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Life Cycle Assessment (LCA) of Bio-Plastics

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The four fundamentals of applied sustainability….

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European Commission Environment

DIN

ISO

THIRD-PARTY VERIFIED EPD ISO 14025 and EN 15804 Institut Bauen und Umwelt e.V.

UNEP Life Cycle Initiative SETAC

Methods
Standards
Compliance schemes

Software
Data(bases)
Foreground Data

Applied Sustainability

Knowhow
Team
Network
Support

Business Cases

thinkstep GaBi
Product Sustainability Performance

thinkstep GaBi
GaBi Databases

thinkstep SoFi
Enterprise Sustainability Performance

FORTUNE GLOBAL 500

40%

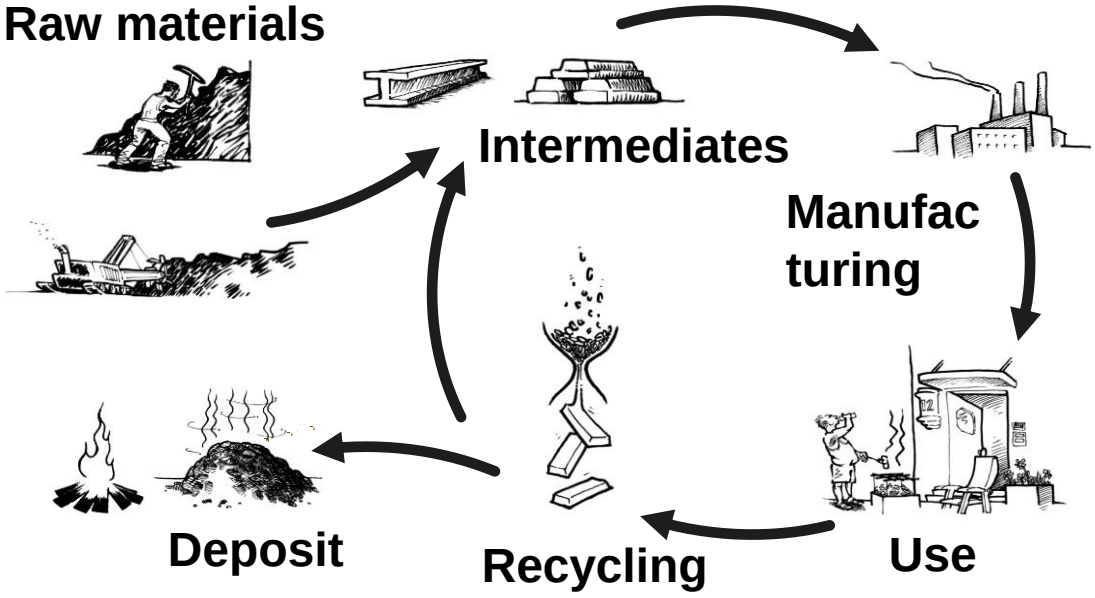
…and how we address it !

GaBi bioplastics database

- First bioplastics LCI data available in the market
- Bio-PP, Bio-PE, Bio-PVC, Bio-PA, Bio-PET, TPS, PLA, PBAT
- 120 new datasets for bioplastics from different sources
- Geographical Coverage for Germany, US and Europe (EU-27)
- Enables modelling of the complete life cycle of biopolymer materials: the database includes the production processes and the related End of Life treatment processes (incineration and recycling) which specifically consider the biogenic carbon balance.
- Recycling processes are available as parameterized and fully adjustable plan systems, for greater flexibility and individual recycling and material recovery scenarios.
- Always up to date, due to thinkstep´s annual database upgrade program

LCA: Definition

- Life Cycle Assessment is a tool for quantified evaluation of ecological impacts of products and services
- LCA analyses the potential environmental burdens of a product or service in its production, use phase and disposal (end of life).



