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Training workshop "Studying international practices in implementation of innovative energy efficiency technologies in the electric power industry. Methodology, goal and objectives of electricity and heat consumers energy survey"

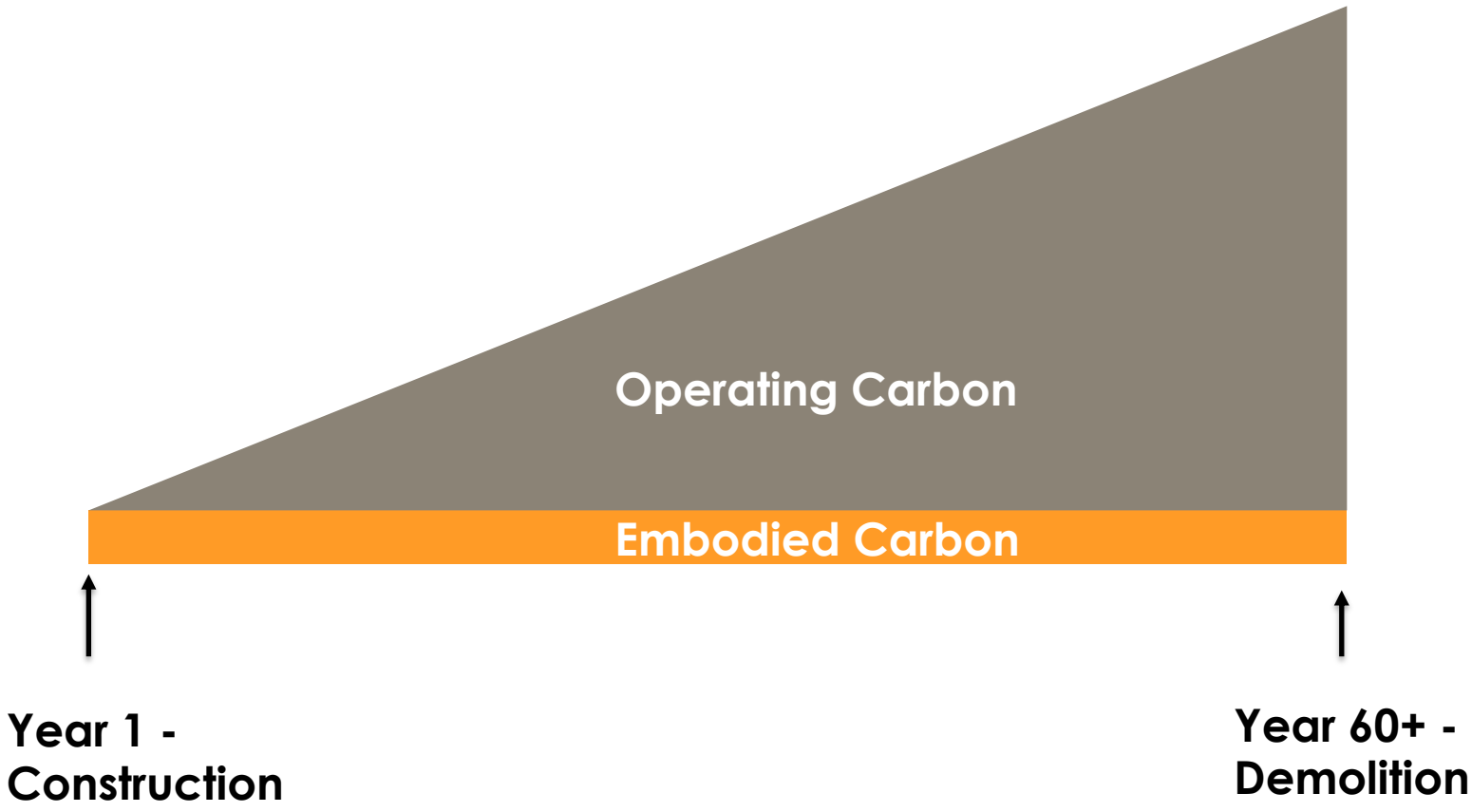
SEIT building, 62 Bayram Khan st, Mary, 13-19 March 2024

Construction materials for sustainable buildings and environmental declaration

Agris Kamenders,
International Consultant, SECCA

Stantec | intec GOPA International Energy Consultants MEMBER OF GOPA CONSULTING GROUP | ACTED | European University Institute | Robert Schuman Centre for Advanced Studies | FSR ENERGY Florence School of Regulation

Building Carbon - Yesterday



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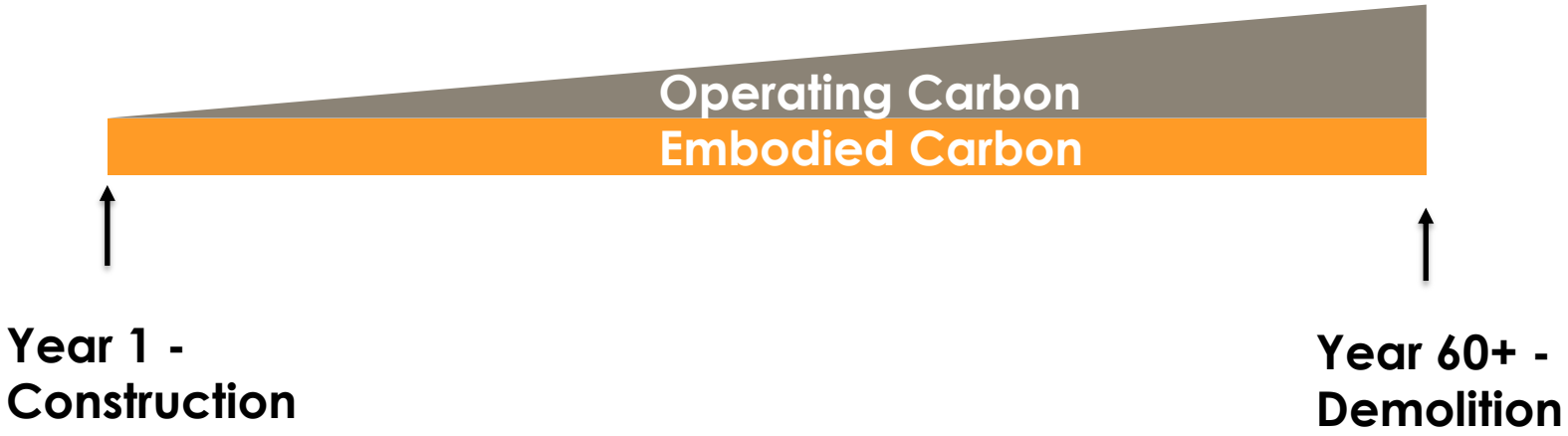
Building Carbon – Today (hopefully)



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Building Carbon – Tomorrow (required!)

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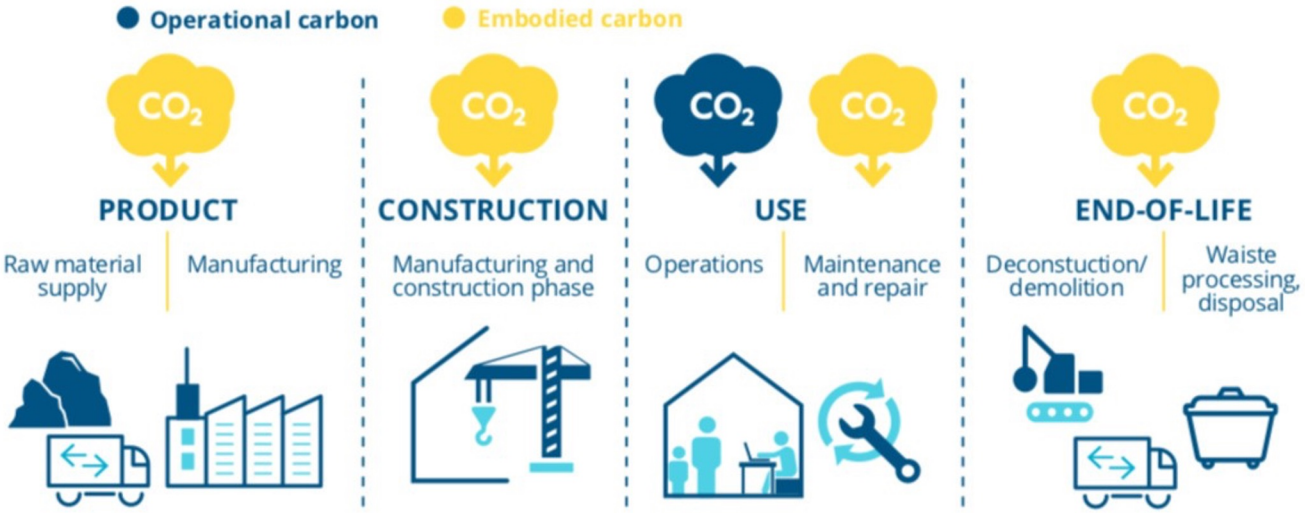

For measuring the climate impact of buildings (CO_2) it is important to understand the impact of materials in the overall CO_2 balance

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What is it?

