What is life cycle assessment (LCA) & carbon footprint (CF)

Deep dive of the IDF Global Carbon Footprint Standard for the Dairy Sector

March 15th, 2023

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Why is dairy different?

Biological system

- All cows, all farms, all systems, all years, all regions are different
- Long production cycle (2+ years for heifer calf to calve)
- Biogenic carbon – agriculture forms part of the problem *and* the solution
- Methane (CH4) contributes a considerable proportion of GHG emissions from dairy – ongoing debate over correct metrics to account for this.

Basic definitions

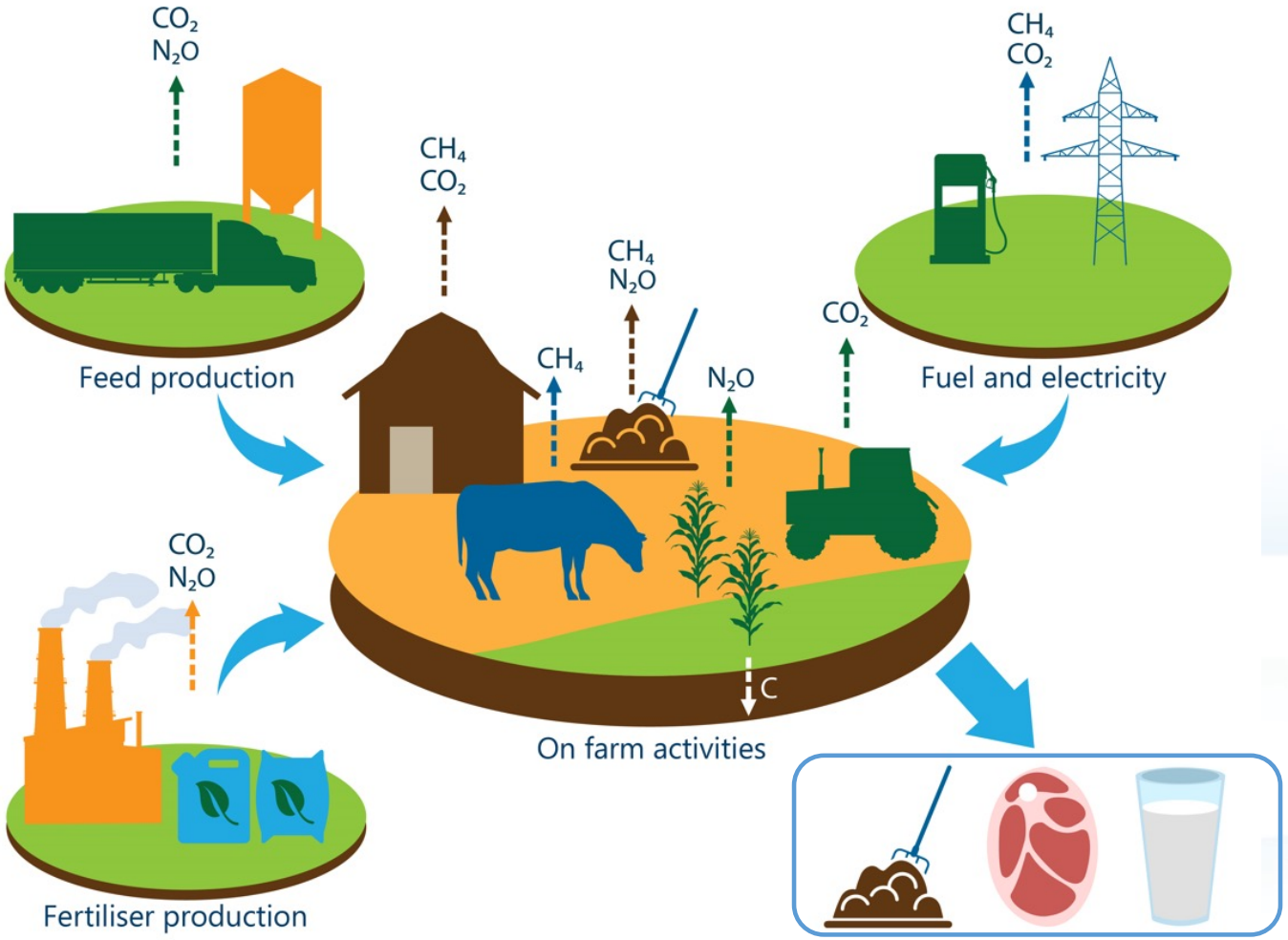
Life cycle assessment (LCA)

