

Analytical approaches to environmental and social life cycle assessments being used in Germany

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Plants, Microbes, Animals, Biodiversity,
Biotechnology, „C“ in CO₂, biological knowledge

Sustainable production and use of biological resources, processes and principles to provide products and services in all economic sectors.

Agriculture/ Forestry/ Fisheries, Food, Paper, Textiles, Energy,
Paper, Chemistry, ICT, Pharma...



Biomaterials in car industry



Enzymes lowering effective washing temperature



Bioplastics



Implants made from spider fibers



Biobased building materials



New sugar substitutes



Biopharmaceuticals based on proteins

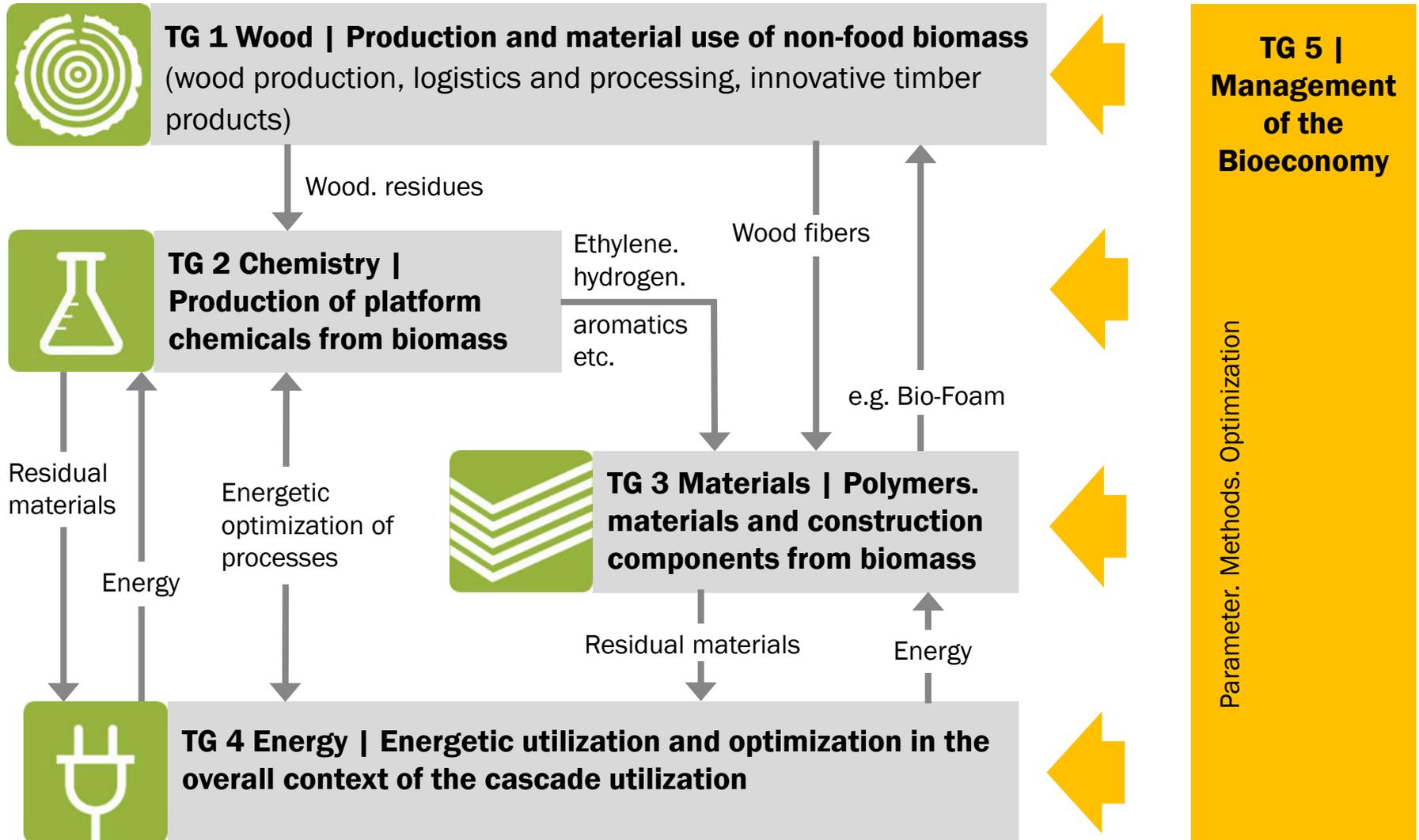


Biofuels based on forest residues, straw etc.

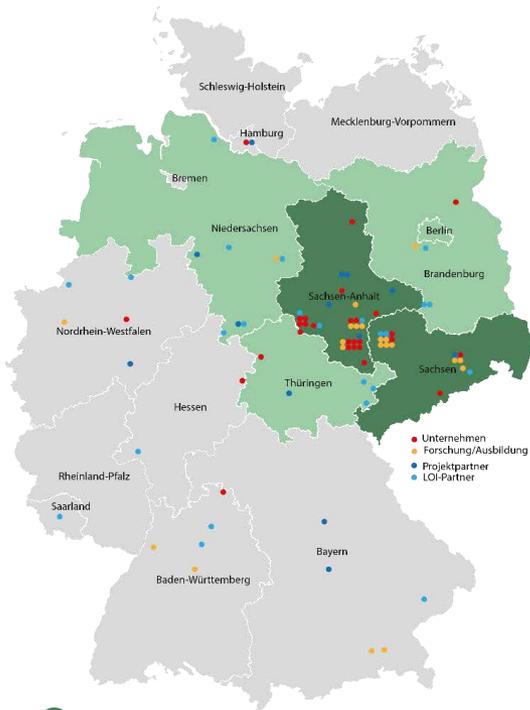
Source: German Bioeconomy Council. (2014). Das ist die Bioökonomie

