Product Carbon Footprint Approach and Calculation Methodology

CDP x CO2AI Pilot: Supplier methodology manual

APRIL 2023

Summary

- Introduction
  How to define my supplier data readiness level?

  Calculation methodology per supplier data readiness

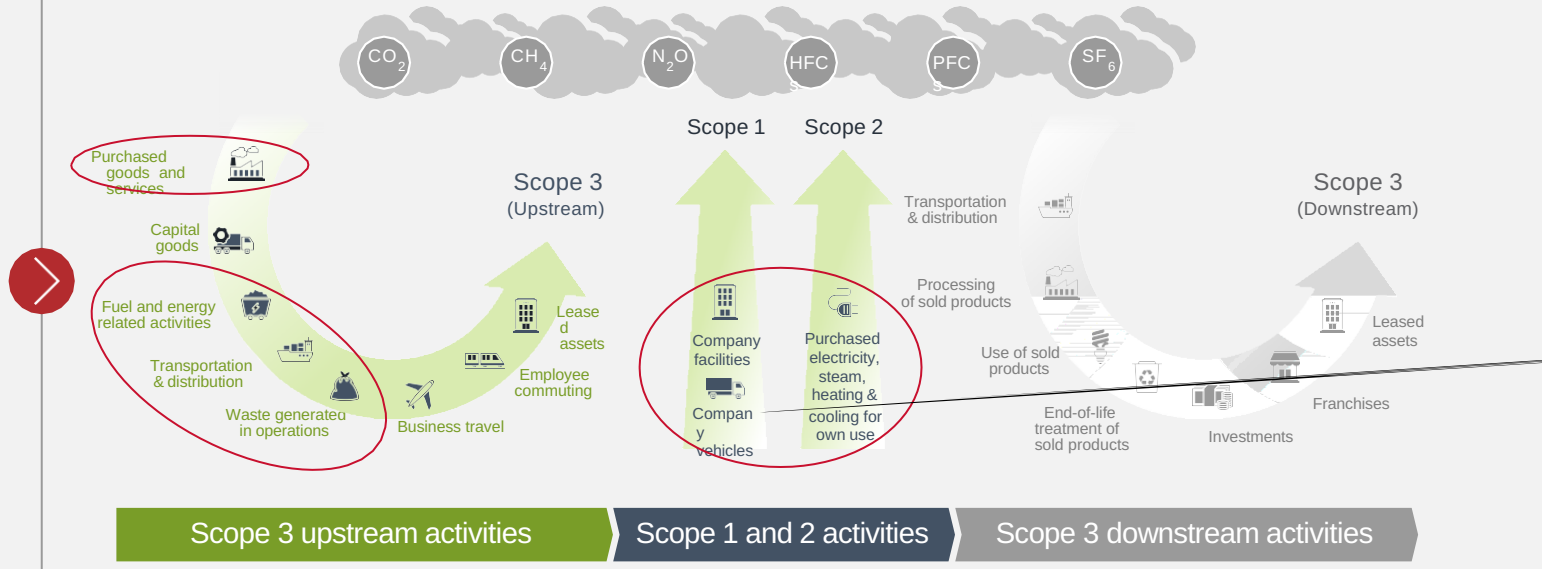
What is a Product Carbon Footprint (PCF)

PCF measures the carbon equivalent **emissions attributable to a product**

It estimates the total emissions of greenhouse gas (GHG) associated with a specific product throughout its life cycle

PCF accounts for:

- Product related emissions of scope 1, 2
- Select product attributable S3 emission[1]
- Product related Transport & Distribution emissions (S3 downstream) to client facilities



Manual terminology

Within this manual, the following terminology respectively refer to:

Studied product

Product for which we want to compute a Product Carbon Footprint (PCF)

Allocation rules

Guidelines to allocate company-level[1] emissions to the studied product

Client

Company requesting a PCF on CO2 AI Product Ecosystem

Supplier

Company submitting its PCF data on CO2 AI Product Ecosystem

Tier 2 supplier

Company providing the supplier with raw material (or packaging) needed to manufacture the studied product

1. Or equivalent e.g., plant, regional

Summary

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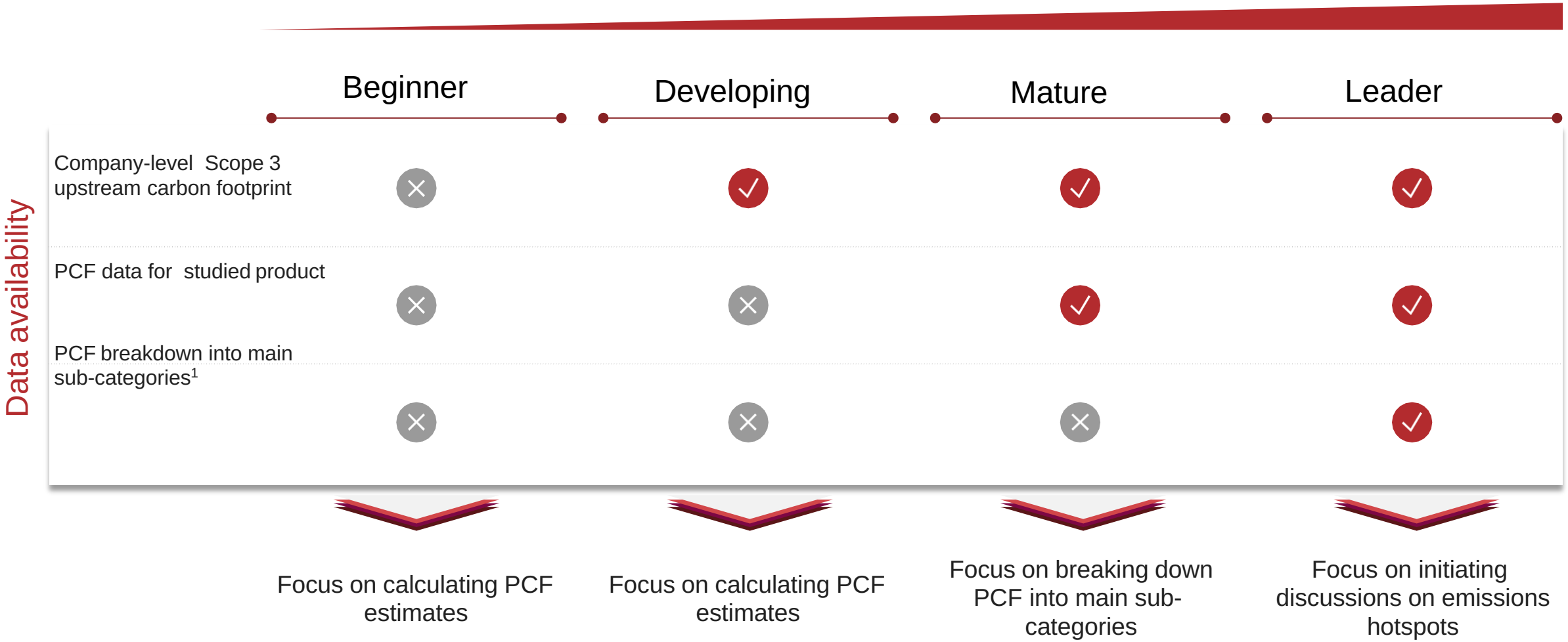
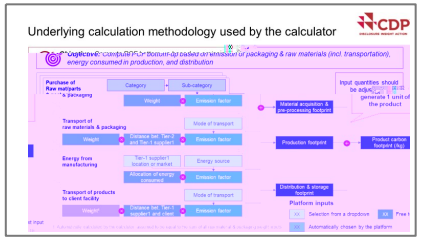
Data availability & effort needed to calculate PCF varies – 4 data readiness levels identified



1. If supplier data allows for categorization (e.g., breakdown of PCF into raw material, production, distribution. categories)

You will find in this manual a differentiated workplan to reach PCF, depending on your supplier data readiness

Beginner



Input

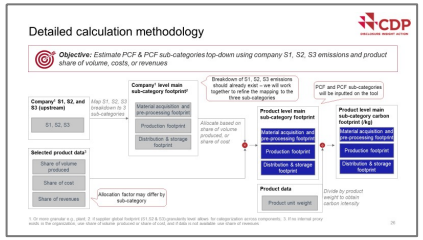
- Studied product cradle-to-gate info : bills of material, packaging, energy consumed & distribution

Output

- PCF bottom-up estimate
- PCF sub-categories breakdown

Use of the self-service calculator feature

Developing



Input

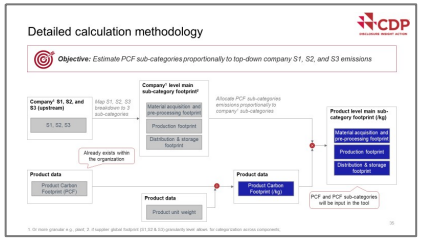
- Scope 1,2 & 3 (upstream) footprint
- Required products volume or costs share (revenue share if not available)

