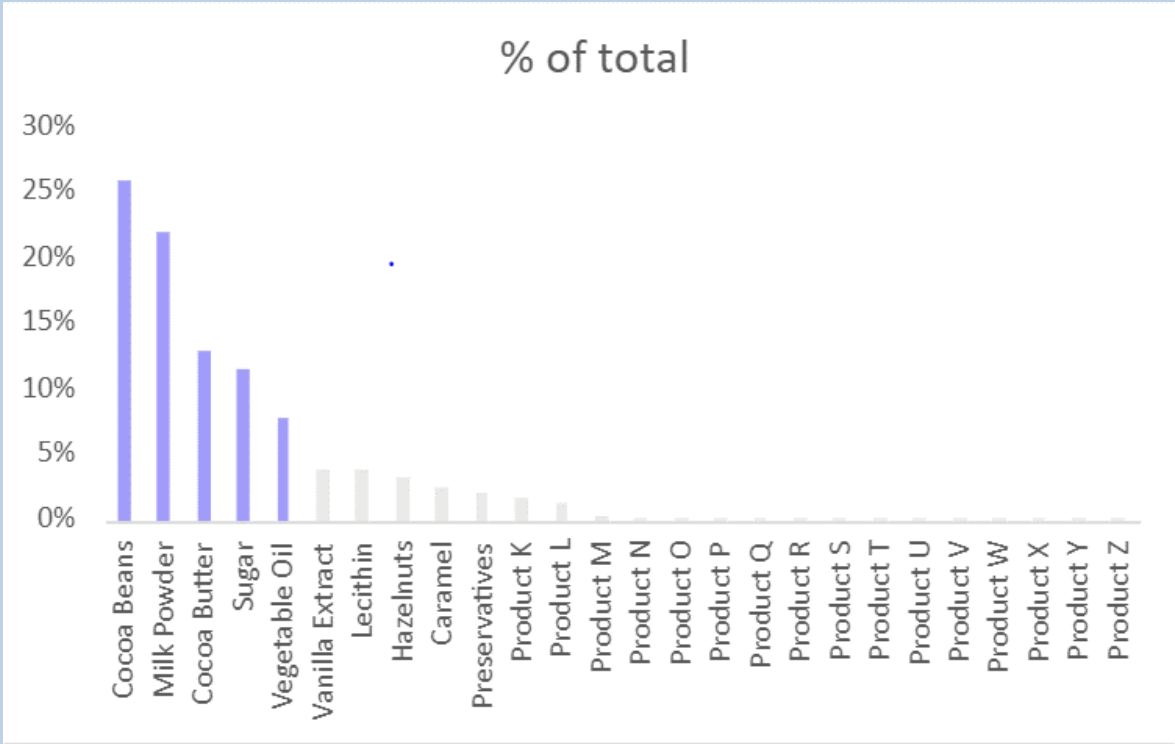
Purchased Goods and Services

3866.1 t

Product	Spend	Emissions	% of total
Cocoa Beans	*$ 1 million*	*10000 t*	*26 %*
Milk Powder	*$ 1.5 million*	*850 t*	*22 %*
Cocoa Butter	*$ 500k*	*500 t*	*13 %*
Sugar	*$ 100k*	*450 t*	*12 %*
Vegetable Oil	*$ 200k*	*300 t*	*8 %*
Vanilla Extract	*$ 50 k*	*150 t*	*4 %*
...	...	...	...

Prioritized goods and services

The top 5 purchased goods account for 80% of the emissions!



Supplier Engagement Case Study: Chocolate Corp. maps key suppliers to prioritized products, allowing them to identify priority suppliers for engagement

Deprioritized

Chosen products	Suppliers			
A Cocoa Beans	**Cocoa Corp.** *50%, Peru*	**Cocoa Ltd.** *30%, Ghana*	**Cocoa Comp.** *20%, Indonesia*	
B Milk Powder	**Milk 1** *25%, France*	**Milk 2** *25%, USA*	**Milk 3** *25%, USA*	**Milk 4** *25%, Swiss*
C Cocoa Butter	**Butter Co.** *95%, Ivory Coast*	**Butter Ltd.** *4%, Ghana*	**Butter Comp.** *1%, Peru*	
D Sugar	**Sugar 1** *60%, India*	**Sugar 2** *30%, Brazil*	**Sugar 3** *7%, India*	**Sugar & Oil Inc.** *US* *Sugar: 3%* *Veg. Oil: 80%*
E Vegetable Oil	**Oil Inc.** *10%, India*	**Oil GmbH** *9%, Austria*	**Veggie Oil 3** *1%, USA*	

Output

- Each prioritized product is linked to **list of suppliers** to engage with
- Chocolate Corp. initially **prioritizes suppliers with material share** of chosen products
- Repeating this exercise for all prioritized products results in a final list of products and product suppliers, including **information about that supplier** (e.g., % emissions, % spend, contact information, etc.)

