

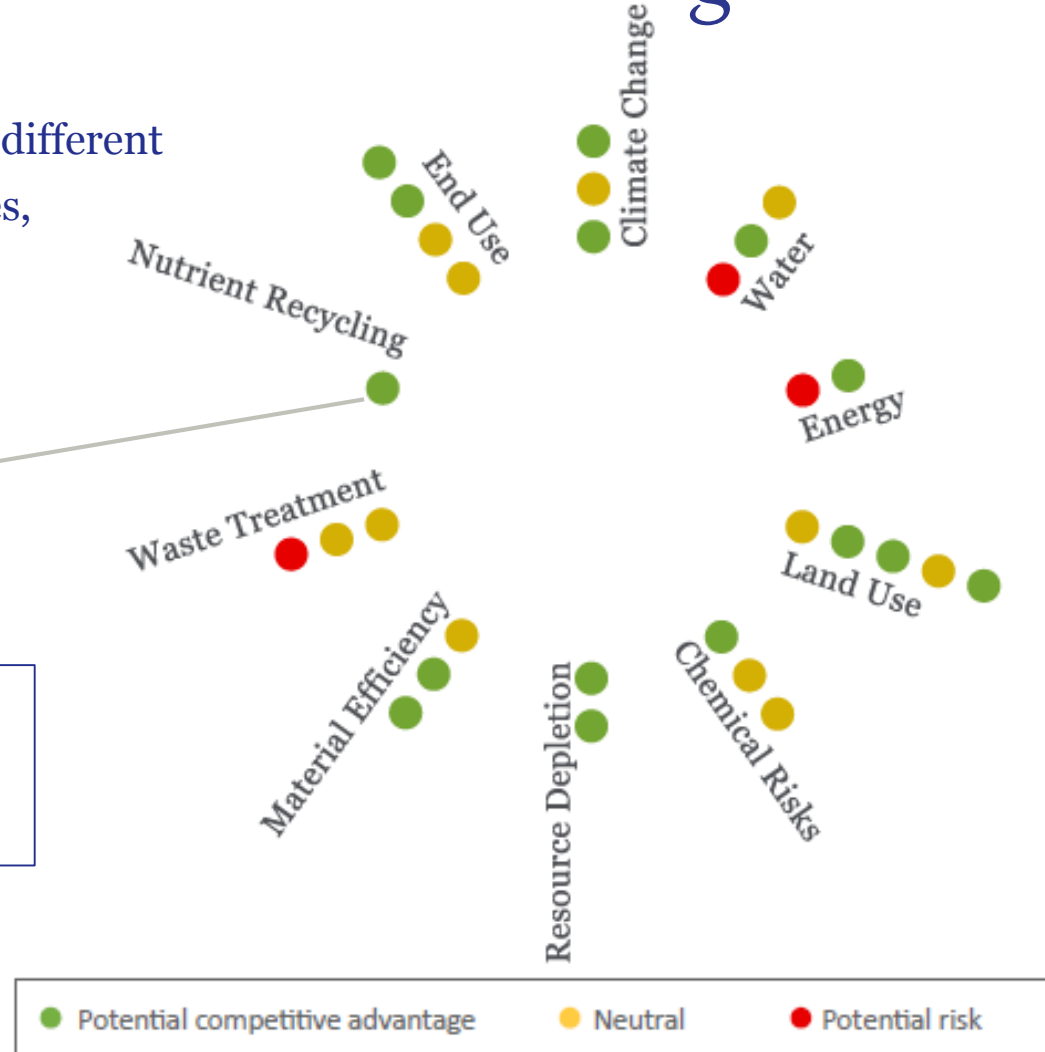
Gaia Biorefiner sustainability indicators



Gaia Biorefiner offers **efficient sustainability benchmarking** of different raw materials, locations, technologies, processes, and product options

Each indicator group includes 1-5 indicators that point out potential competitive environmental sustainability advantages and risks

Colours for quantitative indicators are benchmarked against **product specific reference group**