Output

- PCF top-down estimate
- PCF sub-categories breakdown (if sufficient data granularity)

Not input on the platform, used for offline calculations only

Mature



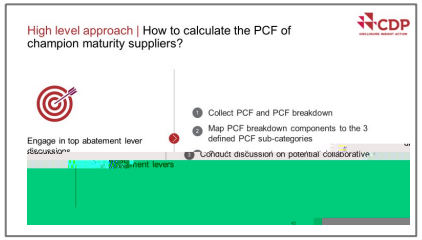
Input

- Scope 1,2 & 3 (upstream) footprint
- Studied product PCF

Output

- PCF sub-categories breakdown (if sufficient data granularity)

Leader



Input

- Studied product PCF
- Product PCF sub-categories breakdown

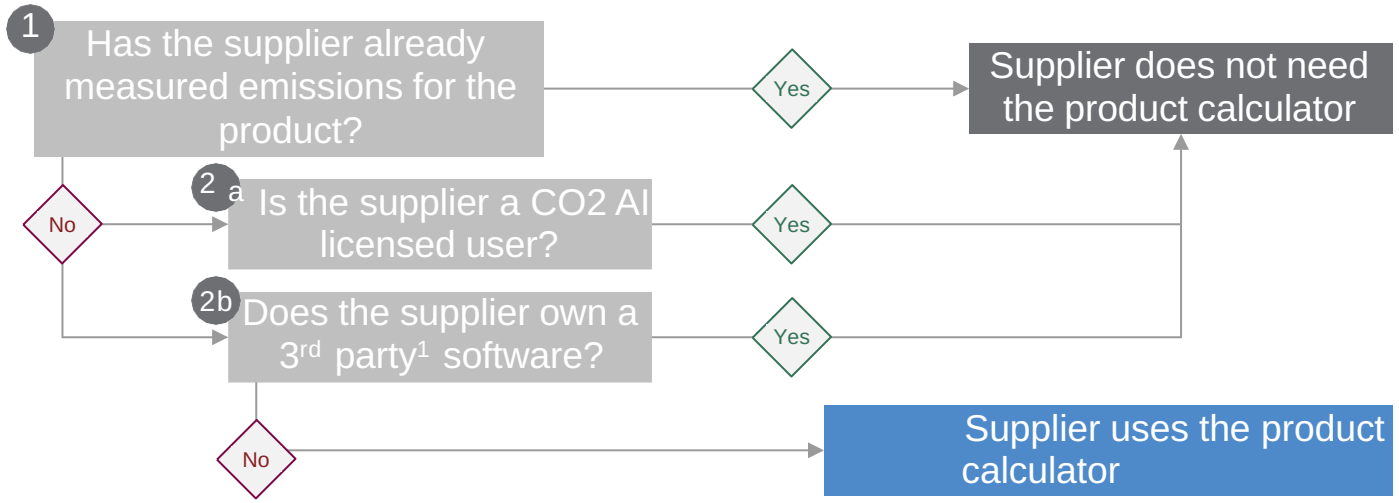
Output

- PCF sub-categories breakdown
- PCF CDP module 4 categories breakdown (if relevant[1])

1. Meant only for suppliers already familiar with CDP module 4 questionnaire, no specific guidance provided

Product Ecosystem calculator aims to provide a safety net to suppliers who are not able to estimate their emissions

Several possible cases for how supplier may measure emissions prior to submitting those on the platform



The product calculator is a "safety net" for suppliers

But all suppliers submit emissions in the same way

Regardless of how suppliers measure emissions, the data is submitted on the platform by **filling the same data request form**

1. E.g., in-house LCA expert, 3rd party consultancy, etc.

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Beginner Developing Mature Leadership

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High level approach | How to help Beginner maturity suppliers to calculate a PCF?

Compute PCF bottom-up based on emission of packaging & raw materials (incl. transportation), energy consumed in production, and distribution

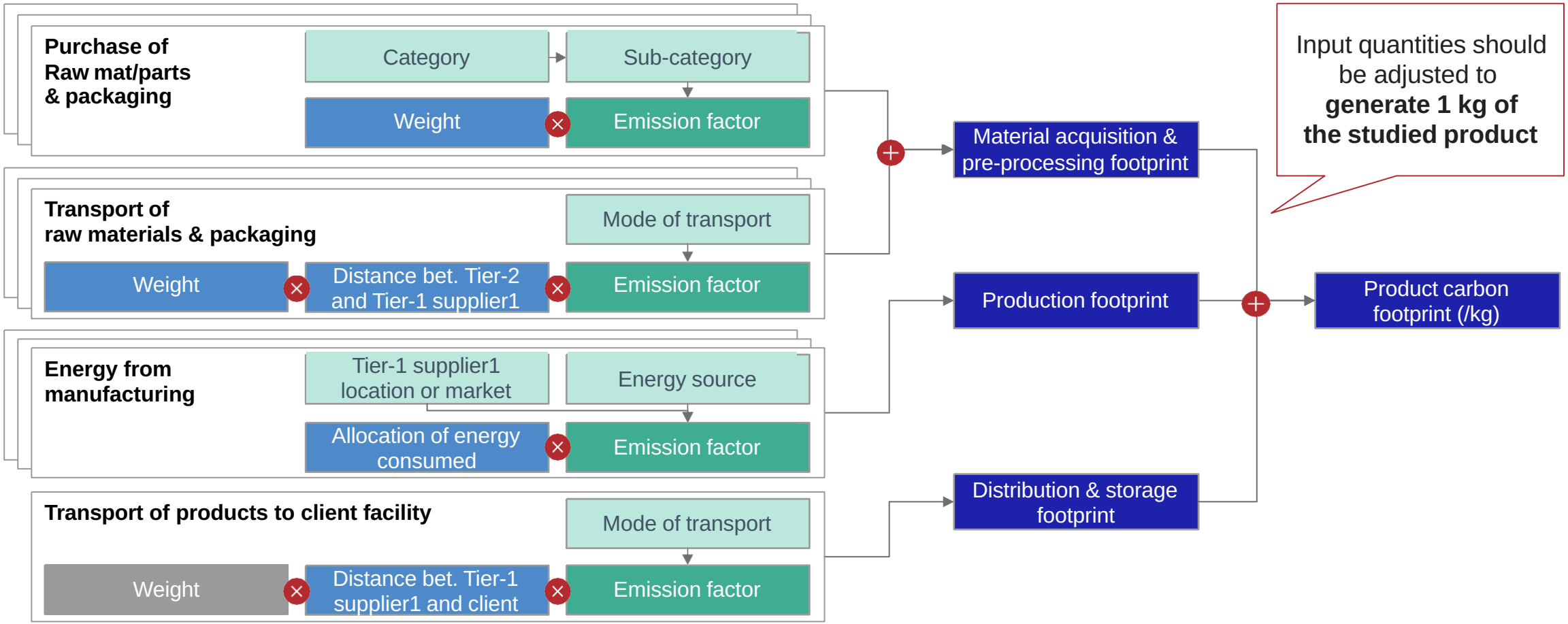
1. Collect product cradle-to-gate inputs needed to generate 1 kg of product (cf. data request)
   - List of raw materials & packaging types, weights and transportation journey (inc. transport modes & distance) to your facilities
   - Quantity & type of energy consumed
   - Distribution journey[1] from your facilities to client facilities
2. Align on allocation rules if needed (primarily for energy consumed)

   Zoom further

   Disclose used allocation rules and justify the choice in the free text field when sharing PCF on the platform
3. Input activity data into free PCF calculator to get PCF estimate

Underlying calculation methodology used by the calculator

Objective: *Compute PCF bottom-up based on emission of packaging & raw materials (incl. transportation), energy consumed in production, and distribution*



