Driving sustainability for piping systems: insights from comparative LCAs to guide environmental impact reduction

Shaping the Future of Water Management in Europe
28th of May 2025

Carolin Spirinckx, VITO

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Europe News July 16, 2021

Floods in Germany and Belgium already leave more than 120 dead | International

Flood damage in Belgium exceeds € 10 billion

15:06, 22.07.2021
Region: World News
Theme: Society, Incidents

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Carbon neutralility

by 2050

The CORE plan to make Europe climate neutral by 2050

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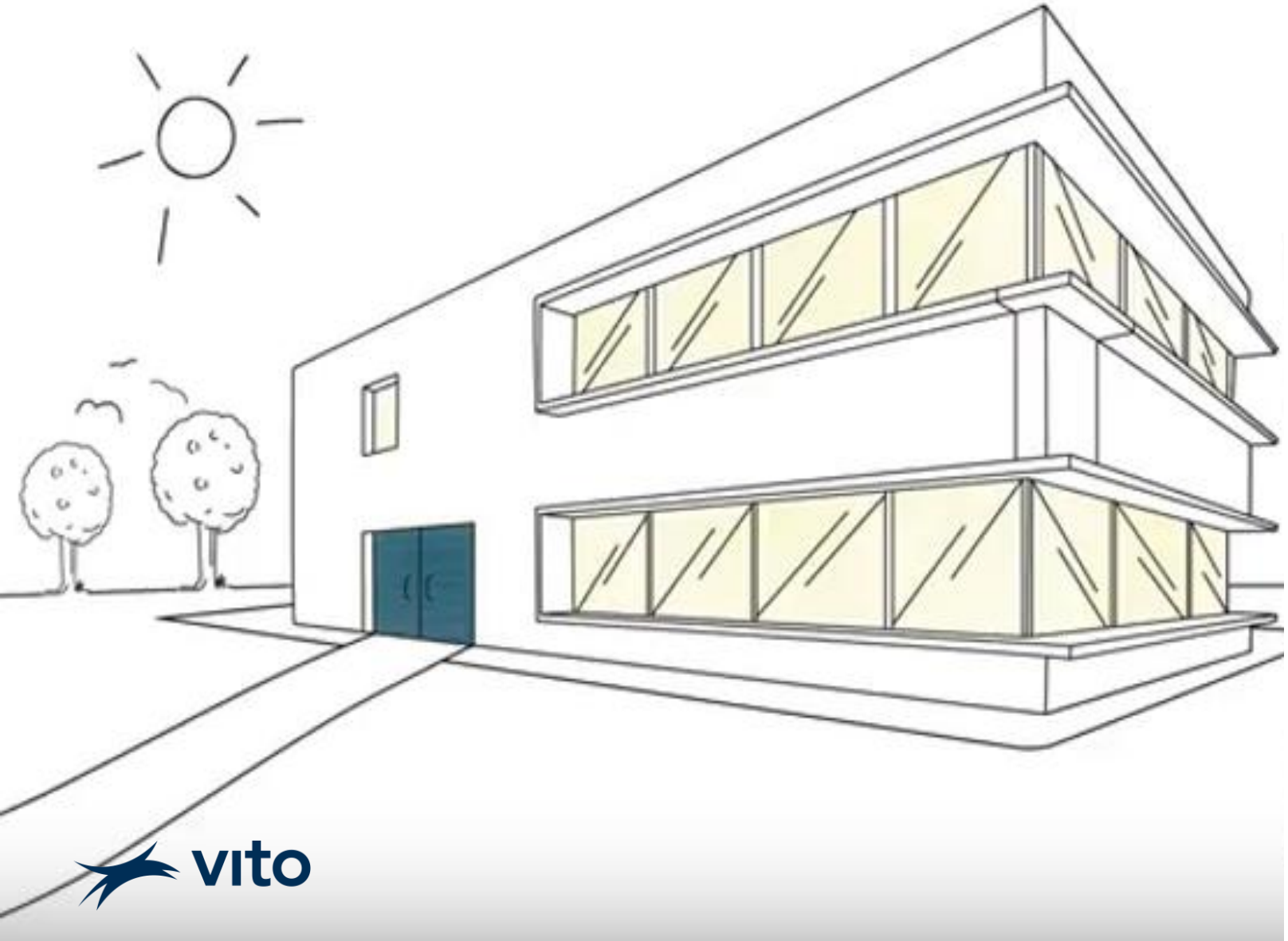
The EU built environment …



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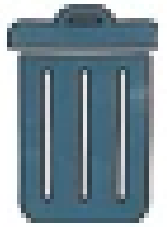
35% 