Supplier Engagement Case Study: In a next step, Chocolate Corp. gathers information from suppliers to understand how advanced they are in their accounting practices

Deprioritized

Suppliers

- **Cocoa Corp.** *50%, Peru*
- **Butter Co.** *95%, Ivory Coast*
- **Sugar 1** *60%, India*
- **Sugar & Oil Inc.** *USA, 3- 80%*
- **Cocoa Company** *20%, Indonesia*

Information requested

Maturity

Does supplier already calculate **corporate emissions? If so, how?**

Does supplier already **calculate PCFs?**

Ambition

Plans to roll out product-level GHG accounting?

Net zero targets or strategies in place?

Capability

What **internal capabilities** exist, e.g., software tools, team expertise or capacity?

Kind of support needed to provide high-quality PCFs?

Output

- Understanding of **suppliers' GHG accounting maturity** and their plans to improve it
- Information request **tailored** to company needs
- Ability to **classify suppliers by level to best define engagement strategy**
- Note: Requesting companies should **leverage publicly available information** as much as possible

Supplier Engagement Case Study: Based on the initial supplier assessment, Chocolate Crop. classifies suppliers to define and tailor engagement strategies

Assessment results

Supplier	Maturity	Ambition	Capability
Cocoa Corp. *50%, Peru*	*High*	*High*	*High*
Butter Co. *95%, Ivory Coast*	*High*	*Med.*	*High*
Sugar 1 *60%, India*	*Med.*	*Med.*	*Med.*
Sugar & Oil Inc. *USA, 3- 80%*	*Med.*	*High*	*Low*
Cocoa Company *20%, Indonesia*	*Low*	*Med.*	*Low*

Supplier archetypes

Archetype (illustrative only)	Engagement Focus
Advanced High maturity around carbon accounting with existing PCF capabilities in place	• **Requesting PCFs** • **Monitoring** and supporting process • Focus on **improving data quality**
Intermediate Corporate carbon accounting practices and capabilities in place, but further capability building required to transition to PCF	• Support around **technical capabilities and processes** • Share **best-practices** on how to transition from corporate to product
Beginner Low maturity and capability – support on basics	• **Basic know-how** to get started with carbon footprinting

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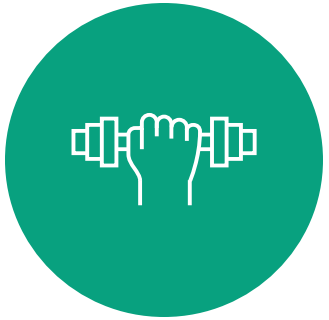
Reflections on the PCF journey and looking ahead



Challenge accepted!

Beginning your PCF journey can seem daunting at first – however, we encourage you to embrace the challenge

After all, **the most important step is to get started!**

You're not alone!

Collaborating with peers, sharing your learnings as well as learning from others, **will make your journey that much easier** and more enjoyable

Improving carbon transparency is a team sport!

Onwards and upwards!

As you move ahead on your PCF journey, it is important to remember that the **quality of calculations and data is expected to improve over the years** – no one is expecting perfection from the beginning, and you won't be penalized for providing more accurate data over time!

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Thank you

For more information and resources, please check the PACT resources page

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Glossary

Glossary

- Attributable Processes: Those processes that consists of all service, material and energy flows that become, make and carry a product throughout its life cycle.
- Biogenic carbon: Carbon derived from living organisms or biological processes, but not fossilized materials or from fossil sources.
- Co-product: A product from a multioutput process that is not deliberately produced in a production process and is not a waste (following the EU Waste Directive 2008/98/EC).
- CO_2e: "Carbon dioxide equivalent" or "CO_2e" is a term for describing different greenhouse gases in a common unit. For any quantity and type of greenhouse gas, CO_2e signifies the amount of CO_2 which would have the equivalent global warming impact.
- Cradle-to-gate: Refers to the lifecycle stages of a product, including all processes up to the point where a product leaves the reporting company's facilities.
- Declared unit: Unit of analysis chosen for PCF, which serves as the reference to which the inputs (materials and energy) and outputs (such as products, co-products, waste) are quantified.
- Life Cycle Assessment (LCA): Compilation and evaluation of the inputs, outputs and potential environmental impacts of a product throughout its entire life cycle.
- Limited Assurance: A level of assurance expressed as a negative opinion whereby the assurer did not find evidence for material misstatements in a report that is being assured.
- Product Carbon Footprint (PCF): Total GHG emissions generated during the life cycle of a product, measured in CO_2e. Within the boundary of the PACT Methodology, only material acquisition, pre- processing, production, distribution and storage are included in the PCF.
- Product Environmental Footprint Category Rules or Product Category Rules: A set of specific rules, requirements and guidelines for calculating PCFs (among other things) and developing environmental declarations for one or more product categories according to BS EN ISO 14040:2006
- Representative Product: A product of a reporting company's overall product portfolio which has characteristics making it representative of other products in the same portfolio. For example, for a chocolate manufacturer, a milk chocolate bar might be representative of other milk-chocolate based products.