From value chains to value webs

BioEconomy cluster



Background BioEconomy Cluster I Introduction



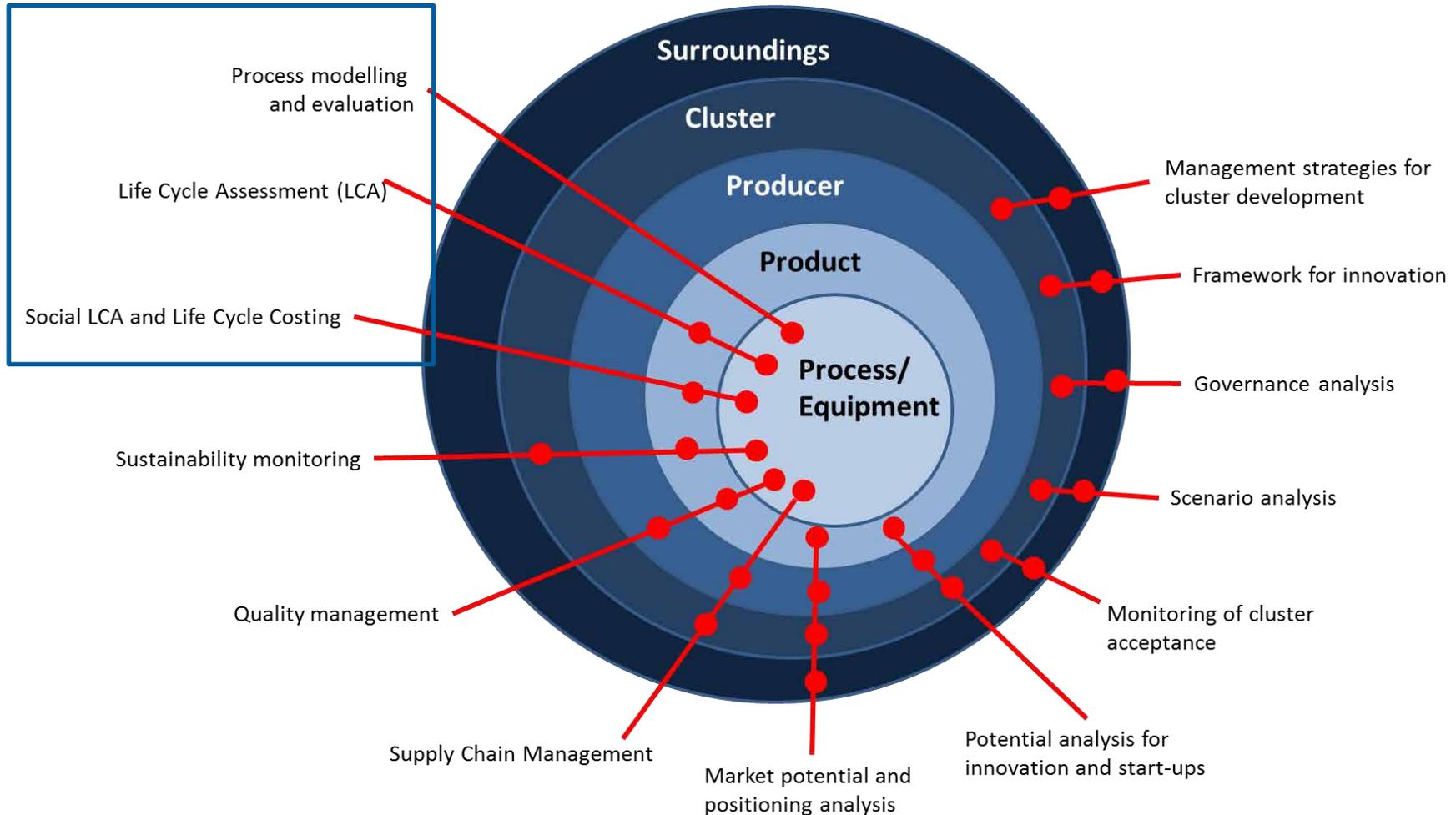
● Kernregion
● Erweiterte Clusterregion

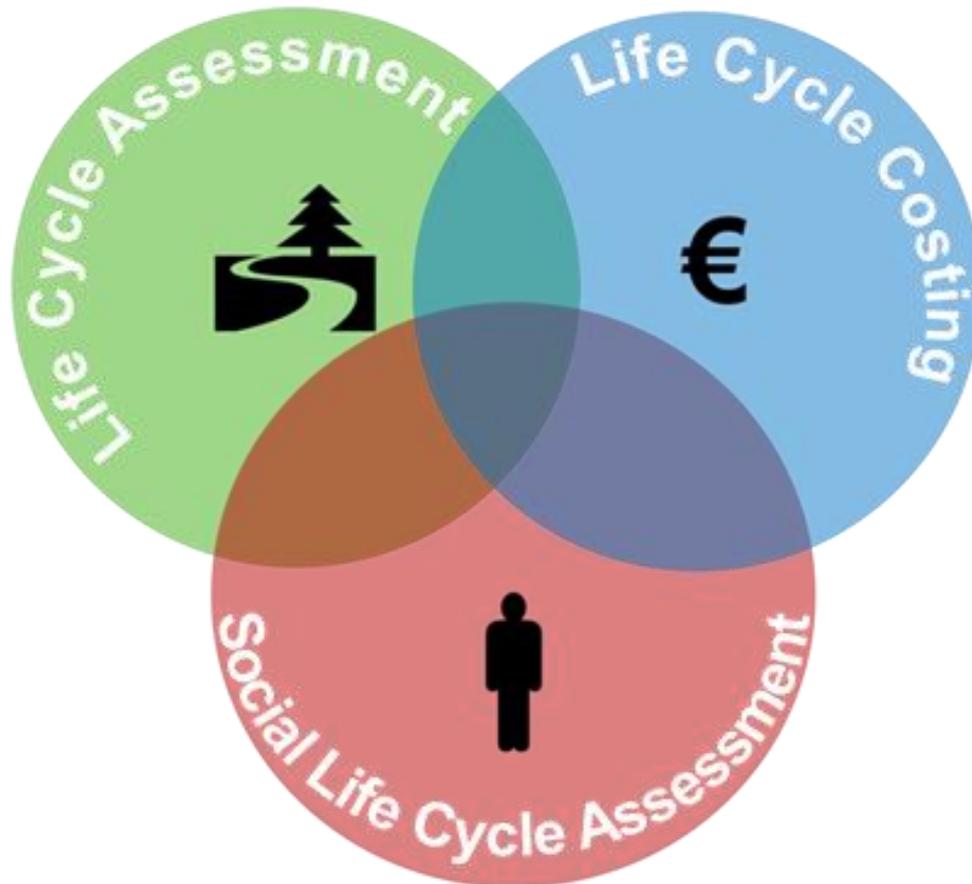
Source: www.biotechnologie.de

Background BioEconomy Cluster | Partners



The accompanying research: Management tools for the BioEconomy cluster in Central Germany