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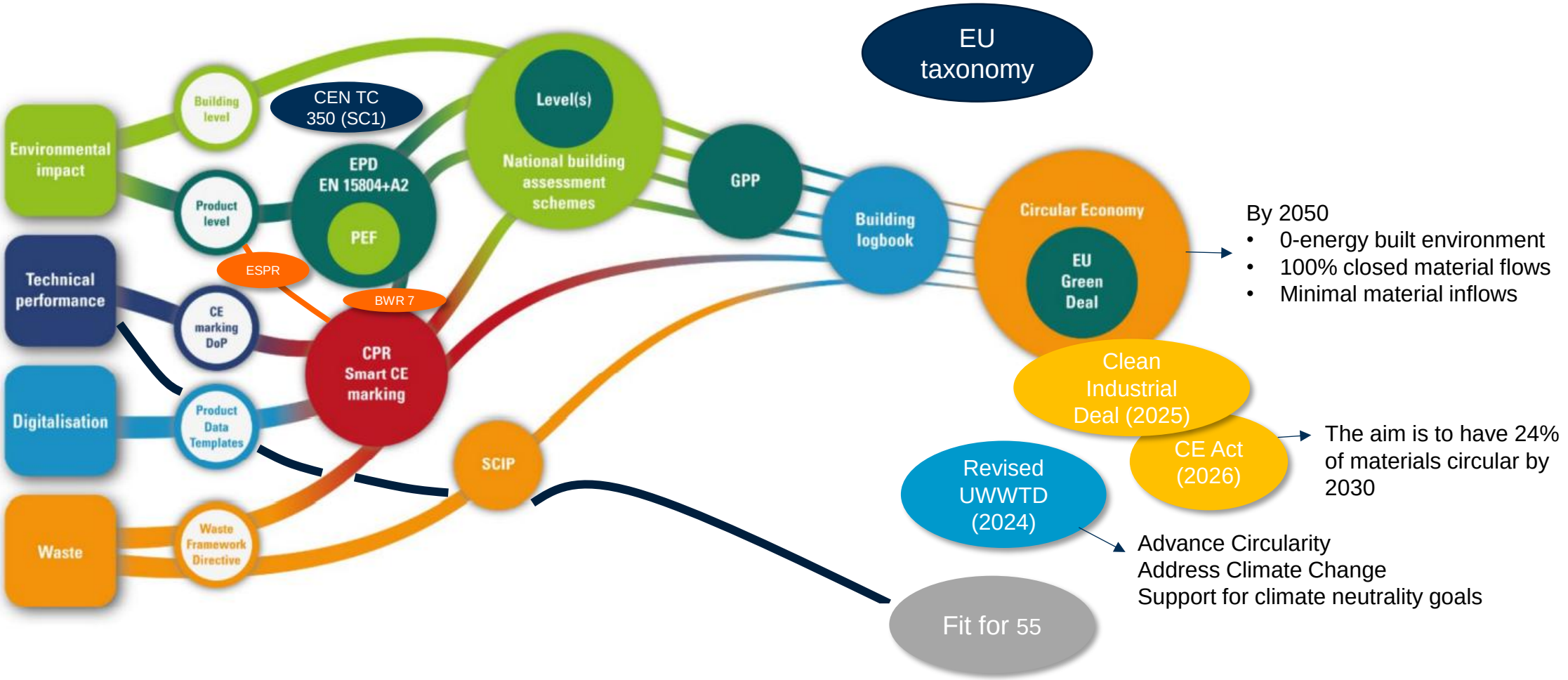
EU policy framework: parallel trends enforce each other towards a common target



Source: Analysis of European initiatives related to the green, digital and resilient construction ecosystem, Sept 2021, construction products Europe – UPDATED by VITO (2025)

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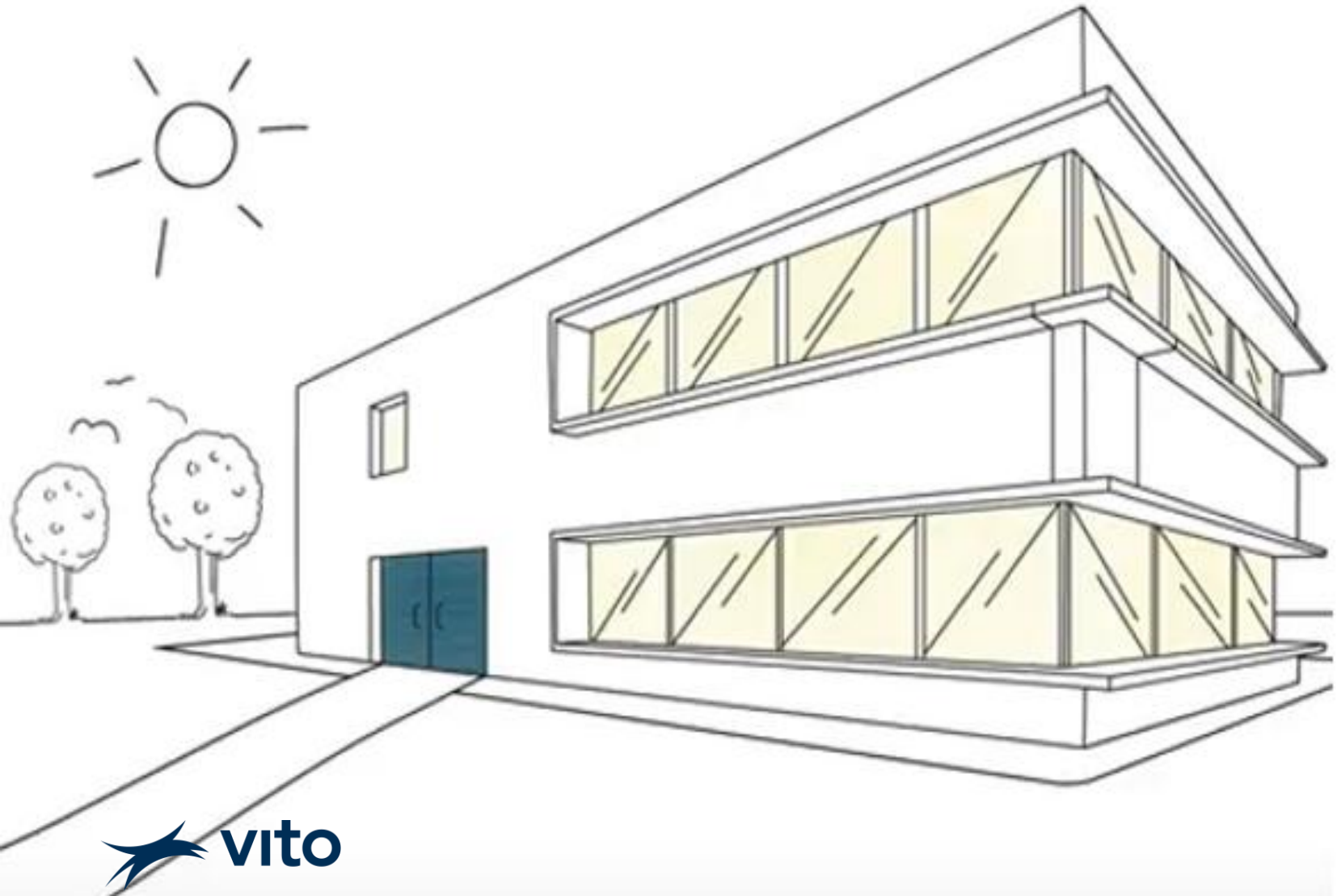
The EU built environment …