Platform inputs

XX Free text input

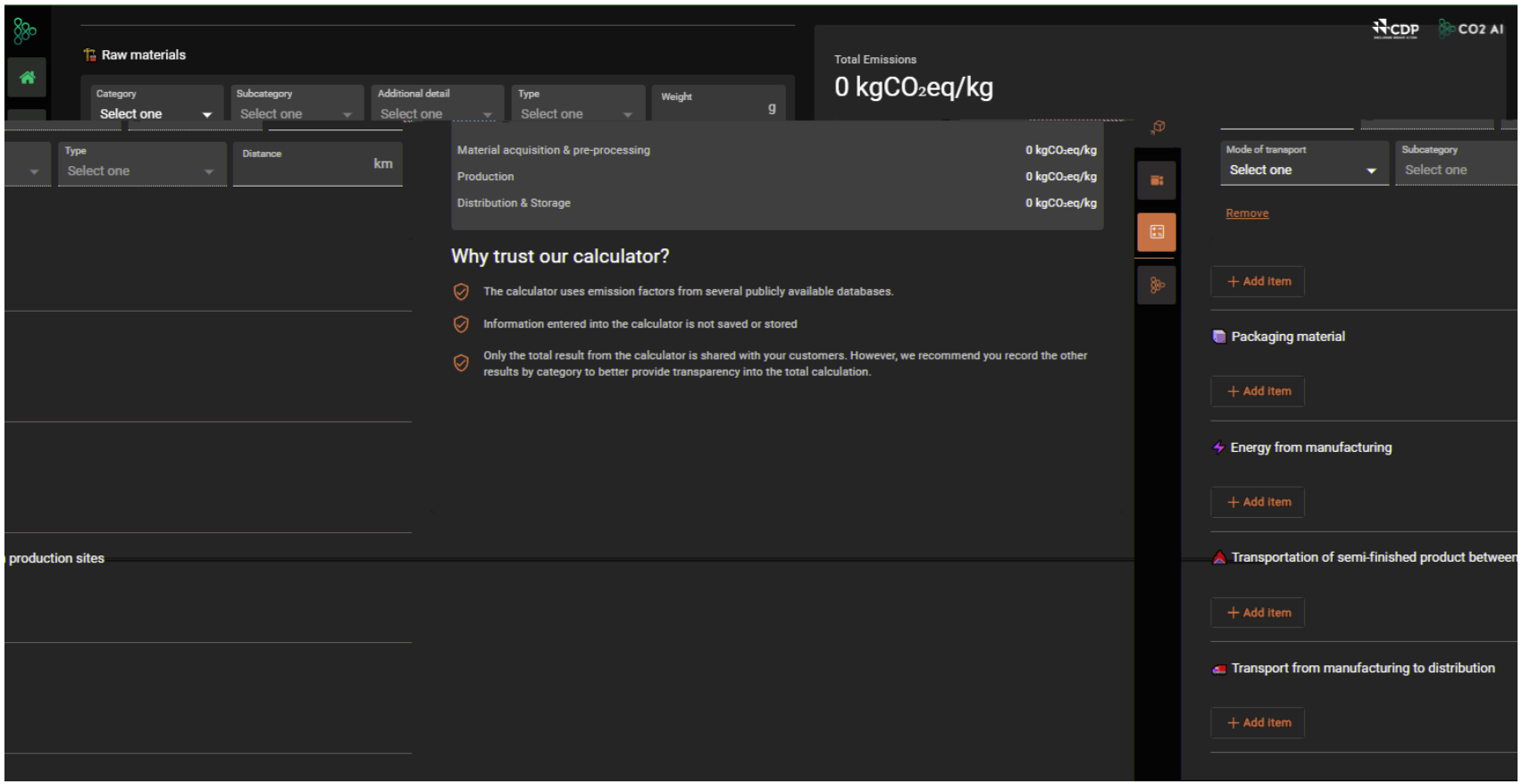
XX Selection from a dropdown

XX Automatically chosen by the platform

ILLUSTRATIVE – May evolve with future versions of the platform

We will leverage our calculator to compute the PCF

Zoom further



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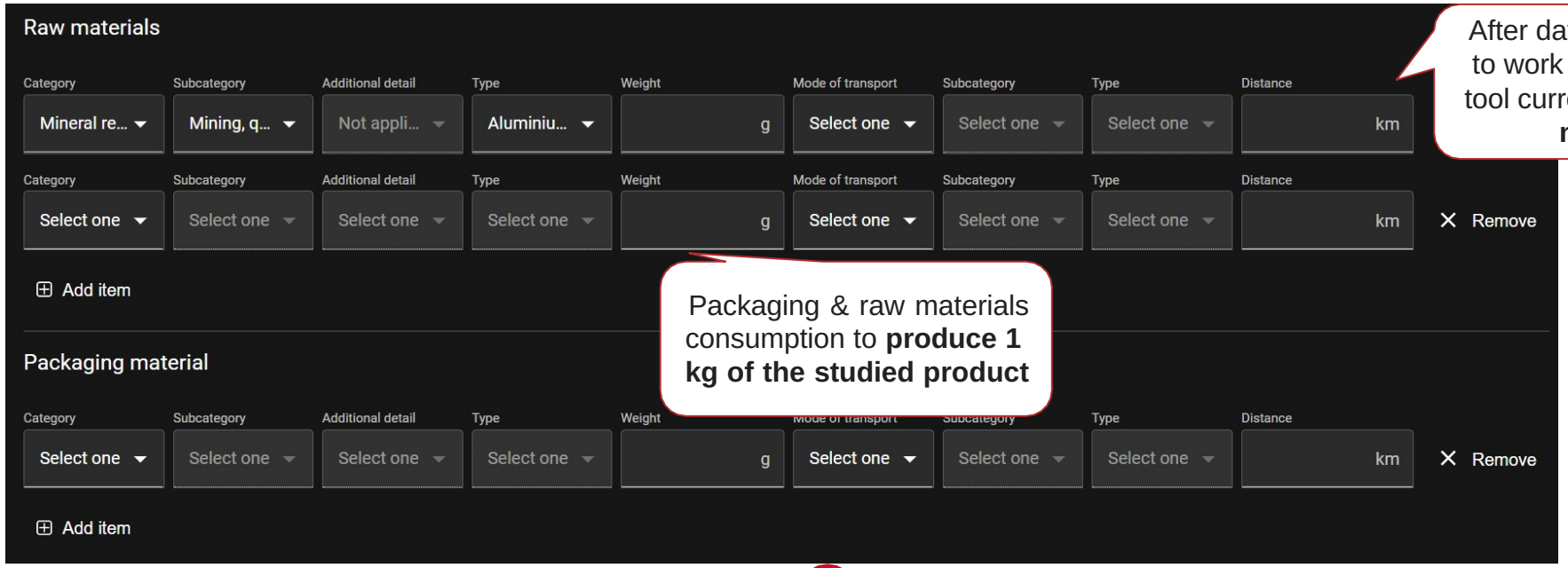
ILLUSTRATIVE – May evolve with future versions of the platform

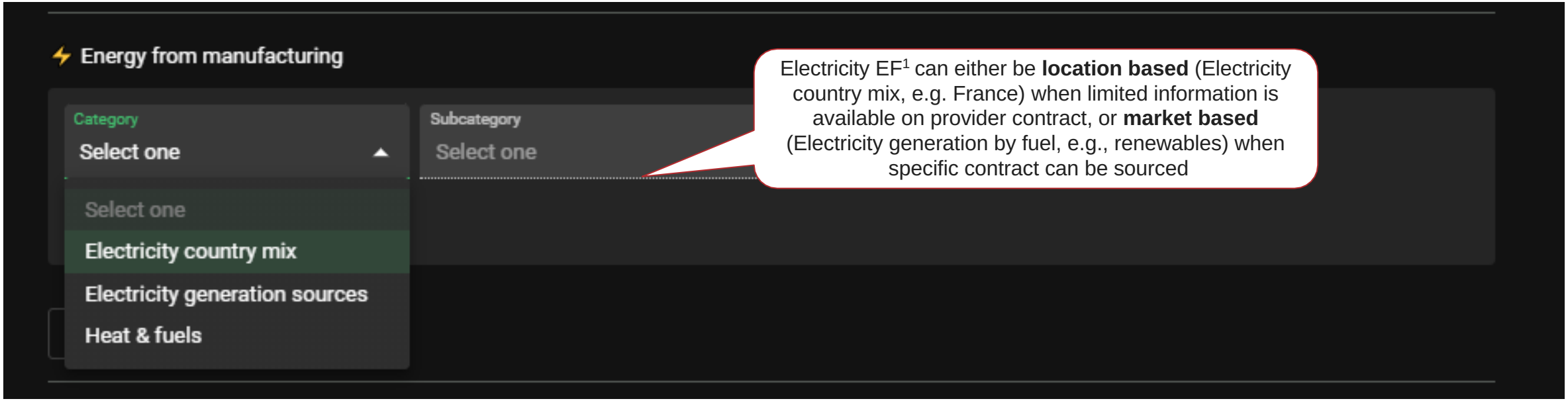
Deep-dive| Purchase and transportation of packaging & raw materials



- What are the types of packaging and raw materials needed in the production of the studied product?
- What quantity (weight in kg) is needed of each packaging and raw material to produce 1 kg of the studied product?
- For each packaging and raw material used in the production, what is the transport mode, distance covered (in km), and weight displaced (in kg) from your suppliers to your facilities? Please collect all transport modes

ILLUSTRATIVE – May evolve with future versions of the platform

Deep-dive| Energy consumed in the manufacturing



- What is the energy consumed in (KWh) to produce 1 kg of the studied product?
- If energy consumed per studied product kg production is not available, allocate energy based on volume produced

1. EF=Emission Factor

Energy consumed emissions

Refer to the document –Allocation rules - "How to determine the electricity generation type to be selected for the studied product?" for more detailed information

Allocation of energy consumed in the production should be **revised based on each supplier**, taking into account available data and **existing internal processes to allocate energy consumption**