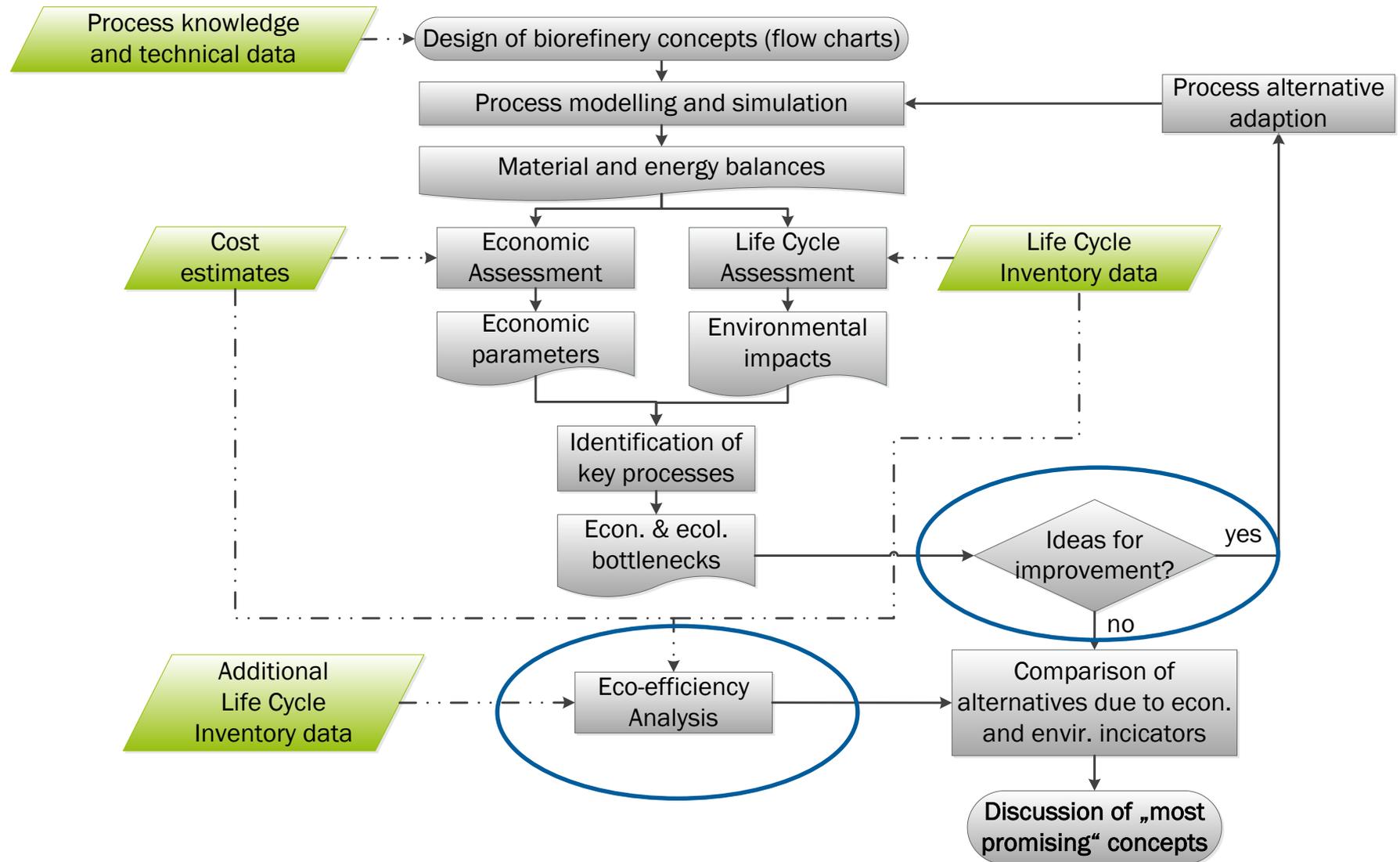
- Development of a social LCA Method
- Evaluation of social, economic and environmental aspects for selected product life cycles
- Early identification of potential opportunities & risks (Hotspots)

Sustainability Monitoring:

Sustainability index for the integrated industrial network in a bioeconomy region