- The result of life cycle assessments are values in various impact categories (e.g. Global Warming Potential, Acidification Potential, Ozone Depletion Potential)
- Framework for calculation of life cycle assessment are the ISO-standards 14040/14044

Bio-Plastics (BP) – market facts and definition

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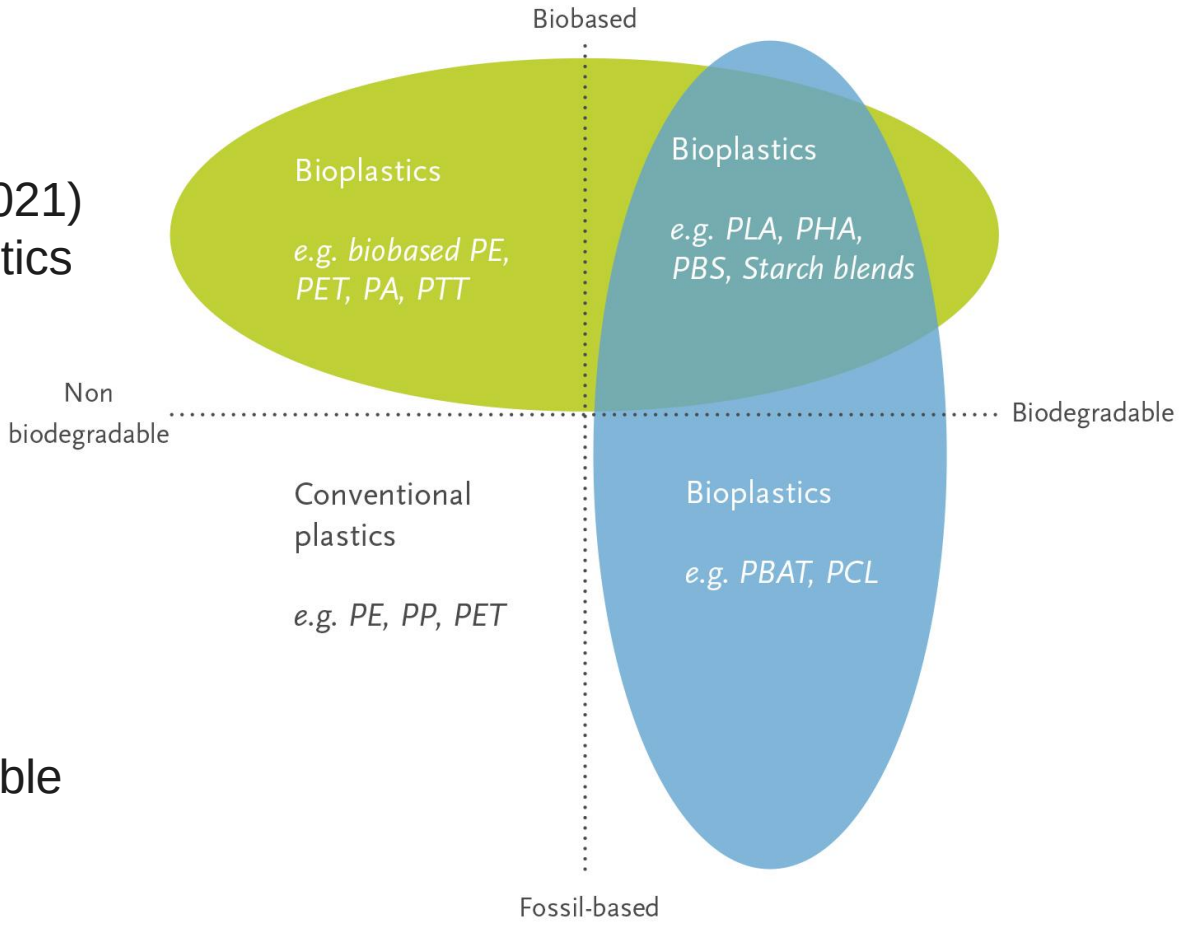
- Market relevance:
  - 3 Mio t of production
  - Exp. growth: 50% (until 2021)
  - 85 % of conventional plastics could be replaced by BP

- 3 main BP groups:
  - Bio-Based vs.
  - Bio-Degradable vs.
  - Bio-Based + Bio-Degradable



Source: European Bioplastics (EuBP) e.V.