Call to action

Efforts will be needed

Opportunities!

Creating Business Value

CIRCULAR WATER TECHNOLOGIES

WATER & ECONOMY
BUSINESS MODELS

Water
@VITO

DIGITAL WATER TECHNOLOGIES

SYSTEMIC TRANSITIONS
LIVING LABS

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CIRCULARITY AS STRATEGY

PEOPLE

Sustainability and Circularity Assessment @VITO

PROSPERITY

PLANET

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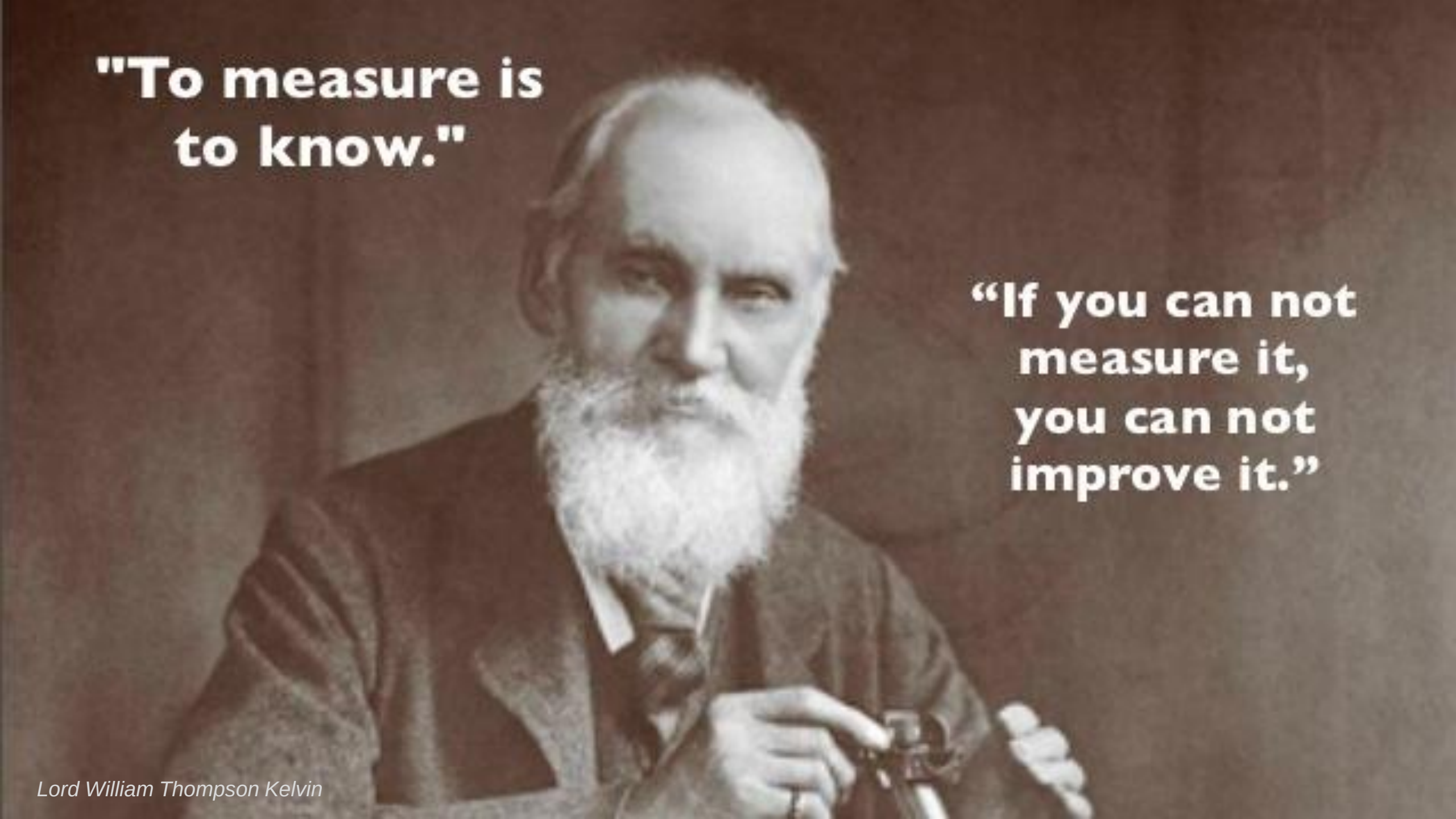
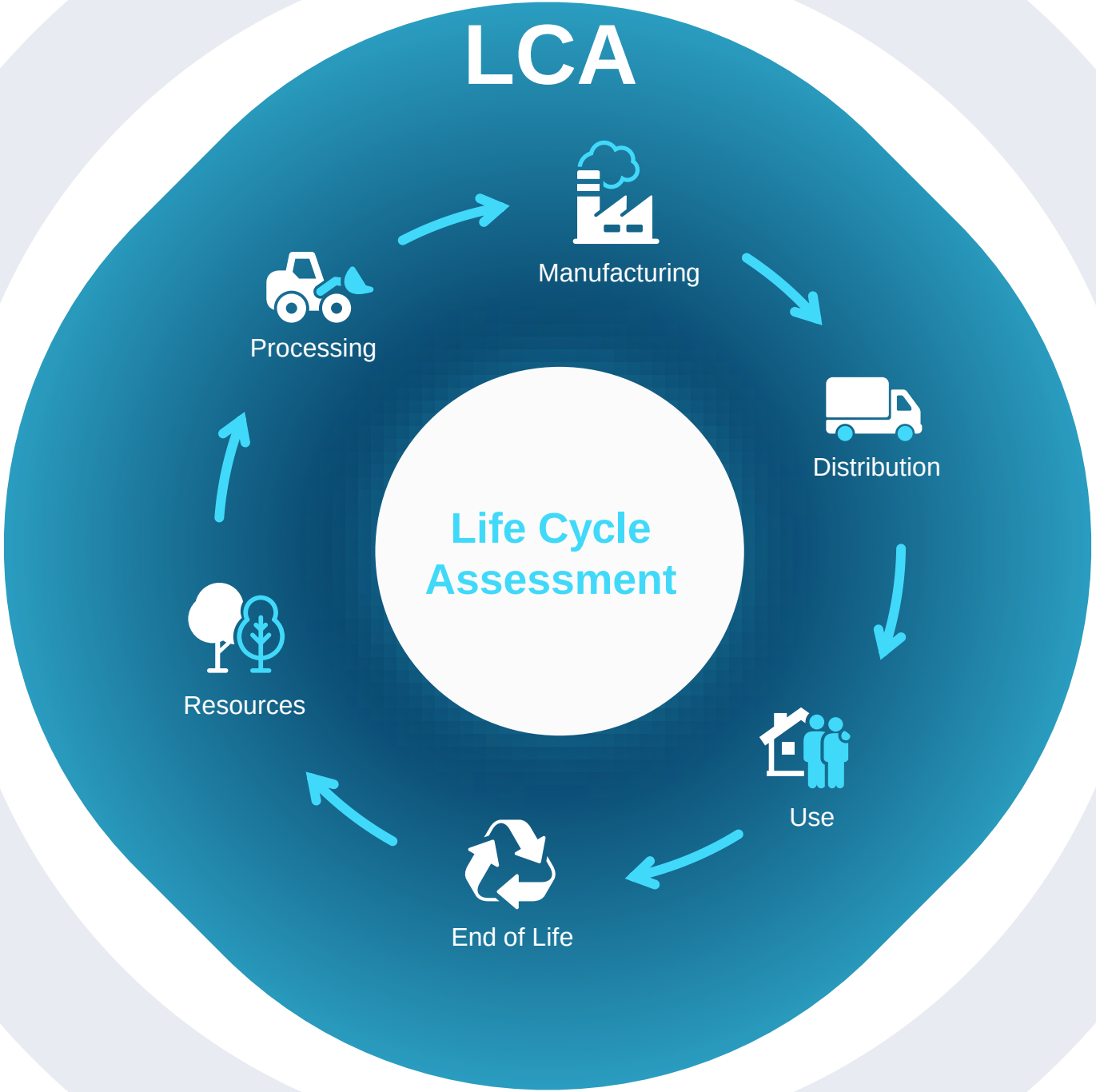