- An LCA analysis systemically accounts for all inputs and outputs for a specific product or production system across a specified system boundary, e.g. a dairy farm, dairy processing plant or the entire dairy production system.
- May be full (all environmental potentials) or partial (e.g. carbon-only)

Carbon footprint (CF)

- A CF is the sum of the impact of all GHG emitted throughout the life cycle of a product within a set of system boundaries, in a specific application and in relation to a defined quantity of a specified product (**functional unit; FU**).

GHG emissions included at the farm level



Carrying out an LCA – the major steps

1. Identify the purpose (**goal**) of the study
   - FU?
   - Attributional or consequential?

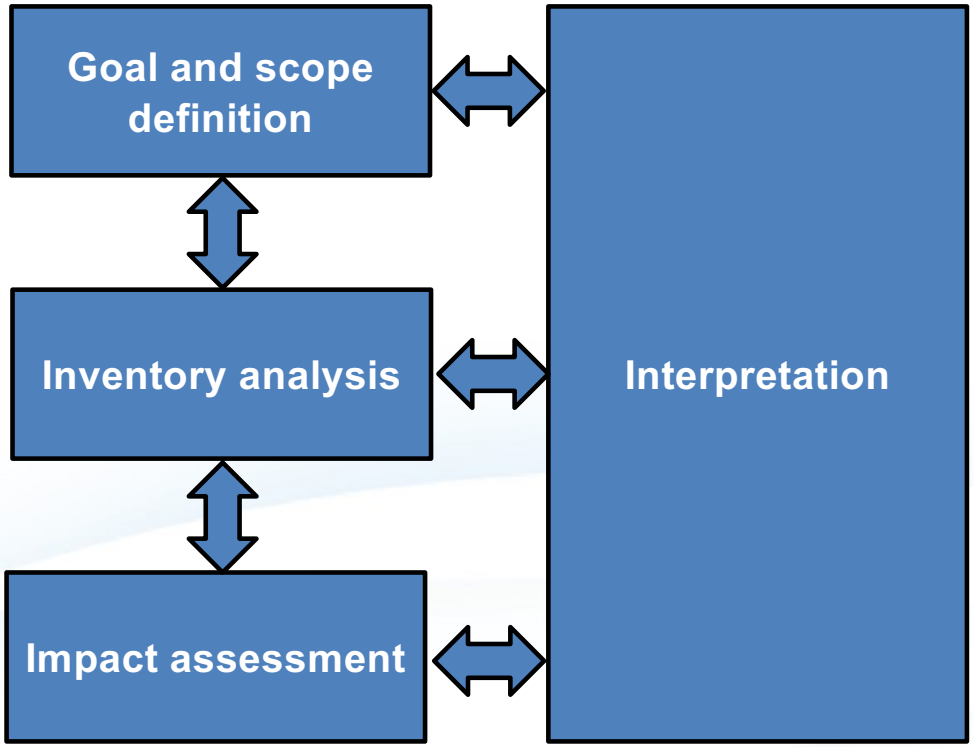
2. Define the **scope** and boundaries
   - "Cradle-to-gate" or "cradle-to-grave"?

3. Data collection (**inventory analysis**)

4. Convert emissions into global warming potentials (CO_2e) and other environmental potentials in the **impact assessment**

5. **Interpretation** – understanding the results from steps 1-4, including sensitivity analysis

