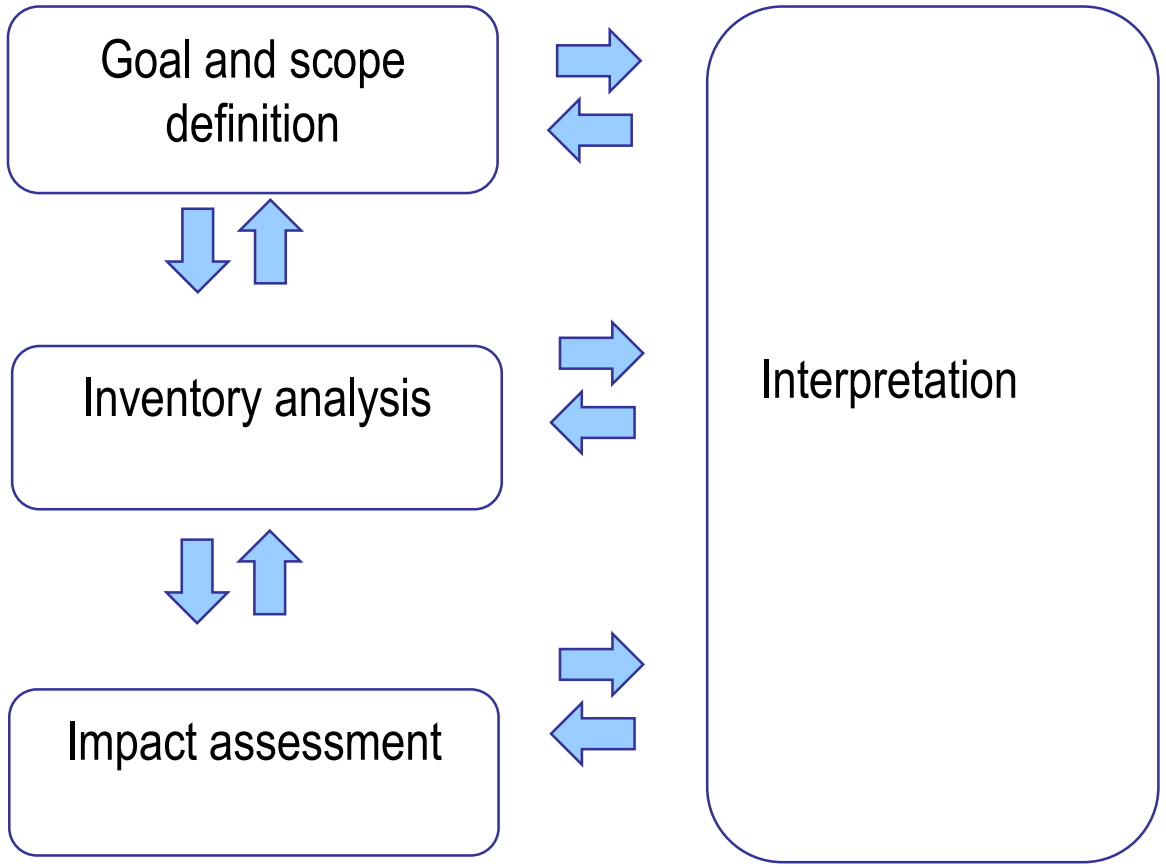
PROGRAMME DE RECHERCHE
BIOPRODUCTIONS

Presentation of the LCA methodology

PEPR B-BEST DAYS – 11/06/2024

Lorie HAMELIN (INRAE), Joël AUBIN (INRAE) and Nicolas ROGY (IFPEN)

Planning, today



Application

- Development and/or improvement of products
- Laws, public policies
- Marketing
- Etc…

ISO 14040 (2006)

Disclaimer: today will only be a quick overview. Many insights will not be touched/deepened.

For more: check out our summer school

https://bioeco.univ-toulouse.fr/biochemistry-summer-school/summer-school-life-cycle-assessment/

Learning objectives

- After this « session », you will be able to:

  - Explain what an LCA is, what it is used for, and what are its key characteristics
  - Understand what is a functional unit in LCA, and what are the 3 main aspects needed to define one.
  - Differences between LCAs said to be ‘consequential’ and ‘attributional’
  - Differences between background and foreground data
  - The different background LCI databases available
  - What Life Cycle Impact Assessment (LCIA) is, and the existing LCIA methods
  - The different existing LCA softwares

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Introduction

What is LCA?

What is LCA?

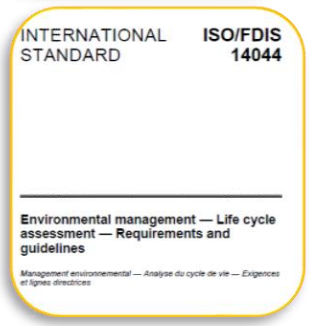
- A leading *__environmental__* assessment methodology
- A **standardized** methodology of the ISO 14040 series
  - ISO 14040: 2006 Environmental management – Life cycle assessment – Principles and framework
  - ISO 14044: 2006 Environmental management – Life cycle assessment - Requirements and guidelines (+amendments: A1/2018; A2/2020)
- Cradle-to-grave
- Includes all substance flows affected
- Comparative
- Quantitative
- Support decisions (evidence-based decision making)


INTERNATIONAL STANDARD ISO 14040

Second edition 2006-07-01

Environmental management — Life cycle assessment — Principles and framework

Management environnemental — Analyse du cycle de vie — Principes et cadre


INTERNATIONAL STANDARD ISO/FDIS 14044

Environmental management — Life cycle assessment — Requirements and guidelines

Management environnemental — Analyse du cycle de vie — Exigences et lignes directrices


7 February 2018

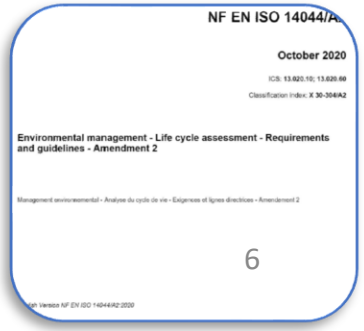
ICS: 13.020.10 ; 13.020.60

Classification index: X 30-304/A1

Environmental management - Life cycle assessment - Requirements and guidelines - Amendment 1

Management environnemental - Analyse du cycle de vie - Exigences et lignes directrices - Amendement 1

English Version NF EN ISO 14044:2018


NF EN ISO 14044/A

October 2020

ICS: 13.020.10; 13.020.60

Classification index: X 30-304/A2

Environmental management - Life cycle assessment - Requirements and guidelines - Amendment 2

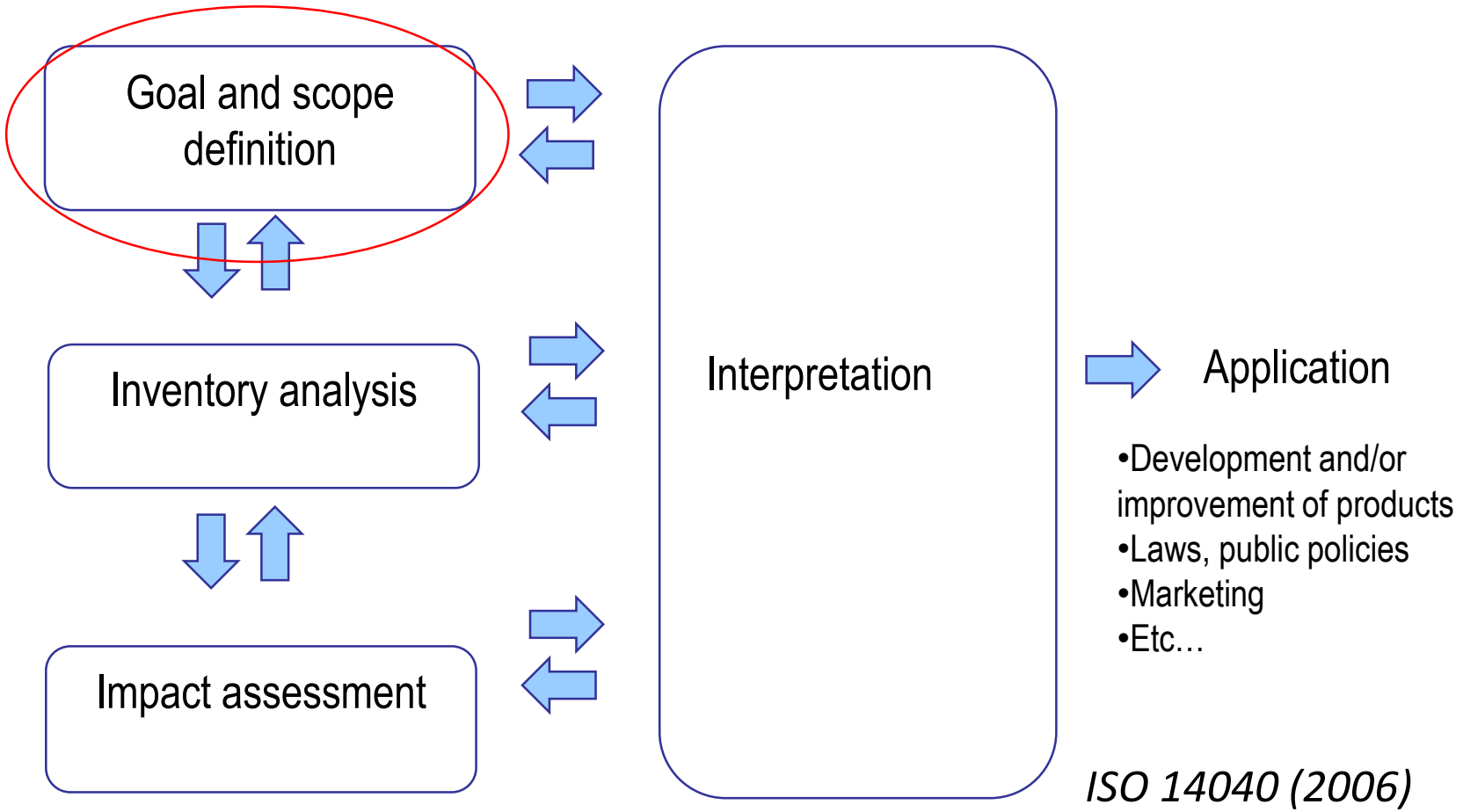
Management environnemental - Analyse du cycle de vie - Exigences et lignes directrices - Amendement 2

What is LCA?

- Typically, an LCA answers 2 main questions:
  - Is A better than B?
  - Where (in the life cycle) are the hot spots?
- **Application covers various perspectives:**
  - *Ex1: What choices to make for the energy system (e.g. biofuels; electrification)? (government perspective)*
  - *Ex2: What to do with my empty mayonnaise (plastic) bottle? // Single use or re-usable diapers? (citizen perspective)*
  - *Ex3: How can my product be more efficient on an environmental perspective? (industry perspective – product development)*

What is LCA?

- In 5 bullets:
  - Focus on services (different ways to provide a given service to society)
  - Comparative (/relative)
  - Holistic (this embeds 2 key aspects: whole product system + all substances)
  - Used to support (investment) decisions
  - Quantifies environmental performance



ISO 14040 (2006)

Case study

In team: Production of Bio-diesel from animal fat. Should we invest in this?

- For this, you will need to produce A MJ bio-diesel:
  - Inputs for esterification process:
    - Pig fat: B MJ
    - Others inputs (methanol and energy) can be considered as “others”
  - Co-products:
    - Co-product 1: C MJ glycerin. Can be used for heat
    - Co-product 2: E MJ distillation residues. Can be used for heat.
    - Co-product 3: G kg catalyst residue. Rich in potassium, can be used in agriculture.

What should we include in this LCA system?

Need:
(i) pen and paper
(ii) Team of 5-6

When done, take a picture and send it to: hamelin@insa-toulouse.fr

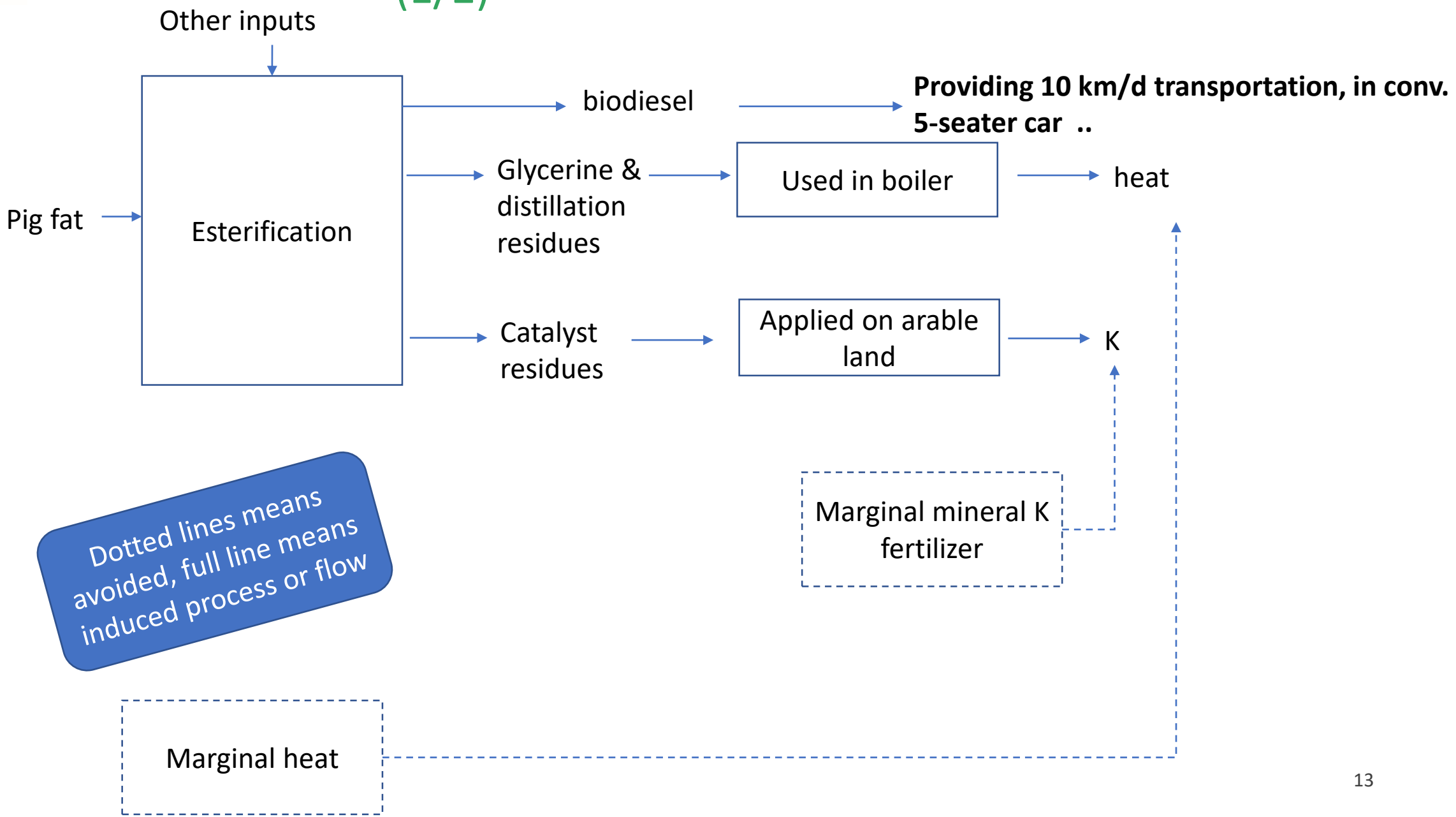
<u>You decide the processes relevant to include</u>