Series ISO 14020: Environmental labels and declarations (set of international benchmarks)

14021: Self-declared environmental claims

Type II: provide credibility for environmental claims that manufacturers; for products and services where there are neither criteria nor labelling schemes

14024: Environmental labelling for consumer awareness

Type I: scheme that award a mark or logo to products or services upon fulfilling a set of criteria; multi-attribute ecolabel developed by a third party (multi-criteria, life-cycle seals); a single-attribute ecolabel developed by the producer themselves, application of a logo

The ‘Blue Angel’

EU Ecolabel

Nordic Swan ecolabel

14025: Environmental declarations - background for the Environmental Product Declaration (**EPD**)

Type III: for specific aspects of products using a life-cycle approach, based on a full life-cycle assessment, guidelines, including ISO 14040-44 requirements, data are independently verified

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What is it?

ISO 14025: Environmental declarations Type III - background for the Environmental Product Declaration (**EPD**) – many EOD program operators

Type III: for specific aspects of products using a life-cycle approach, based on a full life-cycle assessment, guidelines, including ISO 14040-44 requirements, data are independently verified

Product category rules (PCR) – e.g.

EN15804 – construction products

EN 50693 – electronic and electrical products

Many other PCRs for different product categories

LCA – background report

EPD document:

Company description, product technical performances, content declaration, LCA results and additional environmental

- Third party verification
- Voluntary
- Assessment of the performance limits

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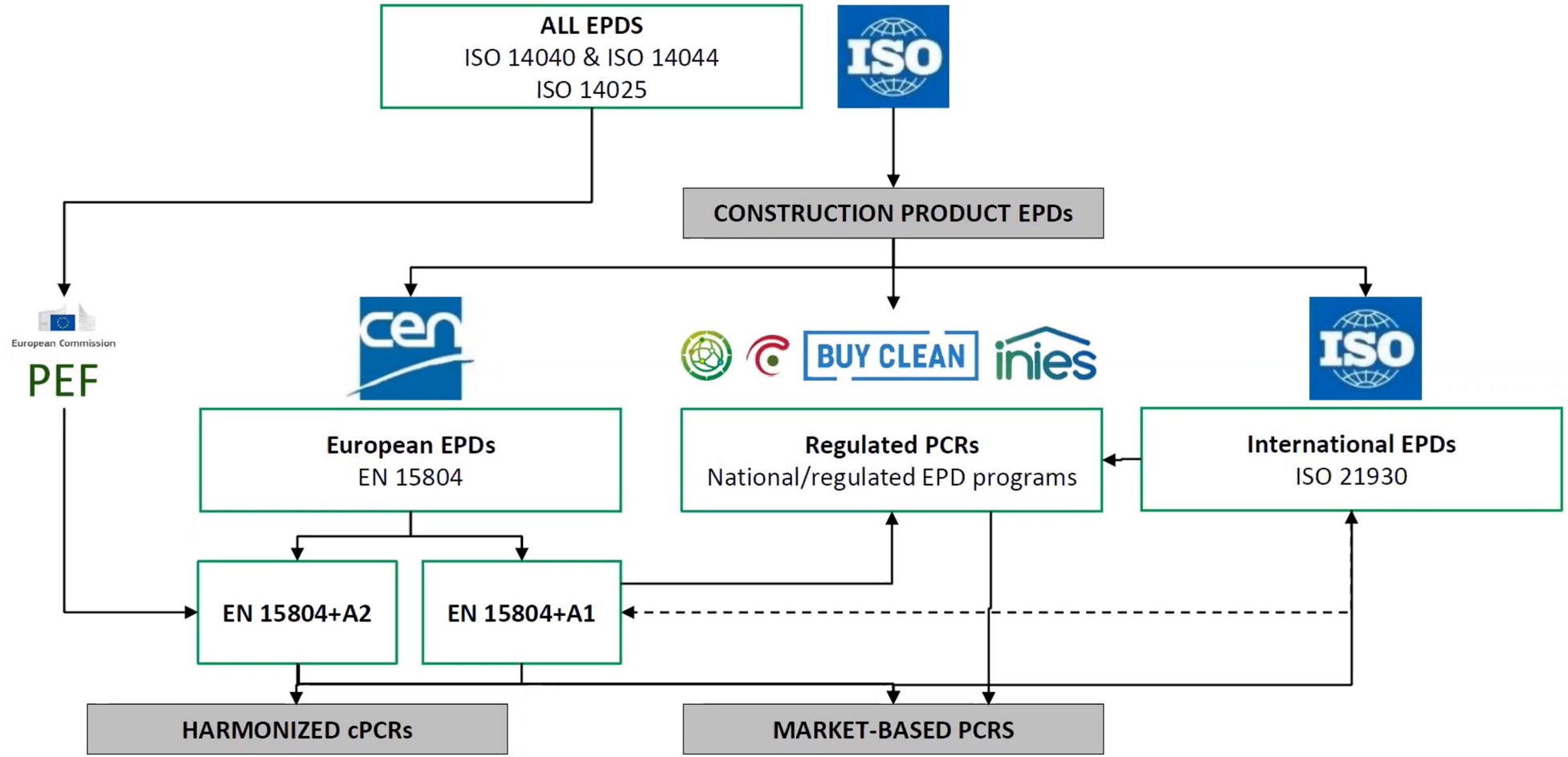
Relevant EPD standards for construction sector



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Need for on construction material CO_2 calculations

- 4 different "Green Building" systems in Austria, including subsidies and financing for "green buildings" based on LCA calculations.
- In France, 7 different "Green Building" systems provided for by law, including EPD, building "green certificates" and other.
- 5 different "Green Building" systems in the Netherlands. There is a law that foresees for the use of LCA.
- 6 different "Green Building" systems in Norway. The law requires the use of LCA.

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Case Of The Netherlands

- Dutch construction law in 2013 already required reports in the form of LCA according to EN 15804 for all buildings >100m^2
- LCA calculations should use the national methodology for environmental impact costs
- Impacts during the use phase of the building are not counted
- From 2018, the new regulations foresees that the impact for new buildings cannot exceed 1 EUR/m^2
- Such a methodology is planned to be applied to infrastructure as well

ENVIRONMENTAL IMPACT CATEGORIES	UNIT	WEIGHING (€/UNIT)
Depletion of abiotic resources (excluding fossil fuels)	Sb eq	0,16 €
Depletion fossil fuels	Sb eq	0,16 €
Global warming	CO2 eq	0,05 €
Depletion ozone layer	CFK-11 eq	30 €
Photochemical oxidant creation	C2H4 eq	2 €
Acidification	SO2 eq	4 €
Eutrophication	PO4 eq	9 €
Human toxicity	1,4-DCB eq	0,09 €
Fresh water aquatic eco toxicity	1,4-DCB eq	0,03 €
Marine aquatic eco toxicity	1,4-DCB eq	0,0001 €
Terrestrial eco toxicity	1,4-DCB eq	0,06 €

The Embodied Carbon Review, 2018 © One Click LCA Ltd / One Click LCA

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Case of Sweden

The EPD climate declaration is mandatory for new buildings from January 1, 2022

A unified database has been introduced for the calculation and assessment of the building's climate impact based on the product EPD climate declarations

The aim is to increase knowledge about the climate impact of building construction and to represent the benefits of climate mitigation

The calculation is based on GHG emissions during the construction of the building, including:

- Acquisition of raw materials
- Material production
- Transport
- Construction works

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Boverket
BOVERKET
National Board of Housing, Building and Planning

Boverket
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Case of Sweden

BOVERKET
National Board of Housing, Building and Planning

Calculation for envelope of building

No interior design

Limiting values:

→Gradual changes in limit value

→Later additional stages might be included in reporting

Benefits:

Reduction of 820,000 tonnes CO2eq each year

The annual benefit is between 99 and 590 mEUR

Building Life Cycle Information												Supplymentary information
A 1–3 Product stage			A 4–5 Construction process stage		B 1–7 Use stage							C 1–4 End of life stage				Supplementary environmental info
A1 – Raw material supply	A2 – Transport	A3 – Manufacturing	A4 – Transport	A5 – Construction-installation process	B1 – Use	B2 – Maintenance	B3 – Repair	B4 – Replacement	B5 – Refurbishment	B6 – Operational energy use	B7 – Operational water use	C1 – De-construction, demolition	C2 – Transport	C3 – Waste processing	C4 – Disposal	Biogenic carbon storage Net exports of locally produced electricity

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Circular economy Italy

- From 2016, for public procurement of projects above a given level there are Minimum Environmental criteria set for different materials
- E.g. Concrete: content of recycled or recovered materials, or by-products, of at least 5% of the weight of the product, understood as the sum of the three fractions
- EPD can be used for this purpose

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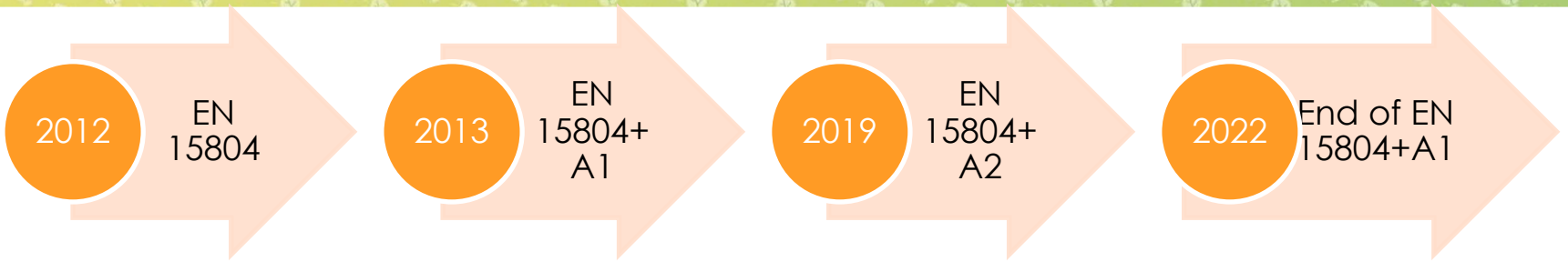
Changes in EN 15804 standards



Required impact categories according to EN 15804 A1

Impact category	Global Warming Potential (GWP)	Ozone Depletion Potential (ODP)	Acidification Potential (AP)	Eutrophication Potential (EP)	Photochemical Ozone Creation Potential (POCP)
Unit	Kg CO2 Eq.	Kg CFC11 Eq.	Kg SO2 Eq.	Kg PO4 Eq.	Kg Etheene (C2H4) Eq.

