Avoided environmental impacts and avoided emissions

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Outline

- Problem definition
- State of the art
  - Attributional and Consequential LCA
  - Avoided impacts and Avoided emissions
    - Description
    - Analysis of methods
    - Discussion and recommandations
- Conclusions and next steps

Problem definition

- **Type 1: Avoided impacts**

Co-production or recycling could lead to environmental benefits outside a product system by the displacement of an alternative production route of the co-product

- **Type 2: Avoided emissions**

The action of a value-chain actor could lead to environmental benefits elsewhere in the product system, making this product system beneficial compared to the product system without this action

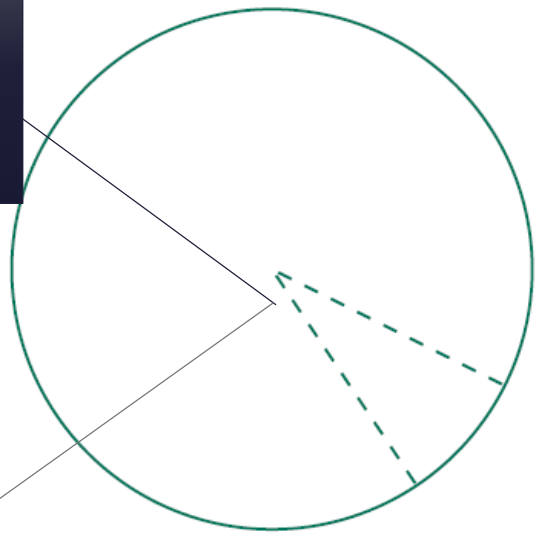
- **How can a value-chain actor calculate and communicate avoided impacts and avoided emissions?**
- **What is the conceptual difference between Type 1 and Type 2?**

State of the art

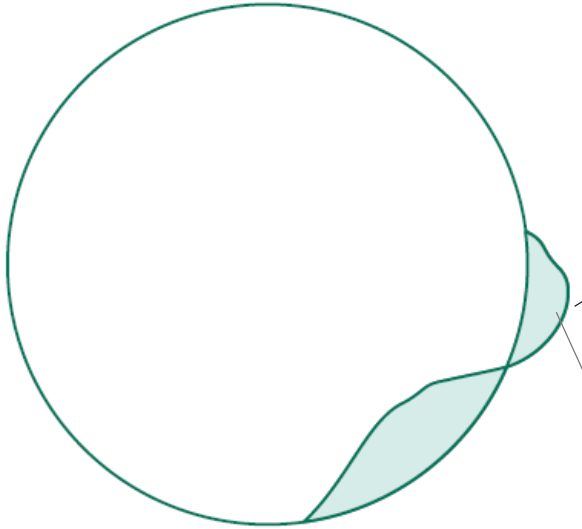
What portion of global burdens can be associated with a product?

Which activities took place in order to provide this product?

Attributional



Consequential



What environmental burdens occur, directly or indirectly, as a consequence of a decision?