Your results

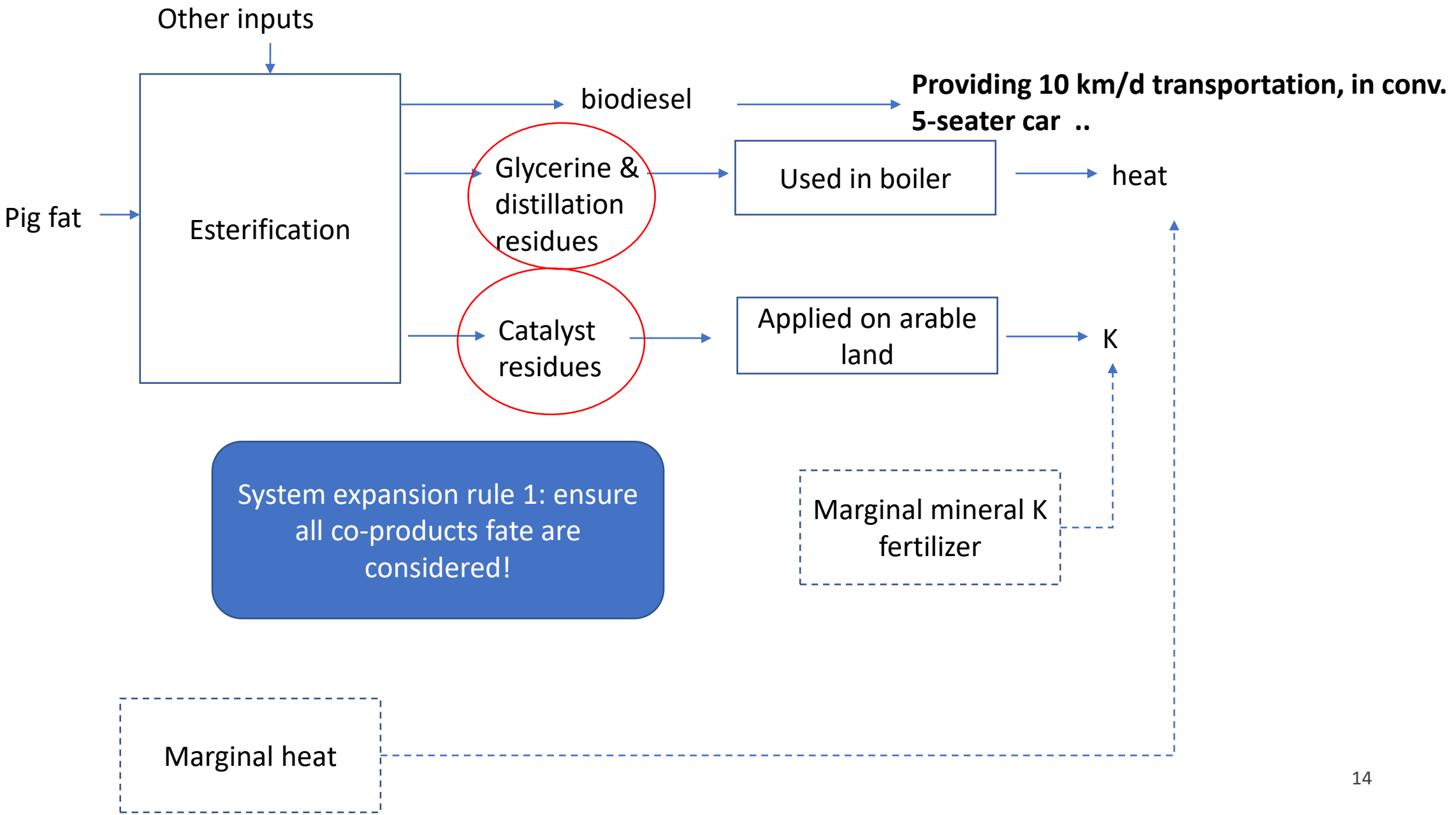
System boundary:

2 main ways of handling multifunctionality

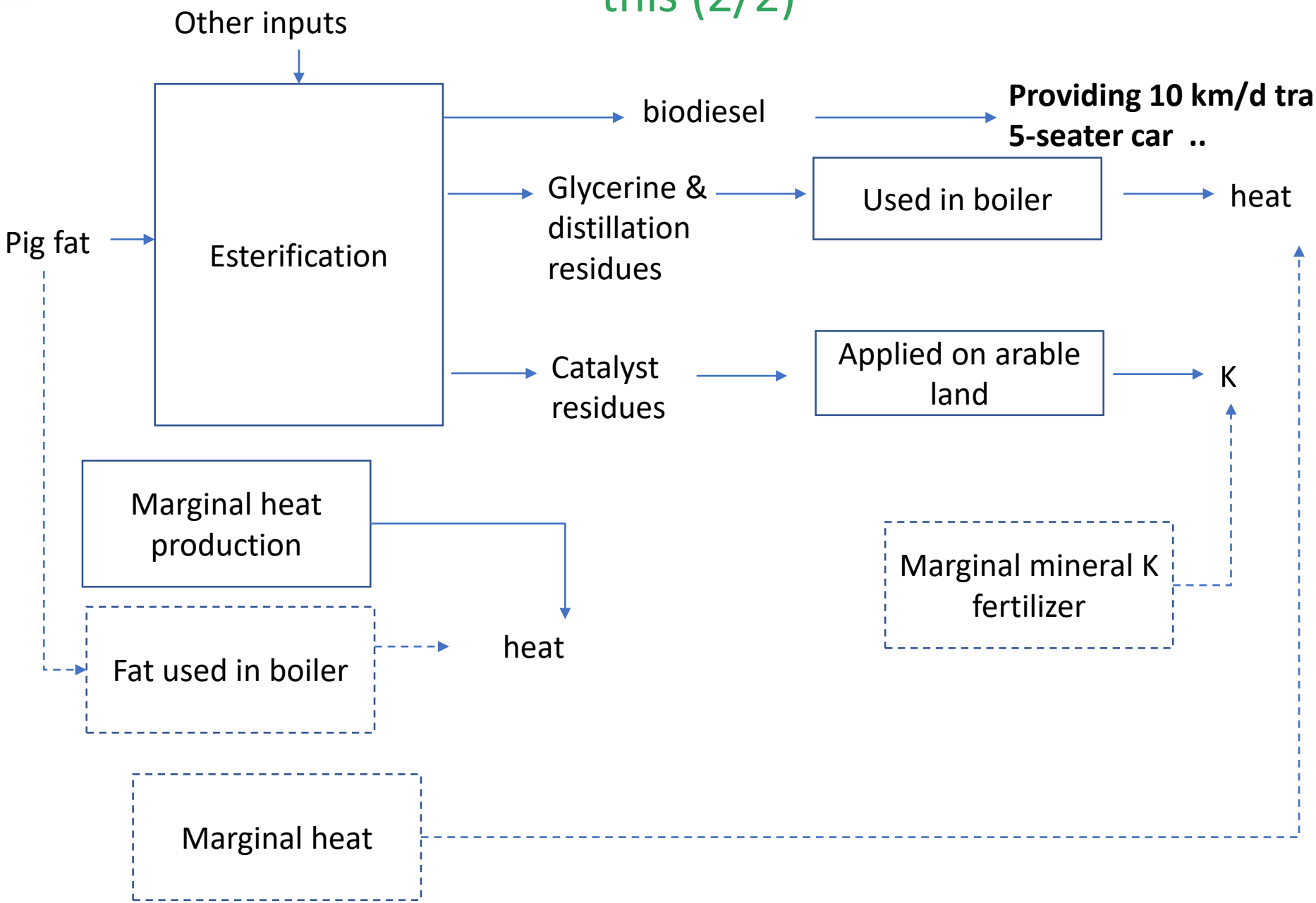
In consequential LCA, it would be modelled like this (1/2)



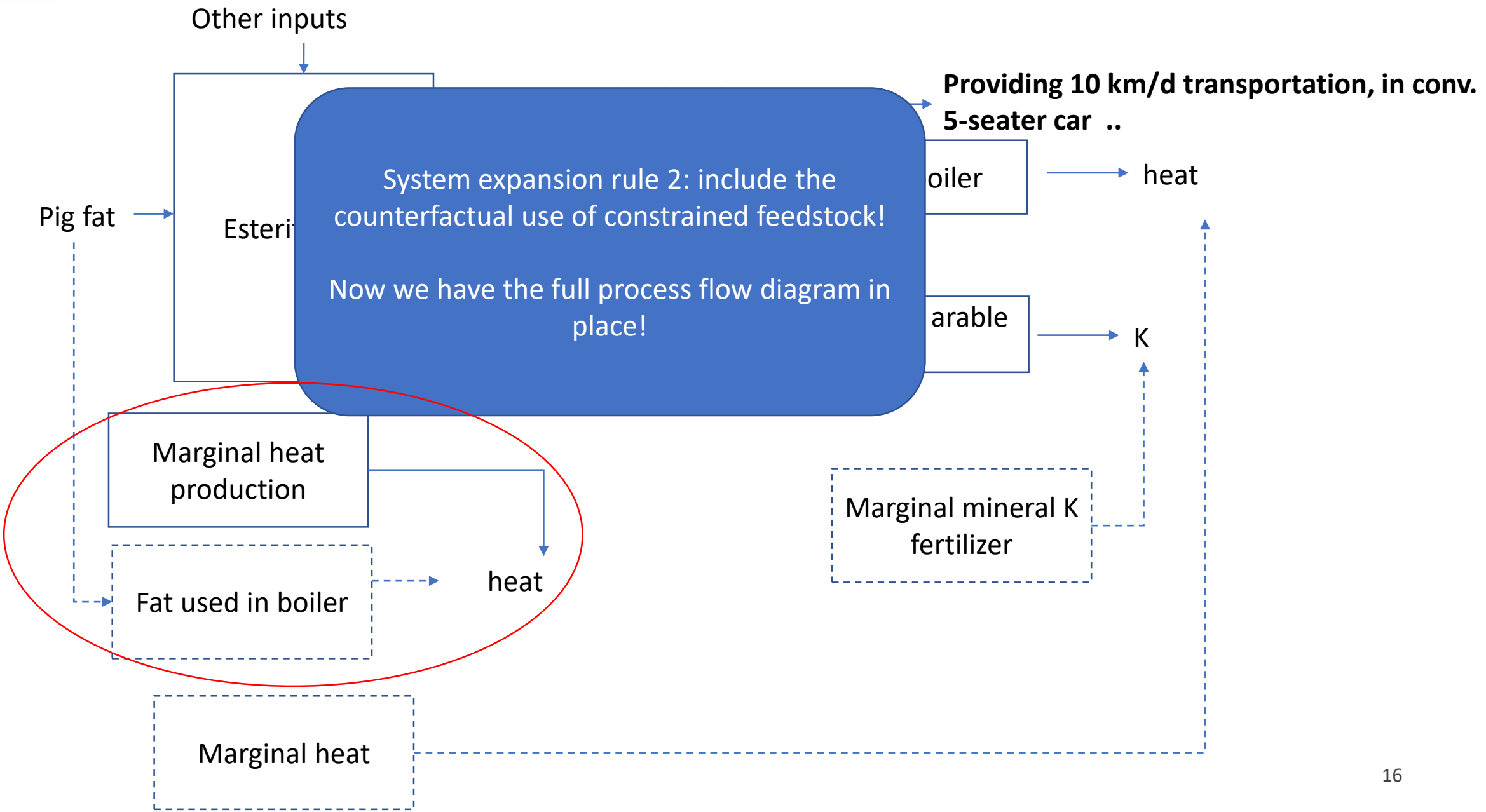
In consequential LCA, it would be modelled like this (1/2)



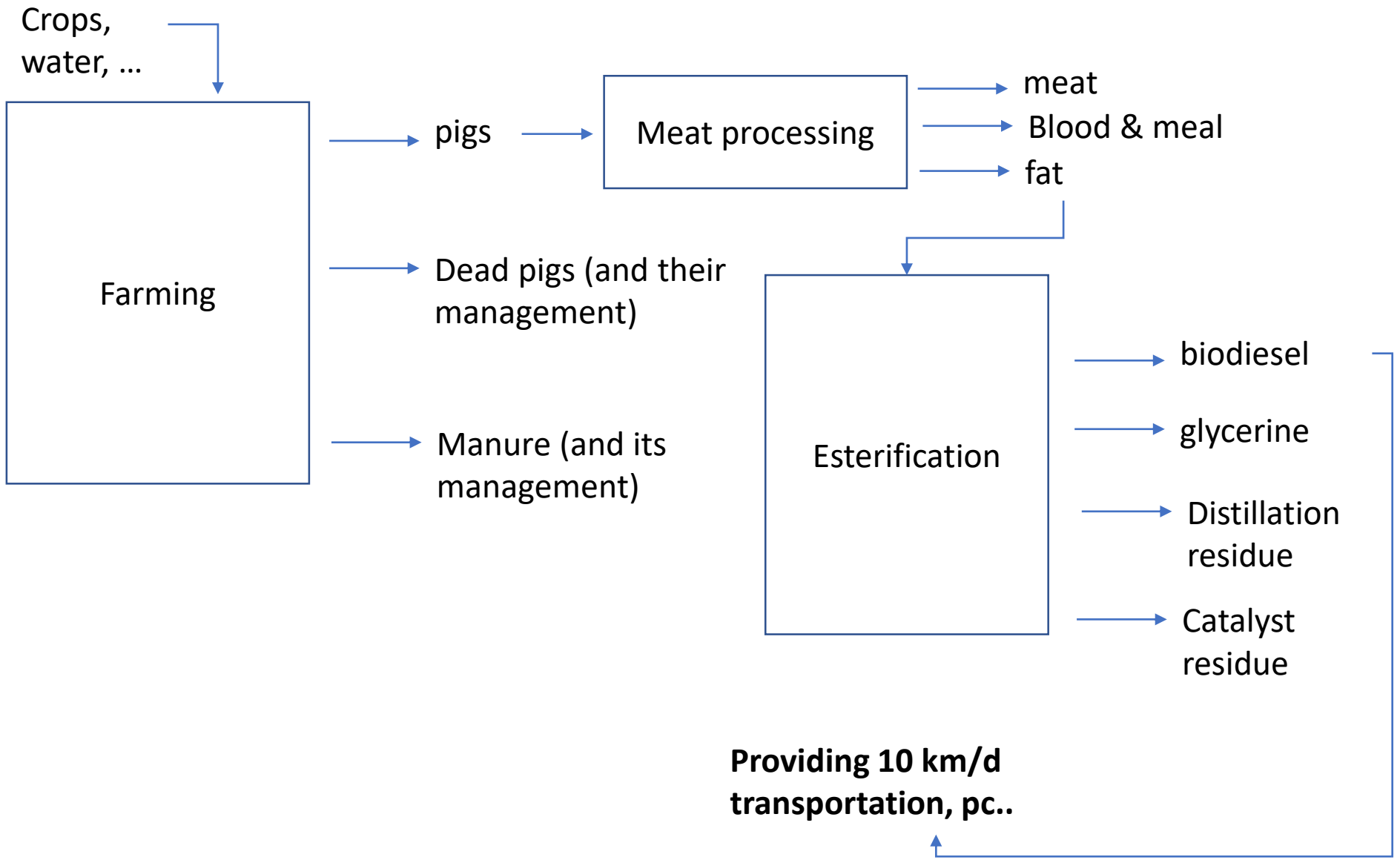
In consequential LCA, it would be modelled like this (2/2)



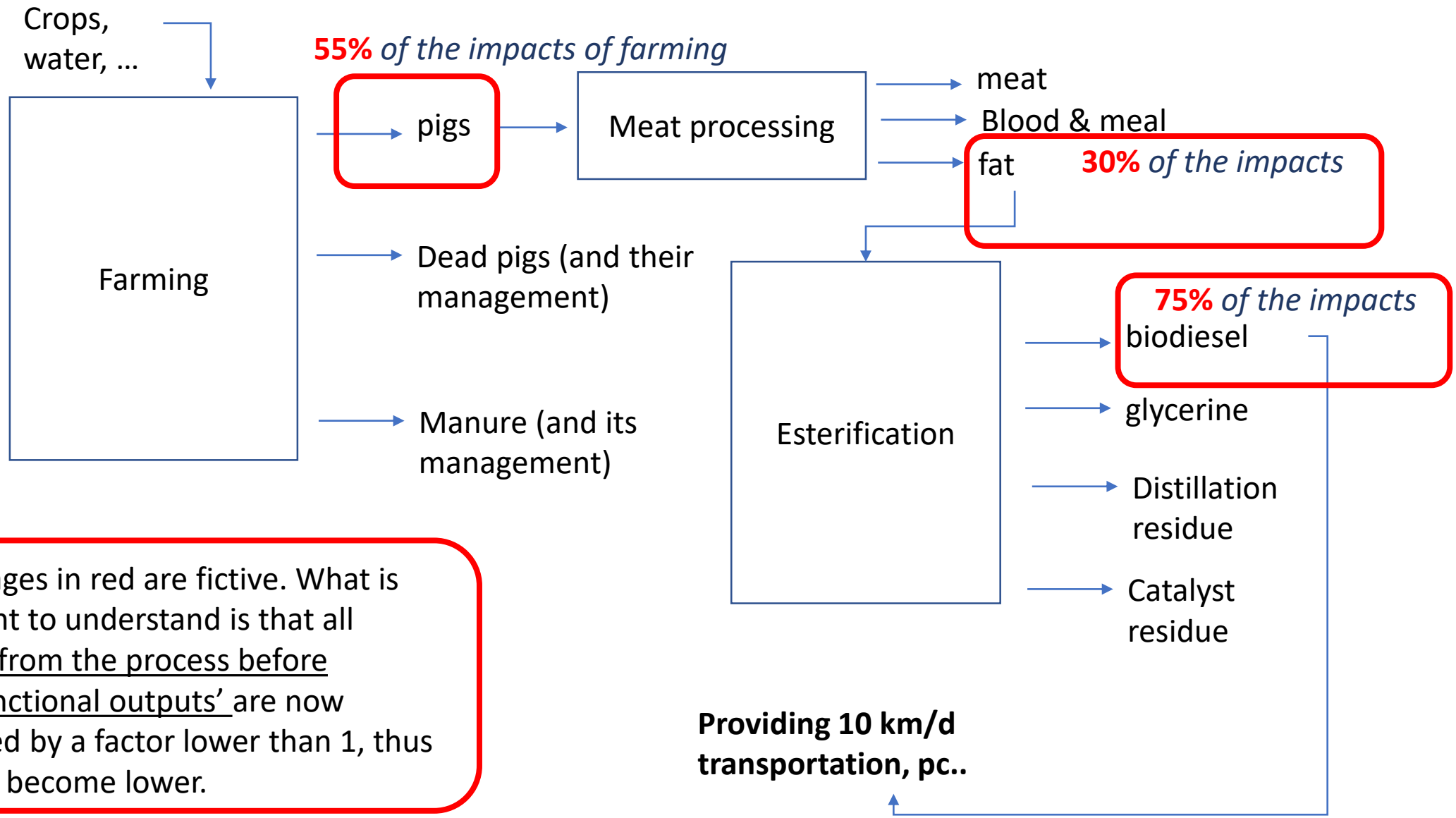
In consequential LCA, it would be modelled like this (2/2)



In attributional LCA, it may be modelled like this



In attributional LCA, it may be modelled like this



Percentages in red are fictive. What is important to understand is that all impacts <u>from the process before 'multifunctional outputs'</u> are now multiplied by a factor lower than 1, thus they will become lower.