Required impact categories according to EN 15804 A2

Impact category	Global Warming Potential - Fossil	Global Warming Potential - Biogenic	Global Warming Potential - LULUC*	Ozone Depletion potential - (ODP)**	Eutrophication Potential - Terrestrial	Eutrophication Potential - Marine	Eurtrophication Potential - Freshwater	Photochemical Ozone Creation Potential (POCP)	Acidification Potential
Unit	Kg CO2 Eq.	Kg CO2 Eq.	Kg CO2 Eq.	Kg CFC 11 Eq.	Mol N Eq.	Kg N Eq.	Kg Po4 Eq.	Kg NMVOC nt	Mol H+ Eq.

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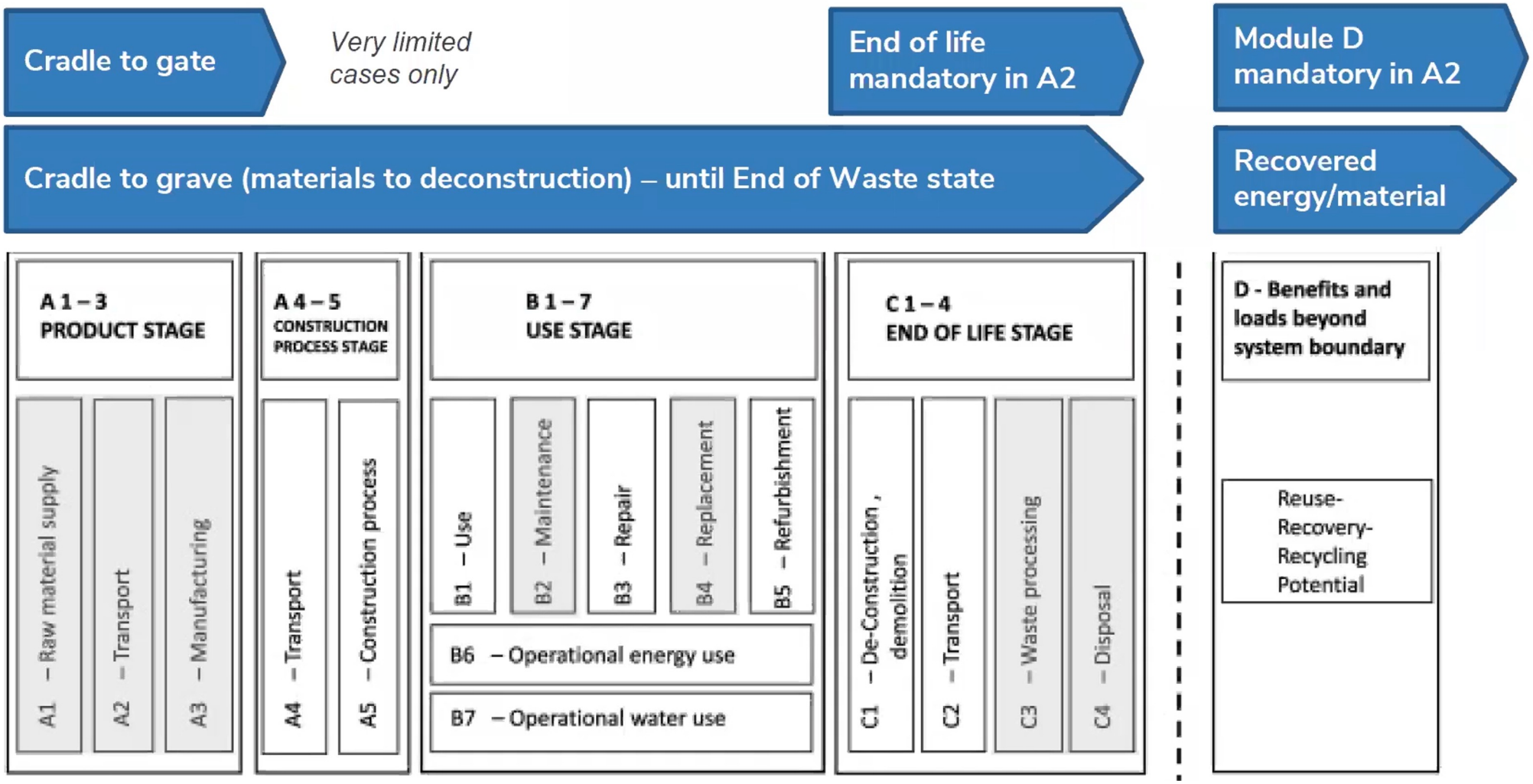
Product life stages according to EN 15804



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EPD CLIMATE DECLARATIONS

- The EPD climate declaration is developed for one environmental impact category of the product based on an existing EPD
- It has existed since 2017 and is compliant with ISO 14025 on the Ecolabel
- Also known as carbon footprint as defined by ISO 14067
- The impact is measured in GWP units - CO_2 eq.
- It is important not to confuse "EPD climate declaration" with "climate declaration"

EPD®
CLIMATE DECLARATION


EPD®
CLIMATE DECLARATION
For D4F 50/50 Cotton Tencel Yarn
Declared unit: 1 kg of Dyed 50% Cotton 50% Tencel Yarn

Upstream	Core	Downstream	TOTAL
7.66 kg CO_2 eq.	0.80 kg CO_2 eq.	0.0009 kg CO_2 eq.	8.66 kg CO_2 eq.

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Why EPD?

Provides information on the environmental impact of the product

Based on life cycle analysis

Real data used

Recognized worldwide

Based on standards

Independently verified and published

Can be developed for several products

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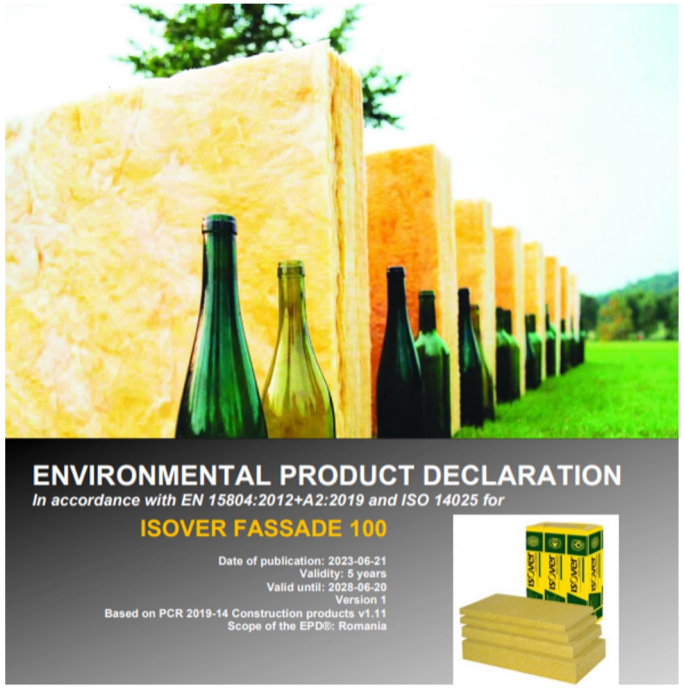
EPD climate declaration application

- Developers - supply chain management and **information for clients**
- **For Green Certification systems** (BREEAM, LEED, ..)
- **Public procurement (**Sweden, Netherlands,..)
- **EU policy Action plan** for transition to a circular economy (main reference point of the EU Green Deal)
- **Sustainable Product Initiative** - Regulation on ecodesign of sustainable products (ESPR)
- **B2B** communication
- **Need for data** in the private sector and **design options**