Gaia Biorefiner sustainability indicators

All relevant environmental sustainability issues covered*



1. CLIMATE CHANGE

1.1 GHG emissions from production REF

1.2 GHG emissions from transport REF

1.3 Carbon balance

2. WATER

2.1 Water withdrawal REF

2.2 Water scarcity where produced

2.3 Desalination before production

3. ENERGY

3.1 Energy intensity of production REF

3.2 Share of renewables in production energy

4. LAND USE

4.1 Land use efficiency of raw material production REF

4.2 Land use synergies through ecosystem services

4.3 Threat to food production from raw material production

4.4 Threat to biological diversity from raw material production

4.5 Risks through indirect land use change

5. CHEMICAL RISKS

5.1 Environmental hazard of production chemicals

5.2 Health hazard of production chemicals

5.3 Safety hazard of production chemicals

6. RESOURCE DEPLETION

6.1 Fossil intensity REF

6.2 Mineral intensity REF

7. MATERIAL EFFICIENCY

7.1 Alternative uses of raw material

7.2 Main raw material utilization rate to products

7.3 Product type ratio

7.4 Waste per product ratio REF

8. WASTE TREATMENT

8.1 Wastewater treatment

8.2 Waste gas treatment

8.3 Solid waste treatment

9. NUTRIENT RECYCLING

9.1 Threat to soil nutrient balance from raw material production

10. END USE

10.1 Product functionality

10.2 Storage properties

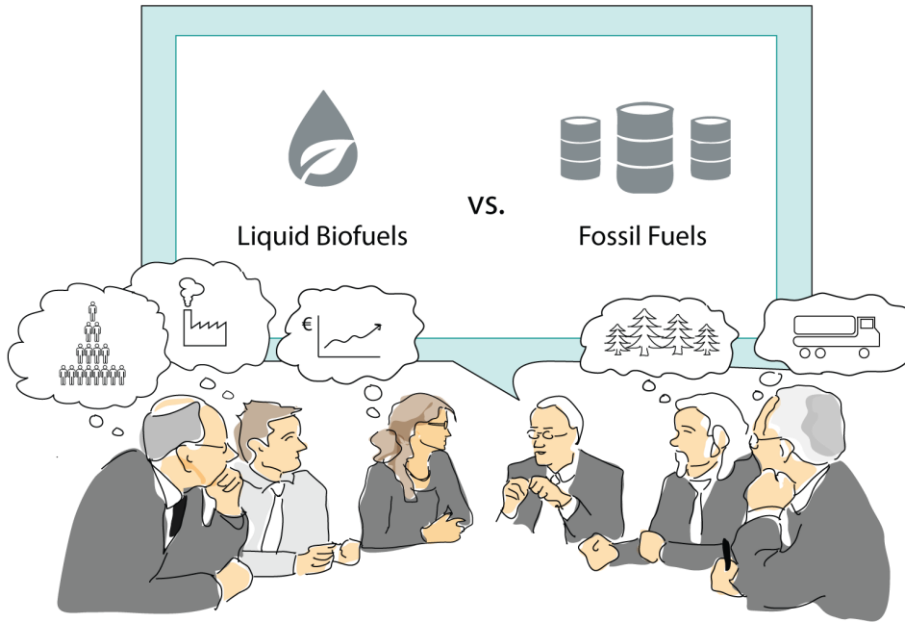
10.3 Risks related to use and disposal

10.4 Biodegradability

* Indicator framework for chemicals

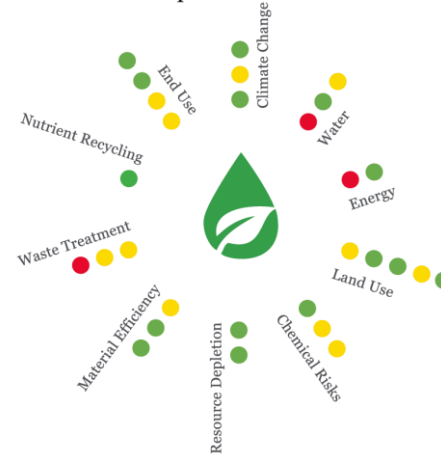
Gaia Biorefiner case example

Benchmarking the environmental sustainability of two heating fuels



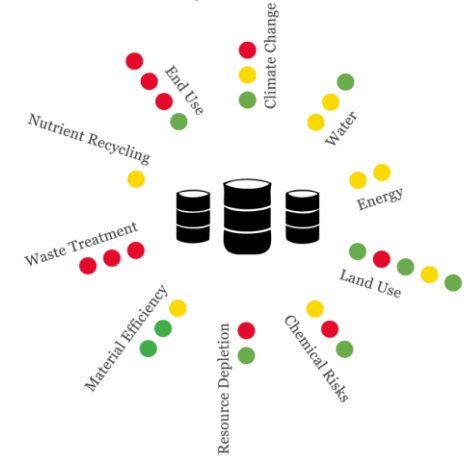
Biofuel:

Wood to tall oil pitch



Fossil fuel:

Crude oil to heavy fuel oil



“Forchem supplies industry-leading products to global players across a wide range of markets. Gaia Biorefiner provides a great way to benchmark the sustainability of our products with competing products and communicate it to our customers. We use the results as a major tool in our sales and marketing. I highly recommend its use to any company working with bio-based products.”

Janne Lukkarinen, Business Development, Forchem