Consequential LCA (vs attributional LCA): 2 key differences

Table 8.3 The meaning of the attributional and consequential modelling frameworks and their handling of multifunctionality

LCI modelling framework	Question to be answered	Handling of multifunctional processes when subdivision is not possible		Modelling of background system
		Before ILCD	ILCD	
Attributional	What environmental impact can be attributed to product X?	Allocation	System expansion or allocation	Average processes
Consequential	What are the environmental consequences of consuming X?	System expansion	System expansion	Marginal processes

1

2

Hauschild et al. (ed) (2018). https://link.springer.com/book/10.1007/978-3-319-56475-3

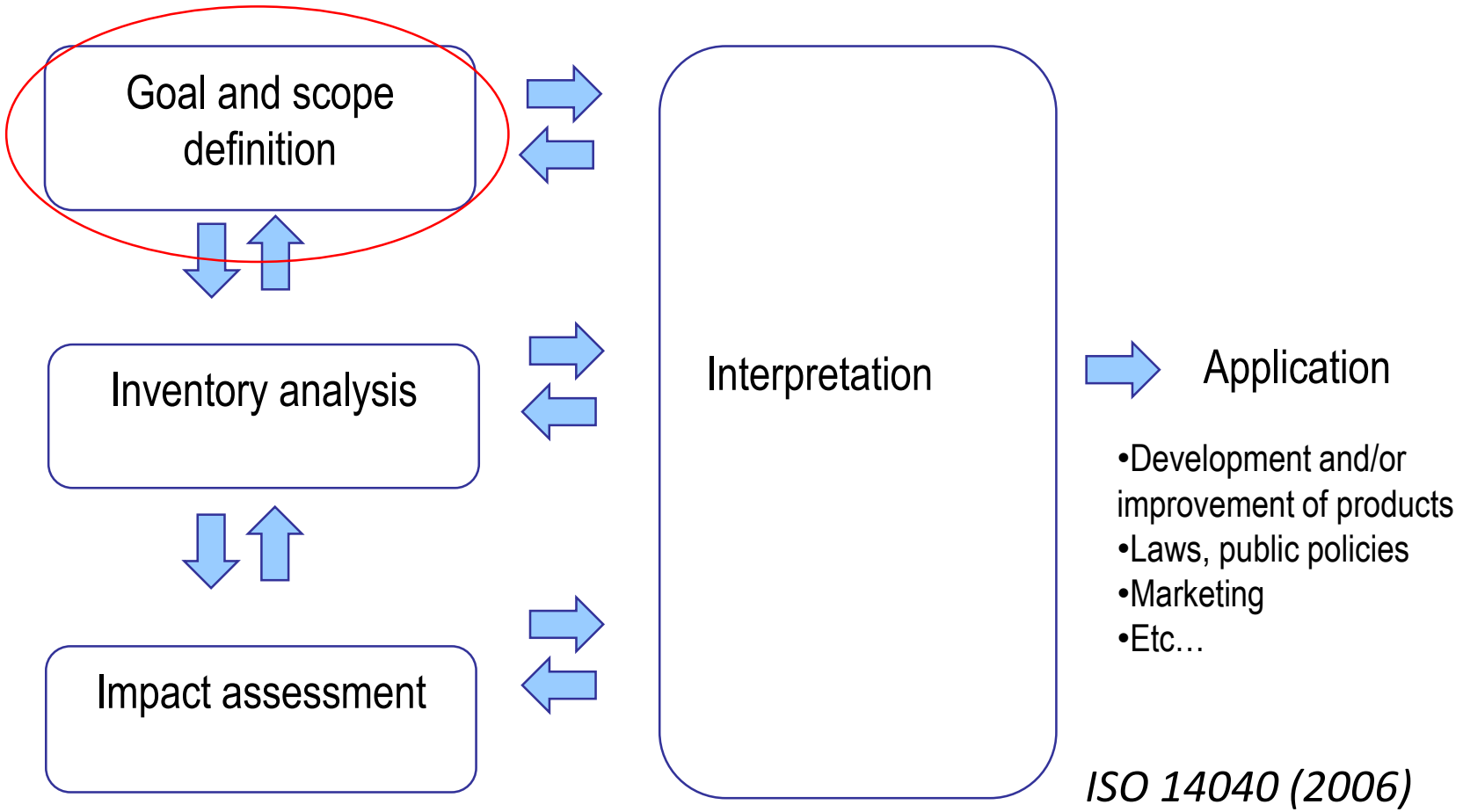
Note! More & more, « attributional » LCAs are stopping to practice allocation and use system expansion. However, they still use *average* data.

In the Ecoinvent LCI database, these are refered to as 'cut-off' or 'alloc', while marginal data are refered to as 'conseq'..

Note!! : ISO 14040:2006 clearly states that allocation should be avoided whenever possible

Functional unit :

ensure you can compare your systems



ISO 14040 (2006)

Functional Unit (FU)

- Consist to define the service in a quantitative way in order to ensure that all alternatives compared deliver exactly the same service to society
- “One of the primary purpose of a functional unit is to provide a reference to which the input and output data are normalized (in a mathematical sense)” (from ISO 14044)
- 2 main types of FU: input-based (e.g. yearly management of 1 tonne residual biomass in region X) and output-based (e.g. producing xxx)
- 3 things to remember when you define your FU:
  - Qualitative description of the service (product properties, qualities, functionalities)
  - Quantity
  - Duration

Reference flow

- All inputs and outputs must be linked to the FU through a reference flow

- The quantity of product necessary to fulfill the service specified by the FU (because of inherent differences between the compared products, e.g. life spans, a different number of product is used to provide the same FU)

- May be different for each scenario (and often is)

(Goal &) Scope

- FU (output-based) and Reference flow examples

Here, the quantity is implicit

DIAPERS

FU: Absorb and contain urine & faeces of a baby (age 0 – 12 month) for 1 year

Data of analyzed system

A: Single use diaper

(38 diapers/week)

B: Cotton diaper

(68 diapers/week)
(150 use/diaper)
(individual hand washing between each uses, also before throwing away for simplicity)

Reference flows

1976 (single use) diapers

23.6 (cotton) diapers
3536 washings

(Goal &) Scope

- FU (output-based) and Reference flow examples

Hot beverage containers at a workplace

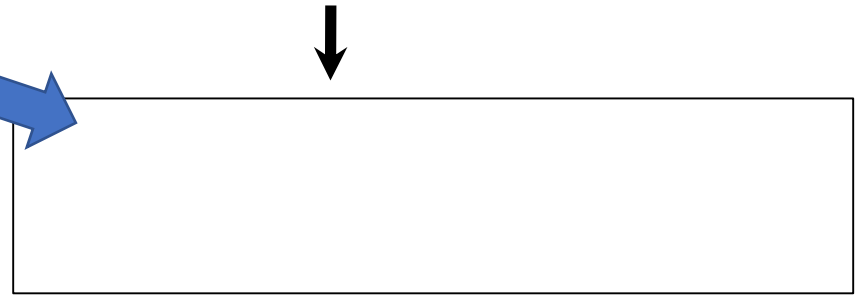
FU: Providing 200 ml of hot beverage 3 times/d for 365 days.

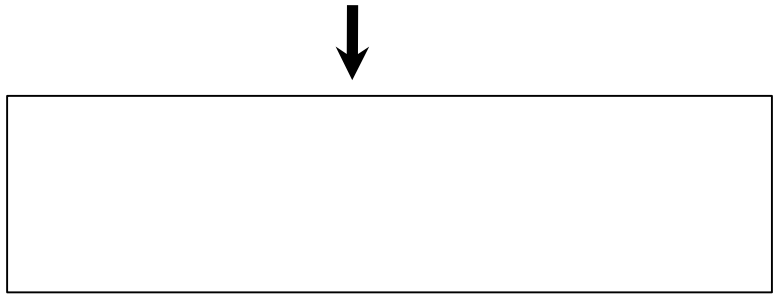
A: Plastic 1-use cup

B: Ceramic mug

Data of analyzed system

Reference flows





(Goal &) Scope

- FU (output-based) and Reference flow examples

Hot beverage containers at a workplace

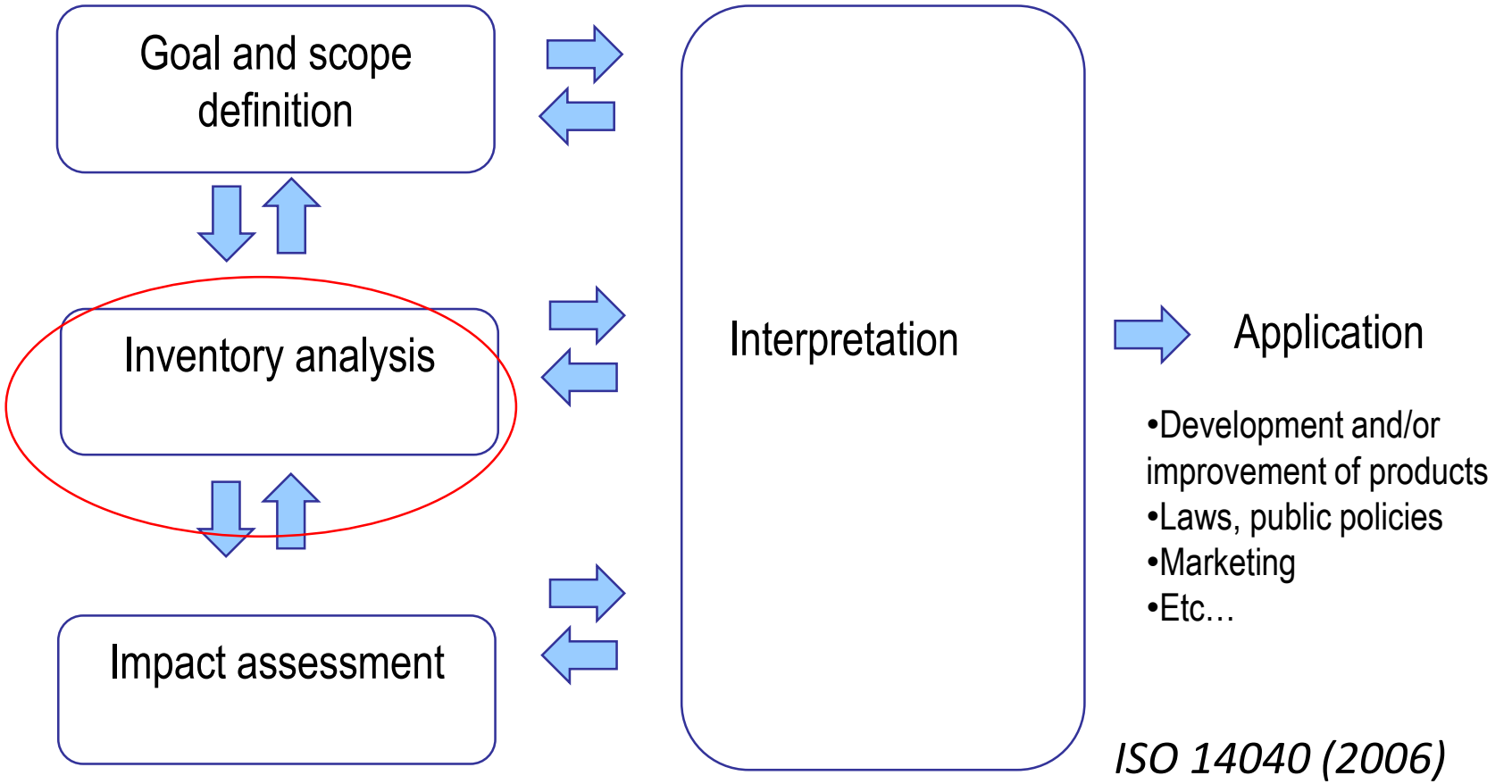
FU: Providing 200 ml of hot beverage 3 times/d for 365 days.

	A: Plastic 1-use cup	B: Ceramic mug
Data of analyzed system	*(usable once per use, assuming there is always only 1 cup/per use, e.g. not doubled for avoiding fingers burning.)*	*(usable for 4380 uses; duration of 4y @3uses/d)* *(washing after each use)*
Reference flows	**1095 units**	**0.25 unit** **1095 washings**

Geographical, Temporal & Technological scope

- Temporal:
  - The results should be valid for how long? What will the World look like when you reach end-of-life?

    (30y is considered as avg. time to see new tech arising; payback time of 10-15y often realistic)
- Technological:
  - What types of technology do I include for the different processes (average, **best case**, worse case, do we consider low “TRL” technologies under development, etc… TRL = Technology Readiness Level, defined on a scale 0-9)
- Geographical:
  - Is the LCA constrained or applying to a specific geographical/political region? If so, your system definition may be influenced by the different regulations of this area (Ex.: Fertilization).



ISO 14040 (2006)

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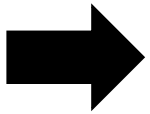
Life Cycle Inventory

Types of products/services supplies

Two distincts ways of modelling the supply of products/services

Average data

Marginal data

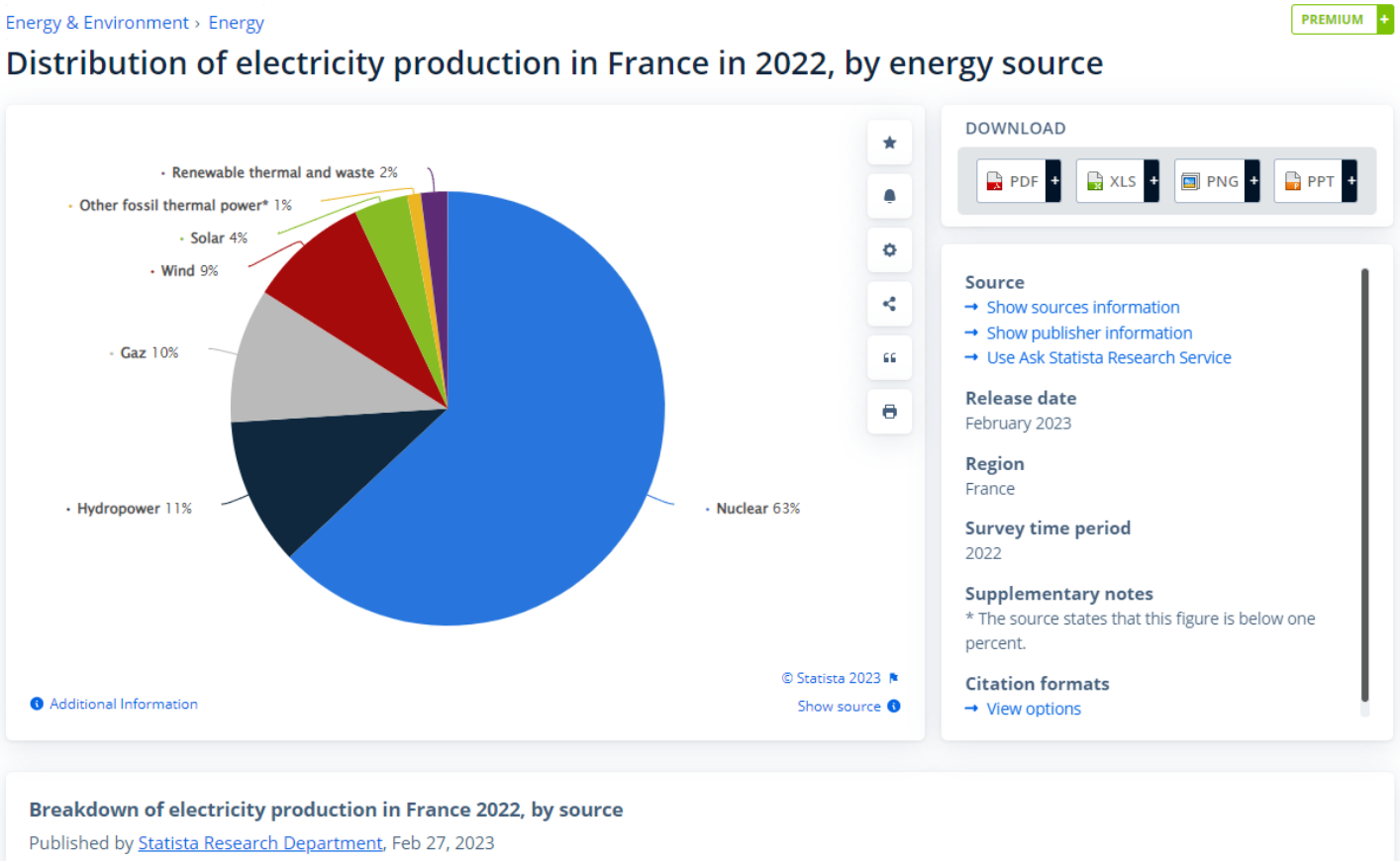


The choice of modelling depends on if we consider that the supply of products/services is affected by a change of demand

Source: Lorie Hamelin

Average data

A picture at a given time point (past or present).