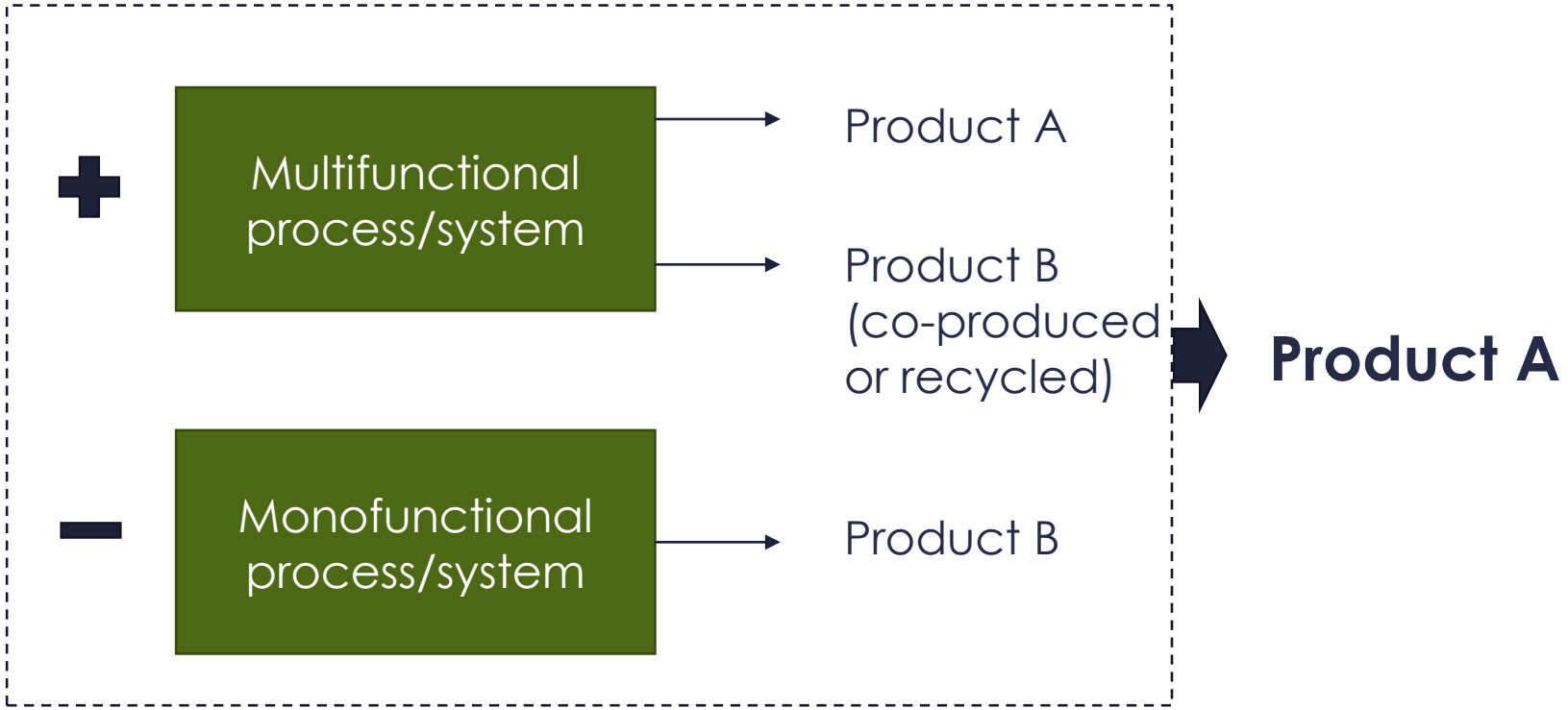
Which activities will be most likely affected by an additional (or decreased) demand for a product?

Circle represents total environmental burdens at any given point in time

Weidema (2003), UNEP/SETAC Life Cycle Initiative (2011)

State of the art

Type 1 : How to evaluate the environmental performance of a multifunctional product system?