The following allocation guidelines can be **leveraged if there is no internal view on energy consumption** or emissions

Step 1: Decide on energy type – for electricity :

- Where possible, source electricity contracts from each supplier to use market-based emission factors
- For a given geography[1], if you miss data about certain providers, then only use geography's location-based factors with aggregate emission factor to avoid any double counting

Step 2: Allocate energy consumption to 1 kg of product:

- Define a period & level at which the calculation will be conducted e.g., over the last 3 years at the plant level

Energy consumed at X level × Studied product share of volume at X level ÷ Number of studied product kg produced at X level

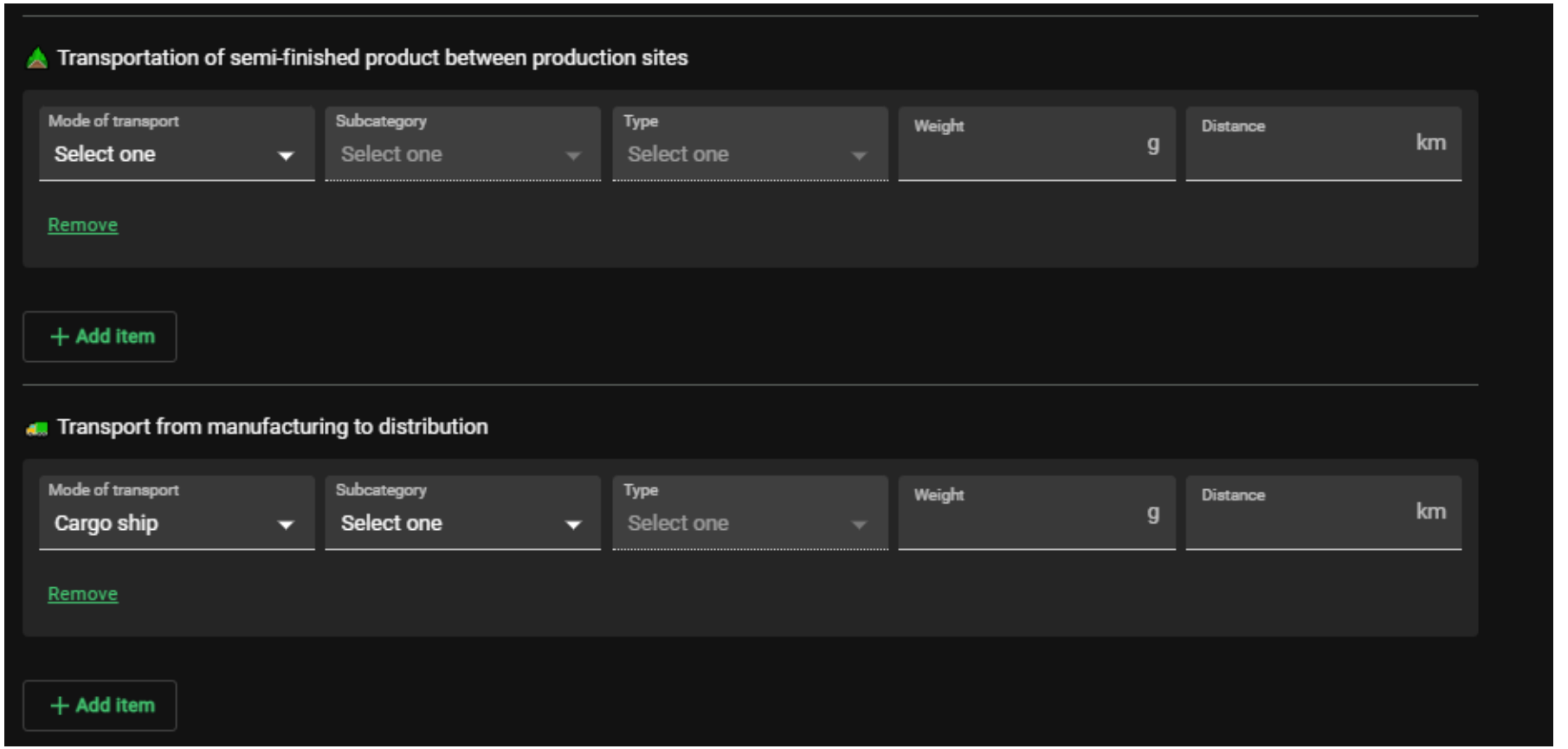
If data is not available, use share of costs or share of revenues

= Amount of energy consumed in the production of 1 kg of studied product (to be input in the platform)

1. Energy providers are in the same geography

ILLUSTRATIVE – May evolve with future versions of the platform

Deep-dive| Transportation of final product to client facilities

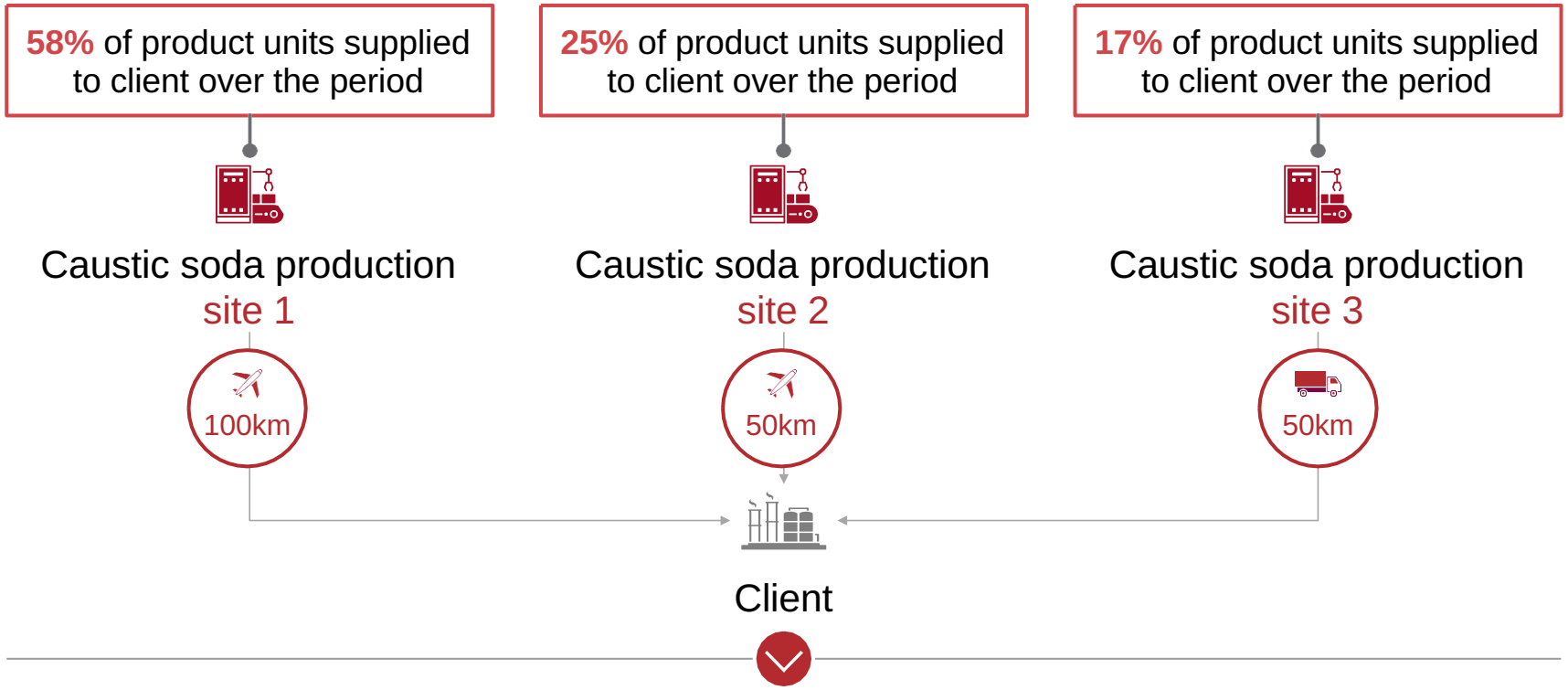


- What is the unit of production currently used for the studied product? (e.g., 1L bottle, 1 roll)
- What is the journey covered by the studied product from your facilities to client facilities in terms of transport mode and distance covered (in km)? Please collect all transport modes

ILLUSTRATIVE – Caustic soda PCF example

Special case: What if studied product is distributed through different journey to customer site?

Input an averaged itinerary into the calculator



Truck

Distance: 17% x 50km=8,5 km

Airplane

Distance: (58% x 100km) + (25% x 50km)= 70,5 km

1. Example of different journey: Customer sources the studied product from different production sites

A journey is defined as by the distance & transport means covered by the studied final product to **get from a specific production site to a specific client location.**

More than 1 journey for a single product[1]?