You only use ONE time point!!

Ref: https://www.statista.com/statistics/1263322/electrical-production-by-sector-france/

Source: Lorie Hamelin

Only suppliers that can react to a demand change!

Marginal data

What suppliers are affected by your demand change?

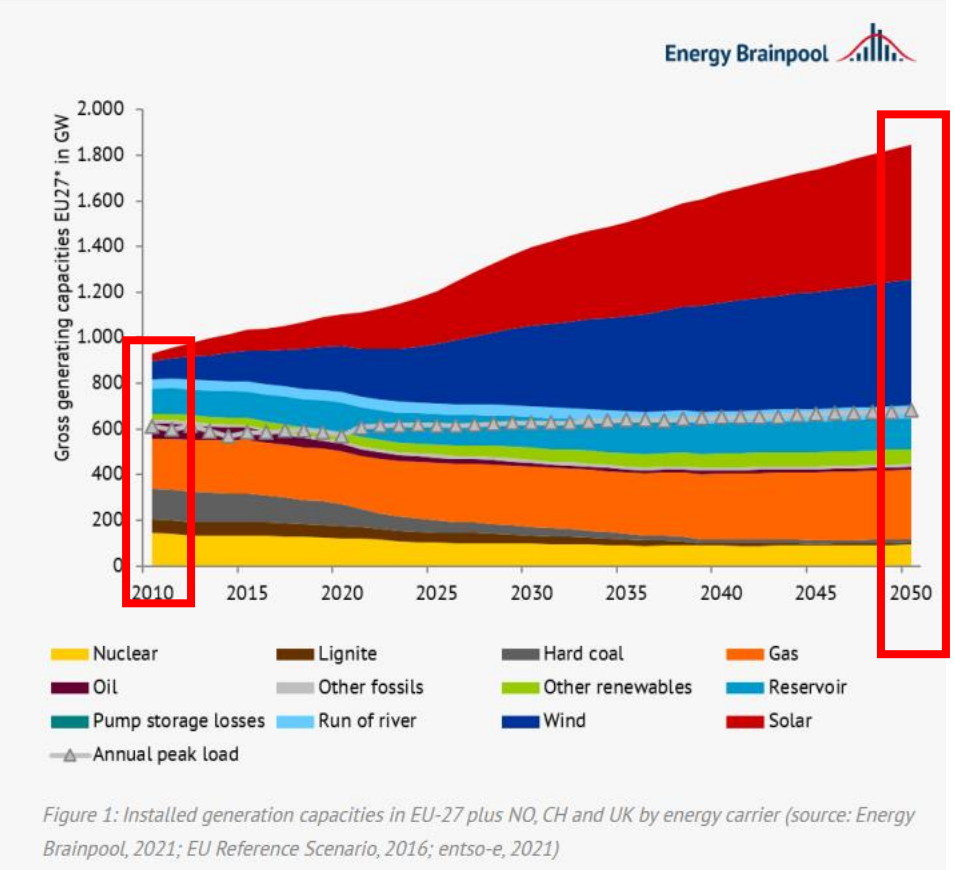


Figure 1: Installed generation capacities in EU-27 plus NO, CH and UK by energy carrier (source: Energy Brainpool, 2021; EU Reference Scenario, 2016; entso-e, 2021)

You need TWO time point!!

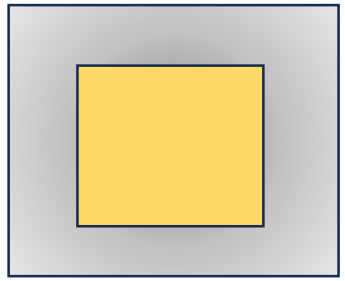
Source: Lorie Hamelin

Tech	2010	2050	delta	% mix
Nuclear	175 GW	100 GW	NEG	0%
Hard coal	125 GW	25 GW	NEG	0%
….				
Wind	100 GW	400 GW	+300 GW	(300/sum of deltas)%
Solar	50 GW	600 GW	+550 GW	(550/sum of deltas)%
…				
SUM			Sum of (positive) deltas	100%

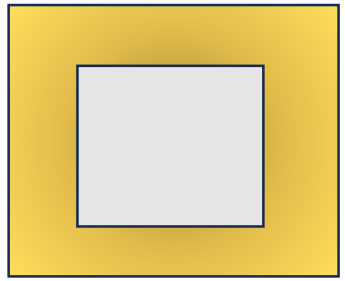
Ref: https://blog.energybrainpool.com/en/update-eu-energy-outlook-2050-how-will-europe-evolve-over-the-next-30-years/

Background and foreground system

Two types of inventory systems according to what you control



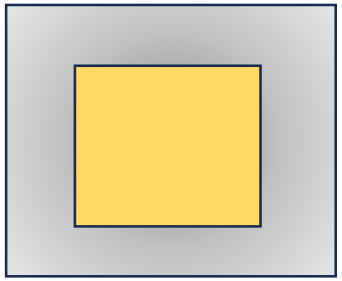
Foreground system: Stages in the life cycle that we control



Background system: Stages in the life cycle that we don’t control

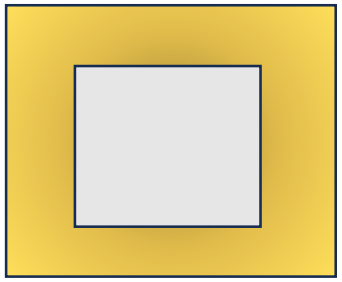
Background and foreground data

Two types of data according to the system boundaries



Foreground system → Primary data

- Directly measured or collected data
- To quantify the most relevant emissions/extractions/consumptions and product flows



Background system → tolerance of Secondary data

- Not directly collected, measured, or estimated, but rather sourced from a third-party life cycle inventory database

Background data

- World's leading supplier of consistent and transparent life cycle inventory data
- 3500 documented industrial processes
- 9 sectors : Energy, transport, building materials, chemicals, washing agents, paper & board, agriculture and waste management
- The database is described at www.ecoinvent.ch

Source: Lorie Hamelin

Other background databases

Food and agriculture

Multisectorial database included in a software

https://www.globallcadataaccess.org/search

Data provider

- Agribalyse (3747)
- Amaru (7)
- Cobalt Institute (5)
- ecoinvent (69472)
- ecoinvent SRI-LCI data (108)
- ecosystem (957)
- ESU-services (2572)
- European Solvents Industry Group (ESIG) (6)
- IBICT (21)
- IDEA (3756)
- Japan Iron and Steel Federation (16)
- KEITI (143)
- LCA Society of Japan (JLCA) (107)
- NorEnviro (36)
- PeruLCA (55)
- Plastics Europe (50)
- RSE SpA (1)
- Sphera (14082)
- TianGong (4092)
- US Federal LCA Commons (1738)
- VitalMetrics Group (389)
- worldsteel (81)

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Life Cycle Impact Assessment (LCIA)

Life Cycle Impact Assessment (LCIA)

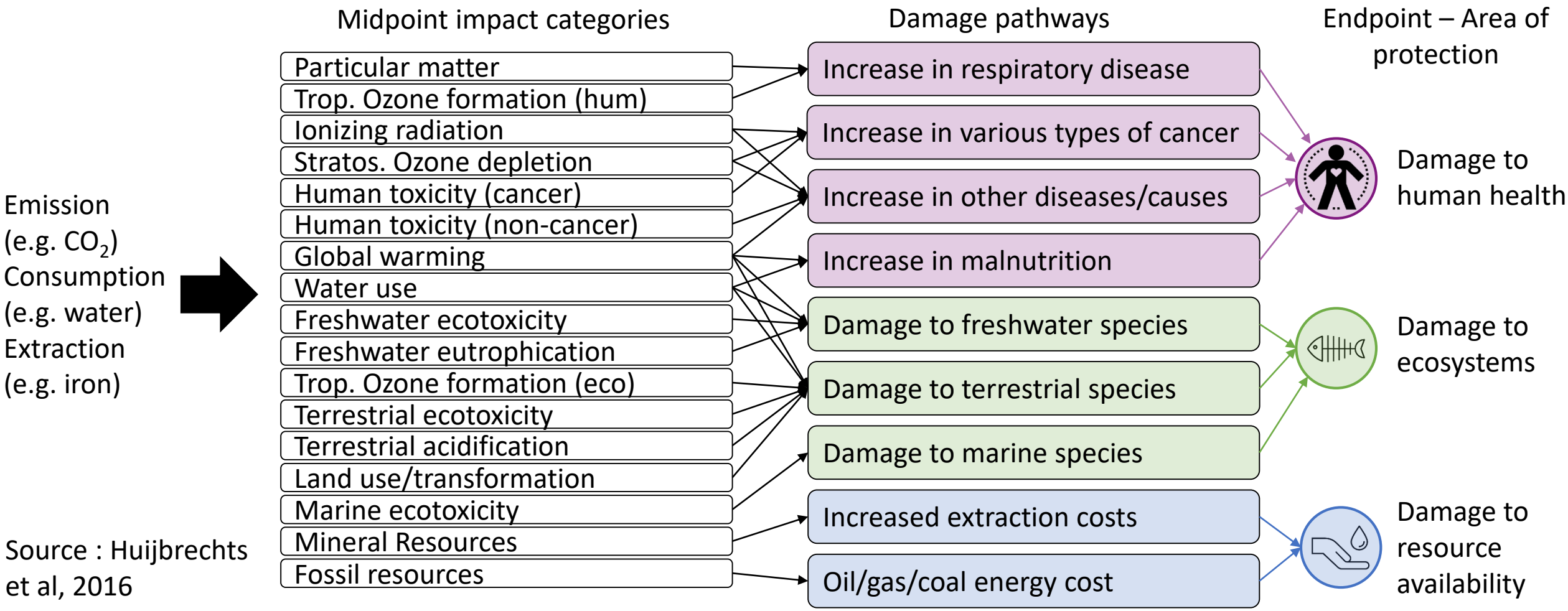
Your turn to play

Write down the name of an environmental impact you know about

https://livecloud.online/fr/wordcloud

Life Cycle Impact Assessment (LCIA)

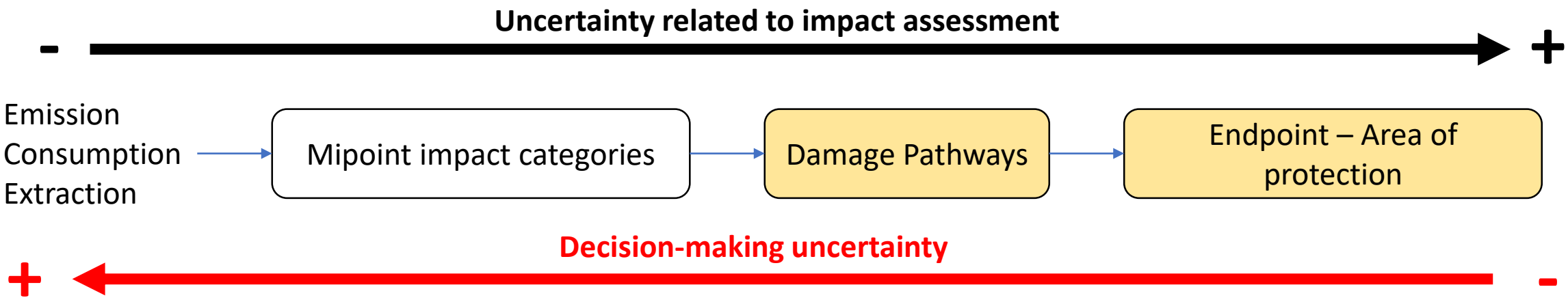
Impacts assessed by the LCA methodology



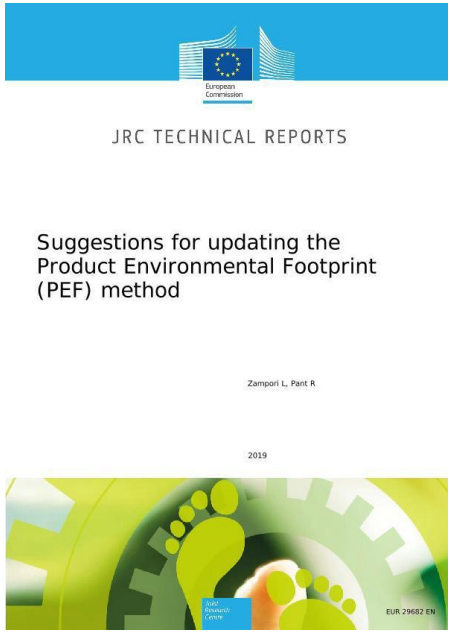
Source : Huijbrechts et al, 2016

Life Cycle Impact Assessment (LCIA)

Midpoint vs endpoint



Life Cycle Impact Assessment (LCIA)



LCIA methods → Allow to translate the emission/consumption/extraction in environmental impacts

- LCIA methods only considering midpoint :
  - Environmental Footprint 3.1 (EF3.1)→ recommended by the EU

- LCIA methods considering both midpoints and endpoints
  - ReCiPe 2016
  - IMPACT World +

- The choice of method could be based on policies, on the need for the spatial differentiation of the impacts as well as the current consensual impacts methods

Application example (Joel Aubin)

Environmental assessment of the use of cane biomass to produce energy

Killian Chary & Joël Aubin

Based on the study: Chary et al. 2018

Cultivating biomass locally or importing it? LCA of biomass provision scenarios for cleaner electricity production in a small tropical island

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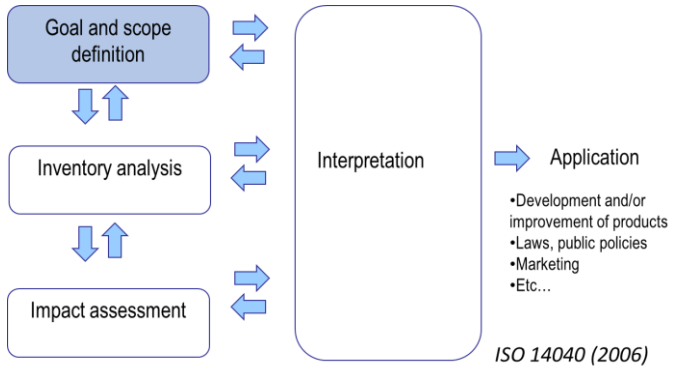
Let’s make a little break!