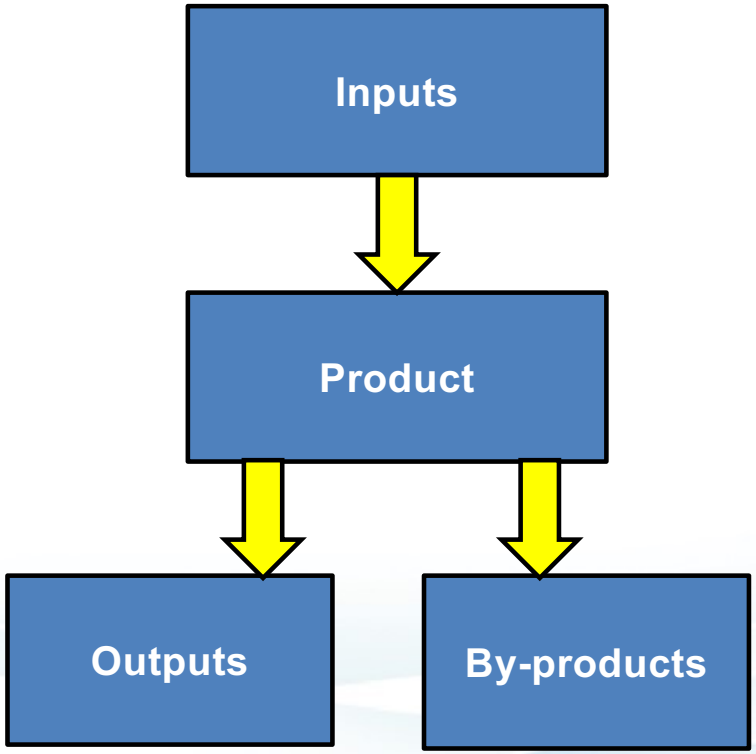
6. Transparently report results



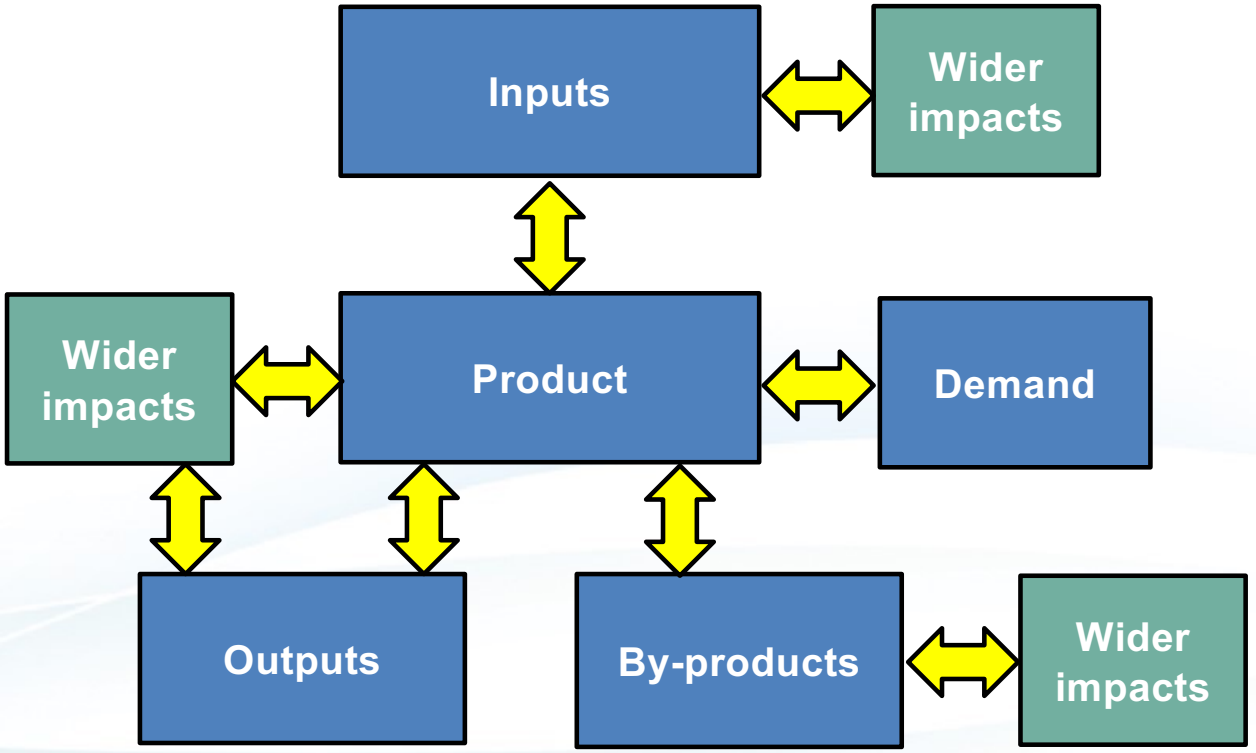
The four phases of LCA

Attributional or consequential LCA?