State of the art

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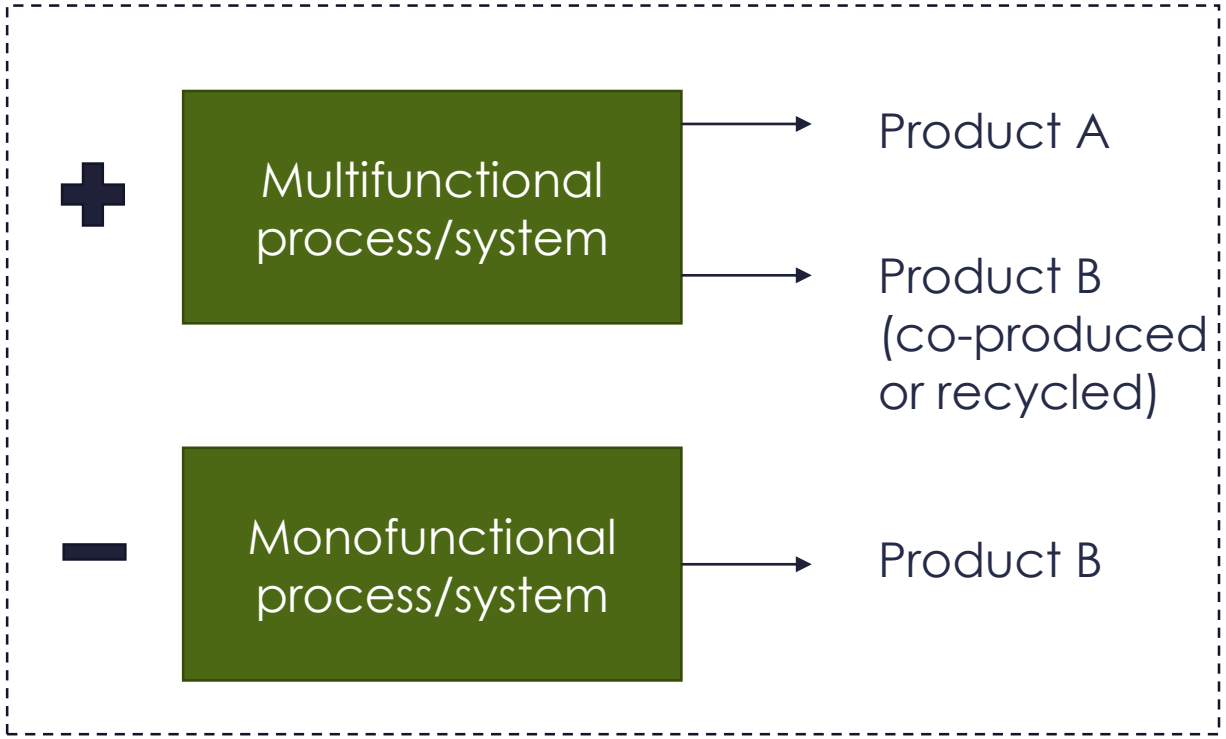
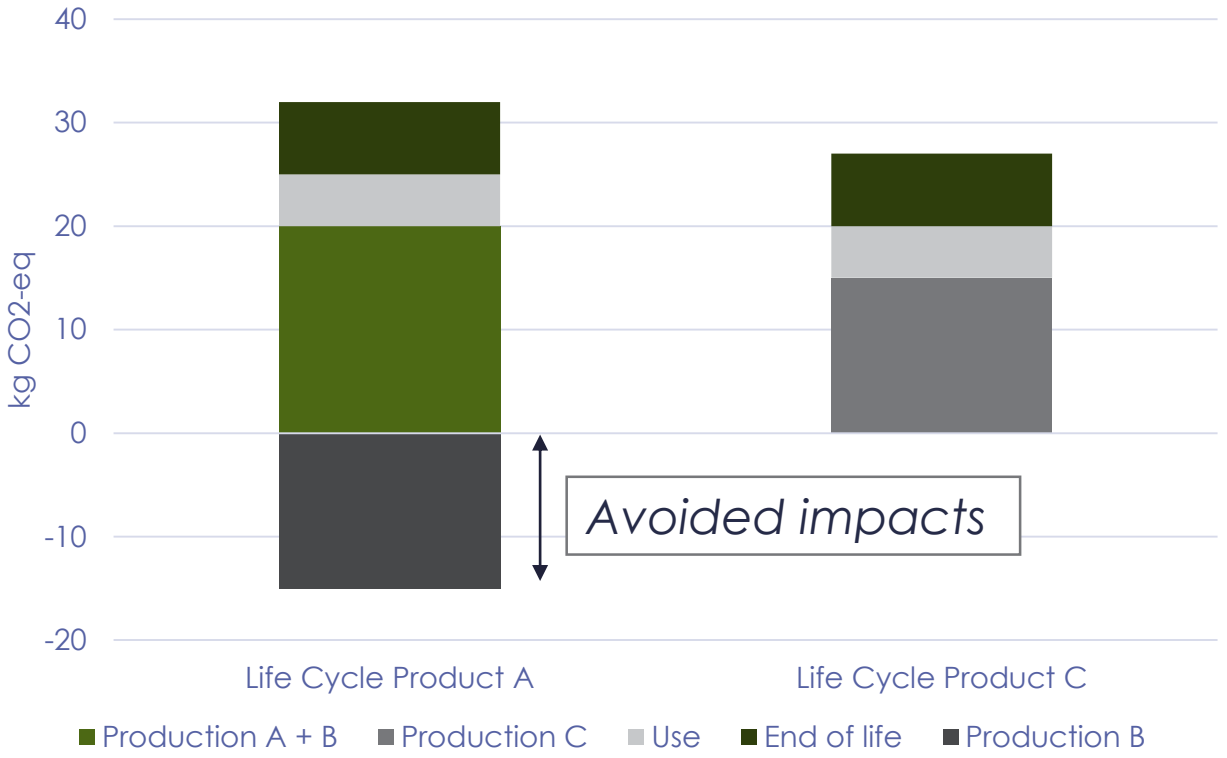