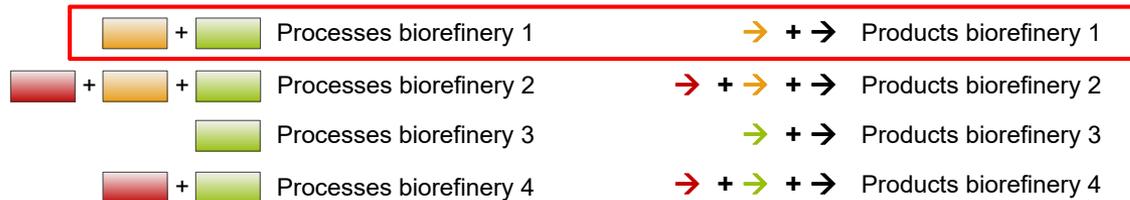
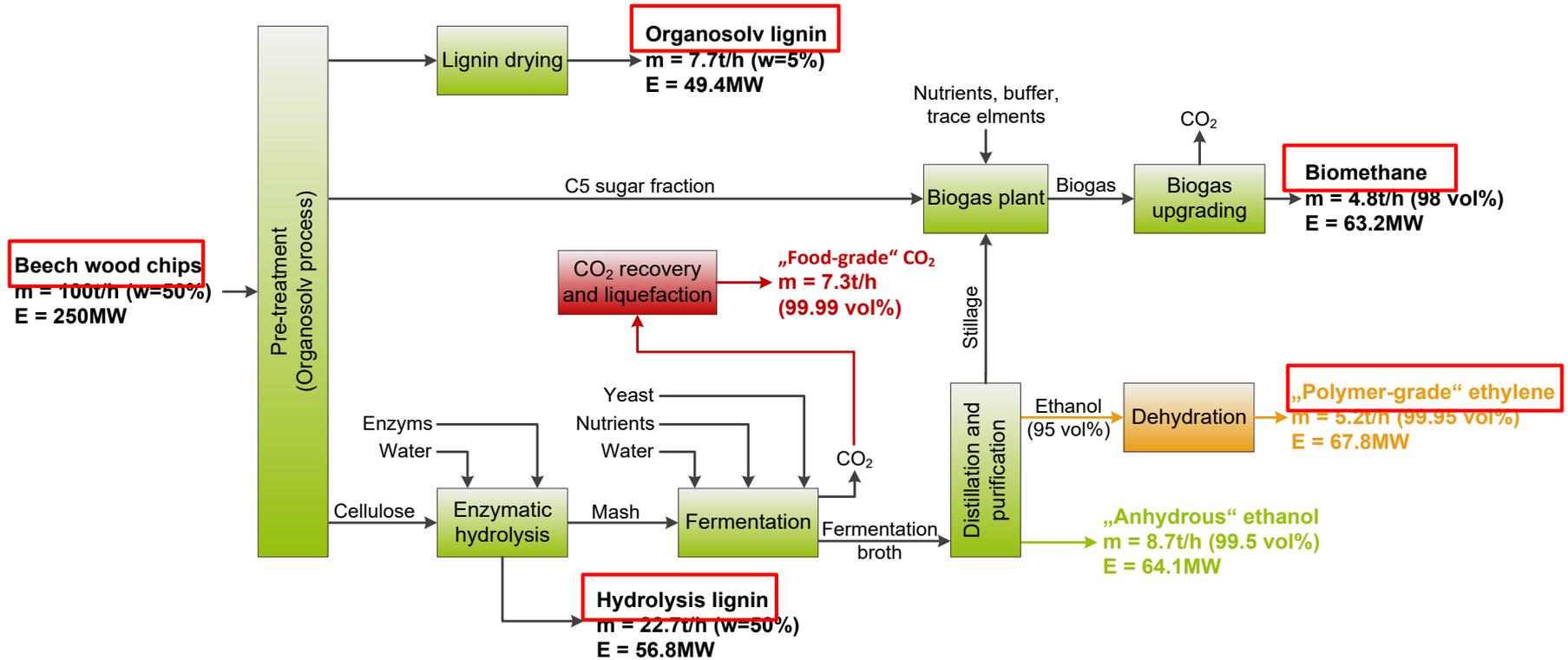
LCC and LCA to support innovation

Method



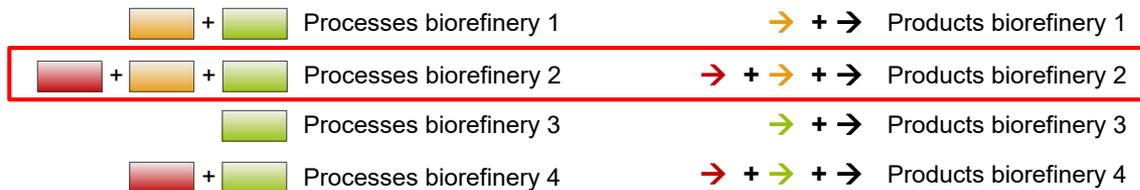
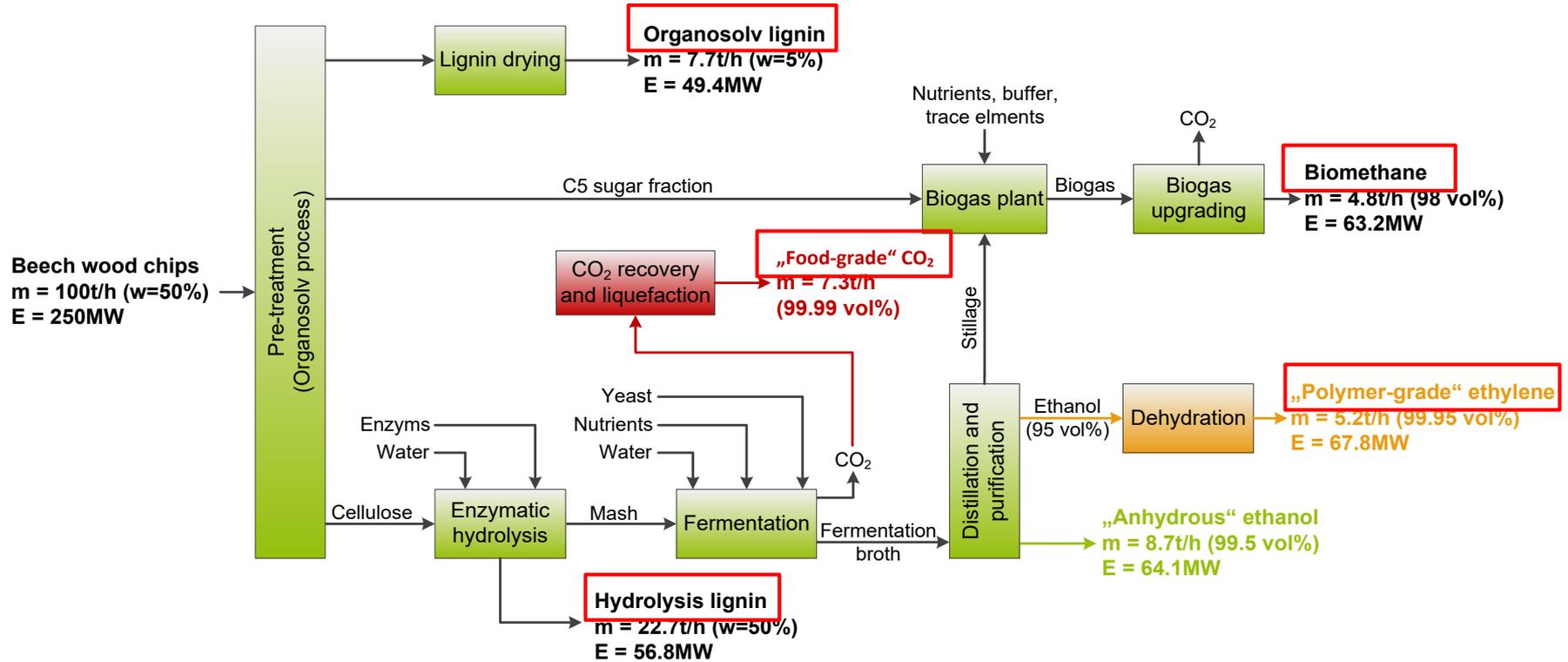
LCC and LCA to support innovation