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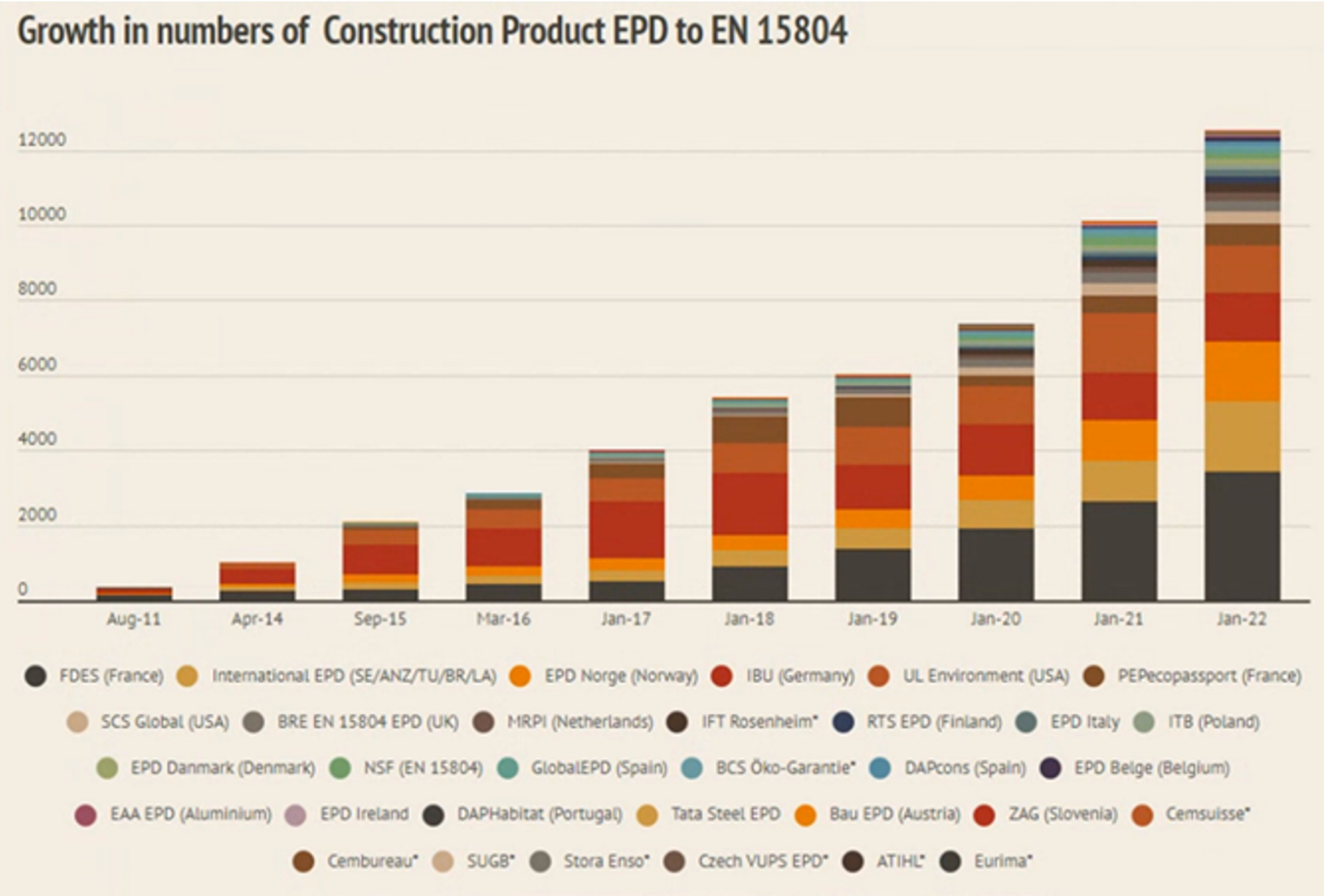
Trends

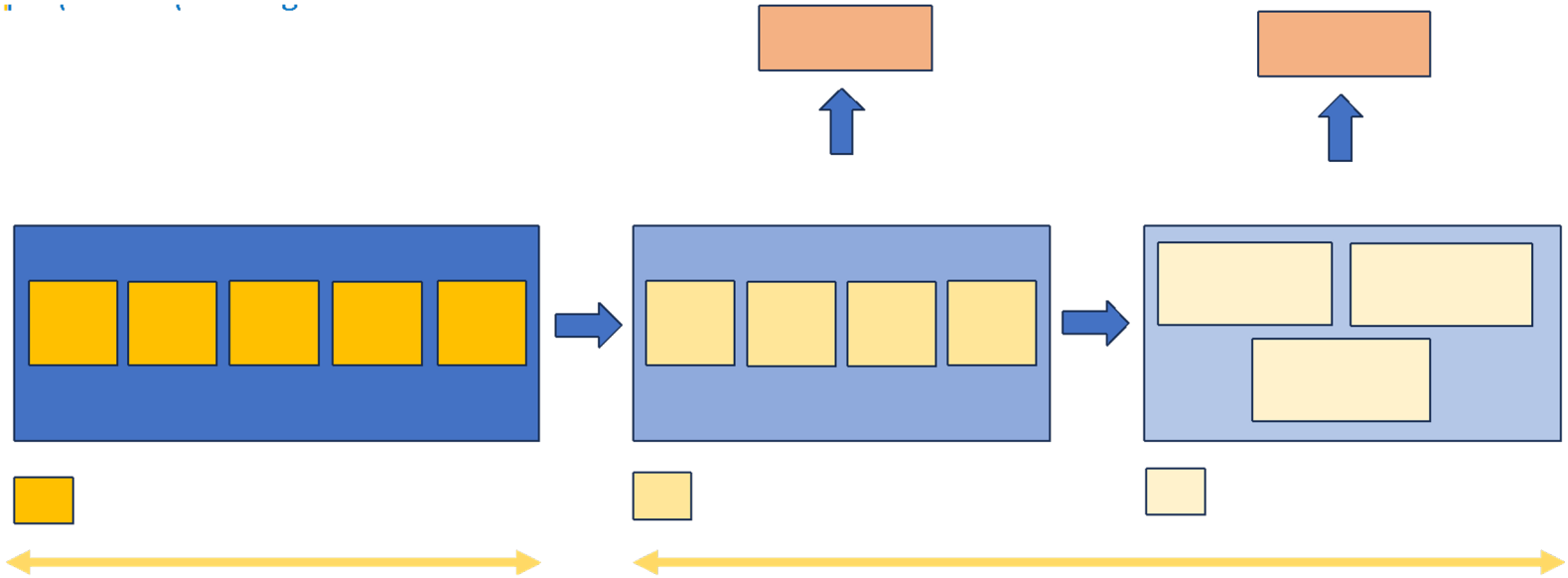


Source: lifecycleexpert.com;

What do you need?

Data…. Data …. and even more data on technologies/manufacturing

- Material consumption
- Energy consumptions
- Waste
- Emissions



Core process

Upstream

- E.g. end-of-life mandatory for construction products

Downstream

- Improvements

Source: lifecycleexpert.com; ETV workshop 5

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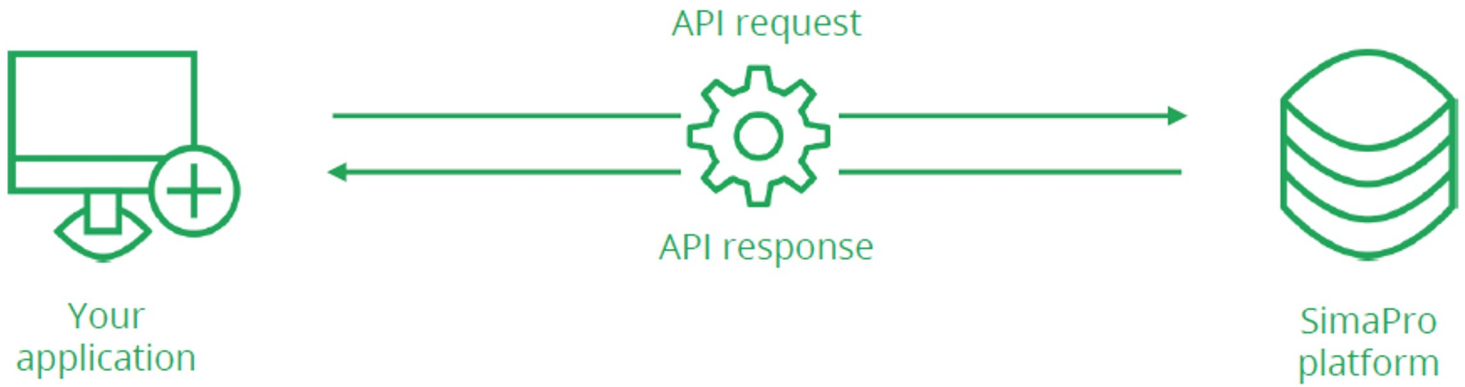
What do you get?

Info about direct/indirect impacts (i.e. scope 1, 2 and 3)

- Verified mass balances
- Hot spots
- Problem unhidden
- Improvement options



Source of:

- Product category rules
- Alternative product/technologies – be…
- Hot spots of product – where to improve
- Digitalization and systemic data collection (i.e. API)

Source: Simapro API Source: lifecycleexpert.com; ETV workshop 5 23.11.22

What is required for an EPD?

- EPD form

Company
logo

ENVIRONMENTAL PRODUCT PROFILE

Welded and surface treated steel products

In accordance with ISO 14025 and EN 15804:2012+A2:2019

Version: 1.0
Valid from: 2022-02-03
Valid until: 2024-02-03

General information

- LCA report

LCI/LCA REPORT

ISO14025 ISO14044 EN 15804:2012+A2:2019

Report no	: Version 3
Commissioner of the study	:
Practitioner of the study	:
Date of report	: 02-02-2022

Welded and surface treated steel products

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TOWARDS LCA/EPD MODELING WITH SIMAPRO

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Life Cycle Impact Assessment

Evaluates the significance of potential environmental impacts using the life cycle inventory analysis results.

Inventory data and emissions calculations are sorted in specific environmental impact categories.

The effect on the environment in each impact category is quantified through category indicators.