Attributional



Consequential



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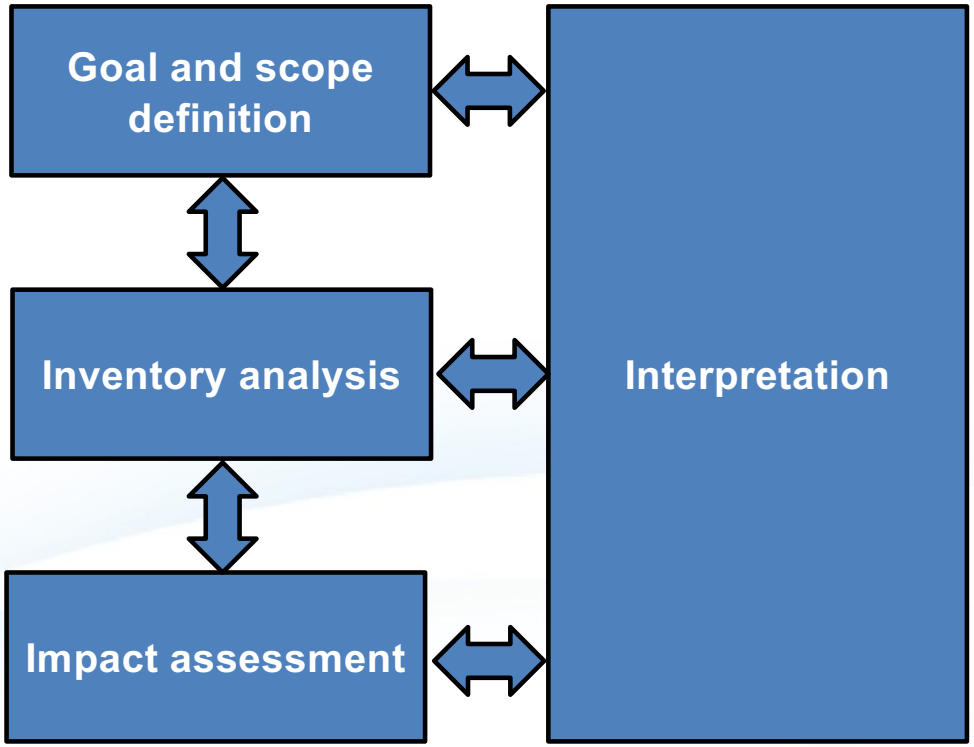