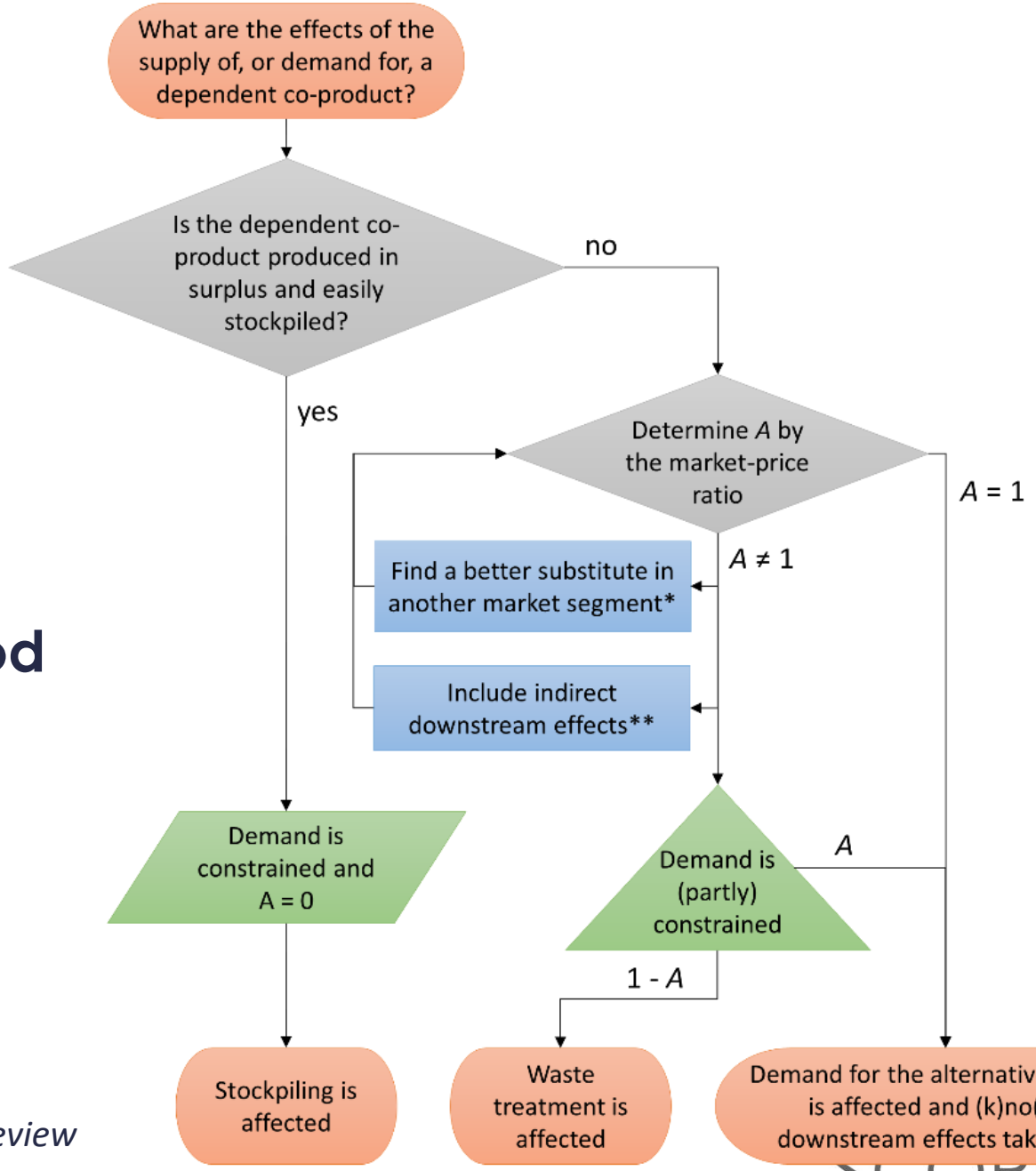
State of the art

Type 1 : *How* can we calculate « avoided impacts » ?