Guadeloupe
Island of the French West Indies

Context

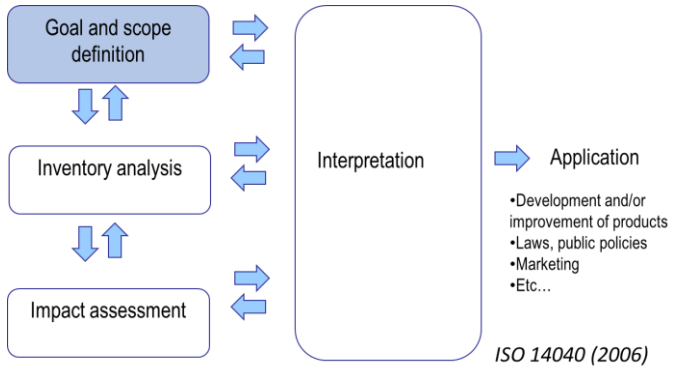


Guadeloupe electricity mix:
83% of electricity from fossil fuels (imported)
Intermittent energies limited to 30%.
Objectives: 50% renewable energies

Development prospects
Strong interest in biomass
- Short carbon cycle
- Stable energy
- Regional development (employment, alternative income)

Main source :
- Energy crops : Sugarcane

Goal and Scope



Goal:

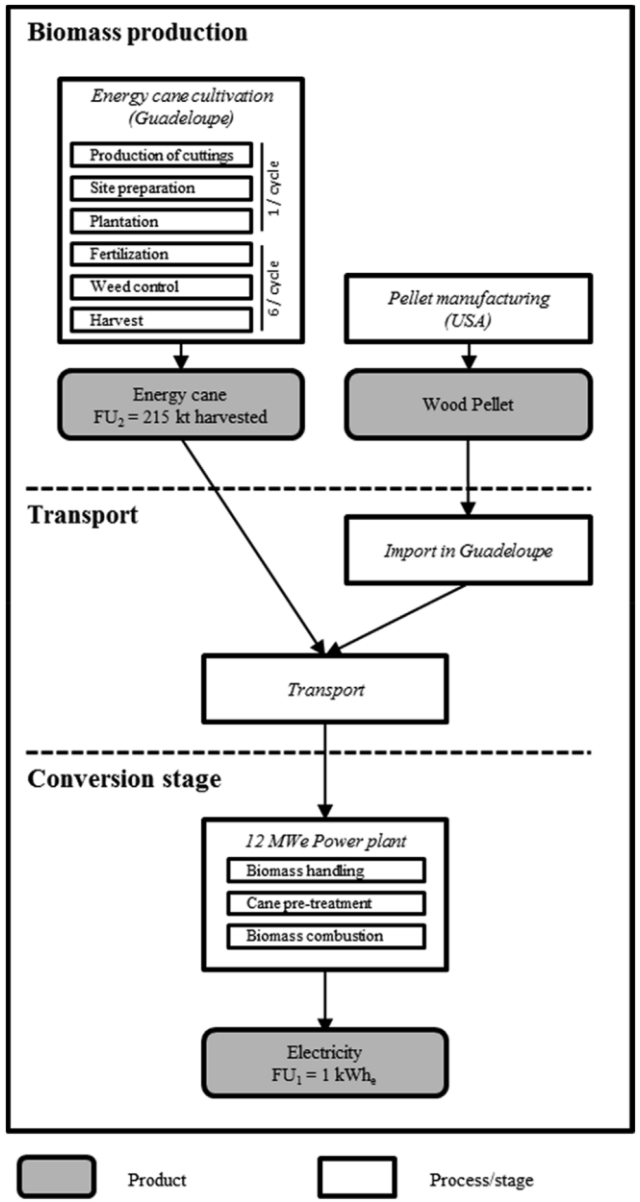
To assess through LCA the environmental impacts of electricity generation from the combustion of locally grown energy cane and imported wood pellets in a tropical island context

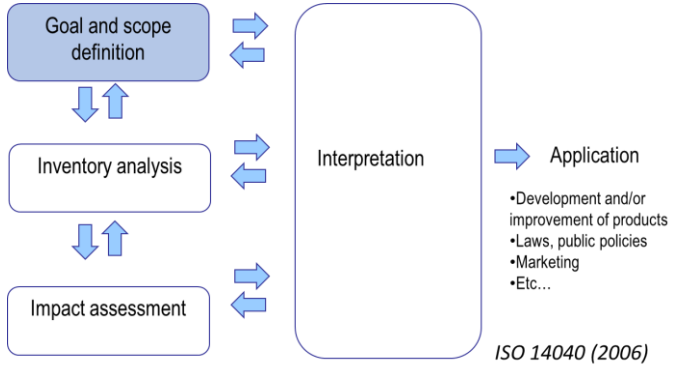
Scope

- Ex-ante assessment of the environmental performances of a new renewable energy source
- Using scenarios of electricity generation from a combined use of energy cane locally cropped with imported pellet
- Main Functional unit : 1 kWh produced
- Intermediate functional unit: 215 kt of biomass harvested, which corresponds to the annual feedstock requirement for a 12MWe power plant

- Craddle to powerplant gate

Goal and Scope

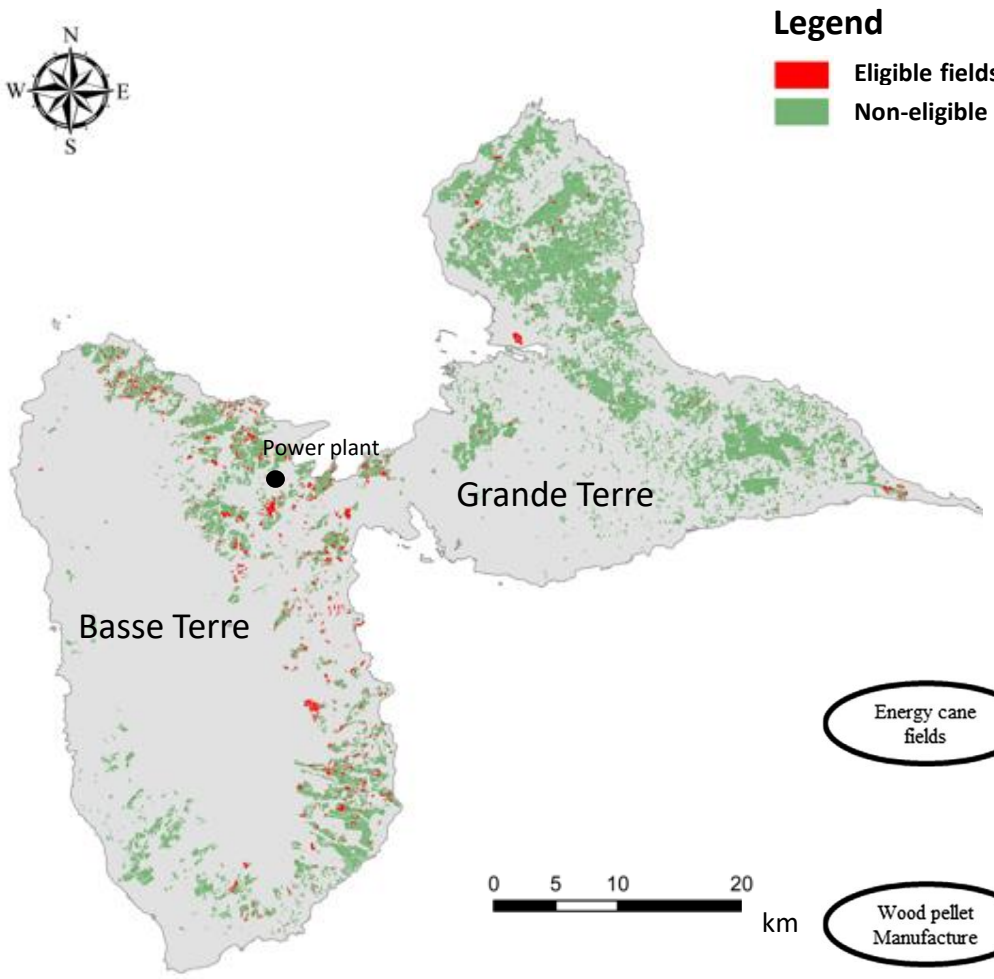


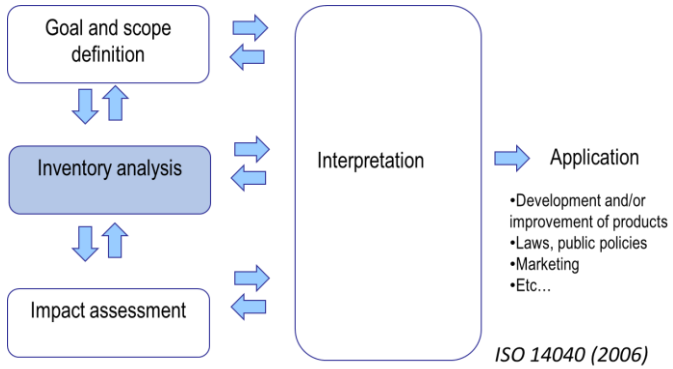


System boundaries:
From the biomass production to the energy plant door

- 3 main subsections:
  - Biomass production including agriculture processes
  - Transportation of the biomass
  - Converstion stage to electricity
    (no stage of electricity distribution)

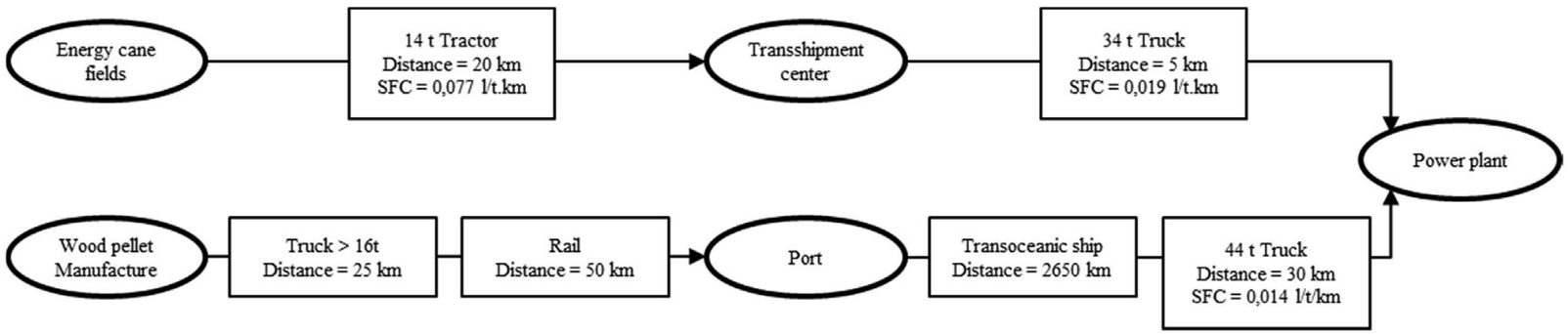
Life Cycle Inventory





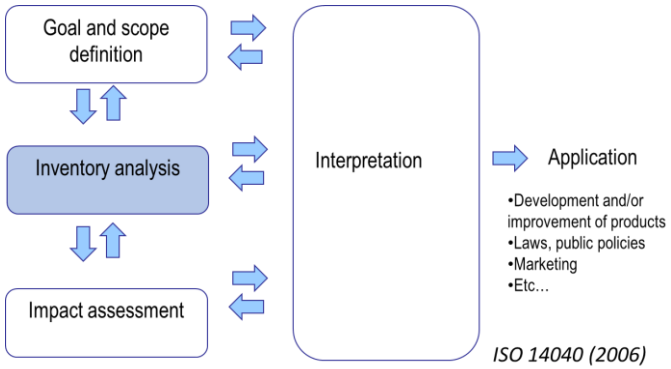
Parameters for cultivation inventory:

- Cultivation processes : plantation, fertilisation, harvesting
- Location, LUC (FAO Ex Act tool)
- Yields
- Emissions to soil, water and air (IPCC models)
- Initial land use



Transport steps of the biomass

Life Cycle Inventory



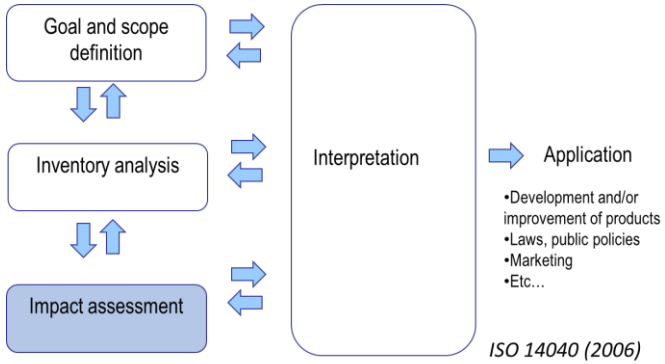
Feedstock supply scenarios of the production of electricity

Scenarios	Percentage of energy cane VS wood pellets	Biomass geographical origin (% of total energy cane mass harvested)
S1	100%/0%	Basse-Terre (90%) and Grande-Terre (10%) islands (Guadeloupe)
S2	100%/0%	Basse-Terre Island (100%)
S3	100%/0%	Grande-Terre Island (100%)
S4	70%/30%	Basse-Terre (85%) and Grande-Terre (15%) islands (Guadeloupe)
S5	0%/100%	Florida (United-States)

Back ground databases:

- EcoInvent
- Agribalyse

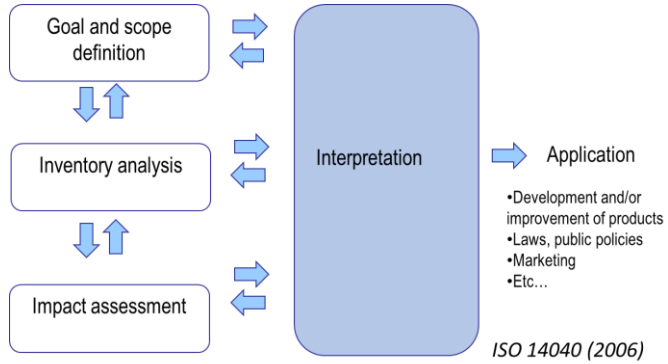
Life Cycle Impact Assessment



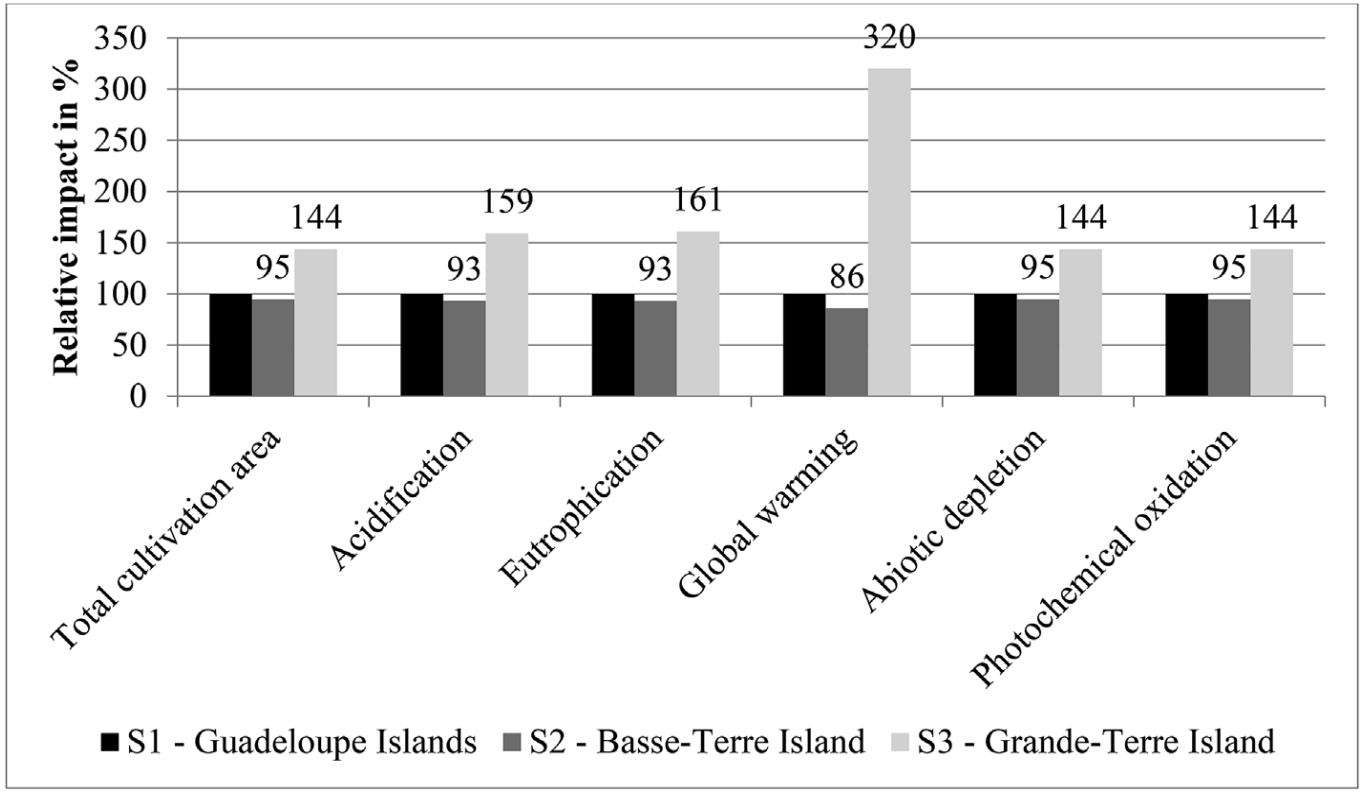
Method CML (2002)

- Acidification: kg SO2 eq
- Eutrophication: kg PO4 eq
- Global Warming: kg CO2eq
- Abiotic depletion: MJ fossil eq
- Photochemical oxidation: kg C2H4 eq
- Land Occupation: m2y