Life Cycle of (Bio-Based) Bioplastics

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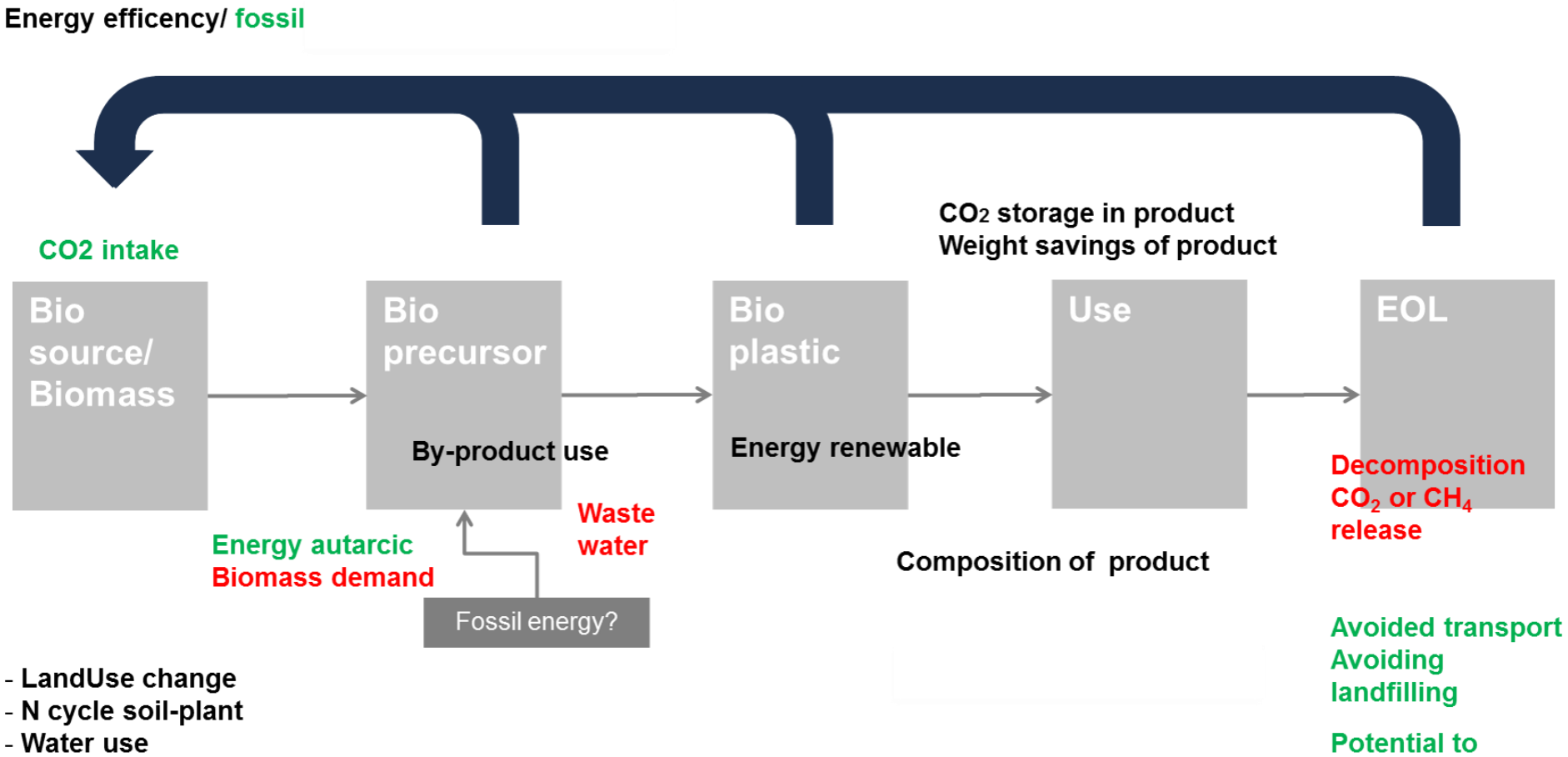
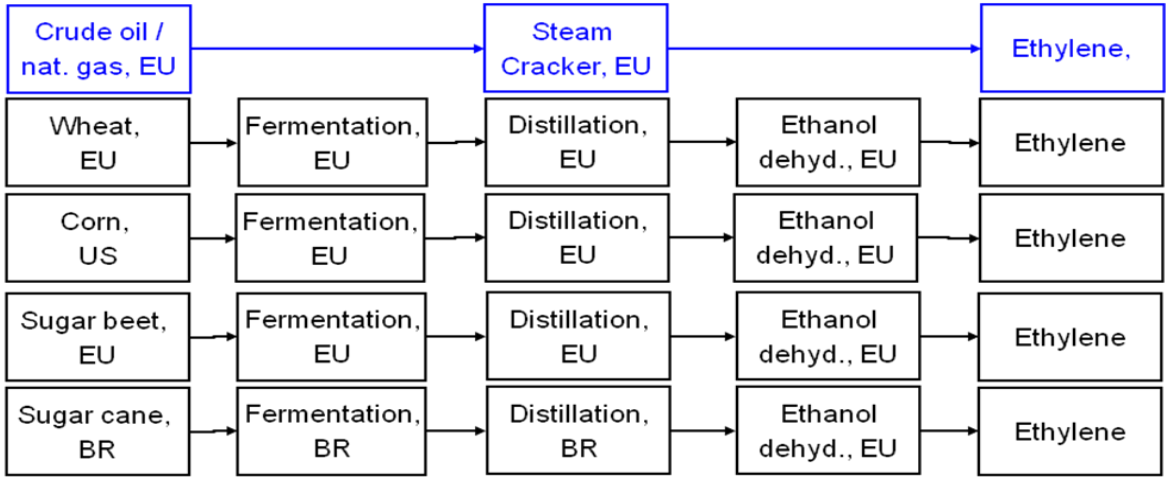