Method	Proposed by
End-of-life recycling method	BPX 30-323-0 (AFNOR, 2011) PAS 2050 (BSI 2011) EN 15804 (CEN 2012) ILCD Handbook (European Commission 2010) Greenhouse Gas Protocol (WRI & WBCSD 2011) Metal sector (Worldsteel Association 2011, Eurometaux, European Aluminium Association 2013,) Scientific literature
Waste mining method	ILCD Handbook (European Commission 2010) Scientific literature
50/50 method	BPX 30-323-0 (AFNOR, 2011) ILCD Handbook (European Commission 2010)
Market-driven substitution method	Scientific literature (Schrijvers 2017, Schrijvers et al. 2016)
Price elasticities	Scientific literature
Circular Footprint Formula	Product Environmental Footprint Guide (European Commission, 2016)

Type 1 : *How* can we calculate « avoided impacts » ?

Market-driven substitution method

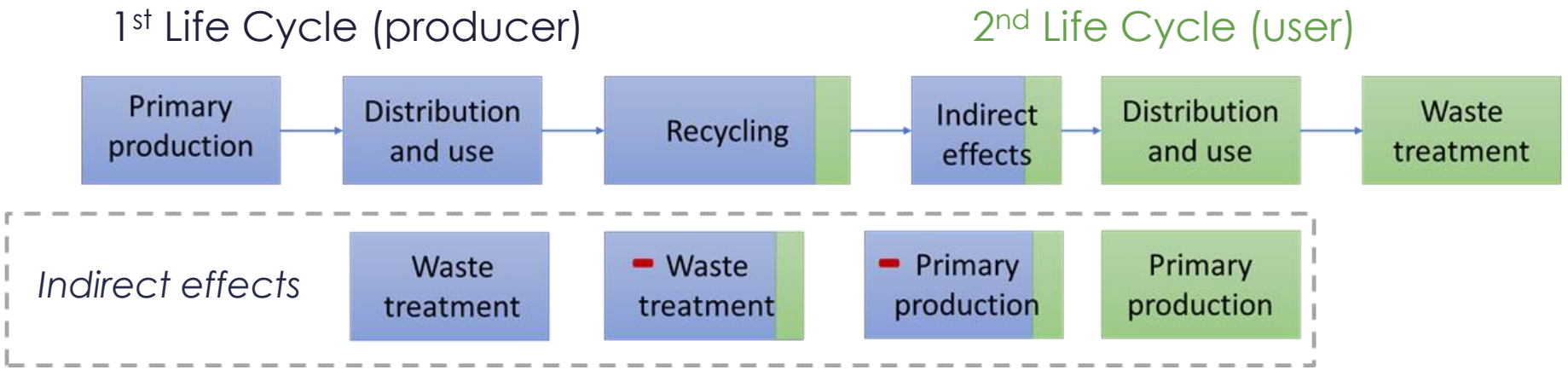


Schrijvers et al, *under review*

State of the art

Type 1 : *How* can we calculate « avoided impacts » ?

Market-driven substitution method



Which actor is favored?	Strong points	Weak points
The supplier of the recycled material if demand is high; the user if the demand is low, or benefits are shared	- Improves the selection of substitutes due to consideration of market segments and downstream consequences - Reflects market responses - Considers stockpiling	- Recent method that has not broadly been applied yet

State of the art

Type 1 : *How* can we calculate « avoided impacts » ?

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State of the art

Type 1 : Points of debate

- Vocabulary « system expansion » and « substitution »
  - **Addition of functions to the functional unit:** Is this production process environmentally competitive?
  - **Substraction of functions/substitution**: Which processes are substituted due to the co-production or recycling?
- Use of « substitution » in an attributional LCA
- Lack of precision between attributional/consequential LCA
- Methodological consistency between co-production and recycling

State of the art

Type 1 : Selected methods – *When* to calculate avoided impacts?