Exemplary biorefinery concepts



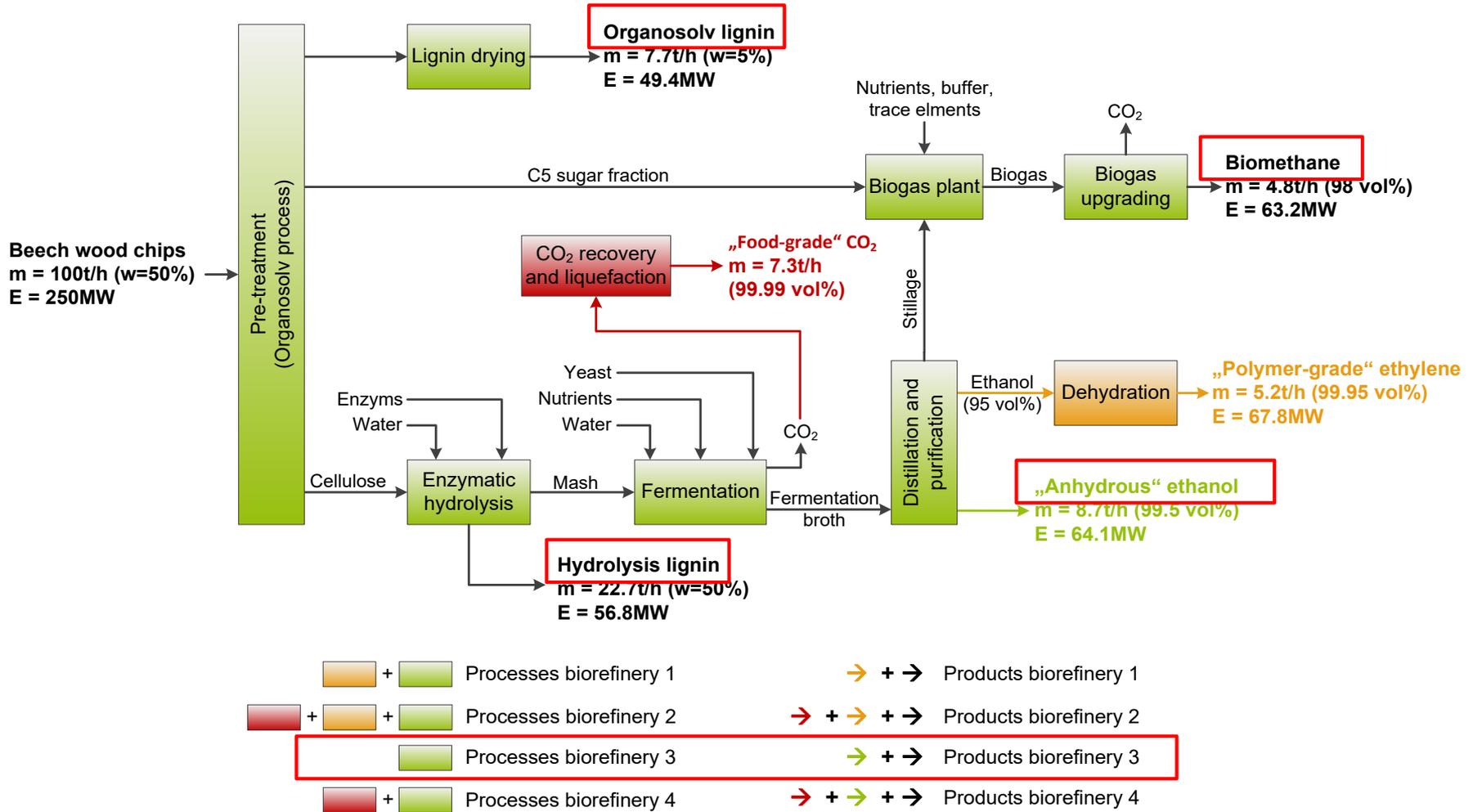
LCC and LCA to support innovation

Exemplary biorefinery concepts



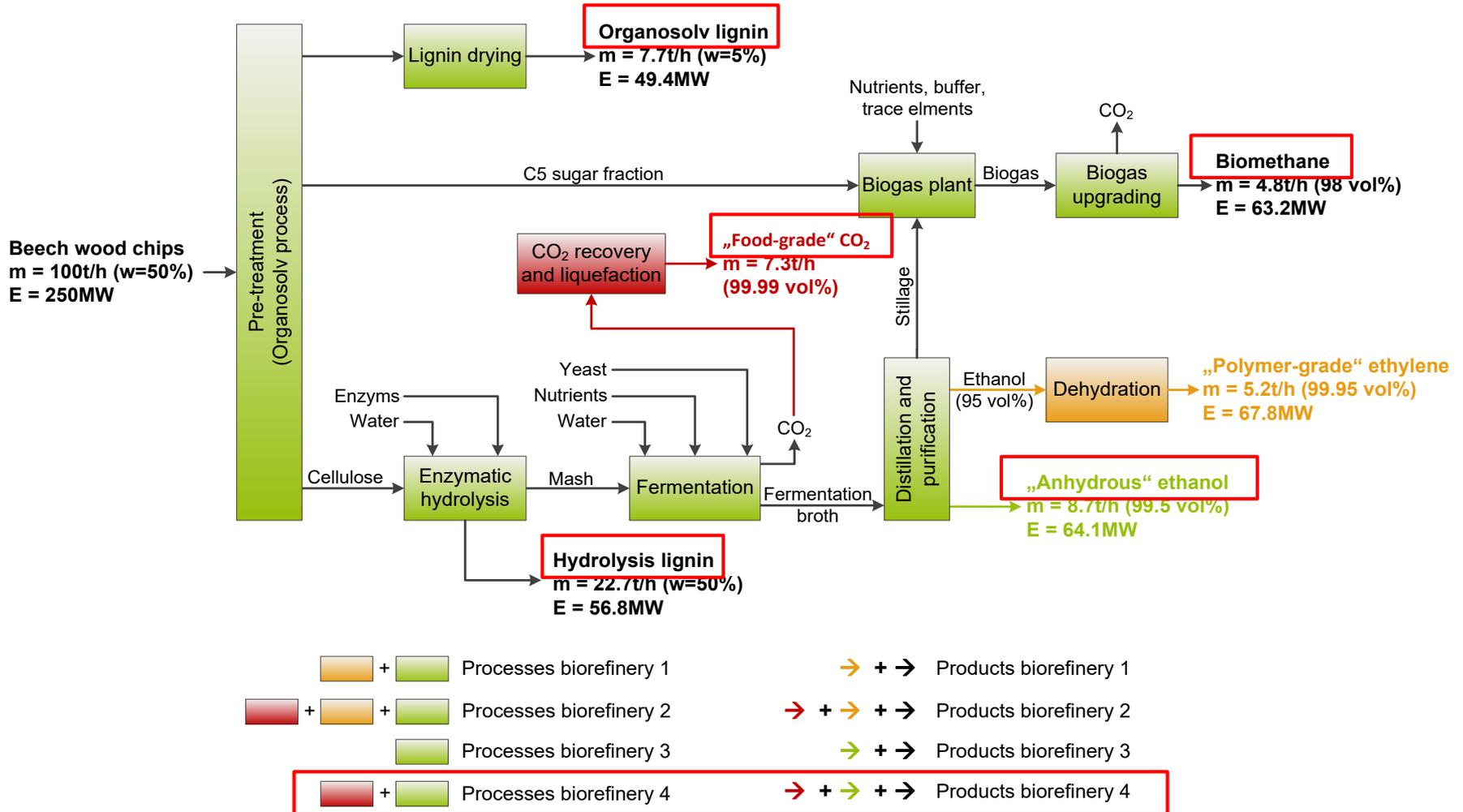
LCC and LCA to support innovation

Exemplary biorefinery concepts



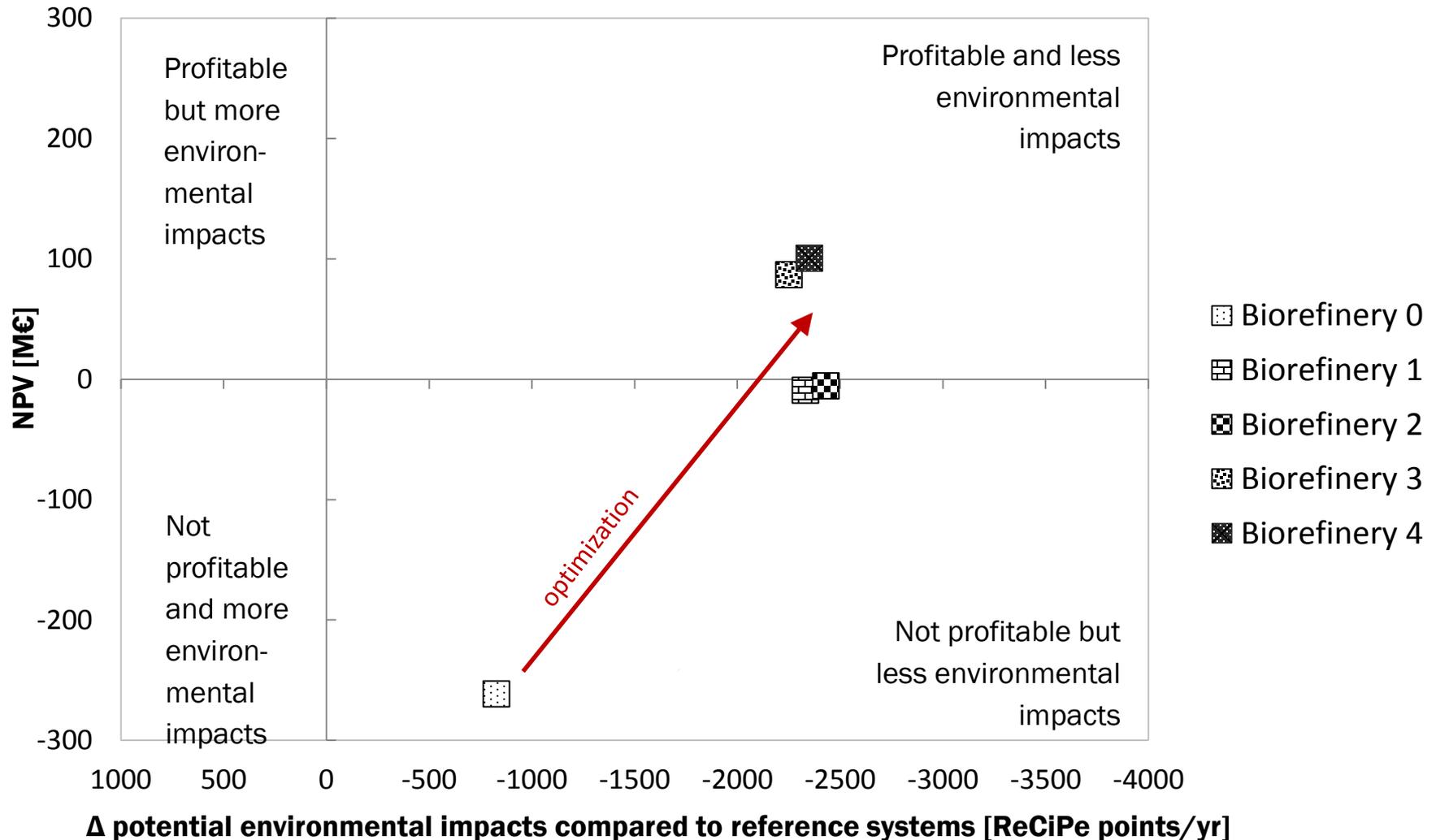
LCC and LCA to support innovation

Exemplary biorefinery concepts



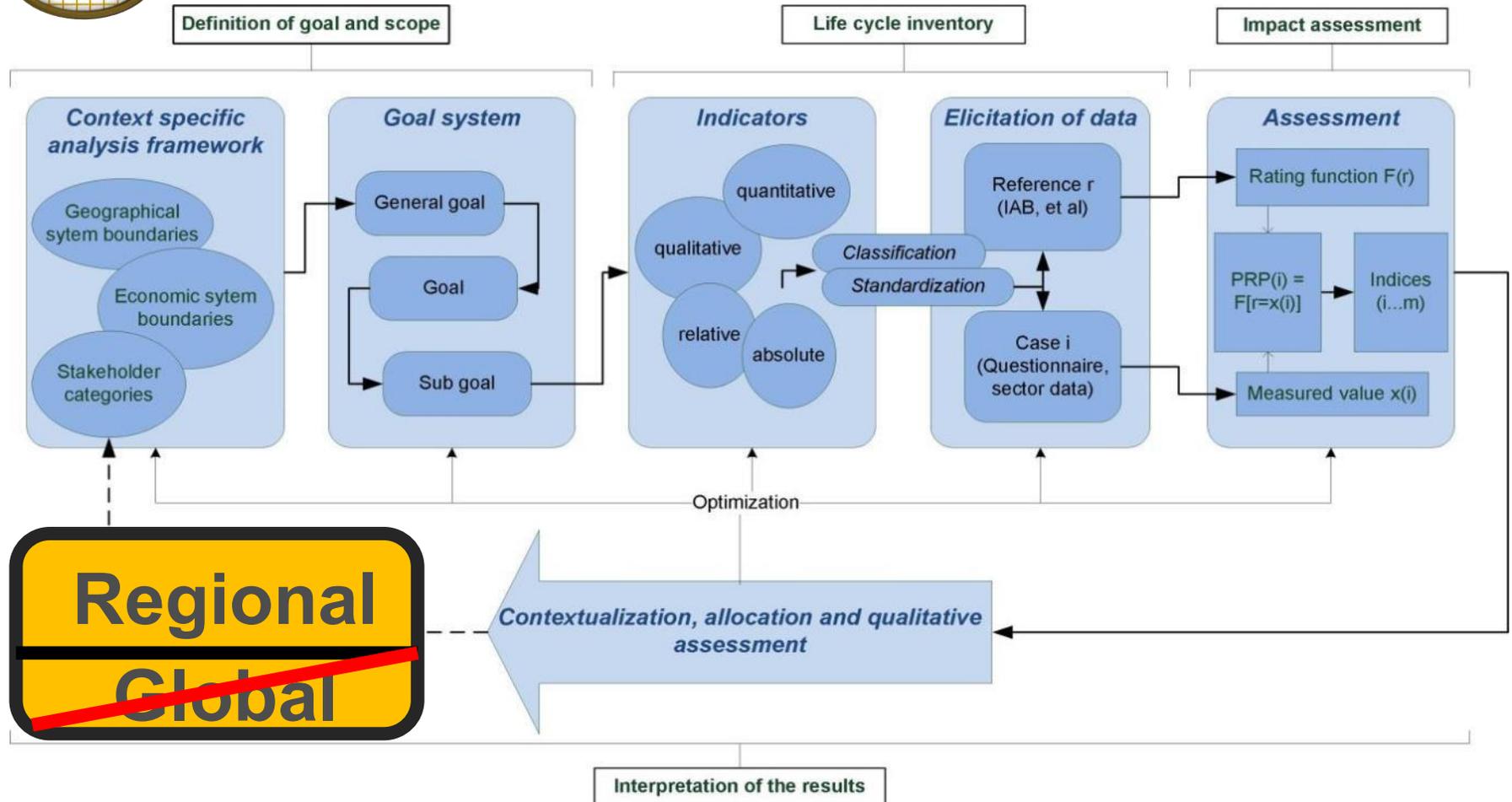
LCC and LCA to support innovation

Eco-efficiency analysis | Examples



Social LCA to assess a regional transformation

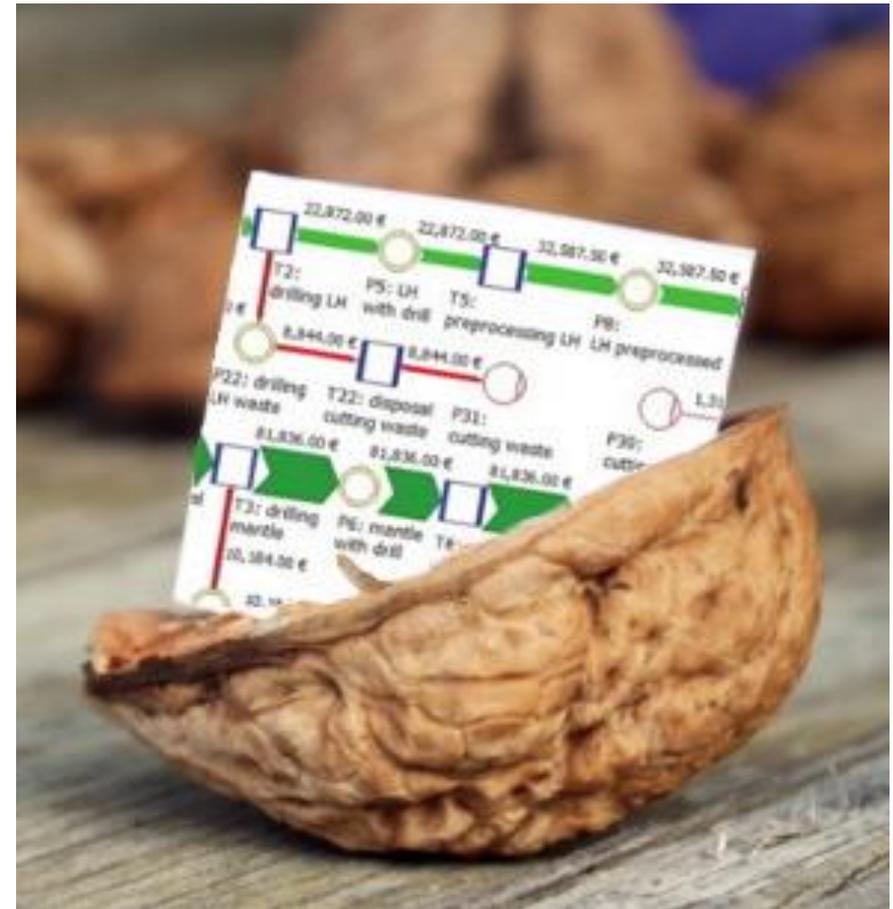
Method and Processes



Social LCA to assess a regional transformation: Indicators and data sources

Goal	Component area	Indicator	Data category	Data source
Protection of human health	Accidents	Accidents per year per 1000 employees	quantitative	KfW/BKK
		Fatal accidents per year per 1000 employees	quantitative	Baua
	Illnesses	Days of illnesses per year per employee	quantitative	AOK/BKK