Refer to the document – Allocation rules - "How to complete the transport section of the calculator when I can inform only 1 itinerary?" for more detailed information

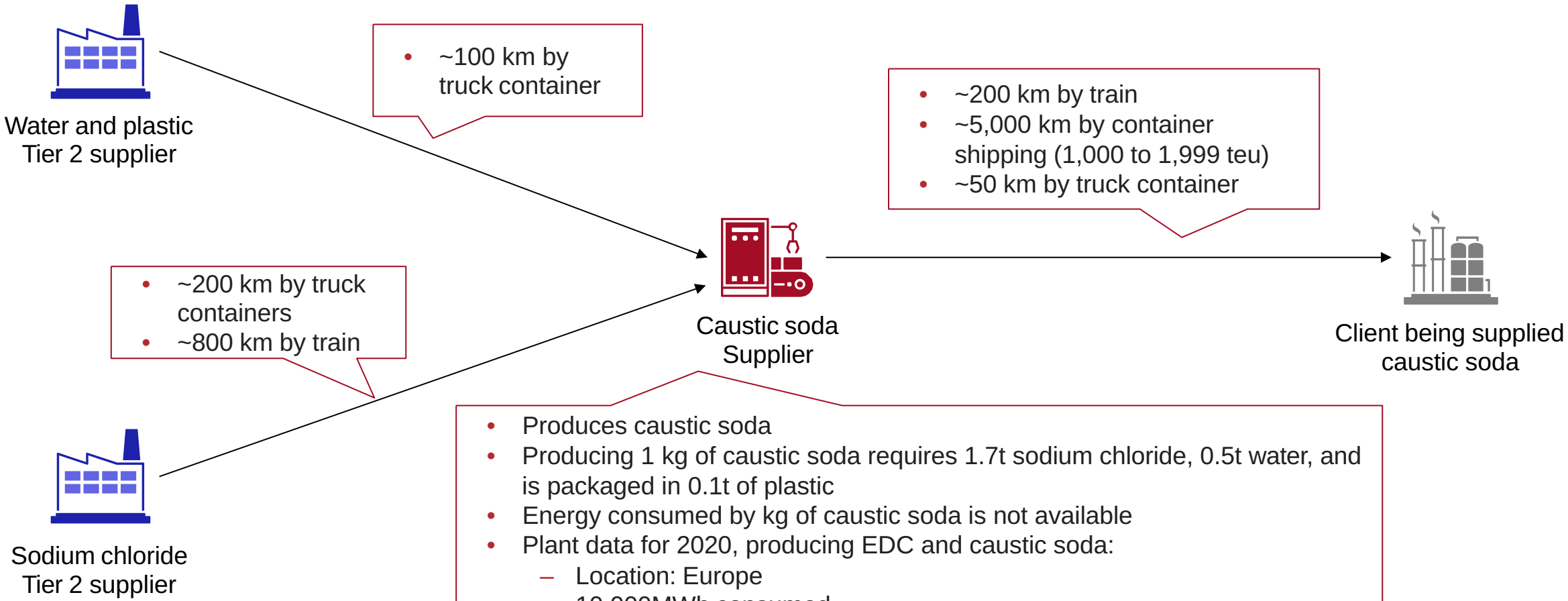
Recap | Data you will need to input the calculator

1. What is the unit of production currently used for the studied product? (e.g., 1L bottle, 1 roll)
2. What are the packaging and raw materials needed in the production of the studied product?
3. What quantity (weight in kg) is needed of each packaging and raw materials to produce 1 kg of the studied product?
4. For each packaging and raw material used in the production, what is the transport mode, distance covered (in km), and weight displaced (in kg) from your suppliers to your facilities? Please collect all transport modes
5. What is the energy consumed in (KWh) to produce 1 kg of the studied product? If energy consumed per unit produced is not available, collect relevant energy consumption data
6. What is the journey covered by the studied product from your facilities to client facilities in terms of transport mode and distance covered (in km)? Please collect all transport modes

Example: Caustic soda PCF for Beginner supplier

Overview of supplier situation

ILLUSTRATIVE



Example: Caustic soda PCF for Beginner supplier

Data input into calculator

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Raw materials

- Sodium chloride:
  - Weight: 1,700 kg
  - Transport: 1,000km through truck given that truck has a higher emission factor than train
- Water:
  - Weight: 500 kg
  - Transport: 100km by truck container

Energy consumed

- Type: location based - country mix, European average given lack of more data
- Consumption:
  - For 1,000 kg of caustic soda: plant energy x share of volume = 10,000 MWh x 30% = 3,000 MWh
  - For 1 kg of caustic soda: 3,000 KWh

Packaging

- Plastic:
  - Weight: 100 kg
  - Transport: 100km by truck container

Distribution

- Transport: create one item per transport mode[1]
  - 200 km by train
  - 5,000 km by 1,000 to 1,999 teu shipping container
  - 50km by container truck

1. Final product follow only 1 journey to be distributed to client site

Appendix - Beginner

Special case: What if 2 different raw materials are shipped using the same transportation mean?

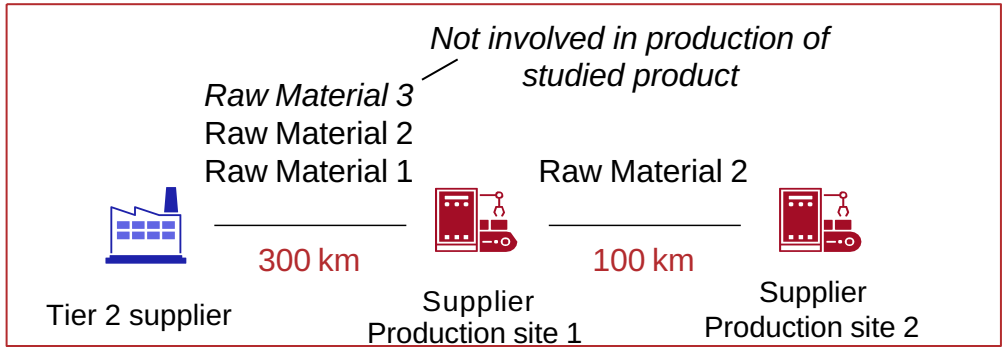
What if 2 raw materials are shipped using the same transportation mean, **how to avoid double counting**?

Emission factors being expressed in carbon intensity per kg of transported raw material (kgCO2eq./kg), there is **no risk of double counting**.

You can **directly enter the distance travelled by each raw material**.

EXAMPLE

You have 1 truck transporting several raw materials (including raw material not used for studied product)



Raw Material 1
- Weight: Input the weight of raw material needed to produce 1 kg of product
- Transport category: Truck
- Travelled distance: 300km

Raw Material 2
- Weight: Idem
- Transport category: Truck
- Travelled distance: 400km

Raw Material 3
- Do not input in the platform as this raw material is not needed to produce studied product

How to account for by-product emissions?

Example: 2kg steel are used & 3,000 KWh of electricity are consumed in the manufacturing process to produce 1kg of studied product. Outputs of the process include:

- 1kg of studied product
- 500g of a co-product
- 70g of waste

		Studied product	Co-product	Waste
Definition		Product whose PCF is being investigated	Output, with an economical value, used to input another product or directly sold to another company	Unused output, without any economical value
Allocation rule		Raw material & energy allocated between studied product & co-product only (exc. waste) based on a physical factor (e.g., weight)		No raw material nor energy allocated to waste
Material acquisition & pre-processing	Steel	~67% of steel = 1,34kg *Volume-based allocation*	~33% of steel = 0,66kg *Volume-based allocation*	0kg of steel allocated to waste
Energy	Electricity	~67% of energy *Volume-based allocation*	~33% of energy *Volume-based allocation*	0KWh of energy allocated to waste

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Beginner Developing Mature Leader

High level approach | How to help Developing maturity suppliers to calculate a PCF?