Type of LCA	Allocation procedure	Functional unit	Data
Process-oriented attributional LCA	System expansion (adding functions to the functional unit)	Production of … kg platina, … kg of copper, and … kg of nickel	Average
Product-oriented consequential LCA	Calculation of avoided impacts via modelling of substitution • Market-driven substitution method	Demand of 1 kg of platina	Marginal

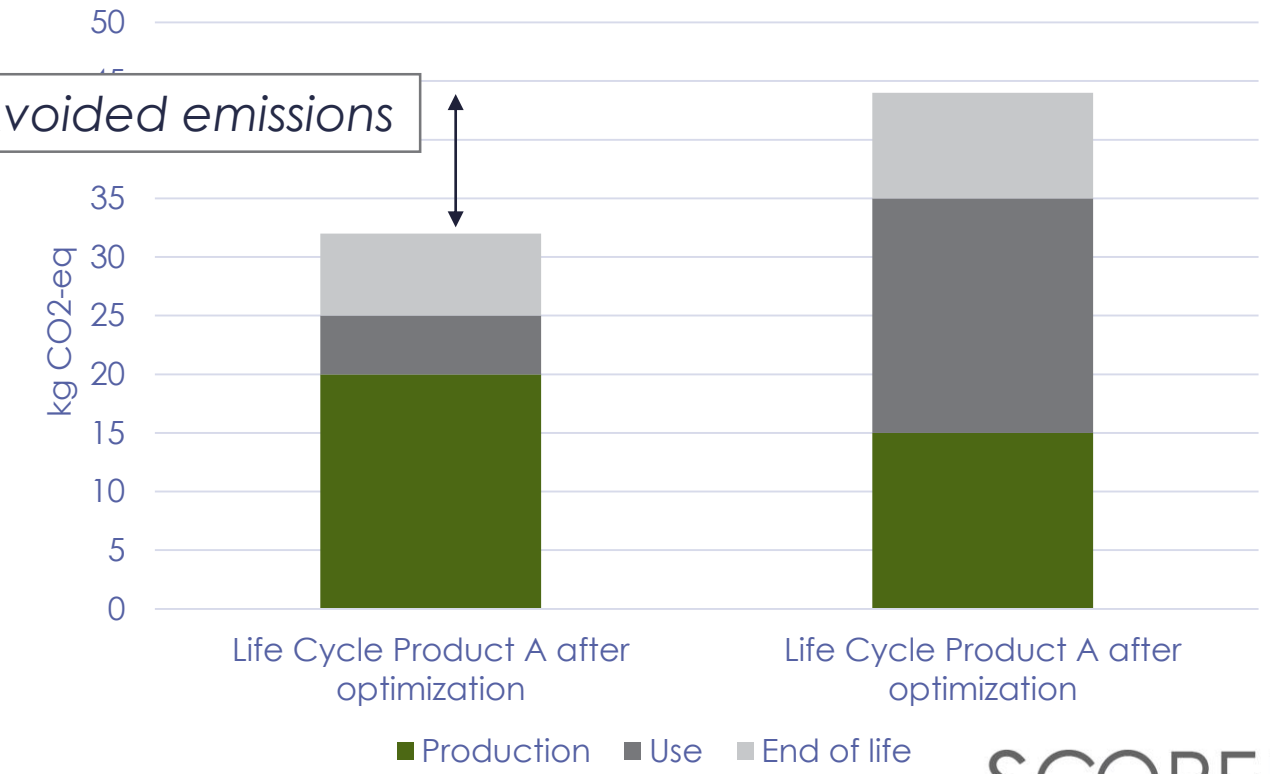
Case study: the co-production of platinum, palladium, rhodium, and other metals in South African mines

Etat de l'art

Type 2 : How to calculate and communicate the relative benefits of a product system?

Process after optimization (high-quality material) → Product A

Process before optimization → Product A



State of the art

Type 2 : Comment calculer et communiquer les bénéfices relatifs d'un système ?