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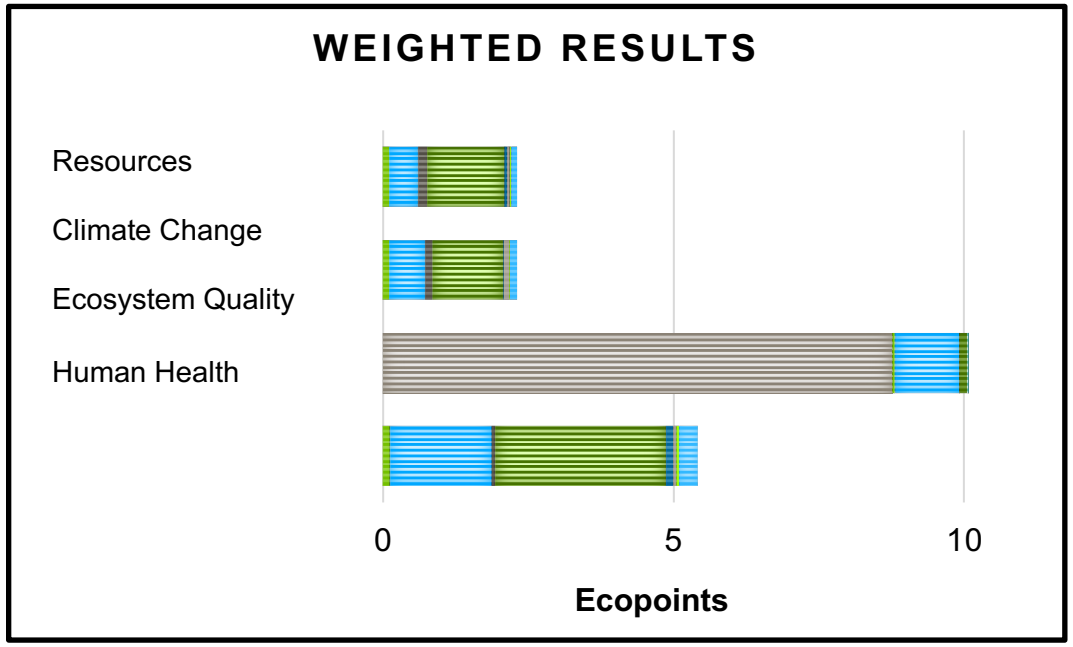
Life Cycle Impact Assessment

Inventory results		*Characterization results*	*Weighting results*
SO_2, NO_x, HCl, etc.	**H^+ equiv.**	Acidification potential	one-dimensional index
NO_x, NH_3, P, etc.	**N- equiv.**	Eutrophication potential	
CO_2, CH_4, CFCs, etc.	**CO_2 equiv.**	Global warming potential;	



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Life Cycle Interpretation (LCI)

Several elements are considered: identification of significant issues based on results, evaluation of consistency and sensitivity checks, and discussion of conclusions, limitations and recommendations.

- Goal& Scope definition
- Inventory analysis
- Impact assessment

LCI

- Identification of significant issues, selection of environmental impact or method
- Reliability of results by: completeness check, sensitivity check, consistency check, etc.
- Conclusions, limitations, recommendations

Application

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Example

Addressing sustainability in food production and sustainable consumption strategies

Evaluate the effectiveness of EEM activities.

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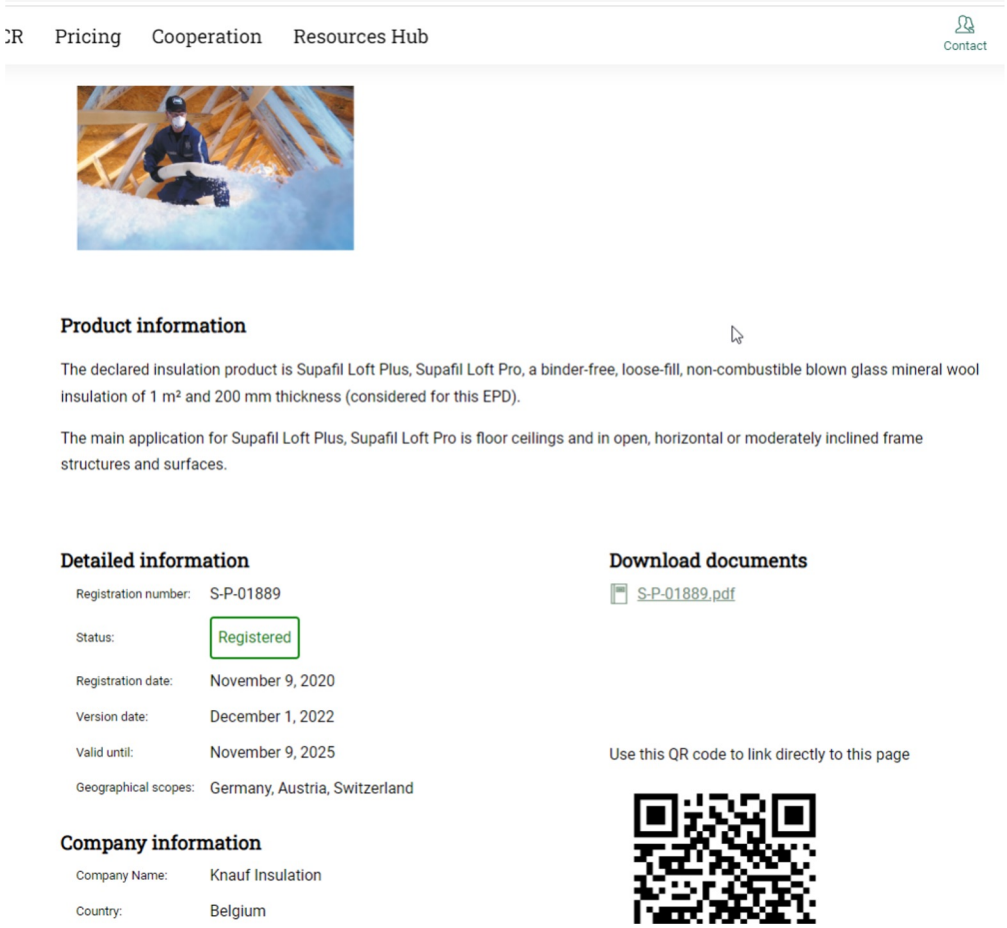
EPD development

The Environmental Product Declaration (EPD) is prepared based on:

1. Collected data from our initial data questionnaire in EXCEL
2. Reference values from impact databases

materials	manufacturer	mass, kg



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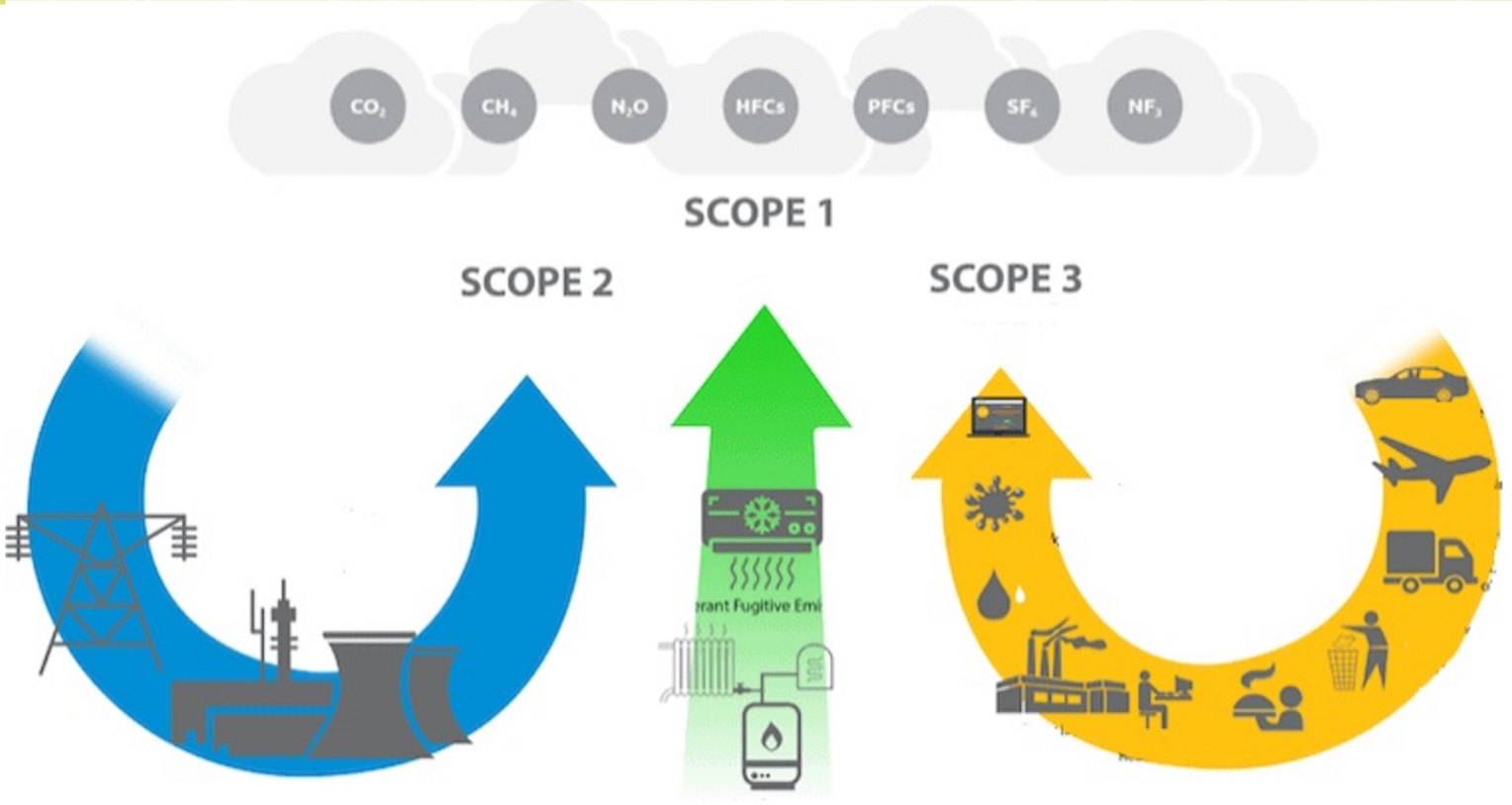
Developing a product environmental statement



Indirect emissions

(transport and other services, materials and raw materials)

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Example: Goal of LCA calculation

Assess the environmental and human health impact of peat substrate throughout the product life cycle.

