
Energetic systems evaluation using Life Cycle Assessment

CHEMICAL ENGINEERING

Processes and Sustainable Development

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LG**C** CHEMICAL
ENGINEERING



Contents

1. Biomass availability
2. Environmental evaluation of biomass utilization
3. Perspectives in biomass and bioenergy field

Type of considered biomass

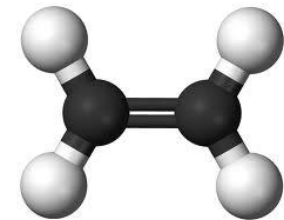
- Limited to crops used for first generation biofuels
 - European energy crops
 - Wheat
 - Sugar beet
 - Non-European energy crops
 - Sugar cane

Biomass utilization

- Sugar cane
 - Transformation in bioethanol via sugars fermentation



- → Proved fuel potential
- → Chemical potential as bioethylene?



Best sustainable choice ?

Biomass utilization – LCA

■ Goals of study

- ❑ To compare ethylene production from bioethanol or from fossil fuels: ‘bioethylene’ vs. ethylene
- ❑ To allow debate on the use of bioethanol

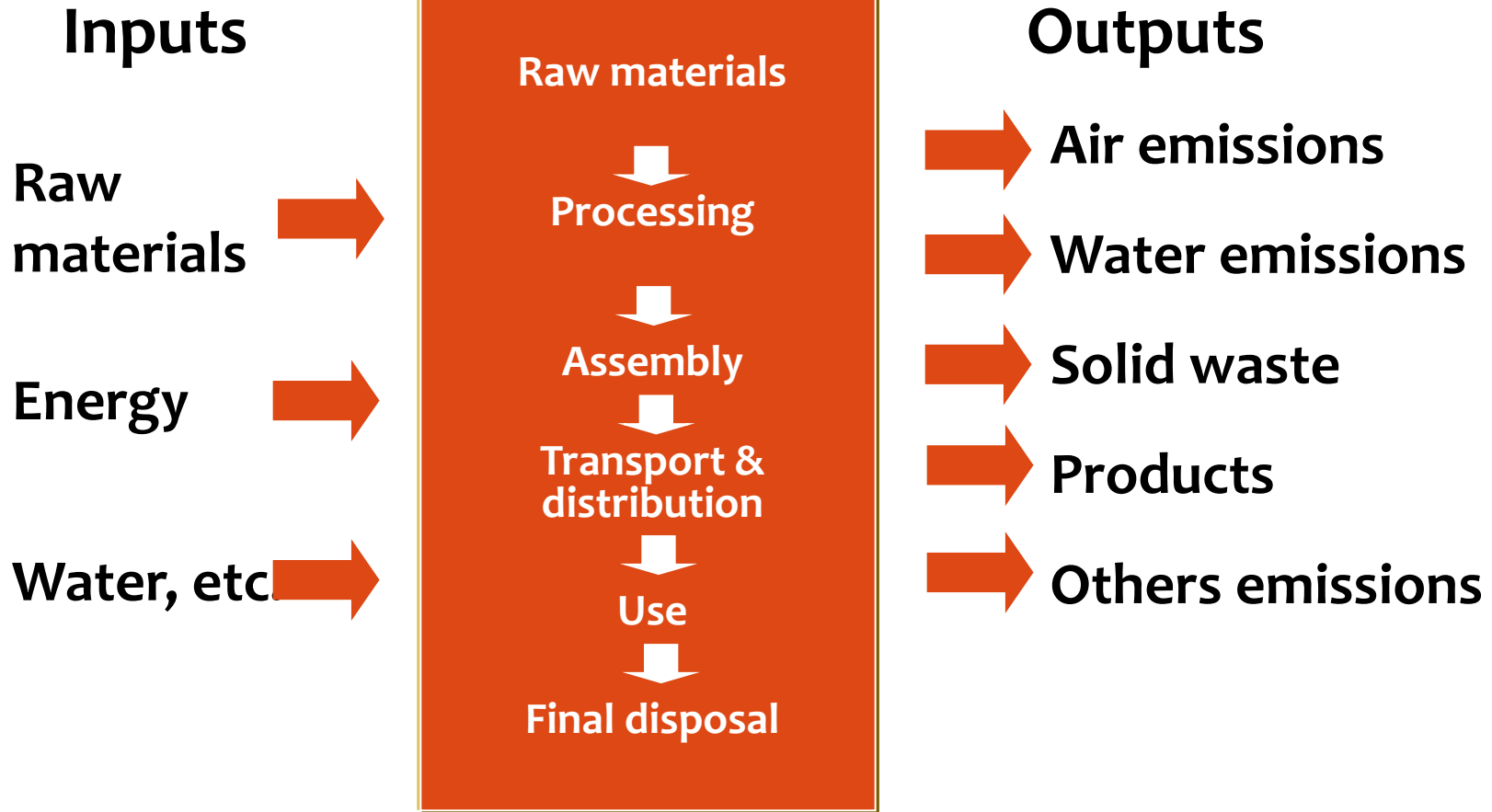
■ Functional unit

- ❑ Production of 1 ton of bioethylene from sugarcane



Biomass utilization – Life Cycle Inventory

Inventory

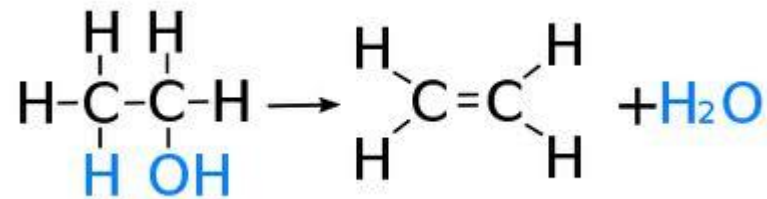


Biomass utilization – Life Cycle Inventory

- Steps for bioethanol production
 - Cultivation of one ha
 - Tillage, fertilizers production, cultivation, harvest, etc.
 - Transportation
 - From agricultural land to transformation plant
 - Production of bioethanol
 - Cleaning, shredding, concentration, fermentation, pasteurization, distillation, drying of byproducts, etc.

Biomass utilization – Life Cycle Inventory

- Steps for bioethylene production
 - Bioethanol production
 - All steps described before
 - Dehydration of bioethanol into bioethylene