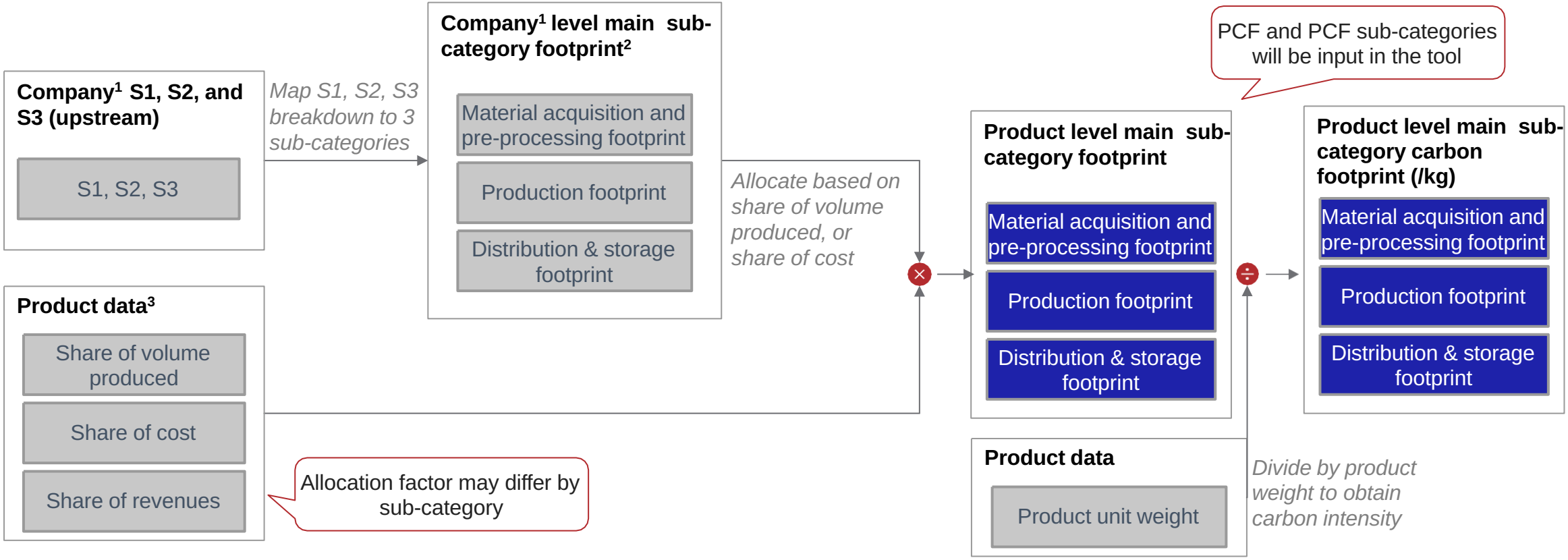
Estimate PCF and PCF sub-categories breakdown top-down using company S1, S2, and S3 emissions and product share of volume/costs[2]

1. Collection | Collect company-level[1] S1, S2, S3 emission data with full available granularity
2. Mapping | Map company-level[1] S1, S2, S3 emissions to 3 defined sub-categories[2]
3. Allocation | Apply product share of volume/costs[3] to the mapping to estimate PCF and PCF sub-categories

1. Or equivalent e.g., plant, regional ; 2. Material acquisition and pre-processing, production, and distribution & storage ; 3. If no internal proxy exists in the organization, use share of volume produced or share of cost, and if data is not available use share of revenues

Detailed calculation methodology

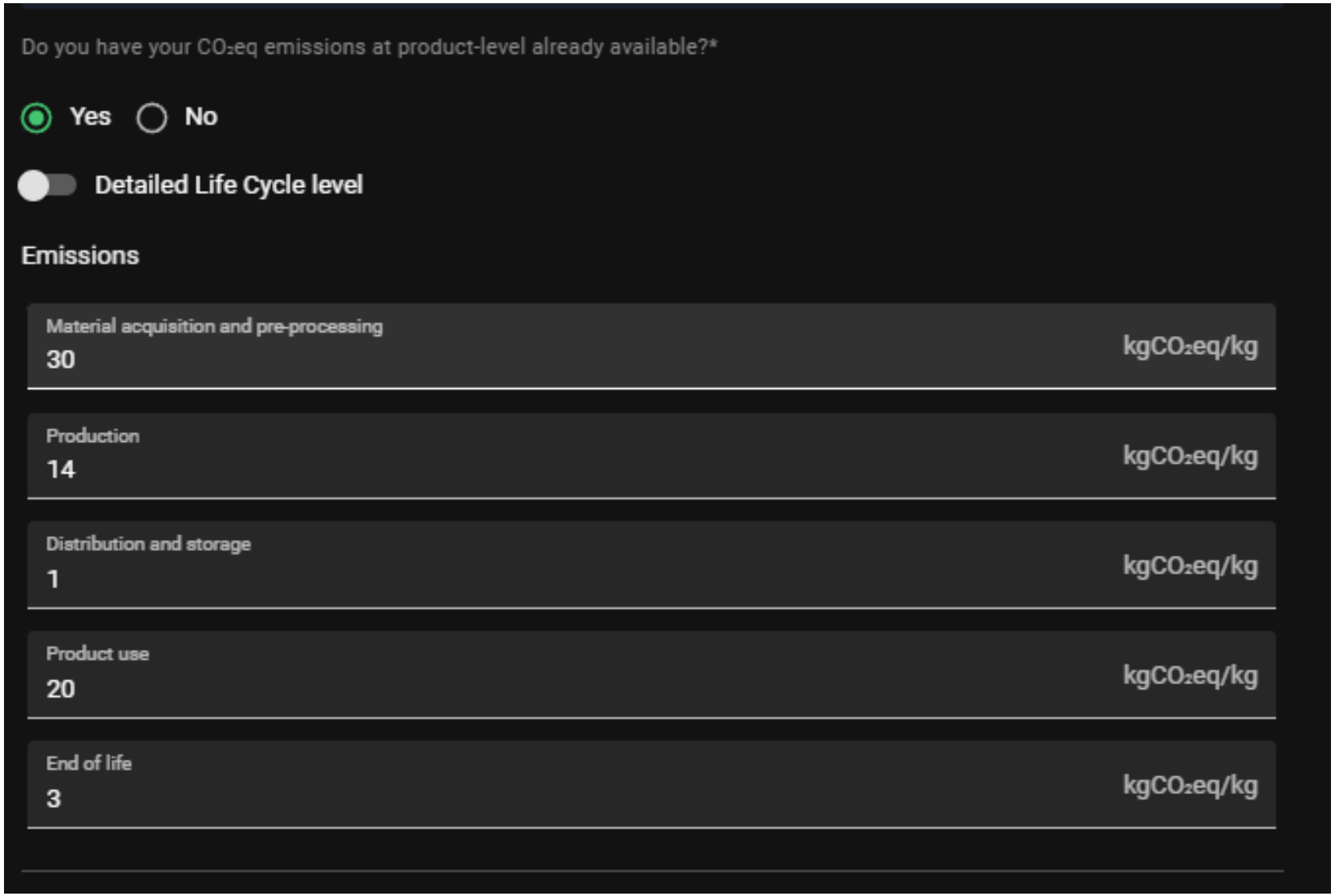
Objective: *Estimate PCF & PCF sub-categories top-down using company S1, S2, S3 emissions and product share of volume, costs, or revenues*



1. Or more granular e.g., plant; 2. if supplier global footprint (S1,S2 & S3) granularity level allows for categorization across components; 3. If no internal proxy exists in the organization, use share of volume produced or share of cost, and if data is not available use share of revenues

ILLUSTRATIVE – May evolve with future versions of the platform

We will input the PCF and PCF breakdown on the tool



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Mapping | We define 3 high level PCF Lifecycle categories

Refer to the document – High level lifecycle glossary - for more detailed information

Material acquisition and pre-processing

Starts with resources extraction, ends with product components entering your production facilities

Primarily S3 upstream

Production

Starts with product components entering your production facilities, ends with finished product exiting your production facilities

Primarily S1 & S2

Distribution & storage

Starts with finished product exiting your production facilities, ends with product entering your client hands

S3 downstream distribution

Source: GHG Protocol ; BCG analysis

INDICATIV

Mapping | How to map company-level emission items into our 3 defined high-level PCF categories?

Scope	Scope details - emission items (GHG P.)	High-level Lifecycle categories (GHG Protocol)
Scope 3 upstream	Purchased goods & services	Material acquisition & pre-processing
	Capital goods	Not included in PCF
	Fuel & energy related activities	Material acquisition & pre-processing
	Transportation & distribution	Material acquisition & pre-processing
	Business travel	Not included in PCF
	Employee commuting	Not included in PCF
	Leased assets	Not included in PCF
	Treatment of waste generated in operations	Production
Scope 1	Direct emissions from owned company facilities	Production
	Direct emissions from owned company vehicles	Upstream transportation to your production facility: Material acquisition & pre-processing Within your own operations: Production Downstream transportation to your client: Distribution & S.
Scope 2	Purchased electricity, steam, heating	Production
Scope 3 downstream	Transportation & distribution	Distribution & storage

Source: GHG Protocol; BCG analysis

Allocation | How to allocate company-level[1] emissions to studied product?

Prioritize allocation factor
in below order, depending on data availability

Best proxy

Fallback proxy

1. Tailored internal estimate of the emissions share to be attributed to the product

To be prioritized only if you have a good confidence level in the estimate

2. Share of product volume or costs

Costs to be preferred over volume when allocating

"Material acquisition & pre-processing" stage

3. Share of product revenue

Allocate company-level[1] emissions
based on chosen proxy

Define a period & level at which the calculation will be conducted e.g., over the last 3 years at the company level

Lifecycle stage emissions × Studied product share (based on chosen proxy) ÷ Number of units produced for studied product

Or company-level total emissions if data granularity did not allow lifecycle mapping

= Product Lifecycle stage carbon intensity

1. Or equivalent e.g., plant, regional

Data you will need to obtain a top-down PCF

Product data

1. What is the unit of production (e.g., 1L bottle) currently used for the studied product and its weight?
2. How many units of the product were produced on a given period / level?