Compare peat substrate with other available products on the market:

- Coconut fiber products
- Mineral wool products.

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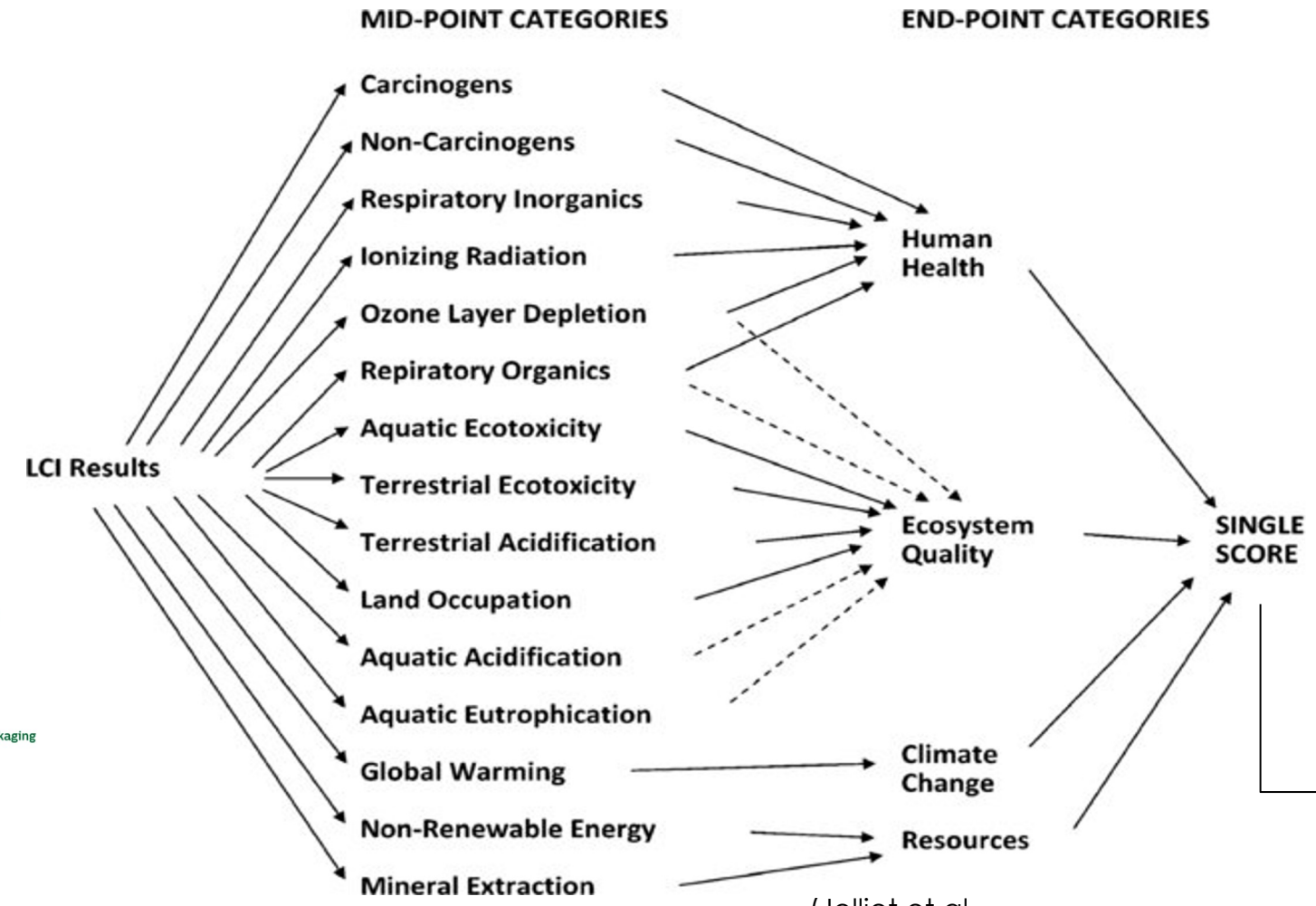
Mid-point, end-point and single score

IMPACT2002 example

Single indicator characterization:
- kg CO2 eq.
- kg SO2
- MJ
- m3



(Jolliet et al., 2002)

End-point categories definition following the same damage pathways:
- kg CO2 eq.
- DALY
- PDF m2 y

Normalized value:
- Ecopoint (Pt)

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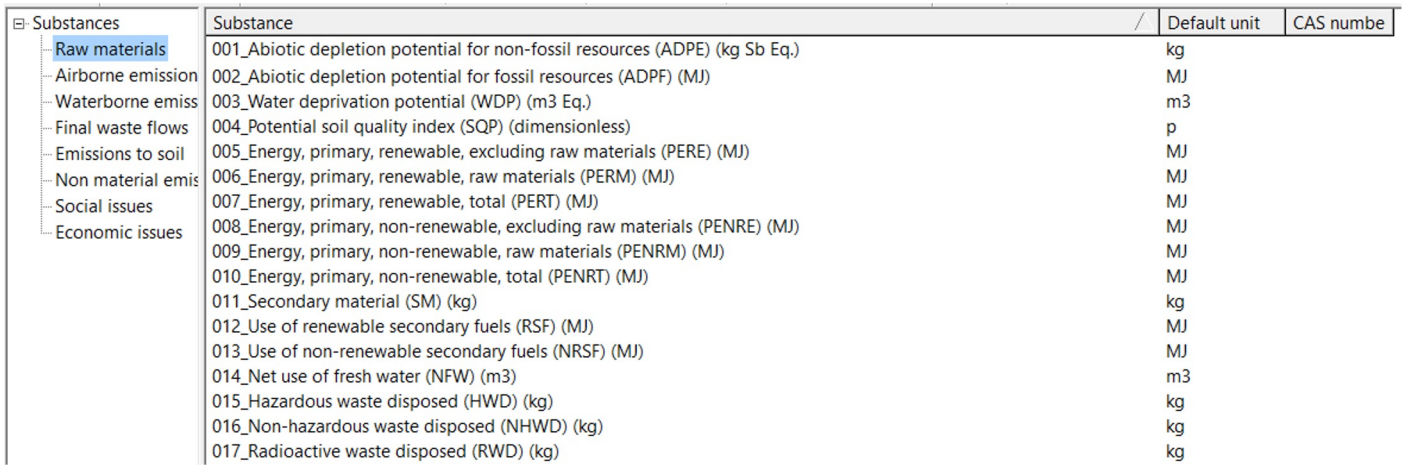
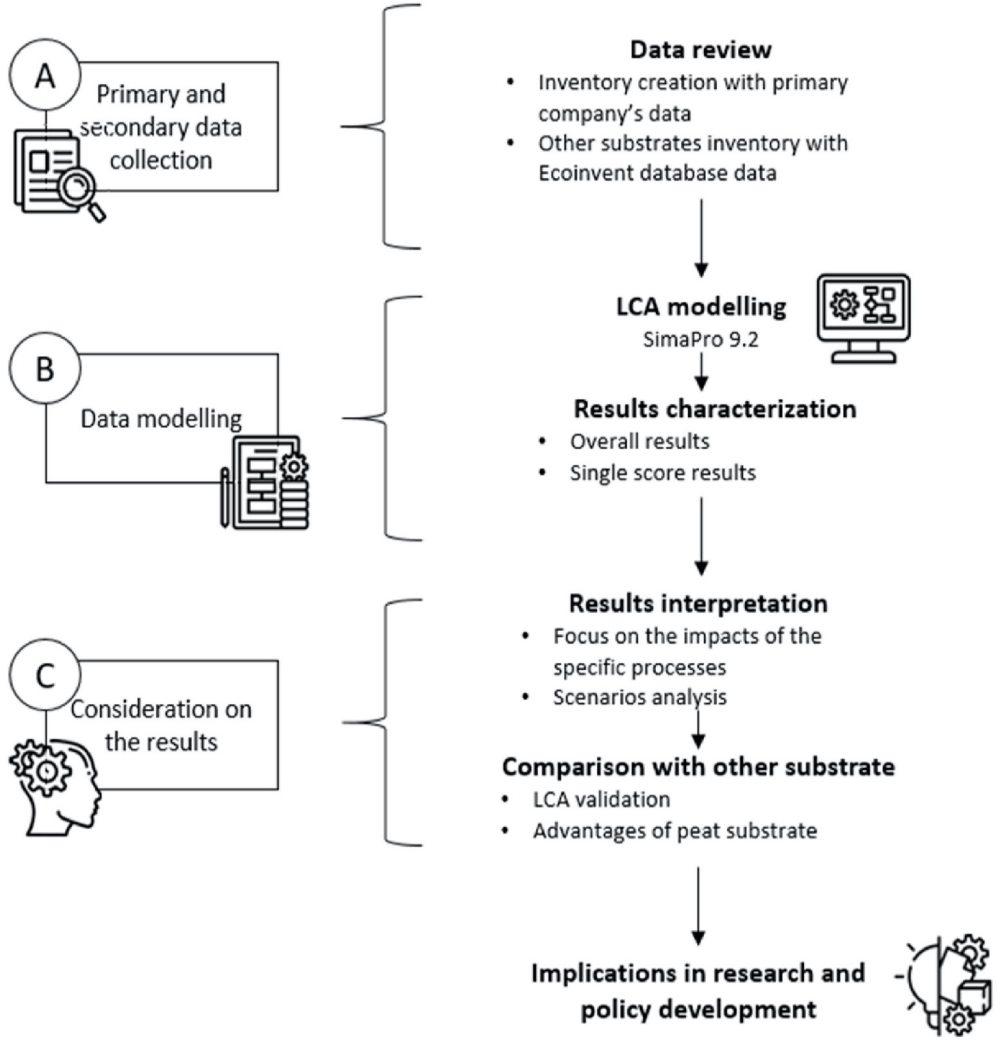
How to include EPD results into SimaPro?