"To measure is to know."
“If you can not measure it, you can not improve it.”
Lord William Thompson Kelvin


Life Cycle Assessment
(LCA)
a science-based
method to measure
environmental impact

Global analysis

over its **entire life cycle**



environmental burdens

(in)directly caused by a product or system

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Environmental Product Declarations (EPDs)

- A standardised format **to report and communicate verified LCA results**
  - ISO 14040:2006 & ISO 14044:2006 in combination with
    - ISO 14025:2006 – all kinds of products
    - EN 15804:2012+A2:2019 or ISO 21930:2017 – construction products
- Although standardised, still **challenging to compare EPDs**

Goal of the study

Commissioned by Steinzeug-Keramo, a solutions and system supplier for the water and wastewater industry

- Demonstrating a way to integrate EPD data into comparative LCAs

- Enhance a more solid foundation to client communication
(e.g. procurement and commercial projects)

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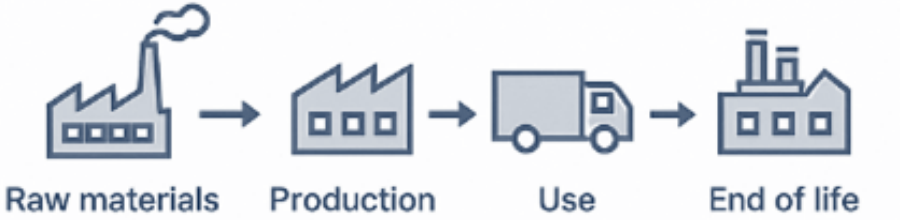
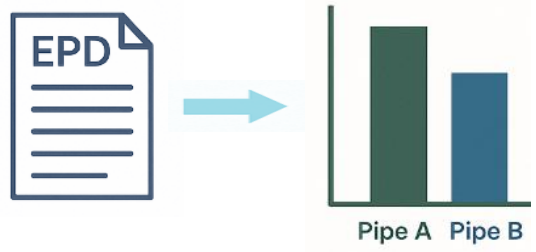
Comparative LCA of piping systems