Emission data

3. What are the components that compose the S1, S2, and S3 emissions? Please collect all available granularity levels
4. How do these components map to defined Lifecycle sub-categories[1]?
5. Do you have an internal estimate of the share of the emissions on a given period / level that should be attributed to the product? If not, please collect share of volume produced or share of cost over the period / level to be used as a proxy[2]

1. Material acquisition and pre-processing, production, and distribution & storage ; 2. Share of revenue can be used if limited information is available on share of volume or cost

Example

Company A produces caustic soda in units of 2 kg

Company A plant level emissions (2020):

- Raw mat. & packaging: 200 ktCO2e
- Non-product attributable: 100 ktCO2e
- Production: 500 ktCO2e
- Distribution: 50 ktCO2e

Company A plant level data (2020):

- Caustic soda: 1,000 units produced accounting for ~40% of volume & 45% of costs

1. 100ktCO2e non-product attributable processes (e.g., employee commuting, business travel) emissions are not included into PCF.

ILLUSTRATIVE – Caustic soda PCF example

Data input

Caustic soda PCF sub-categories

- PCF material acquisition and pre-processing

$$= \frac{(\ \textit{Plant level material emissions} * \%\ \textit{of costs}\ )}{\textit{Number of units produced}} = \frac{(200 ktCO2eq * 45\%)}{1000\ units} = 0.08 ktCO2e$$

- PCF production

$$= \frac{(\ \textit{Plant level production emissions} * \%\ \textit{of volume}\ )}{\textit{Number of units produced}} = \frac{(500 ktCO2eq * 40\%)}{1000\ units} = 0.2 ktCO2e$$

- PCF distribution & storage

$$= \frac{(\ \textit{Plant level distribution emissions} * \%\ \textit{of volume}\ )}{\textit{Number of units produced}} = \frac{(50 ktCO2eq * 40\%)}{1000\ units} = 0.02 ktCO2e$$

Caustic soda PCF

- PCF[1] of all caustic soda produced = sum of PCF sub-categories emissions
  = 0.08ktCO2e + 0.2ktCO2e + 0.02ktCO2e = 0.3ktCO2e
- Carbon intensity of caustic soda = caustic soda PCF/ caustic soda weight
  = 0.03ktCO2e / 2kg=0.015ktCO2e/kg

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High level approach | How to help Mature maturity suppliers to breakdown a PCF?

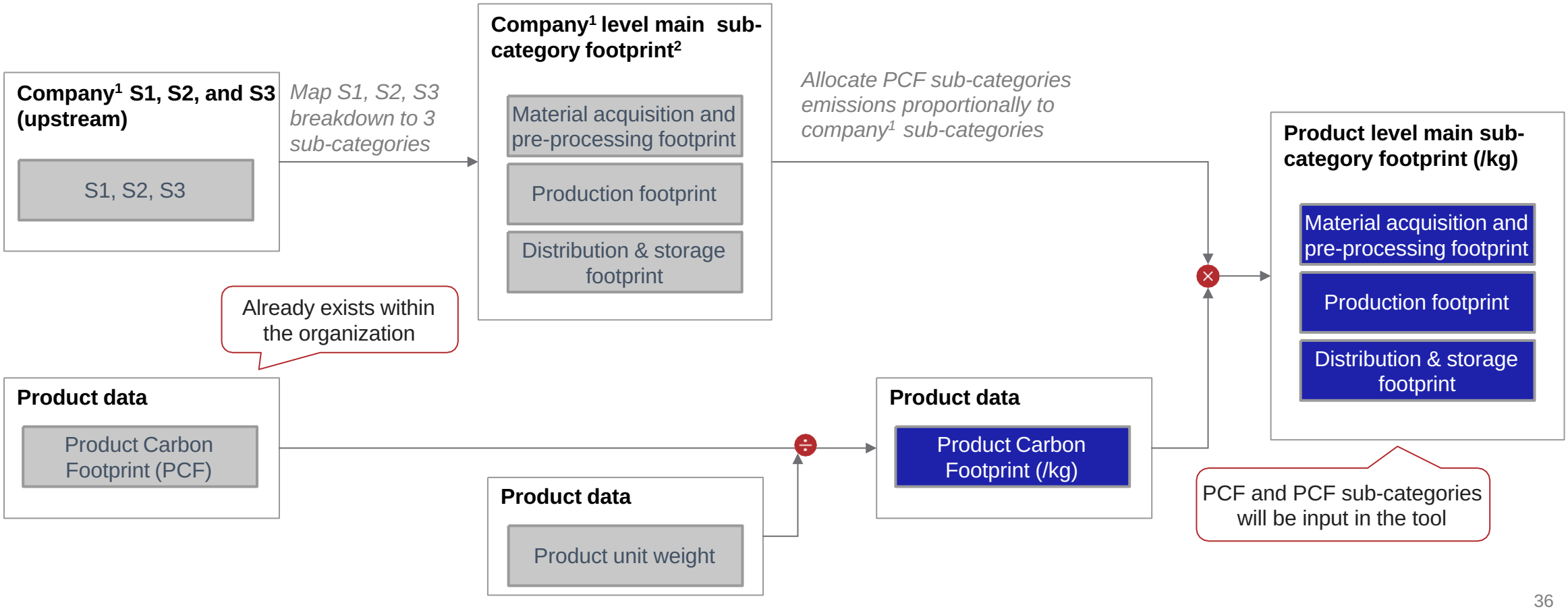
Estimate PCF sub-categories proportionally to top-down company S1, S2, and S3 emissions

1. Collection | Collect company-level[1] S1, S2, S3 emission data with full available granularity
2. Mapping | Map company-level[1] S1, S2, S3 emissions to 3 defined sub-categories[2]
3. Allocation | Allocate PCF sub-categories emissions proportionally to company[1] sub-categories

1. Or equivalent e.g., plant, regional ; 2. Material acquisition and pre-processing, production, and distribution & storage

Detailed calculation methodology

Objective: *Estimate PCF sub-categories proportionally to top-down company S1, S2, and S3 emissions*



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ILLUSTRATIVE – May evolve with future versions of the platform

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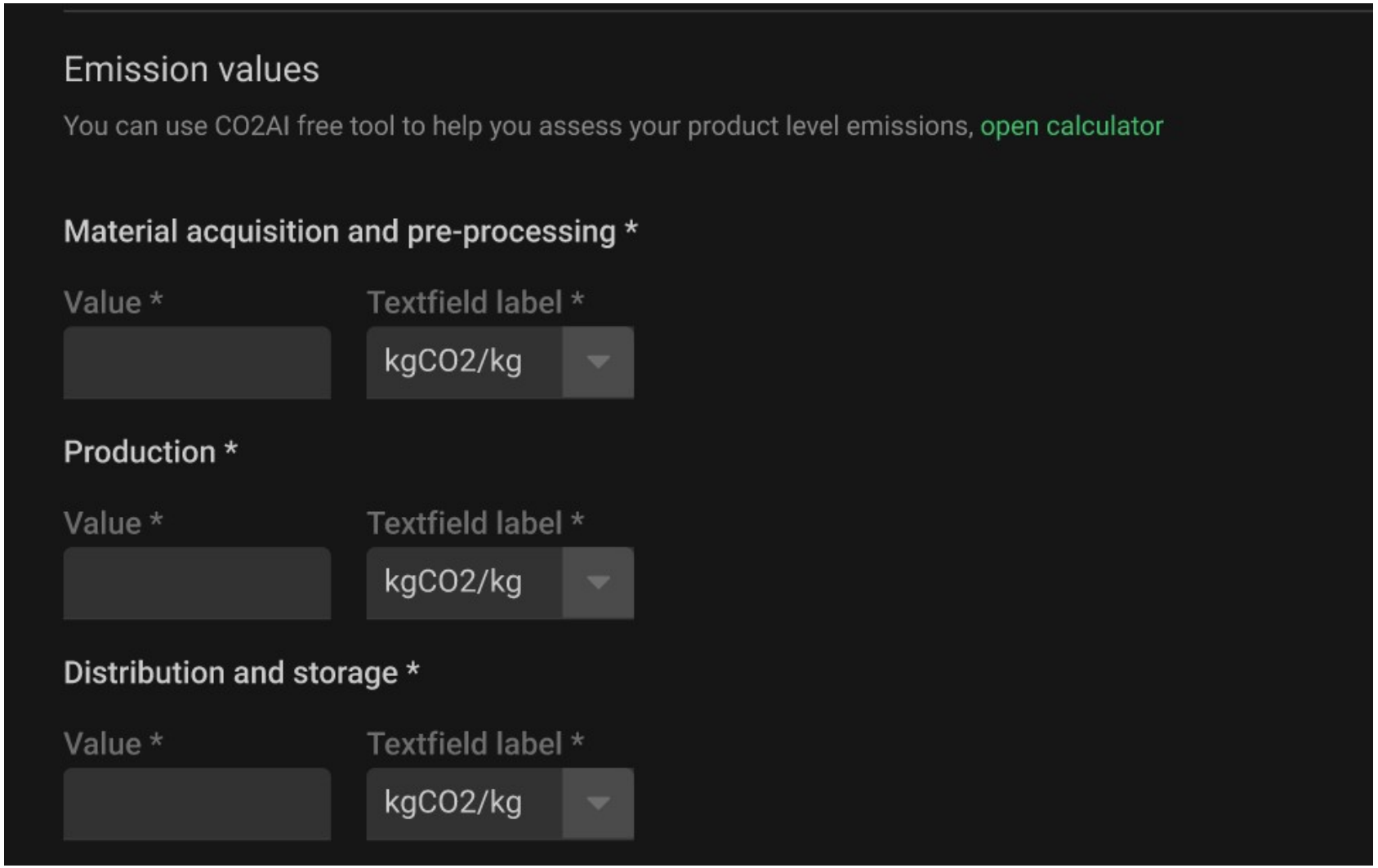