1. Create the ''substance'' with the name of EPD indicators.



- Substances
  - Raw materials
  - Airborne emission
  - Waterborne emiss
  - Final waste flows
  - Emissions to soil
  - Non material emis
  - Social issues
  - Economic issues

Substance	Default unit	CAS numbe
001_Abiotic depletion potential for non-fossil resources (ADPE) (kg Sb Eq.)	kg	
002_Abiotic depletion potential for fossil resources (ADPF) (MJ)	MJ	
003_Water deprivation potential (WDP) (m3 Eq.)	m3	
004_Potential soil quality index (SQP) (dimensionless)	p	
005_Energy, primary, renewable, excluding raw materials (PERE) (MJ)	MJ	
006_Energy, primary, renewable, raw materials (PERM) (MJ)	MJ	
007_Energy, primary, renewable, total (PERT) (MJ)	MJ	
008_Energy, primary, non-renewable, excluding raw materials (PENRE) (MJ)	MJ	
009_Energy, primary, non-renewable, raw materials (PENRM) (MJ)	MJ	
010_Energy, primary, non-renewable, total (PENRT) (MJ)	MJ	
011_Secondary material (SM) (kg)	kg	
012_Use of renewable secondary fuels (RSF) (MJ)	MJ	
013_Use of non-renewable secondary fuels (NRSF) (MJ)	MJ	
014_Net use of fresh water (NFW) (m3)	m3	
015_Hazardous waste disposed (HWD) (kg)	kg	
016_Non-hazardous waste disposed (NHWD) (kg)	kg	
017_Radioactive waste disposed (RWD) (kg)	kg	



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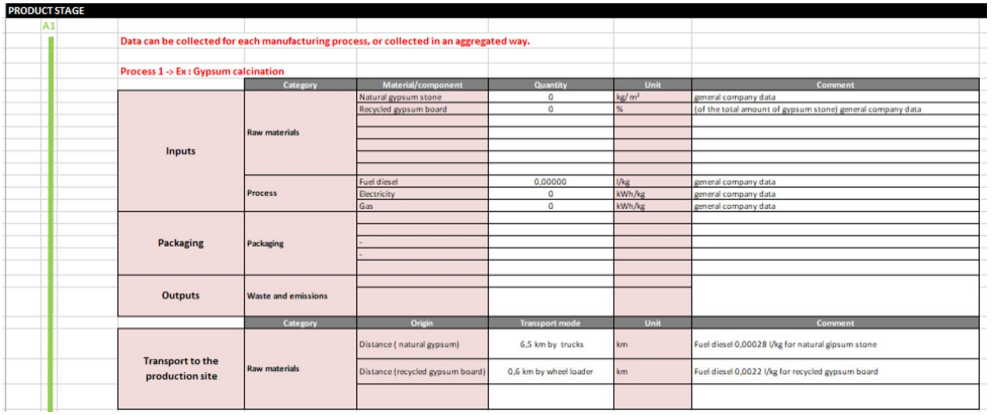
EPD development scheme

1. “KICK OFF MEETING” AT THE MANUFACTURER – inspection at the production facility, setting goals, clarifying the scope of LCA, determining deadlines and responsible persons and dividing responsibilities;

2.COLLECTION – filling in the excel "collection" table. The company is responsible for coordinating data collection with suppliers and production managers;



PRODUCT STAGE

A1

Data can be collected for each manufacturing process, or collected in an aggregated way.

Process 1 -> Ex : Gypsum calcination

		Category	Material/component	Quantity	Unit	Comment
Inputs	Raw materials		Natural gypsum stone	0	kg/m²	general company data
			Recycled gypsum board	0	%	(of the total amount of gypsum stone) general company data
	Process		Fuel diesel	0,00000	l/kg	general company data
			Electricity	0	kWh/kg	general company data
			Gas	0	kWh/kg	general company data
Packaging	Packaging					
Outputs	Waste and emissions					
		Category	Origin	Transport mode	Unit	Comment
Transport to the production site	Raw materials		Distance (natural gypsum)	6,5 km by trucks	km	Fuel diesel 0,00028 l/kg for natural gipsum stone
			Distance (recycled gypsum board)	0,6 km by wheel loader	km	Fuel diesel 0,0022 l/kg for recycled gypsum board

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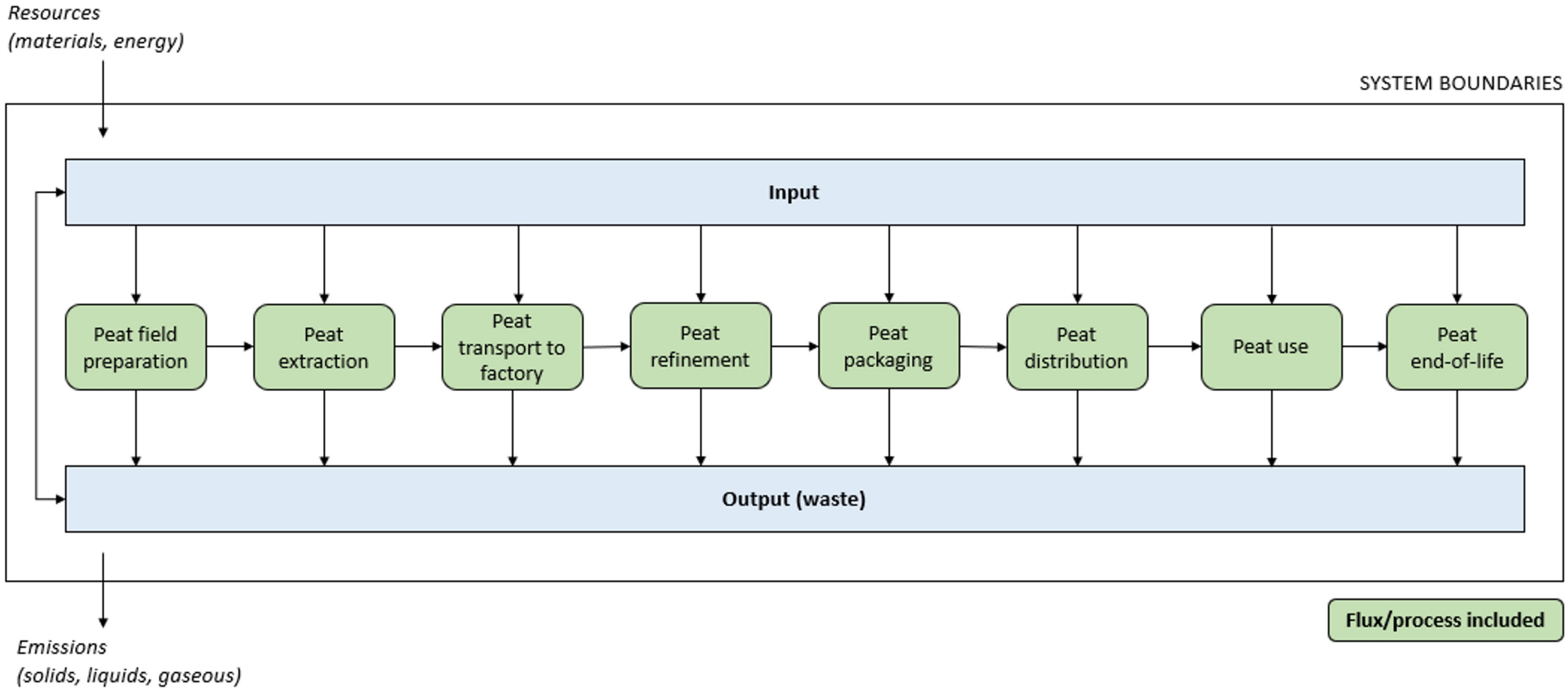
Product energy and material flow