		Preventive measures in the organisation	qualitative	IAB
Employment and pay	Direct employment	Percentage of qualified employees in the organisation	quantitative	IAB
		Average annual recruitment	quantitative	IAB
	Average payment	Average salary in an organization	quantitative	BA
	Job security	Temporary agency workers rate (Leiharbeiter)	quantitative	IAB, Lit
		Limited term employees per total employees	quantitative	IAB
	Work life balance	Part-time working ratio per total employees	quantitative	IAB/BA
Sustainable development of human and knowledge capital	Working time	Average working time per week	quantitative	IAB
		Overtime	qualitative	IAB
		Handling of overtime	qualitative	IAB
	Training of local community	Trainee ratio	quantitative	IAB/BA
		Trainee takeover ratio	quantitative	IAB
	Internal training	Support of further training through assumption of cost or exemption	qualitative	IAB
		Nr. of employees participated in training or traininghours	quantitative	IAB
R&D	Employess working in R&D	quantitative	IAB	
Stakeholder-participation	General participation	Existence of work councils	qualitative	IAB
	Financial participation	Possibilities for financial contribution for employees	qualitative	IAB
Conservation of social resources and equality of opportunity	Work life balance	Measures for reconciliation of work and family life	qualitative	IAB
	Equality of working conditions	Women in higher positions	qualitative	IAB
		Measures to increase equality between men and women in the organisation	quantitative	IAB
	Disabled persons	Ratio of disabled people in the organisation	qualitative	IAB
	Racial discrimination	Ratio of Employees with immigrant background	quantitative	BA
	Disadvantaged groups	Ratio of long-term unemployed	quantitative	BA
Work life balance	Measures to support older employees	quantitative	IAB/BA	

- Regional clusters provide options for innovation and sustainability