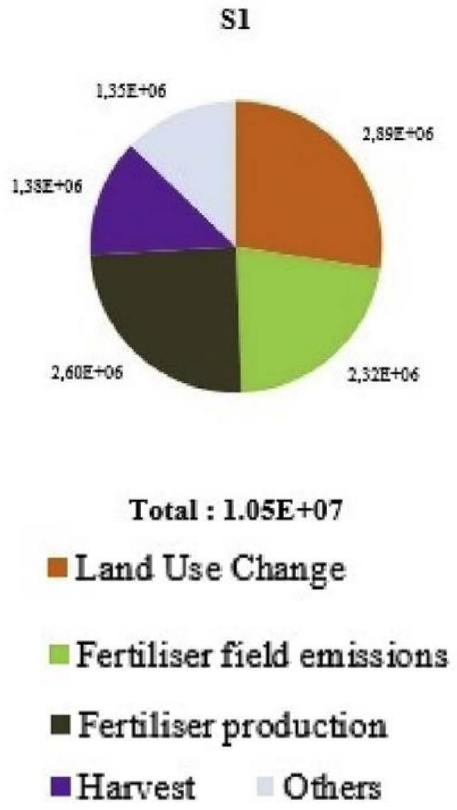
Results



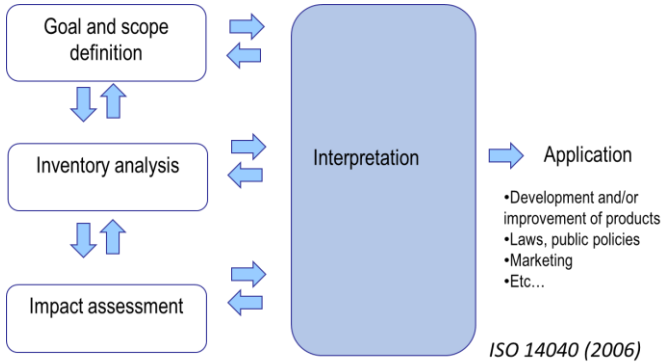
Relative environmental impacts of cane biomass produced

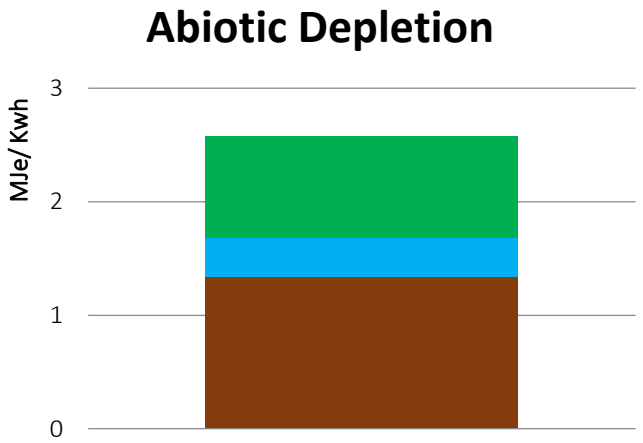


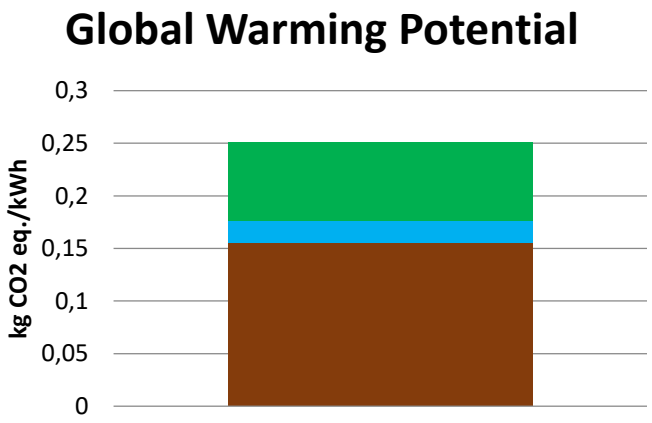
GWP kg CO2eq/215 kt energy cane

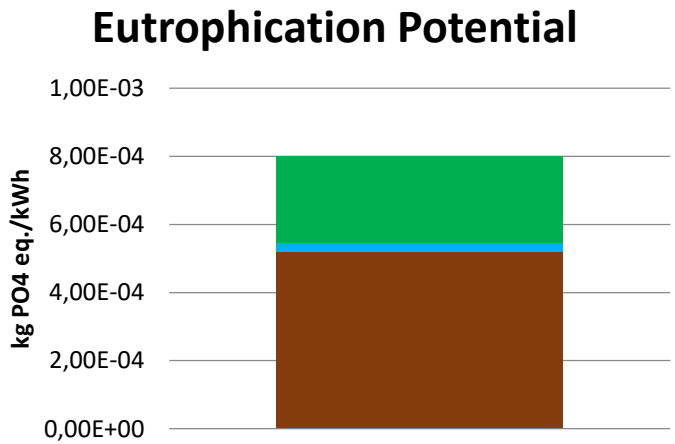


Results



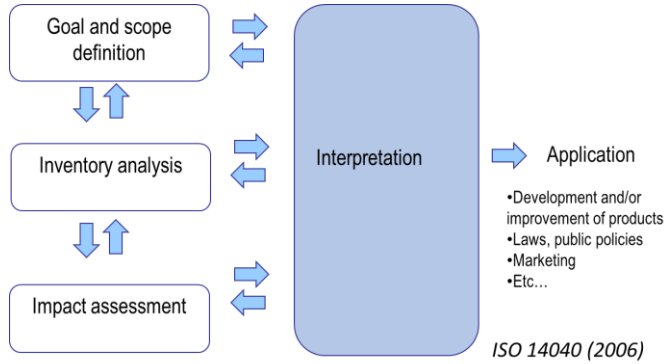


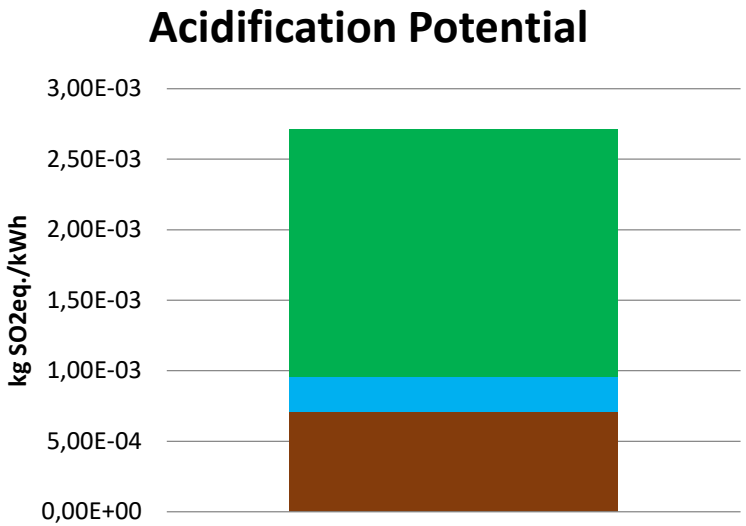


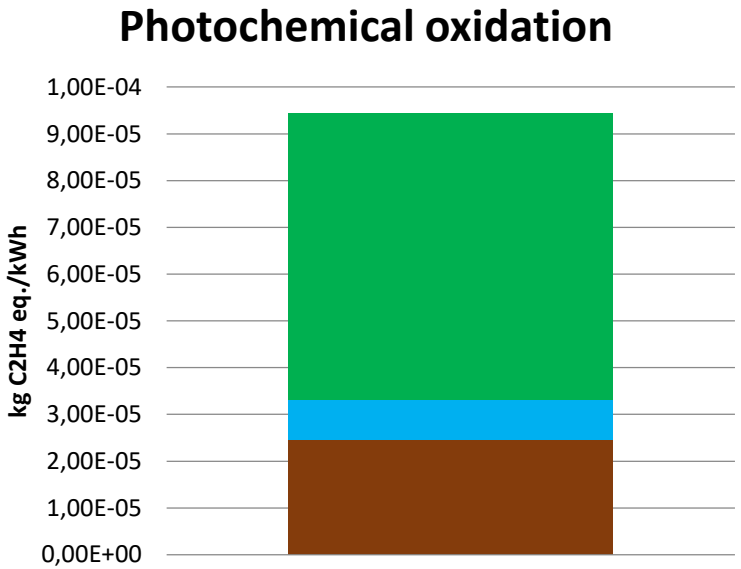


Biomass production Transport Power plant

Results

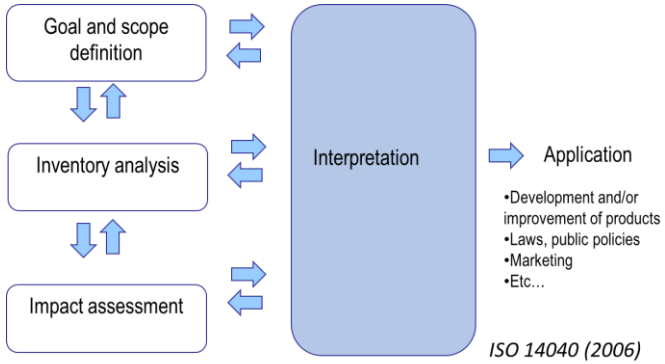


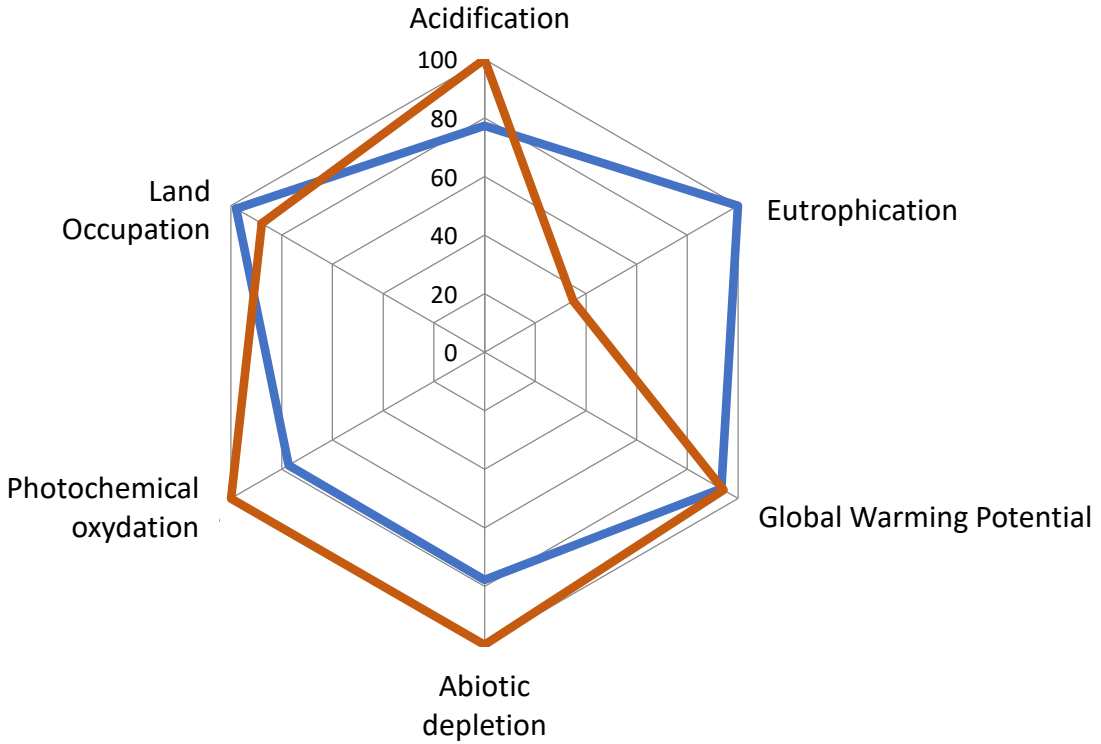




Biomass production Transport Power plant

Results





S1: Biomass from energy cane

S5: Wood pellets from Florida (US)

To conclude

- Biomass, an environmentally sustainable option
- Better environmental profile for CF than for imported wood pellets
- Variable impacts during the agricultural phase (spatial heterogeneity of arable land, productivity, etc.).
- Biomass helps mitigate climate change and reduce dependence on fossil fuels
- ...But generates significant eutrophying emissionsAnd can generate competition with other land uses
- Energy cane, an option for the energy transition in tropical island regions

To conclude

- LCA: an interesting tool to take decision, highlight hot spots and trade-offs
- Complete the environmental balance with other impact indicators on biodiversity, changes in soil organic matter, etc.
- Verify economic viability and social acceptability

Breathe!

Thank you for your attention

Do you have questions?

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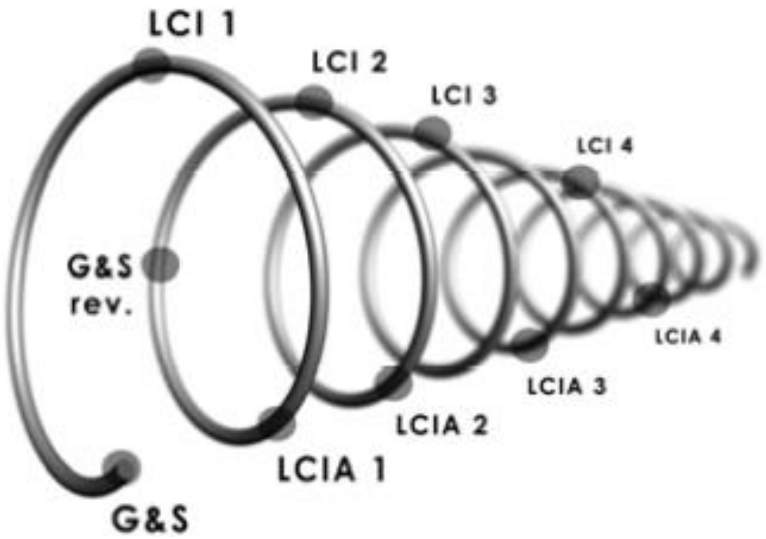
Data needs, sensitivity and uncertainty

Data needs

LCA is an iterative process

- LCA is an iterative process … you need the result in order to scope it!



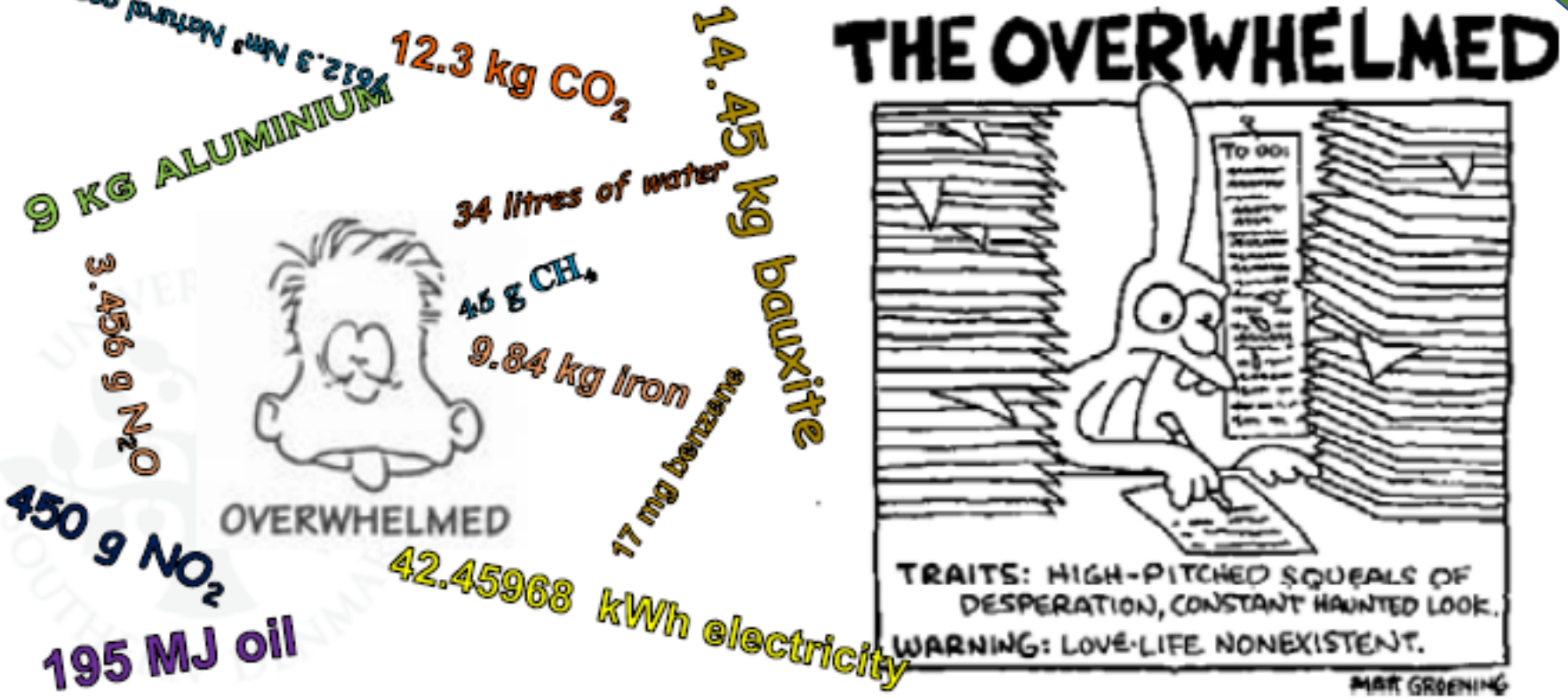
Source: Hauschild et al. (ed) (2018). https://link.springer.com/book/10.1007/978-3-319-56475-3

LCA is not a one click method

Source: Lorie Hamelin

Data needs

Focus data quality only on what is important



Remember: in the 1st iteration, do not waste time searching for the perfect data! The 1st iteration will show you what is important. Focus data quality only on what is important!