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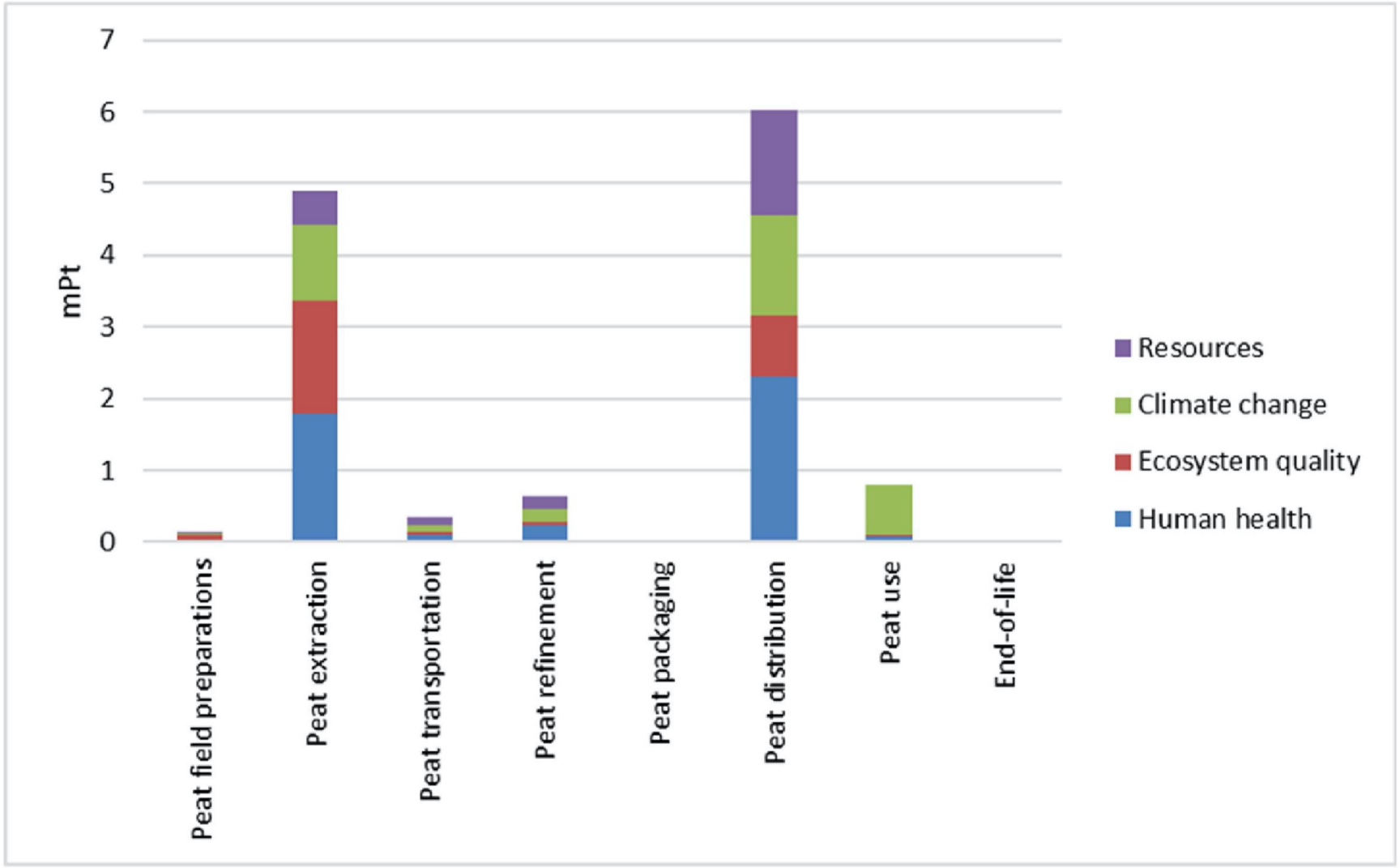
PROCESSES WITH THE GREATEST IMPACT



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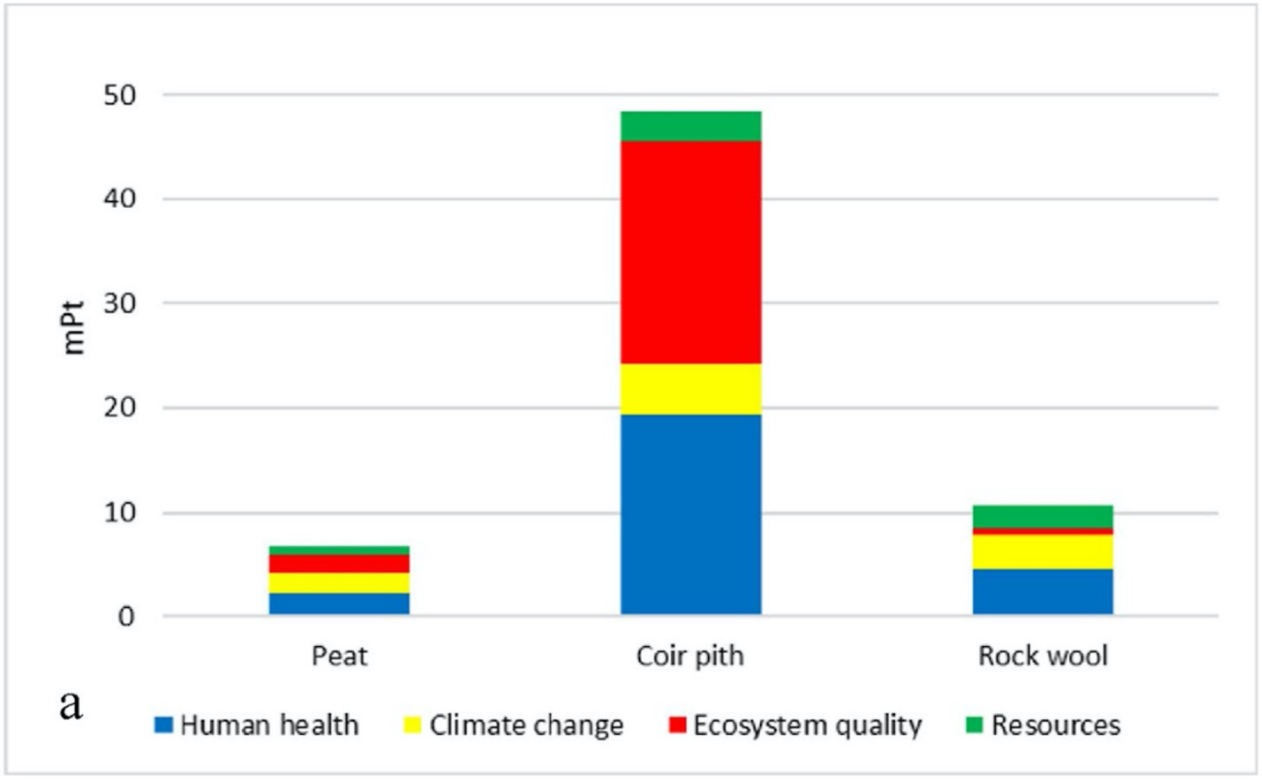
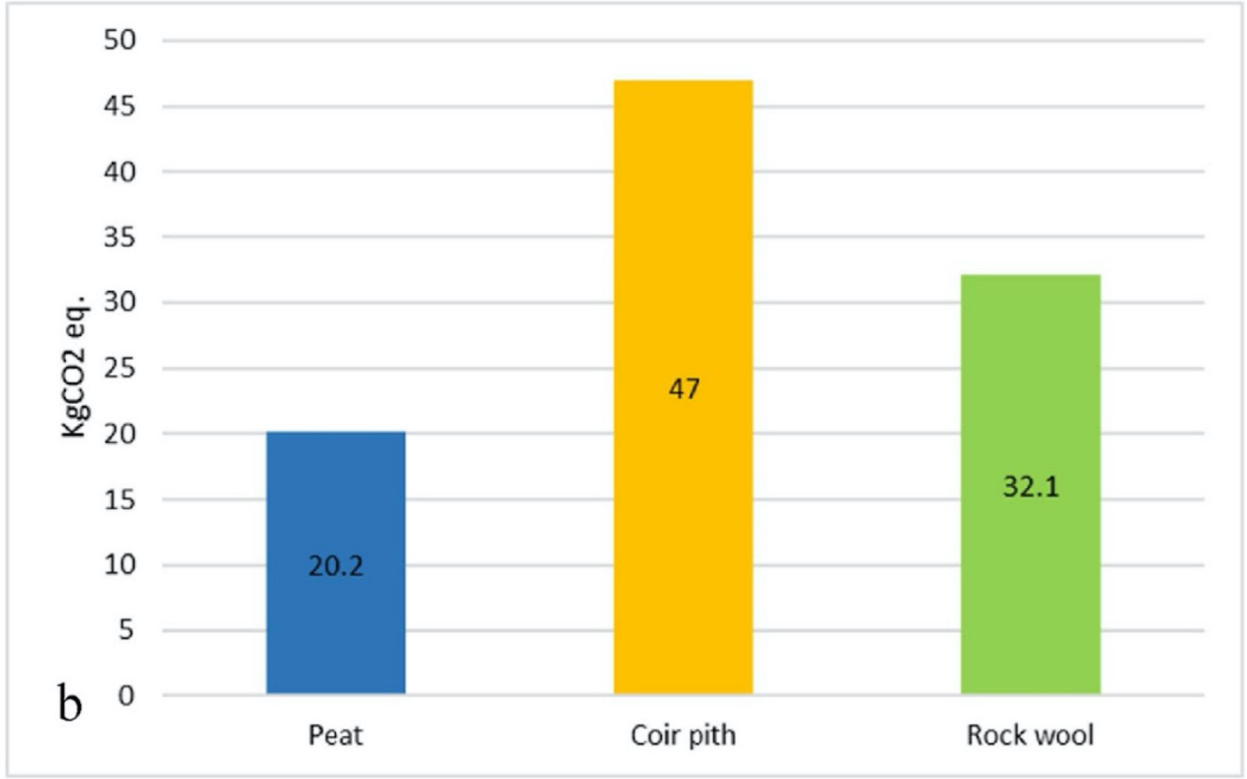
Environmental performance of various substrates (One-dimensional Index)





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