Method	Proposed by
QuantiGES: Quantifier l'impact GES d'une action de réduction des émissions -V2	ADEME (2016)
ILCAJ: Guidelines for Assessing the Contribution of Products to Avoided GHG Emission	Institute of LCA Japan (2015)
Entreprises pour l'Environnement: Avoided emissions - Companies assess their climate solutions	Entreprises pour l'Environnement (2018)
ICCA & WBCSD: Avoiding Greenhouse Gas Emissions - the Essential Role of Chemicals: Guidelines - Accounting for and Reporting Greenhouse Gas (GHG) Emissions Avoided along the Value Chain based on Comparative Studies	ICCA & WBCSD (2017)
Consequential LCA	UNEP/SETAC Life Cycle Initiative (2011), Weidema et al. 2009

	QuantiGES (ADEME)	ILCAJ	Entreprises pour l'Environnement	ICCA & WBCSD	Consequential LCA
Subject	GHG impacts of an **action**	**Contribution of sales** of a product to avoided emissions throughout its life cycle	**Avoided emissions** of a product throughout its life cycle	**Decreased GHG emissions** of a product throughout its life cycle	Net impacts of a **decision**
Definition of the baseline	Most probable scenario in **absence of the action**	Final product that would be used in **absence of the target product**	**"Reference solution"**	The solution that is **displaced**	The scenario **without action or decision**
Examples of baseline scenarios	Continuation of **historical situation** including the influence of external factors	- **Average** product - Old product - Conventional product - Product that is most used	- **Average** of the company - Average on the market - Sector « norm » - Best available technology	- **Average** of the market - Specific solution - Dominant solution - Marginal solution	**Decision tree** to identify the marginal process

State of the art

	QuantiGES (ADEME)	ILCAJ	Entreprises pour l'Environnement	ICCA & WBCSD	Consequential LCA
Upscaling of results	Not recommended	Multiplication with the number of final products in use	Not recommended	Not mentioned but applied in an example	Possible depending on the type of consequences
Calculation of contribution rate of actors	Not mentioned	Recommended but not explained	Not recommended, but if necessary a consensus should be found	Not recommended, but if necessary a qualitative attribution should be done	Possible depending on the formulation of the functional unit

State of the art

Type 2 : Points of debate

- Credibility is affected by a lack of reproducibility of methods
- Compatibility with ISO 14040, 14044, or 14067
- Calculation of avoided emission should be consequential
- Evaluation of trade-offs between impact categories
- The definition of the baseline scenario should not be too free
- Avoided emissions are not always linear
- Risk of double counting when contribution of value-chain actors is calculated
- There is a difference between « avoided emissions » and « reduced emissions »

State of the art

Method	Strong points	Weak points
QuantiGES (ADEME)	- **Detailed** guidance - Coherent with a **consequential** approach - Calculation of **net** avoided emissions	- No reference to ISO 14044 - Only GHG emissions are considered
ILCAJ	- Adapted by the Japanese **Ministry** of Economy - Acknowledges **contribution** of value-chain actors	- Choice of baseline scenario is relatively free - No detailed guidance - Assumes linearity between the functional unit and the consequences
Entreprises pour l'Environnement	- Wide support of French actors - Difference between **avoided** emissions and emission **reductions**	- Choice of baseline scenario is relatively free - No detailed guidance
ICCA & WBCSD	- Availability of **case studies** - Acknowledges **contribution** of value-chain actors qualitatively	- Focus on the chemical industry - Choice of baseline scenario is relatively free
Consequential LCA	- Standardized by **ISO 14044** - Supported by the **scientific** community - Availability of **data** (ecoinvent v3) - Flexibility to evaluate **contribution** of value-chain actors	- The method can be considered complex - No additional guidance for the development of scenarios

Conclusions

- A large range of methods are available for the quantification of avoided impacts and avoided emissions – each with strong and weak points
- Diverse methods are selected for demonstration in case studies

Case studies and methods	Type 1 : Avoided impacts	Type 2 : Avoided emissions
Case study	Coproduction of platinum and other metals	Recycling of polypropylene

Methods	- Attributional LCA
	  - System expansion with addition of functions to the functional unit
	- Consequential LCA
	  - Market-driven substitution method
		- Attributional LCA
		  - Entreprises pour l'Environnement
		- Consequential LCA
		  - Consequential methodology as referred to by the UNEP/SETAC life cycle initiative (2011), Weidema et al (2009), and ecoinvent 3

Next steps

- Guidance will be given to apply the methods and communicate the results with the support of the case studies
- Differences and similarities between Type 1 and Type 2 will be analysed
- Recommendations will be provided on how a company can evaluate and communicate the environmental benefits of its actions

Thank you!

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