Whole life cycle performance

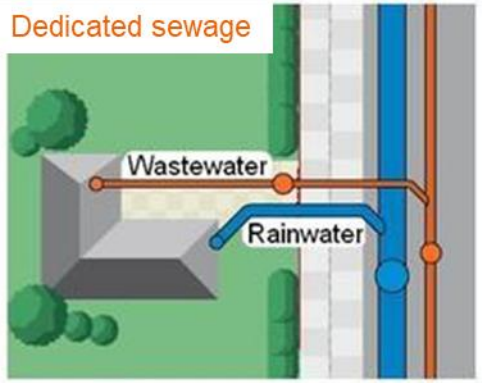


Beyond GHG emissions and climate change

A showcase of how science-based LCA methods can be applied and aligned within comparative LCAs using EPD data

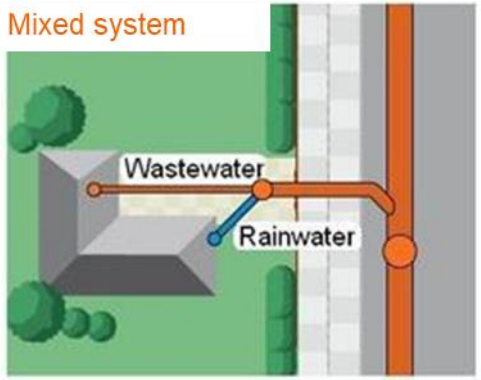


Assessed products for two applications



Dedicated sewage piping systems (DN250)

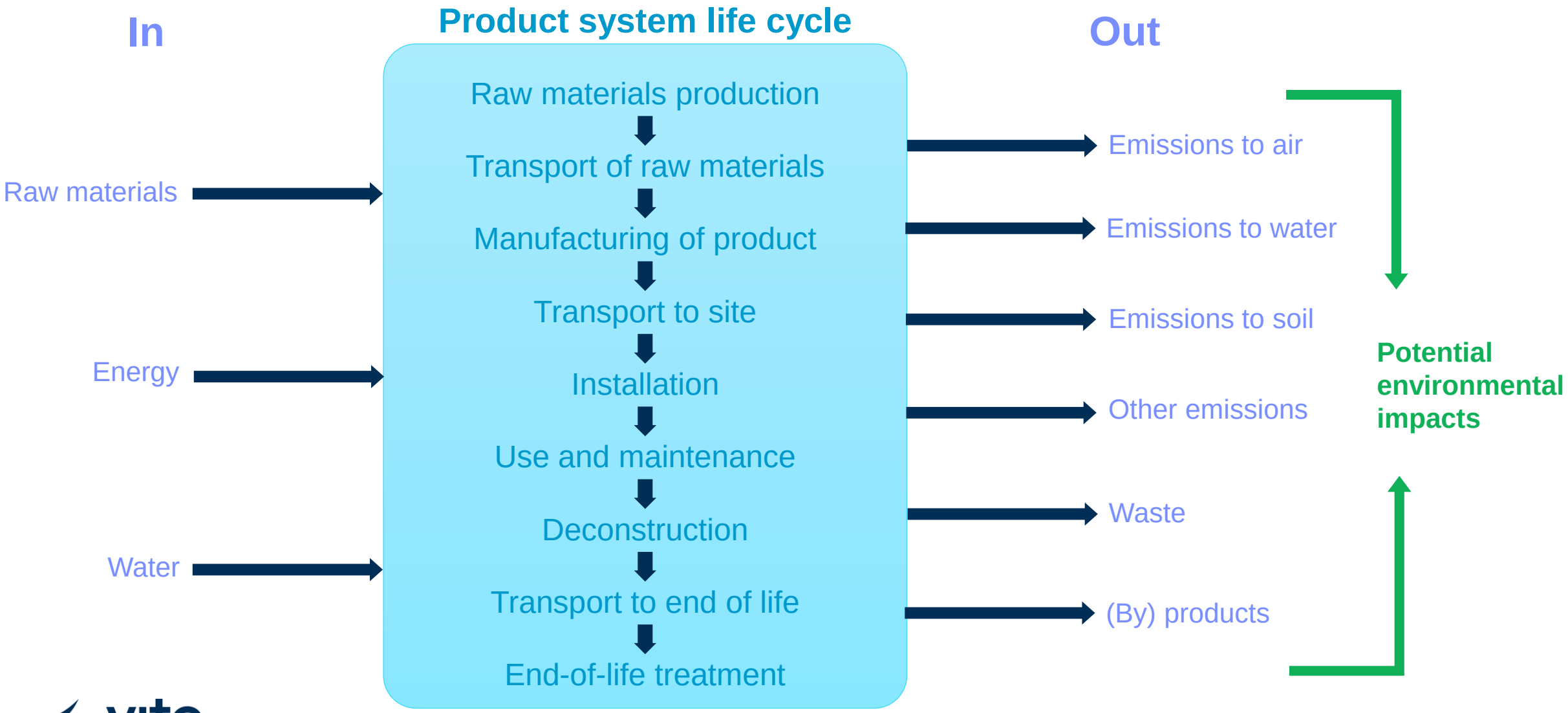
- Vitrified clay
- PVC monolayer
- PVC foamed with recycled content
- PP monolayer
- PP multilayer
- Glass fibre reinforced plastic (GRP)
- Sulphur concrete



Mixed piping systems (DN500)

- Vitrified clay
- Reinforced concrete
- PP corrugated
- PVC monolayer
- PP monolayer
- PP multilayer
- GRP

Life cycle inventory (LCI)