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Data you will need to breakdown PCF into Lifecycle stages

Product data

1. What is the unit of production (e.g., 1L bottle, 1 roll) currently used for the studied product and its weight?

Emission data

2. What is the PCF of the product?
3. What are the components that compose the S1, S2, and S3 emissions? Please collect all available granularity levels
4. How do these components map to our defined sub-categories[1]?

1. Material acquisition and pre-processing, production, and distribution & storage

Example

Company A produces caustic soda in units of 2kg

Over 2020, Company A conducted an emission analysis and identified a caustic soda of PCF of **0.3ktCO2e/kg** without further breakdown

Company A plant level emissions (2020):

- Raw mat. & packaging: 200 ktCO2e
- Non-product attributable: 100 ktCO2e
- Production: 500 ktCO2e
- Distribution: 50 ktCO2e

ILLUSTRATIVE – Caustic soda PCF example

Data input

Plant-level emission sub-categories

- Total plant level attributable emissions[1] = 200ktCO2e + 500ktCO2e + 50ktCO2e = 750ktCO2e
- Material acquisition and pre-processing = 200ktCO2e, (i.e. ~27% of total plant emissions)
- Production = 500ktCO2e (i.e. ~67% of total plant emissions)
- Distribution & storage = 50ktCO2e (i.e. ~6% of total plant emissions)

Caustic soda PCF

- PCF = 0.3ktCO2e/kg

Caustic soda PCF sub-categories

- PCF Material acquisition & pre-processing

  $= (\textit{Plant level material emissions ratio} * \textit{PCF}) = 0.03 ktCO2e/kg * 27\% = 0.08 ktCO2e/kg$

- PCF Production

  $= (\textit{Plant level production emissions ratio} * \textit{PCF}) = 0.03 ktCO2e/kg * 67\% = 0.2 ktCO2e/kg$

- PCF Distribution & Storage

  $= (\textit{Plant level distribution emissions ratio} * \textit{PCF}) = 0.03 ktCO2e/kg * 6\% = 0.02 ktCO2e/kg$

1. 1. 100ktCO2e non-product attributable processes (e.g., employee commuting, business travel) emissions are not included into PCF.

Summary

Introduction
How to define my supplier data readiness level?

Calculation methodology per supplier data readiness

Beginner Developing Mature Leader

High level approach | How to help Leader maturity suppliers to breakdown a PCF?

Map your PCF breakdown into our defined categories & engage in emissions hotspots discussions

1. Collecting | Collect PCF and PCF breakdown
2. Mapping | Map PCF breakdown components to the 3 defined PCF sub-categories

Suppliers already submitting to **CDP module 4** can directly share module 4 breakdown on the platform[1]

3. Engaging | Conduct discussion on emissions hotspots

1. When entering emission values, select "Detailed Life Cycle level" on Product Ecosystem interface to share CDP module 4 PCF breakdown

Mapping | We define 3 high level PCF Lifecycle categories

Refer to the document – High level lifecycle glossary - for more detailed information

Material acquisition and pre-processing

Starts with resources extraction, ends with product components entering your production facilities

Primarily S3 upstream

Production

Starts with product components entering your production facilities, ends with finished product exiting your production facilities

Primarily S1 & S2

Distribution & storage

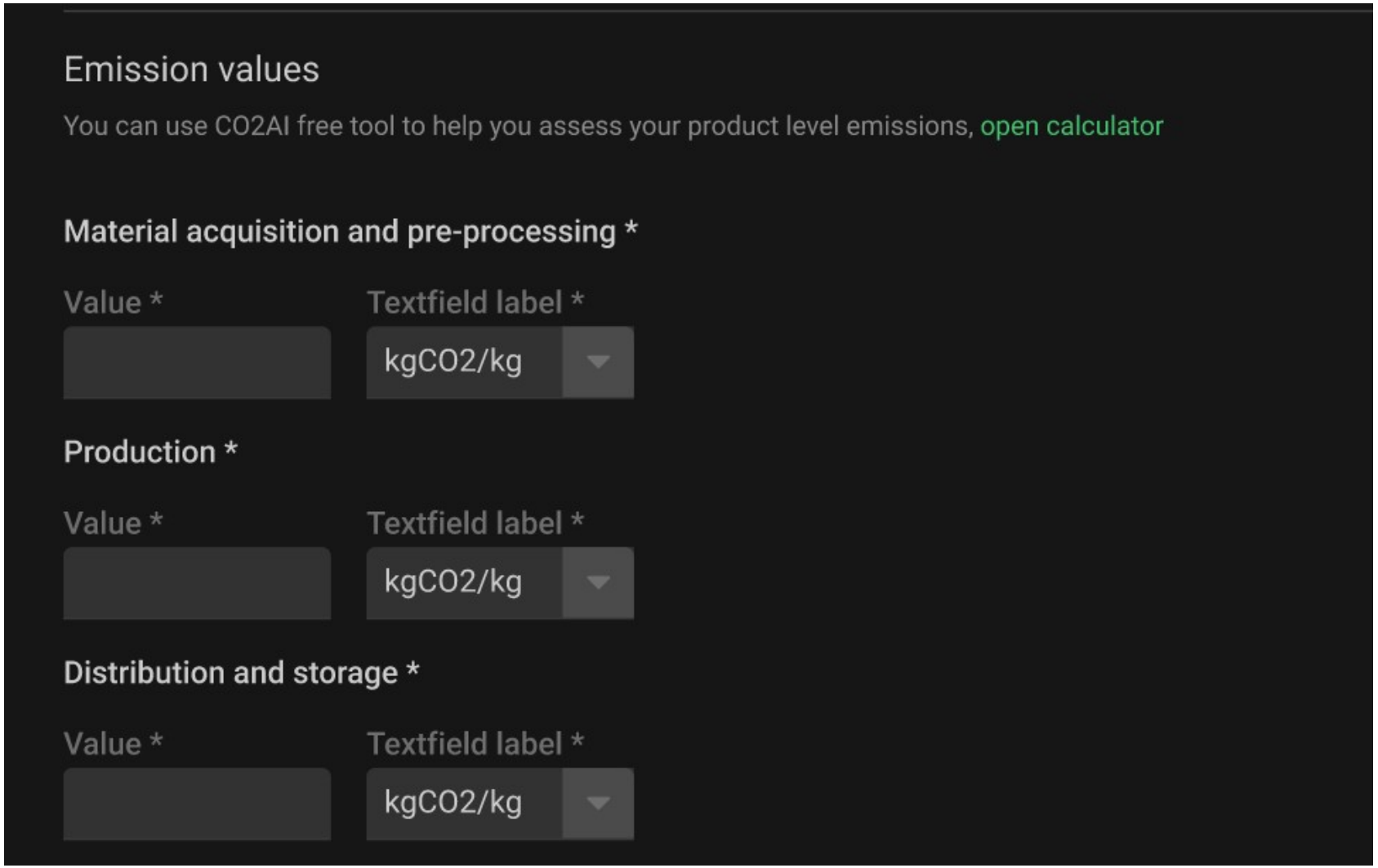
Starts with finished product exiting your production facilities, ends with product entering your client hands

S3 downstream distribution

Source: GHG Protocol ; BCG analysis

ILLUSTRATIVE – May evolve with future versions of the platform

We will input the PCF and PCF breakdown on the tool



If not already completed, please share the **name and email of your point of contact** to receive login credentials

Data you will need to map your PCF breakdown into Product Ecosystem sub-categories

Product data

1. What is the unit of production (e.g., 1L bottle, 1 roll) currently used for the studied product and its weight?

Emission data

2. What is the PCF of the product?
3. What are the components of the PCF? Please collect all available granularity levels
4. How do these components map to our defined sub-categories[1]?

1. Material acquisition and pre-processing, production, and distribution & storage