Example: Bio-Supply chain of Polyethylene



Renewable sources	Input	Output	By-products
Ethylene from wheat	5,6 kg wheat (15% water)	1 kg Ethylene	1,97 kg DDGS dry
Ethylene from corn	5,3 kg corn (12% water)	1 kg Ethylene	1,97 kg DDGS dry
Ethylene from sugar beets	20,9 kg sugar beets (75% water)	1 kg Ethylene	0,73 kg DDGS dry + 1,1 kg pellets dry
Ethylene from sugar cane	23,3 kg sugar cane (74,5% water)	1 kg Ethylene	0,88 kg vinasse 60% water + 5,99 kg bagasse 50% water

Tendencies in impact of bio vs. fossil products

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Global Warming		CO_2-neutral
Energie demand fossil		correlation with GWP (often more total energy needed)
Photosmog		tendency to save fossil conversions → save HC emissions
Acidifiction		tendency disadvantage, fertiliser use
Eutrophication		tendency disadvantage, fertiliser use
Ecotoxicity		Less convertional sustances used and dispersed in processing vs. substance use in biomass production (agro chemicals), very product specific, very biomass specific
Humantoxicity		tendency advantage, less fossil energy supply and less combustion processes (e.g. coal,…)
Water		Agricultural products tend to use much water

General conclusions

- “Bio” is not generally **sustainable**, fossil not per se un-sustainable
- “Bio” LC aspects are **region, product and company specific**
- **Competition** fossil based products vs. bio based products through different aspects within the life cycle being hotspots.
- **Synergy** fossil based (LC) components plus bio based (LC) components
- Bio products deserve same **standardized approach** as non bio products

Environmental communication

- Environmental claims are key in the marketing of Bio-Plastics
- Claims should be:
  - Specific, measurable and verifiable
  - Distinct, not misleading
  - Accurate, relevant and truthful
- Claims should be substantiated with standards, labels, etc.:
  - Bio-Based:
  - Bio-Degradable:

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