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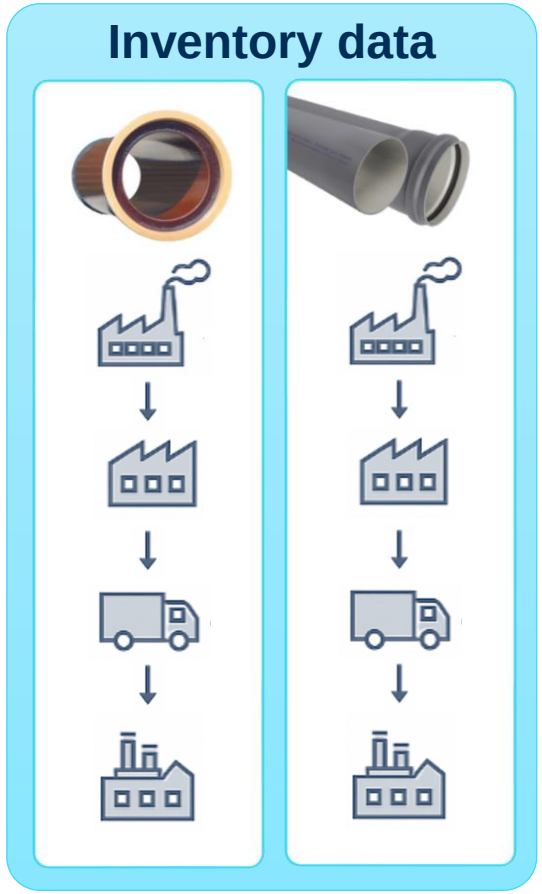
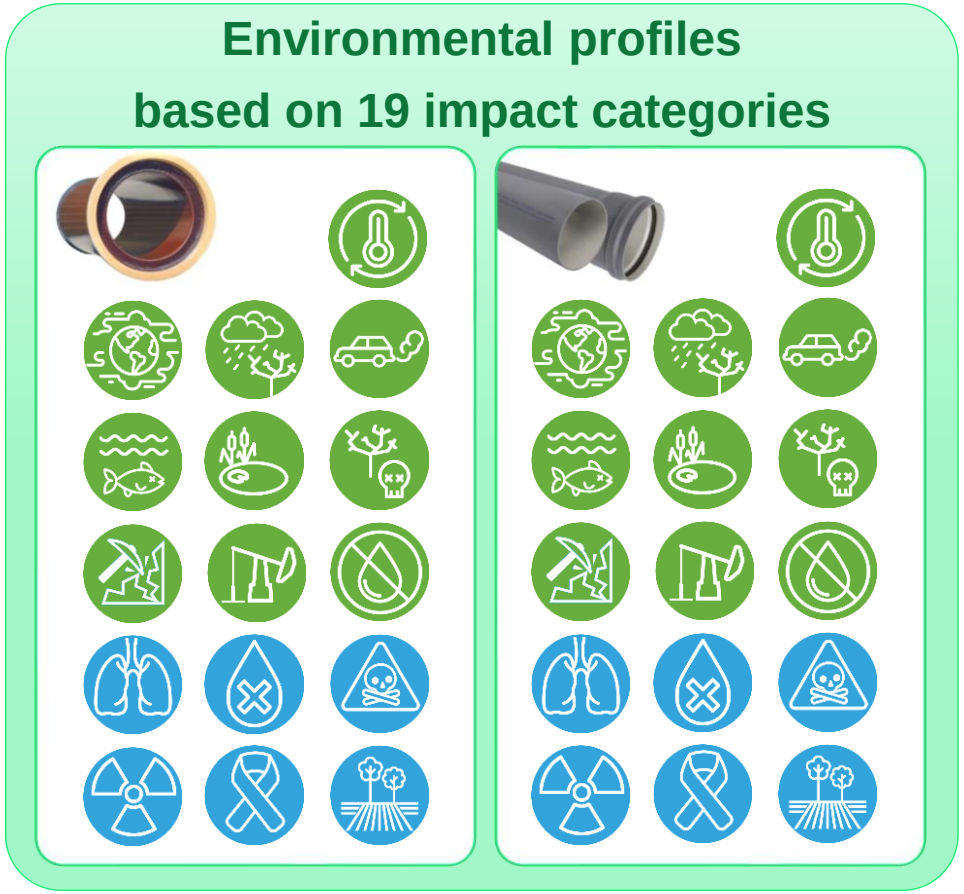
Additional LCI efforts in this comparative study

- **To increase comparability of the EPDs**, the following boundary conditions were aligned
  - Functional unit
  - Application-specific scenarios
    - Transport to trench
    - Installation processes
    - Maintenance
    - Deconstruction at end of life
  - EPDs all based on same standard
    – EN 15804:2012+A2:2019
  - EPDs using same background database
    – ecoinvent (however some with older versions)

Life cycle impact assessment (LCIA)