LCA is not a one click method

Source: Lorie Hamelin

Sensitivity

Sensitivity analysis → how sensitive the final results are to these choices

Uncertain about some data/assumptions/calculations methods ?

Sensitivity analysis

Perform the LCA again by changing the potentially sensitive parameter by another, one-at-the-time, and evaluate how this affects the results

- Perturbation analysis on data (e.g. +10%)

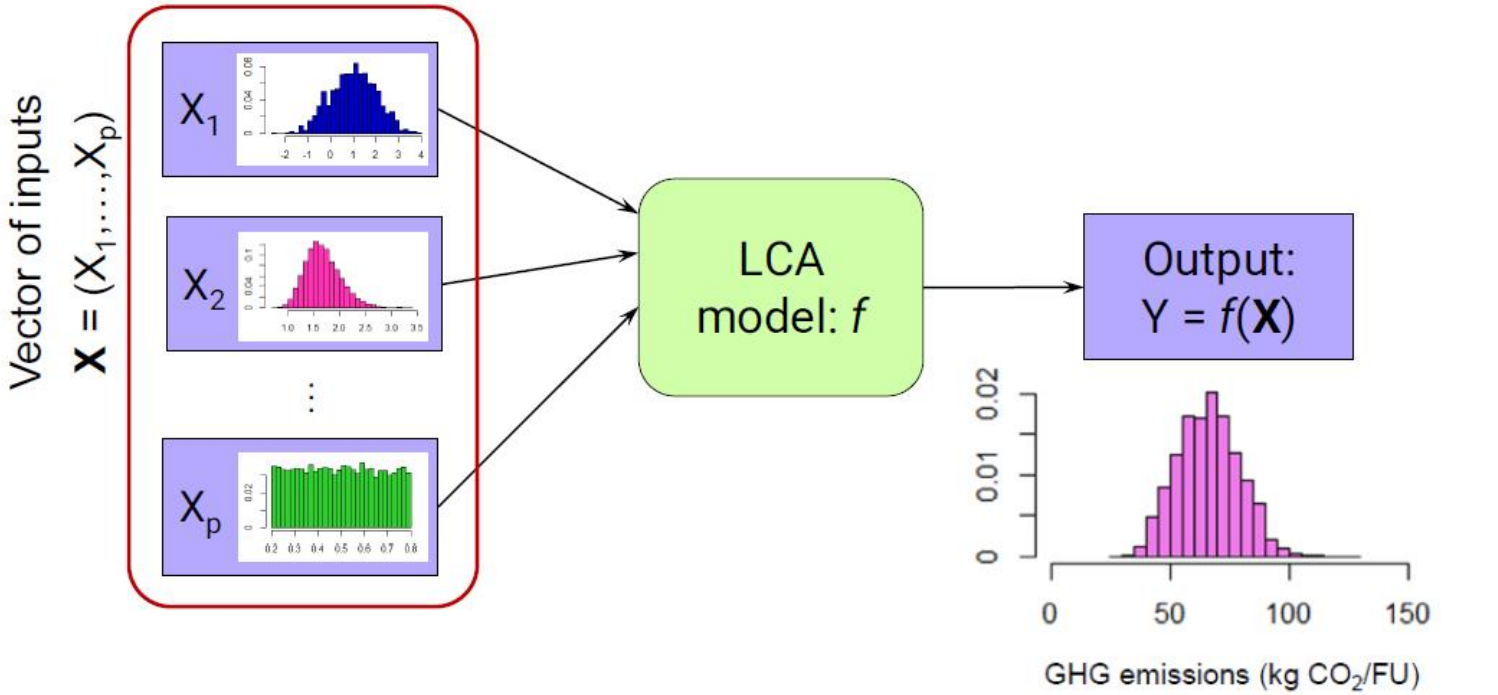
- Scenario-analysis (e.g. changing the marginal supplier of a specific activity of interest)

- Sensitivity about the LCIA method : Choosing another LCIA method

Source: Lorie Hamelin

Uncertainty

Uncertainty : Often based on Monte Carlo Analysis



Generation of Monte Carlo sample for the inputs

Generation of Monte Carlo sample for the output

Source: Formation Doctorale d'excellence FD1 – Advanced LCA Methodologies & Tools: Uncertainties & Variability – (Perez Lopez, 2023)

Data needs

Analysis method of Monte Carlo outputs

Method >	Deterministic LCA (point values)			Discernibility			Impact category relevance				Overlap area				NHST			Modified NHST		
Meaning of result >	Does *j* have a lower impact than *k*?			% of total runs in which *j* has a lower impact than *k*			Which impact is important for the comparison of *j* and *k*?				Overlap area between distribution of impact of *j* and *k*				Are the mean impacts of *j* and *k* significantly different?			Is the mean impact of *j* at least 0.2 standard deviation units significantly lower than		
		no	yes		0%	50%	100%	least	0,24	6,68	most	no overlap	0,00	1,00	full overlap		no	yes		no	yes
Impact																					
Photochemical Oxidation	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC
	ICE		no	no	ICE		0%	0%	ICE		2,37	2,53	ICE		0,01	0,00	ICE		yes	yes	ICE		no	no
	FBE	yes		no	FBE	100%		17%	FBE	2,37		0,81	FBE	0,01		0,63	FBE	yes		yes	FBE	yes		no
	HFC	yes	yes		HFC	100%	83%		HFC	2,53	0,81		HFC	0,00	0,63		HFC	yes	yes		HFC	yes	yes	
Acidification	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC
	ICE		no	no	ICE		45%	0%	ICE		0,24	5,44	ICE		0,88	0,00	ICE		yes	yes	ICE		no	no
	FBE	yes		no	FBE	54%		0%	FBE	0,24		6,68	FBE	0,88		0,00	FBE	yes		yes	FBE	no		no
	HFC	yes	yes		HFC	100%	100%		HFC	5,44	6,68		HFC	0,00	0,00		HFC	yes	yes		HFC	yes	yes	
Ionizing Radiation	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC	j↓ k→	ICE	FBE	HFC
	ICE		yes	no	ICE		100%	0%	ICE		1,27	0,34	ICE		0,13	0,79	ICE		yes	yes	ICE		yes	no
	FBE	no		no	FBE	0%		0%	FBE	1,27		1,36	FBE	0,13		0,08	FBE	yes		yes	FBE	no		no
	HFC	yes	yes		HFC	100%	100%		HFC	0,34	1,36		HFC	0,79	0,08		HFC	yes	yes		HFC	yes	yes	

Montecarlo | Statistical param. | Statistical param. | Montecarlo

Ref. Mendoza Beltran et al. (2018) (Excel-based additional material)

Source: Lorie Hamelin

Mendoza Beltran A, Prado V, Font Vivanco D, Henriksson PJG, Guinée JB, Heijungs R. Quantified Uncertainties in Comparative Life Cycle Assessment: What Can Be Concluded? Environ Sci Technol 2018;52:2152–61. https://doi.org/10.1021/acs.est.7b06365

Why using the LCA methodology?

Use of LCA

Regulation and communication tool

- Environmental regulation

<u>Batteries and waste batteries</u>
Regulation N°2023/1542

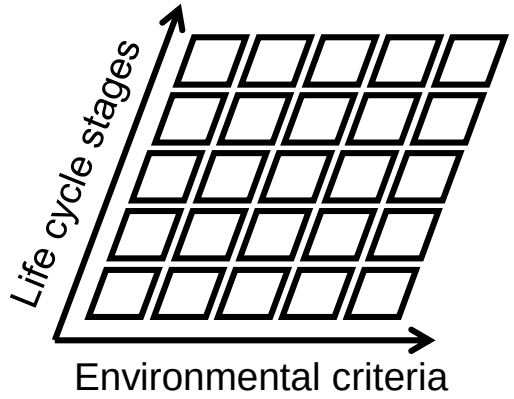
- Environmental communication

Carbon footprint declaration and performance display (*"bear a conspicuous, clearly legible and indelible label indicating the carbon footprint of the battery"*)

Carbon footprint → Climate change impact category of LCA

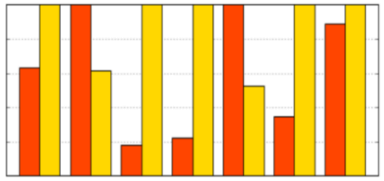
LCA → aims to be exhaustive

Comparison between some environmental assessment methodologies

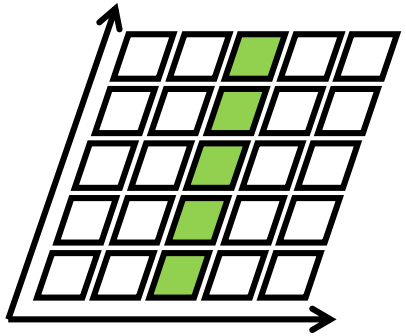


Life cycle approach → entire system

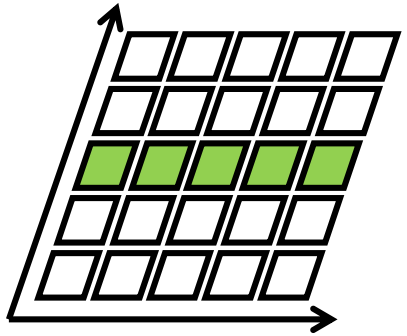
Multicriteria approach → multiple impact categories



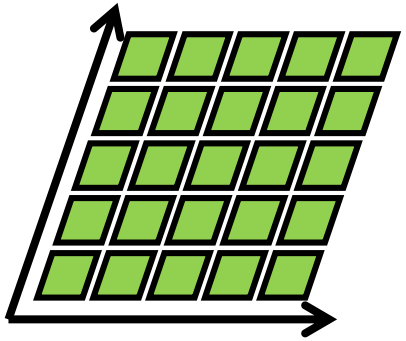
Functional approach → provided service



ex: bilan carbone®



ex: environmental risk assessment



LCA

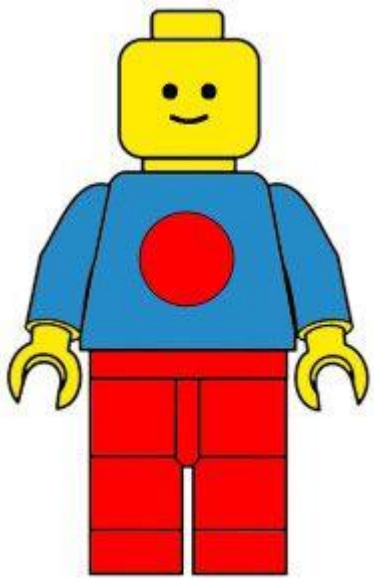
Limits of the LCA methodology

Compromise between robustness of the methodology and the representativity of the processes → example for Human toxicity

Risk assessment – Human toxicity

Toxicity depending on the age or the sex

Life Cycle Assessment – Human toxicity



Toxicity on a mean human

Limits of the LCA methodology

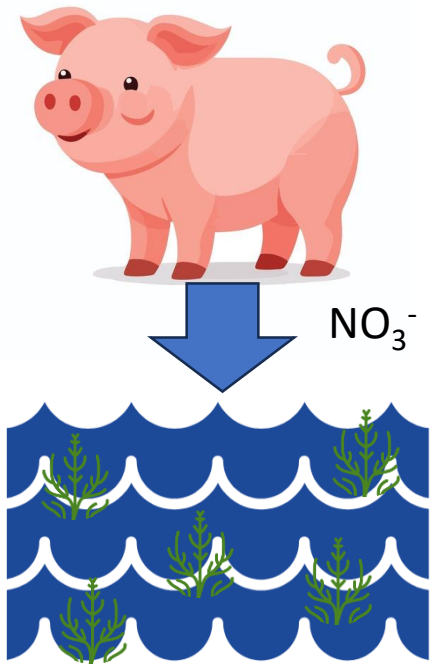
Accounting for marginal effects onthe ecosphere

Ceteris paribus – the fundamental assumption behind LCA

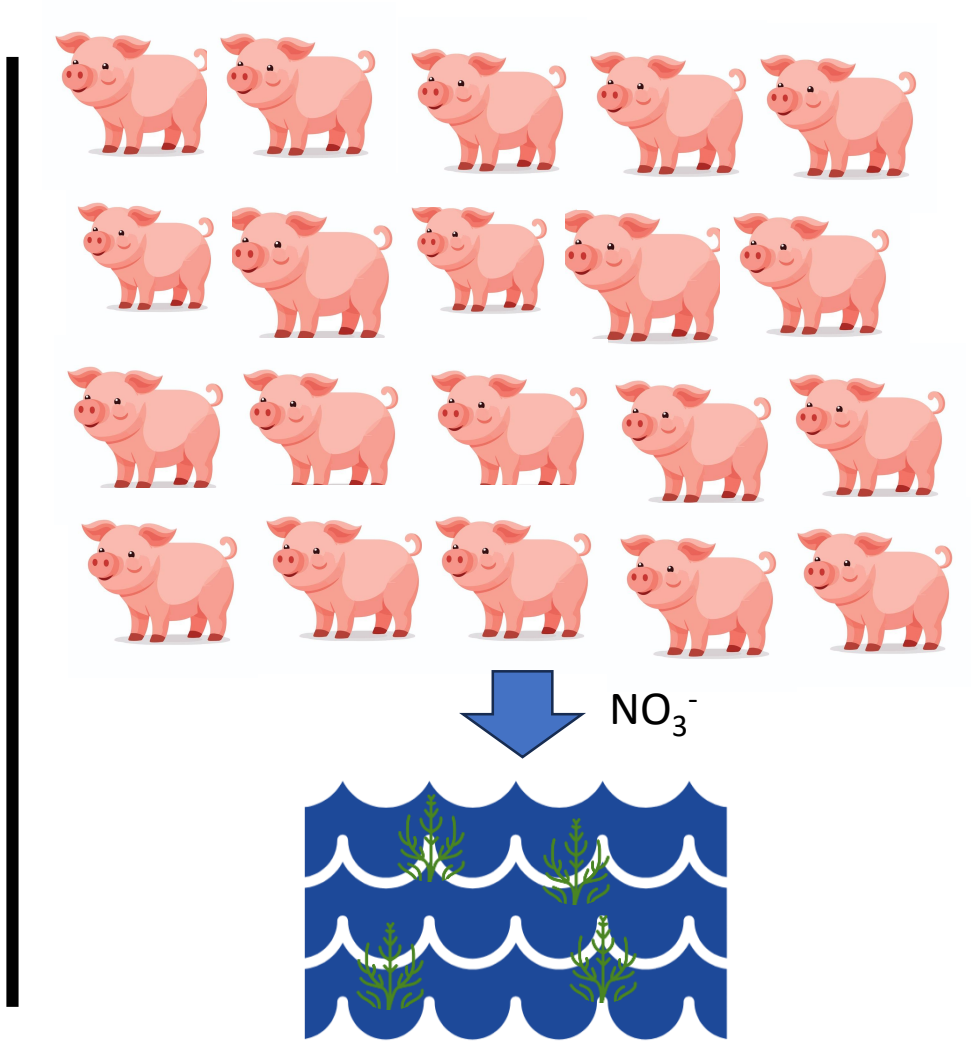
Marginal impacts on top of the current level of pollution in the environment

Example for Marine Eutrophication

Marginal change = OK



Non marginal change = not OK



Limits of the LCA methodology

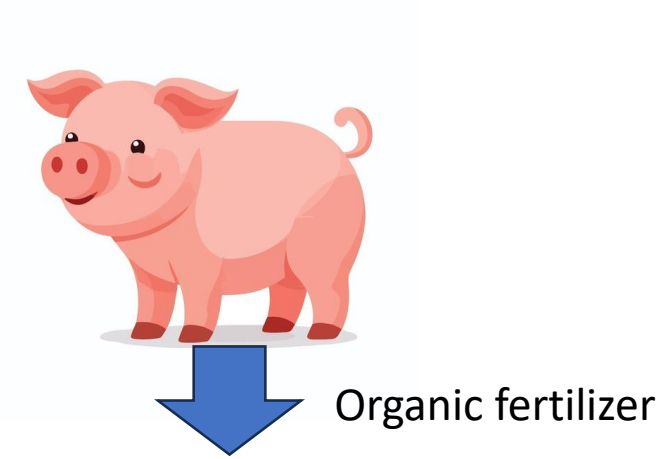
Accounting for marginal effects on the market

