Swiss Centre for Life Cycle Inventories
Consistent treatment of waste and by-products in LCA

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Content

- Definitions: Unambiguity ensures consistency
- Distinction between waste and by-product becomes irrelevant
- Modelling of materials for treatment: Negative mass flows
- Recycling activities: Allocation at the point of substitution
- Product lifetime, stocks, and linking to future waste treatment
- Consequences for mass flow accounting
Definitions: Unambiguity ensures consistency

- The activity dataset: The basic building block of LCA

Exchanges from environment → Activity → Exchanges to environment
Intermediate exchanges (from other activities) → Reference products
                      ↓                        ↓
                      By-products / Wastes

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Definitions: Unambiguity ensures consistency

- **Reference product** = Determining product: A co-product for which a change in demand will affect the production volume of the activity.
- When there are alternative production routes, an activity will always have *only one* reference product as determined by the constraints imposed by the relative, normalised market trends of the co-products.
- If *more than one* product from a joint production has no alternative production routes, all of these are reference products.
Definitions: Unambiguity ensures consistency

- **By-product/Waste** = Dependent output: Any output that is neither a reference product nor an exchange to the environment
- **Must have** either:
  - an alternative production route,
  - a treatment activity that transforms the by-product/waste into a product with an alternative production route
  - a treatment activity that transforms the by-product/waste into an exchange to the environment
Definitions: Unambiguity ensures consistency

• A *material for treatment* is a by-product/waste that *cannot* - without further treatment - substitute a reference product as an input to an activity.

• It is not the economic value that determines whether a material is a material for treatment, but exclusively its need for treatment.

• Wastes and by-products are treated in exactly the same way.

• Distinction between waste and by-product becomes irrelevant.

• Different waste definitions can be supported by the same data.
The use of negative product flows

- W \rightarrow \text{Waste treatment} \quad \text{Production} \rightarrow - W

- W \downarrow - W \downarrow - W \downarrow - W

- W \rightarrow \text{Waste treatment} \quad - W \rightarrow \text{Production}

- An input can be modelled as a negative output
- An output can be modelled as a negative input
- Allows to maintain mass balances when modelling the physical and economic causality for materials for treatment

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Definitions: Unambiguity ensures consistency

- **Recycling activity**: A treatment activity that results in by-products that do not require further treatment
- The **point of substitution**: The end of the recycling activity where the by-product can - without further treatment - substitute a reference product as an input to an activity.
Allocation - at the point of substitution:

Co-producing activity C

Treatment scenario (market) → Final disposal activity (treatment) → Recycling activity (treatment) → X

C*: Co-producing activity C, with treatment of wastes and by-products

X Y Z

Final disposal activity (treatment) → Treatment scenario (market) → Co-producing activity C → X Y Z

Recycling activity (treatment) → Treatment scenario (market) → Material for treatment service → X Y Z

Material for treatment → Material for treatment → Material after recycling → X Y Z

Material after recycling → X Y Z

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Allocation
- at the point of substitution:

Final disposal activity (treatment) → Treatment scenario (market) → Co-producing activity C → X, Y

-or-

Recycling activity (treatment) → Treatment scenario (market) → Co-producing activity C → X, Y

C*: Co-producing activity C, with treatment of wastes and by-products → Z

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Allocation
- at the point of substitution:

- All treatment activities are attributed to the activities that produce the materials that need treatment, disregarding whether these are defined as wastes or by-products.
- Allocation result unaffected by choices of the degree of detail (result cannot be manipulated by moving treatment in or out).
- The full value of the by-products is attributed to the product system that gives rise to these by-products (any value-correction unnecessary).
- Price of the by-product is always available (while the price of a waste or by-product before or during treatment often can only be estimated, and if available may often be influenced by irrelevant properties of other wastes or regulatory conditions).
Product lifetime, stocks, and linking to future waste treatment

- Products with a lifetime of more than one year (capital goods):
  - Distinguish the by-product/waste output as an addition to stock (by adding the property “lifetime”):
  - The future waste treatment of the output can then be placed at the right point in time, applying the relevant future scenarios and technologies.

- Having “additions to stock” as separately identifiable flows also allows the use of LCA data in temporally and geographically delimited mass flow analyses (MFA).
Conclusion

- **Consistency** through unambiguous definitions (Determining products vs. dependent outputs, Materials for treatment, Recycling, Point of substitution)
- **Independency** from specific waste definitions or prices
- **Maintaining mass balances** when modelling the physical and economic causality for materials for treatment, by applying negative mass flows
- **Consistent allocation** when applied at the point of substitution
- **Temporally consistent** modelling with "additions to stock"
Questions?

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