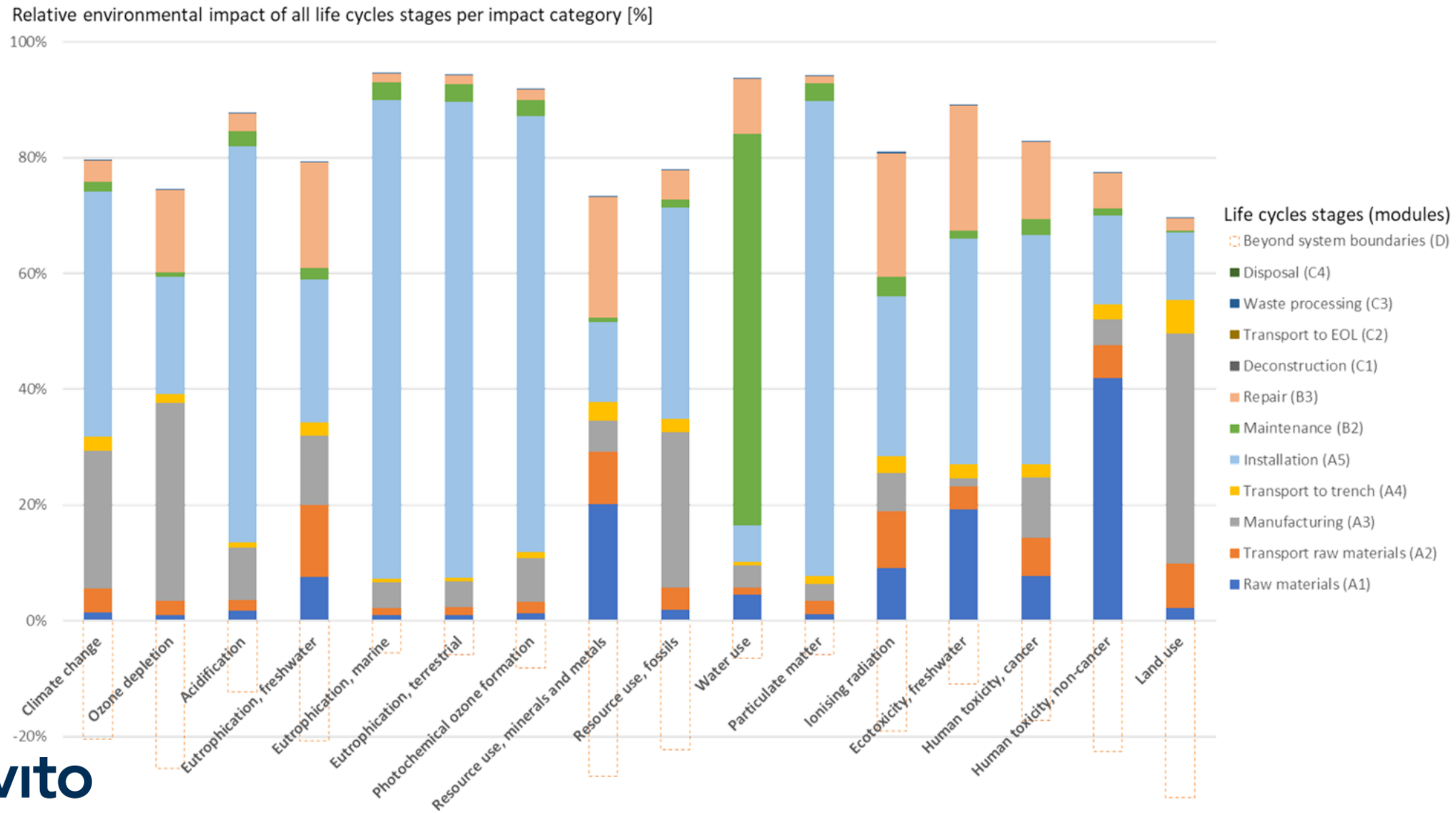


Impact assessment models
with
characterisation factors, e.g.:
1 kg CO_2 = 1 kg CO_2 equivalents
1 kg CH_4 = 25 kg CO_2 equivalents
….



LCIA result

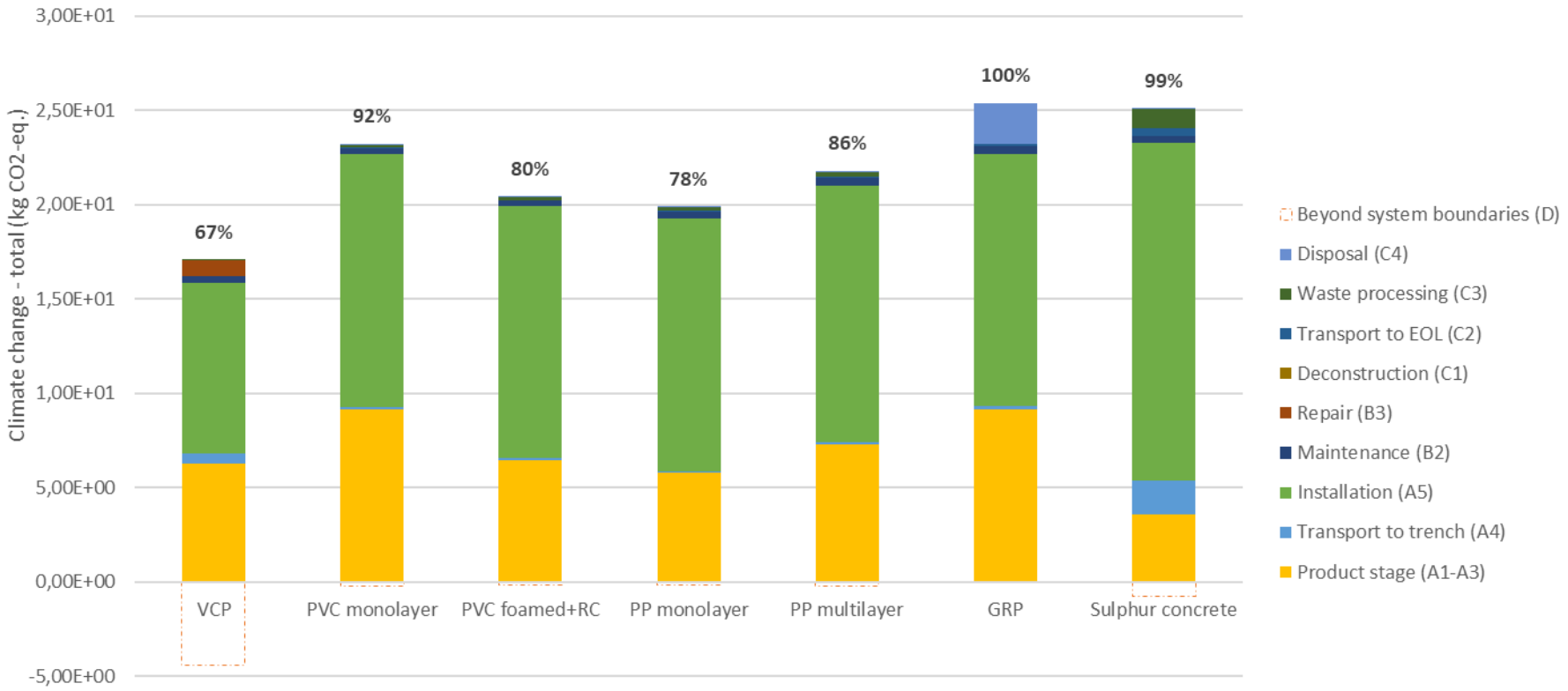
Individual environmental profile of VCP DN250