- To manage the transformation towards bioeconomy - a toolbox of assessment methods is necessary
- Through adopting LCC, LCA and sLCA methods we can improve the positive effects, i.e. optimising new processes or figuring out the effects to the people in the region



Source: http://www.knowtheflow.com/wp-content/uploads/2013/05/ktf_MFCA-nutshell.jpg

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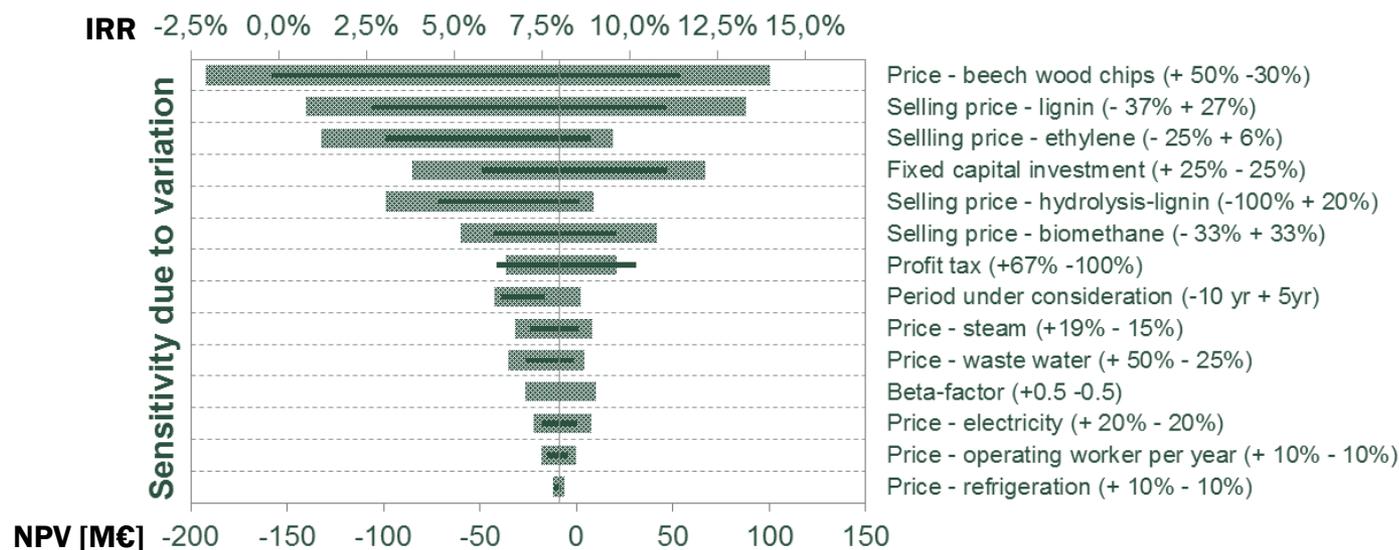
Funded by:



Back up LCC and LCA for innovation support: Economic assessment

	Non-optimized ethylene concept (BR 0)	Optimized ethylene concept (BR 1)	Optimized ethylene concept + CO2 (BR 2)	Optimized ethanol concept (BR 3)	Optimized ethanol concept + CO2 (BR 4)
NPV	-261.5 M€	-9.1 M€	-5.4 M€	87.0 M€	100.6 M€
IRR	--	7.95 %	8.10 %	11.32 %	11.54%
Payback time (dynamic)	--	--	--	16.6 yr	16.08 yr

**Economic results are greatly sensitiv!
Example for BR 1**



Source: Nitzsche et al. 2016

Backup: LCC and LCA for innovation support: Environmental assessment