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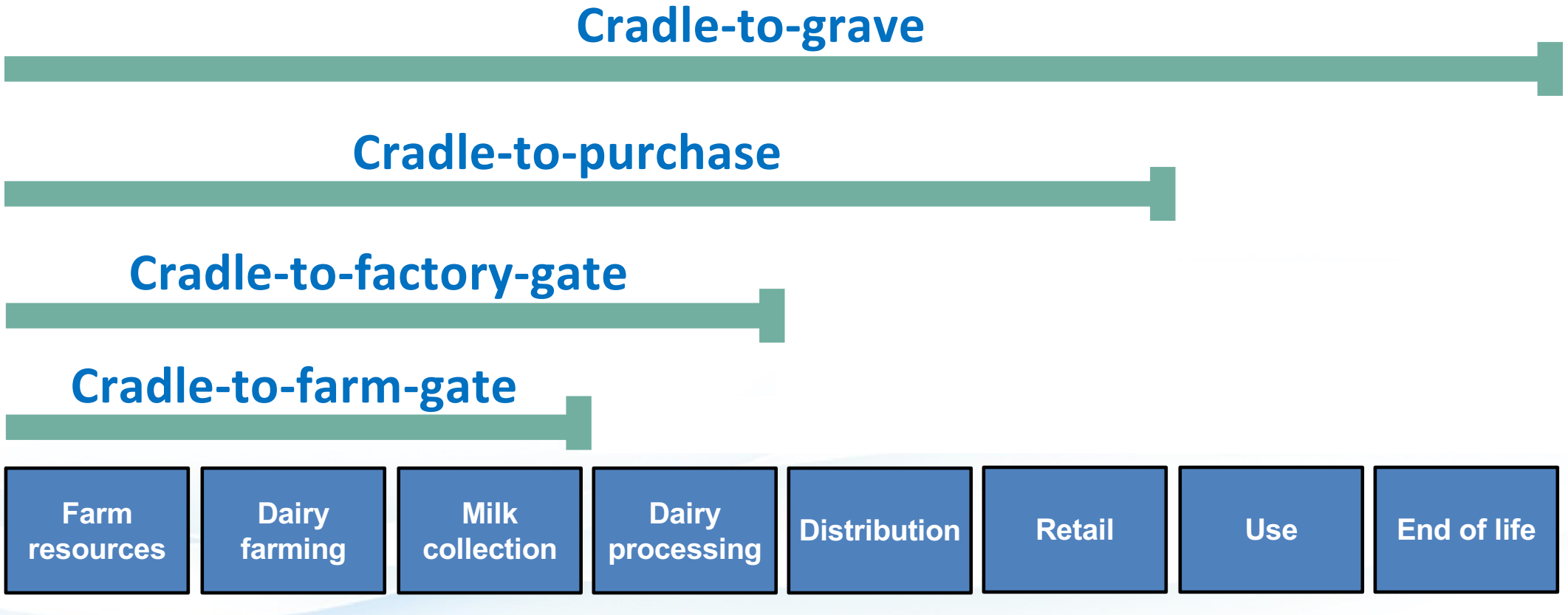
Defining LCA scope – Cradle-to…. where?



The eight stages of dairy production

Defining the functional unit 1

Dairy products vary!

Consistent FU allows studies and products to be compared

- Mass – kg milk or kg fat-and-protein-corrected milk (FPCM)?
- Fat content – skimmed or semi-skimmed?
- Stage of chain – 1 litre purchased milk or 1 litre consumed milk?
- Nutritional value – kg protein or nutrient rich food (NRF9.3) score?
- Economic value – which currency?

Defining the functional unit 2

- Cradle-to-farm-gate: IDF recommends 1 kg FPCM as the FU, i.e. 1 kg liquid milk corrected to 4% fat and 3.3% protein at the farm gate, in the country where the analysis is taking place
- Cradle-to-factory-gate: use a mass or volume-based approach, either packaged or in bulk
- Cradle-to-purchase or grave: mass of product purchased or consumed (end of life)
  - Mass purchased includes retail sale and waste, but no emissions post-consumer purchase
  - Mass consumed includes consumer storage, preparation, dish washing and waste (product + packaging)