LCIA result

Comparison of total life cycle impact DN250 systems

Climate change - total impacts per year under product-specific service life

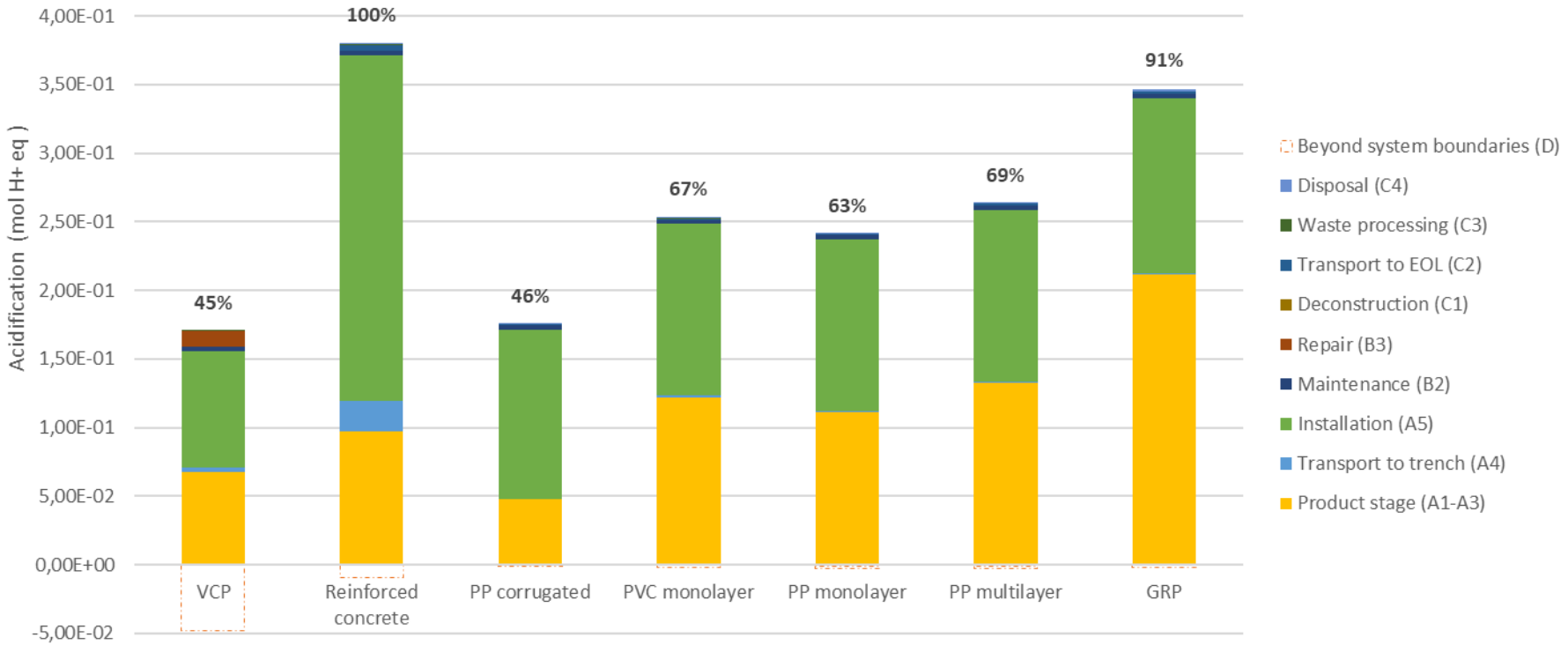


Interpretation and conclusion of the comparisons are based on limitations/assumptions

LCIA result

Comparison of total life cycle impact DN500 systems

Acidification impacts per year under product-specific service life



Interpretation and conclusion of the comparisons are based on limitations/assumptions

Key messages

- **Overall goal**
  - Reduce the environmental impact
  - Understand hotspots and improvement potential
- **When comparing** different product systems
  - EPDs are key to support the market and decisions
  - But quite some challenges in:
    - Methodological aspects regarding study periods/ service life
    - Alignment of background data
    - Alignment of scenarios
- We took a first import step by **aligning** as many parameters as possible
  - Alignment between EPDs is desired

Final conclusions
Opportunities – We can benefit from it!

- **Sustainability is not only about CO_2** but also about good quality, extended lifespan, weight, affordability, …

- **A level playing field in Europe**
  - Example in Belgium: TOTEM – tool to assess the total environmental impact of materials – science-based approach
    - Mutal recognition by other systems (e.g. BREEAM, Level(s), …)
    - Integration of B-EPDs

- **EPDs as important B2B communication format**
  - Mandatory in case of green claims
  - Will gain more importance
    - Construction Products Regulation – CPR
      → BWR7 – Declaration of Performance and CE marking
    - Ecodesign for Sustainable Products Directive – ESPR
      → LCA PEF based

Thank you for your attention!
Let's stay in contact

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