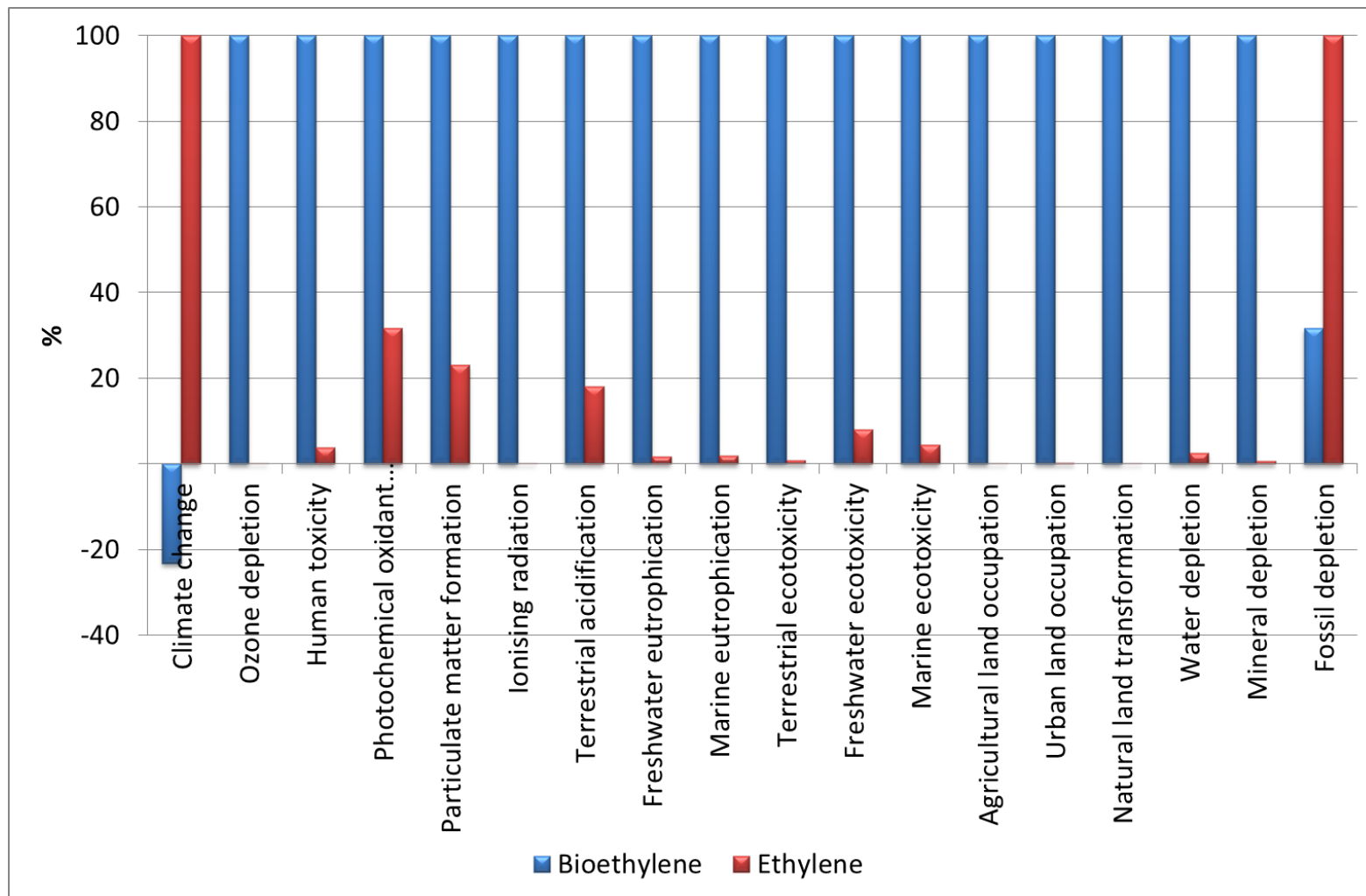


- Production of fossil ethylene
 - Use of database

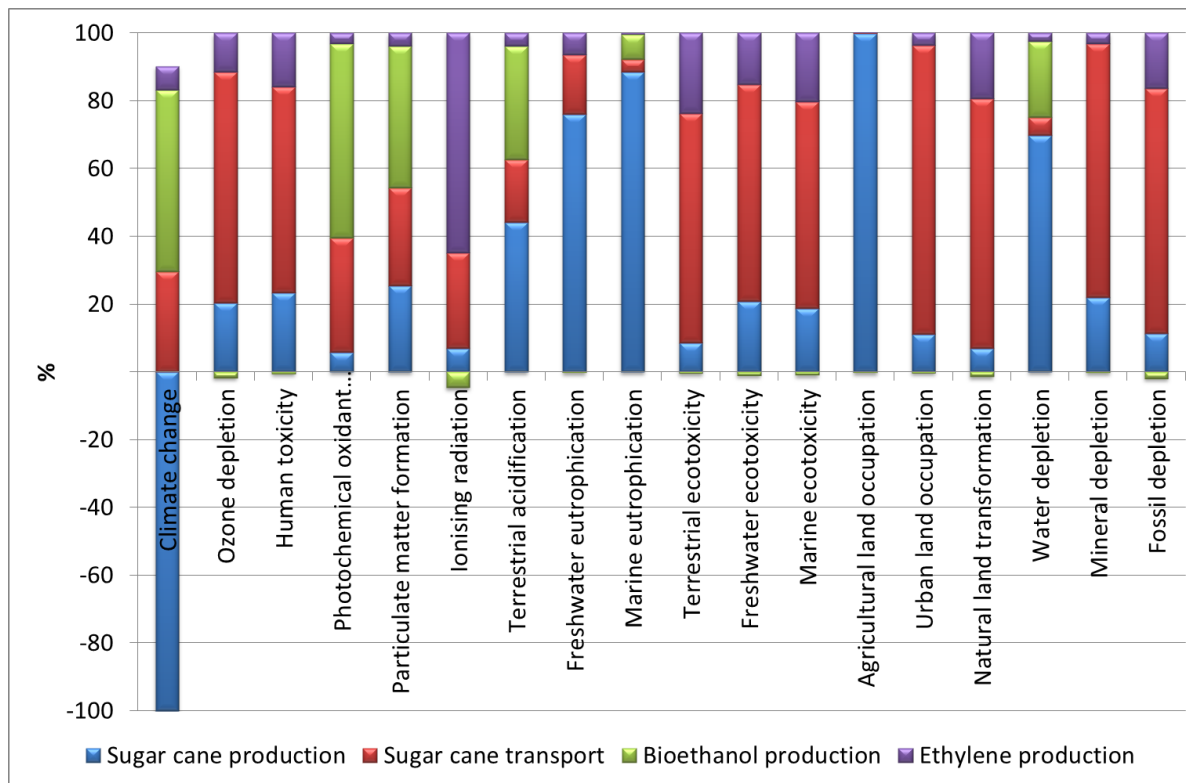
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Biomass utilization – Impact assessment



Biomass utilization – Impact assessment



Impact	Unit	Bioethylene	Ethylene	Economy (Eth – Bioeth)
Climate change	kg CO ₂ eq	-341	1463	1804
Fossil depletion	kg oil eq	514	1623	1109

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Perspectives – Biomass

- Other crops to analyze
 - Sugar beet
 - Wheat
- Questions to answer
 - What is the best way of using energy crops?
 - Is it better to produce energy or chemical components?
 - How can we valorize waste?

Perspectives – Biomass

- Limitation of the study
 - Soil transformation (pastures or forests to arable land → lost of carbon)



OR



- To find a way to evaluate this transformation and the carbon stocks

Thank you for your attention!

Any questions?