Ceteris paribus – the fundamental assumption behind LCA

Marginal effects on the market on top of the current state of the market

Example for organic fertilizer

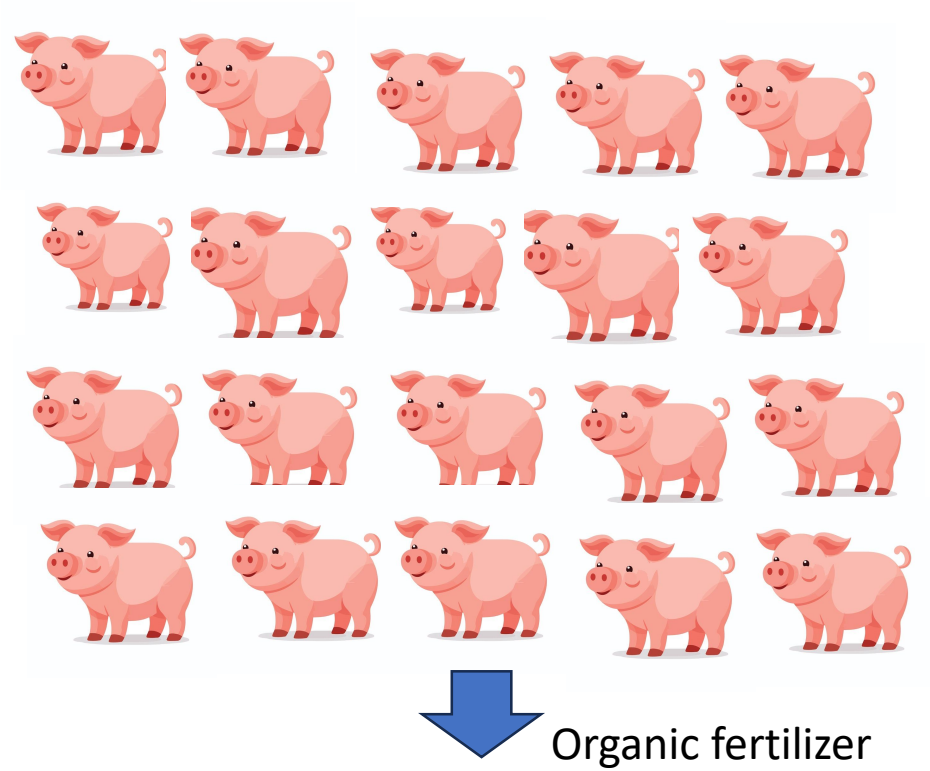
Marginal change = OK



Organic fertilizer

No changes on the market of mineral fertilizers

Non marginal change = not OK



Organic fertilizer

Possible changes on the market of mineral fertilizers

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Towards Life Cycle Sustainability Assessment

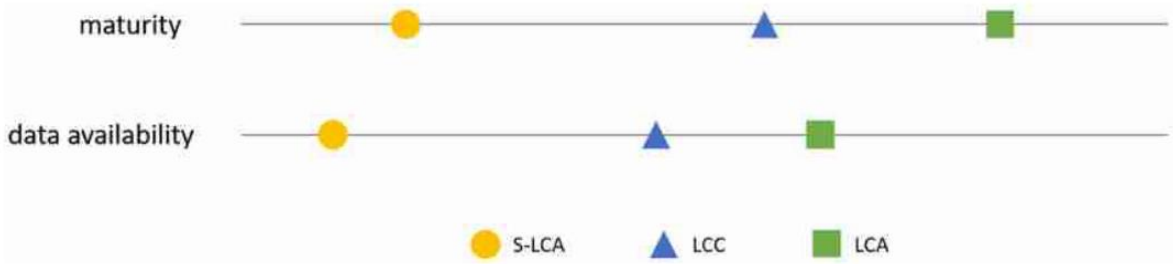
Towards Life Cycle Sustainability Assessment

Life cycle methodologies with different maturity and data availability for assessing different aspects of sustainability

Life Cycle Assessment (LCA) → **The LCA of this presentation is fundamentally an environmental assessment methodology**

Social Life Cycle Assessment (S-LCA)

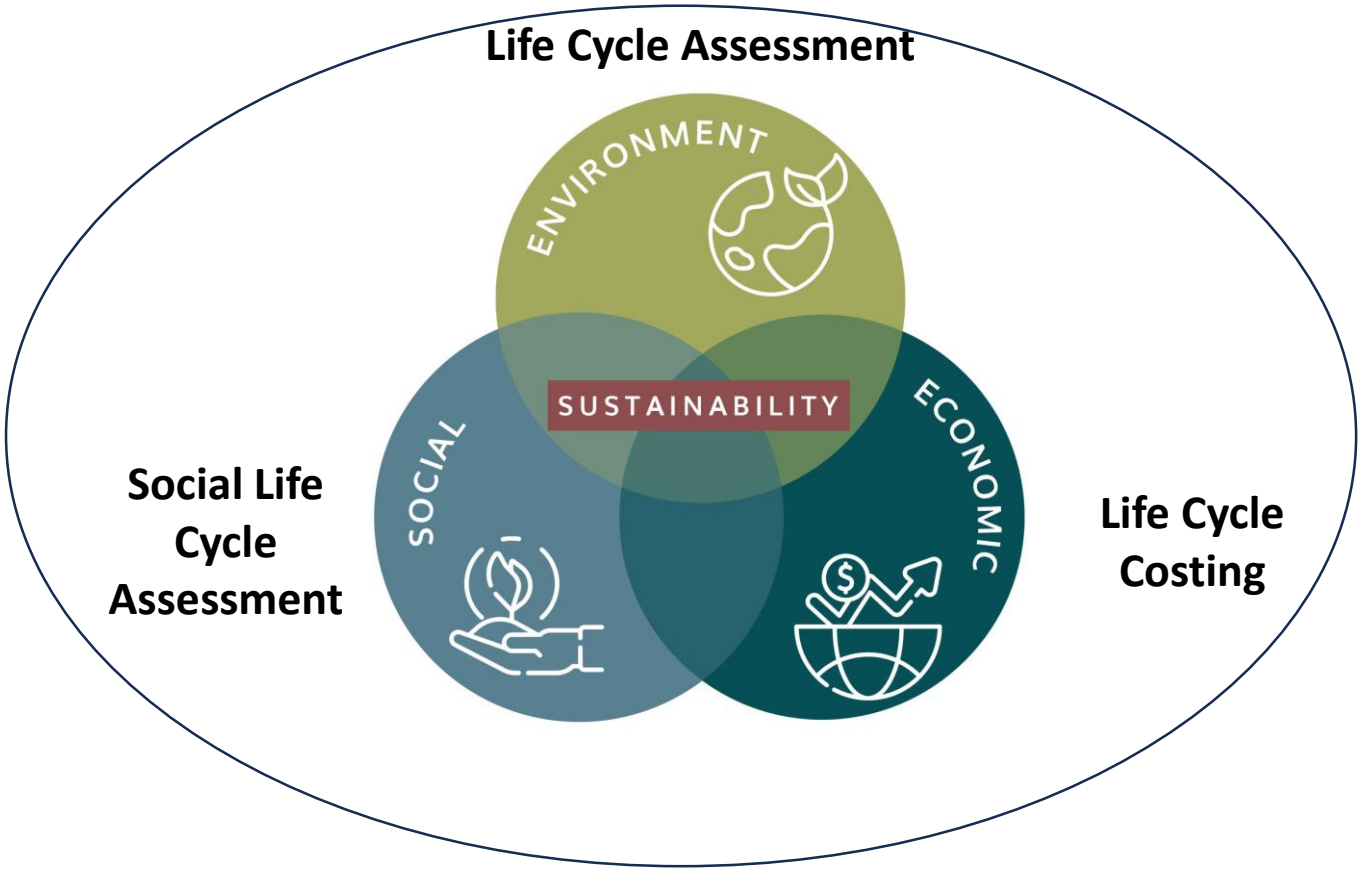
Life Cycle Costing (LCC)



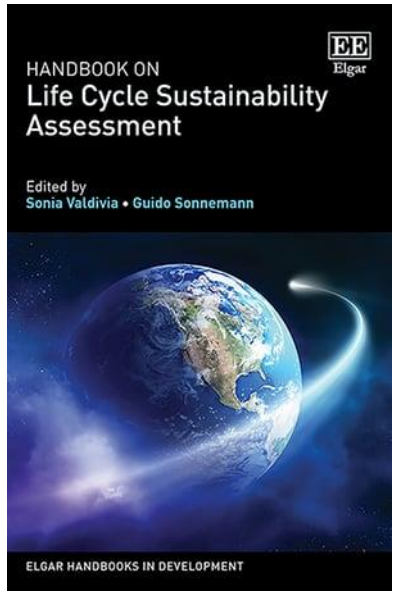
Source : (Valdivia et al., 2021)

Towards Life Cycle Sustainability Assessment

Starting an harmonisation of the life cycle sustainability assessment methodology



Life Cycle Sustainability Assessment



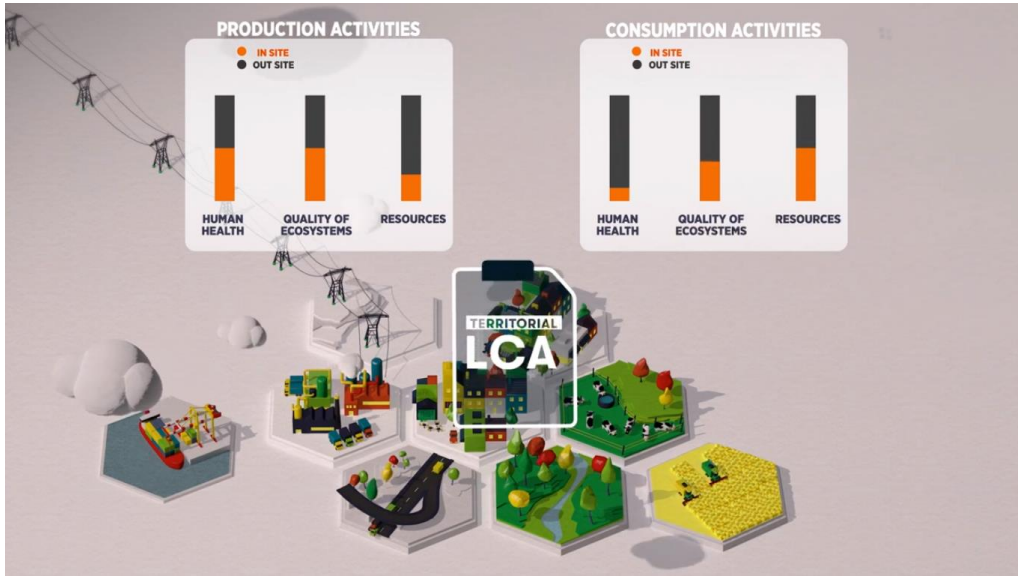
Perspectives

Perspectives

Scale of the methodology

Product/service approach

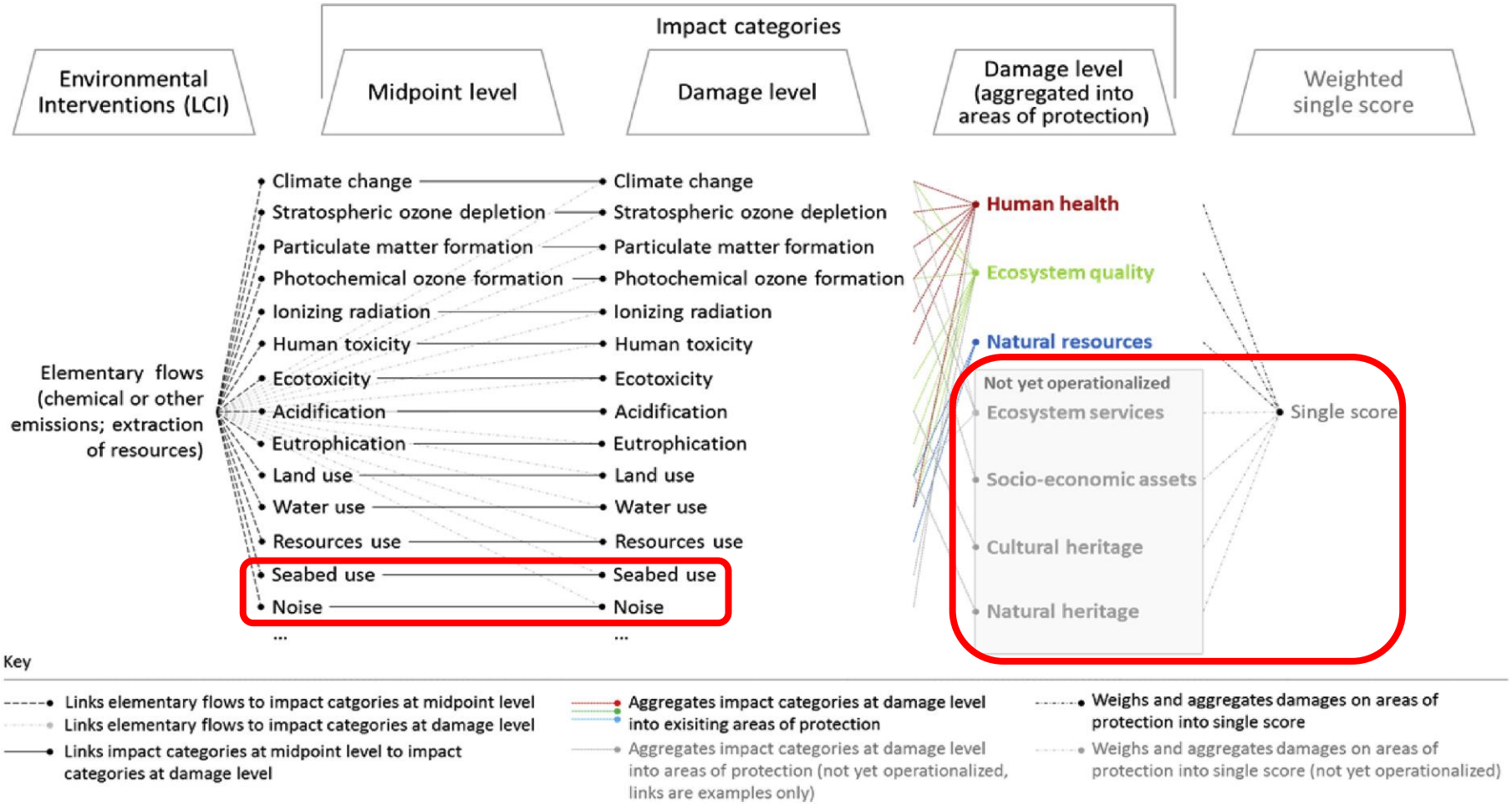
Towards T-LCA



Territorial approach

Perspectives

LCIA → quantification of impacts on other impact categories



Source : Verones et al., 2017

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Perspective

Latest state-of-the-art **LCA of bio-based** products methodological development made accessible & operational:
Check our multiples ALIGNED deliverables!

zenodo

ALIGNED Project - Aligning Life Cycle Assessment methods and bio-based sectors for improved environmental performance

ALIGNED

https://alignedproject.eu/ Project Aalborg University ROR ,
Biomass Technology Group (Netherlands) ROR ,
Norwegian University of Science and Technology ROR , University of Antwerp ROR ,
Institut National des Sciences Appliquées de Toulouse ROR

https://zenodo.org/communities/aligned-he/records

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Learning objectives

- After this « session », you will be able to:

  - Explain what an LCA is, what it is used for, and what are its key characteristics
  - Understand what is a functional unit in LCA, and what are the 3 main aspects needed to define one.
  - Differences between LCAs said to be ‘consequential’ and ‘attributional’
  - Differences between background and foreground data
  - The different background LCI databases available
  - What Life Cycle Impact Assessment (LCIA) is, and the existing LCIA methods
  - The different existing LCA softwares

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Background information

Limit of LCA

Ceteris paribus – the fundamental assumption behind LCA:

LCA analyses different alternatives in isolation from the rest of the economy, assuming all other things remain the same.

The moment this assumption is no longer valid, because the studied LCA decision has large implications on the rest of the economy, we have reached the limits of LCA. Yet, this 'limit of LCA' is a vastly unexplored field, also no clear alternatives are yet proposed in this case.

The typical decisions studied by an LCA are thus said to be « **small-scale** », defined as decisions that does not affect the trend in market volume and constraints on production costs.