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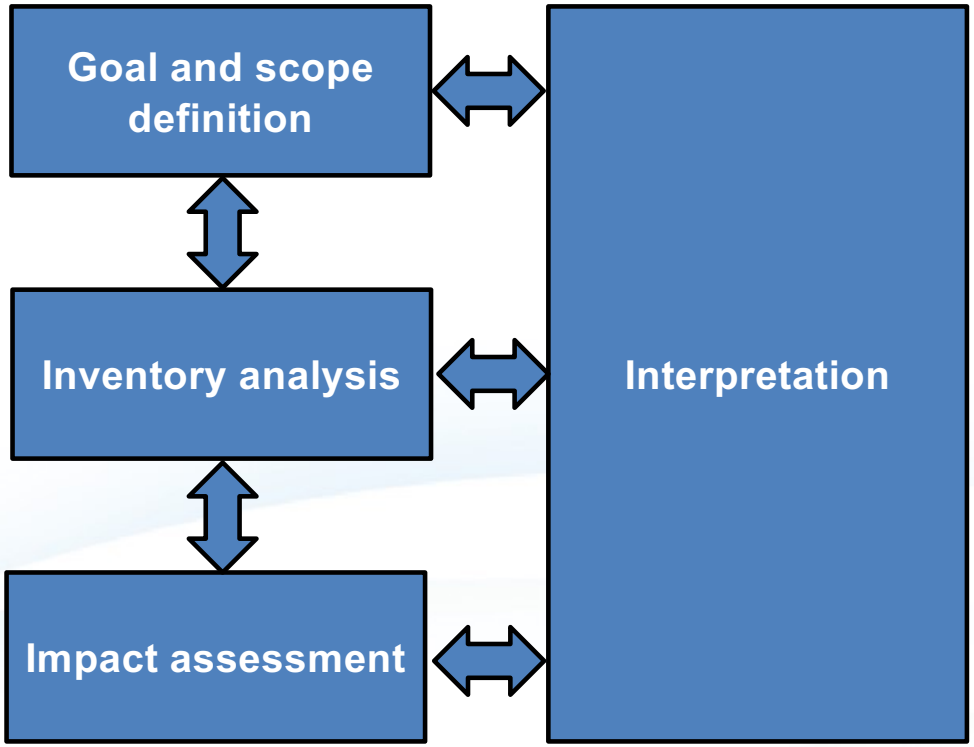
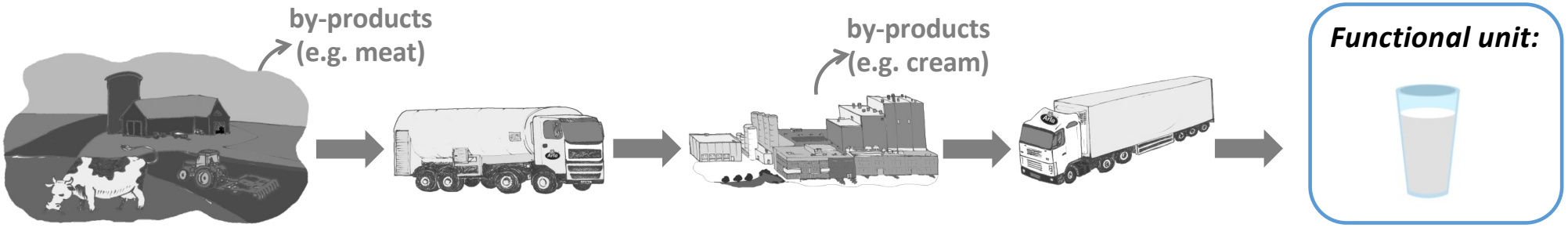


The four phases of LCA

LCA summary – the CF of liquid milk

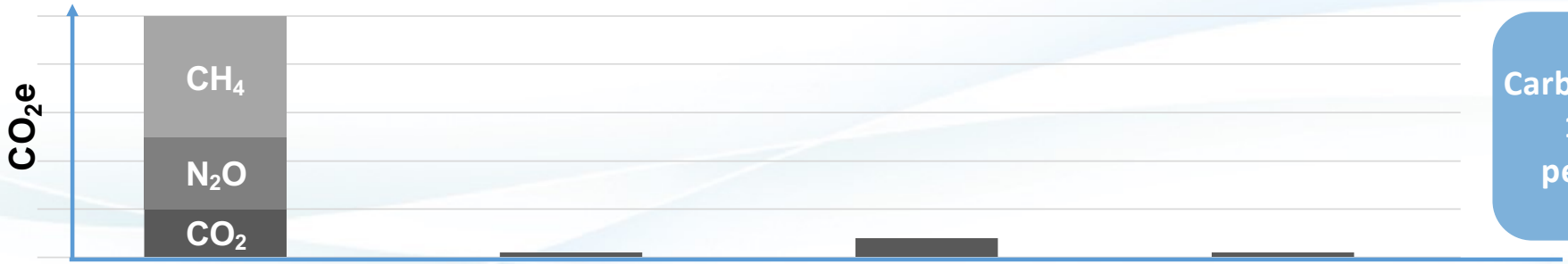


CH_4 (methane)

N_2O (nitrous oxide)

CO_2 CO_2 CO_2 CO_2

CO_2e



Carbon footprint:
1 kg CO_2e
per kg FPCM