



Sustainability Issues of 2nd Generation Biofuels

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What is 'Sustainable'?

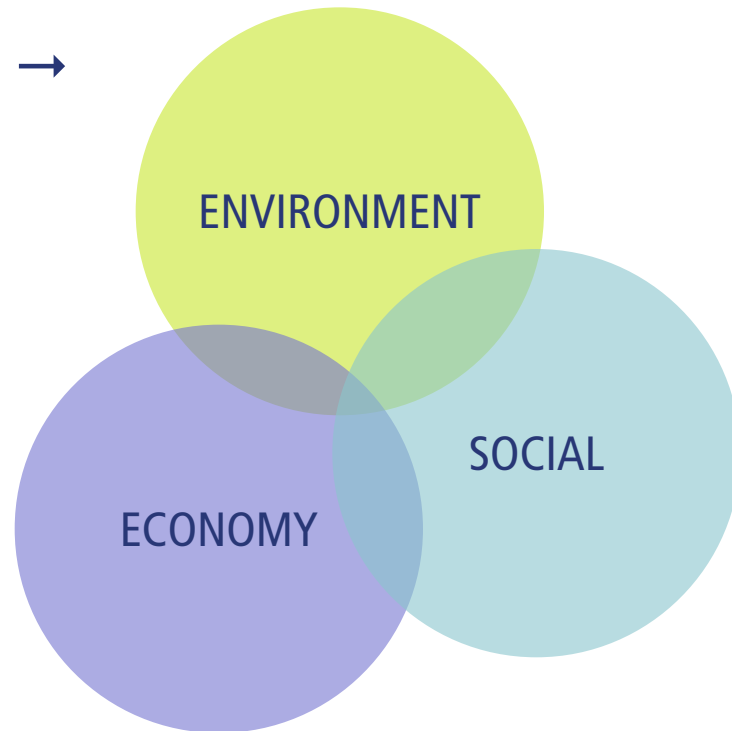
- Sustainability Initiatives
- Sustainability Issues (Focus 2G Biofuels)

What is ‚Sustainable‘?



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- The 3 pillars of sustainability →



- Global climate equality:
 - ↳ „Convergence and Contraction“: Greenhouse gas (GHG) emission reduction of at least 80% by 2050 for developed countries to allow economic development for developing countries
 - ↳ 2 t_{CO2e}/capita by 2050

Sustainability Criteria



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1 Environmental	1.1 Climate	1.1.1 GHG balance	
		1.1.2 Carbon sinks	
	1.2 Biodiversity	1.2.1 Biodiversity	
	1.3 Local environmental effects	1.3.1 Air quality	
		1.3.2 Soil quality, erosion	
		1.3.3 Water quality and resources management	
2. Social	2.1 Social well-being	2.1.1 Social well-being of employees and local population	
		2.1.2 Health and safety	
		2.1.3 Pay and conditions for employees, trade unions	
		2.1.4 No child employment	
		2.1.5 No discrimination	
		2.1.6 Women's rights	
3. Economic	3.1 Local economic effects	3.1.1 Local prosperity	
4. Other	4.1 Competition with food/ other indirect effects of land use change	4.1.1 Food competition	
		4.2.1 Transparency, stakeholder participation	
		4.2.2 Compliance with applicable laws, regulations and customary rights	
		4.2.3 Land use rights	
		4.2.4 Documentation, implementation, monitoring	
	4.2 Governance	4.2.5 Training	
		4.2.6 Continuous improvement in social and environmental aspects	
		4.3 Good Agricultural Practice	4.3.1 Minimum level of maintenance
			4.3.2 Use of agrochemicals
4.3.3 Waste reduction, recycling, re-use, disposal			

Content



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Sustainability Initiatives



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- Bioland – Organic Agriculture – Germany
- FSC – International Forest Stewardship Council
- RSPO – International Roundtable for Sustainable Palm Oil
- RTRS – International Roundtable for Responsible Soy
- RSB – International Roundtable on Sustainable Biofuels
- ISCC – International Sustainability & Carbon Certification
- LCFS – California Low Carbon Fuel Standard
- RTFO – UK Renewable Transport Fuel Obligation
- EU-RED – European Union Renewable Energy Directive
 - ↳ BioKraft-NachV – German Biofuel Sustainability Ordinance
- ISO 13065 – International Standard Sustainable Bioenergy

EU Renewable Energy Directive (RED)



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*„Promotion of the use of energy from renewable sources”
(EU-RED – Directive 2009/28/EC)*

- Adopted on 23 April 2009 > Applicable from 1 January 2011
- Mandatory target of 10% renewable transport fuels by 2020 for each EU Member State
- Includes sustainability criteria for
 - all bioenergy feedstocks
 - all countries of origin (EU and import)
 - all bioenergy uses (“biofuels” and “bioliquids”)
- EU Fuels Quality Directive (FQD) contains the same sustainability criteria
- First sustainability certification schemes accredited in Germany early 2010 (ISCC, REDcert)
- Some 1 dozen schemes currently under EU accreditation in Brussels

EU Renewable Energy Directive: Criteria



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*„Promotion of the use of energy from renewable sources”
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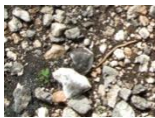
Mandatory thresholds (exclusion criteria):

- Article 17 (2) – Greenhouse Gas Emissions
- Article 17 (3) – High Biodiversity Value Areas (primary forest, ...)
- Article 17 (4) – Land with High Carbon Stock (forests, wetlands)
- Article 17 (5) – Drained peatland
- Article 17 (6) – Good Agricultural Practice (GAP)



Reporting obligations (Article 18 (3) – Measures taken for...)

- Soil, water, and air protection
- Restoration of degraded land
- Avoidance of excessive water consumption
- Social sustainability
- Availability of foodstuffs at affordable prices
- Development issues
- Land use rights
- International treaties (ILO, et al.)



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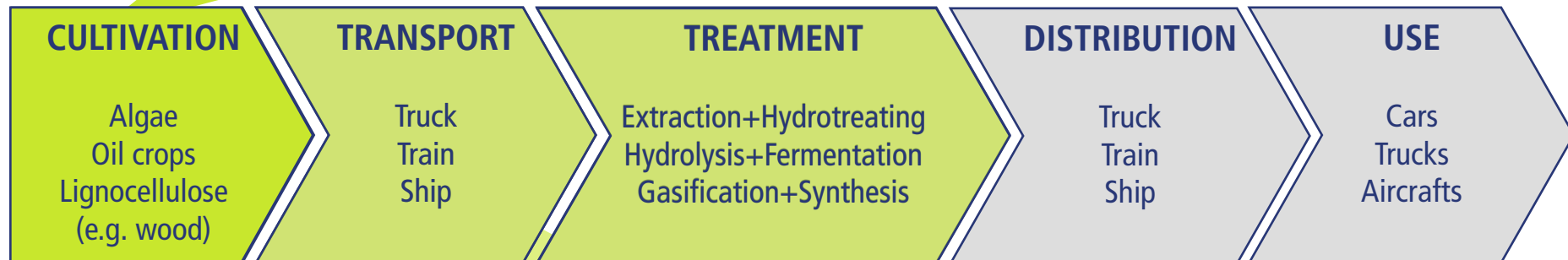
Sustainability Issues (Focus 2G Biofuels)

Generic Supply Chain 2nd Generation Biofuel



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- **Cultivation** of biomass usually dominates biofuels' sustainability performance, especially with regard to greenhouse gas emissions.
- Sustainability of **waste biomass** is generally robust.

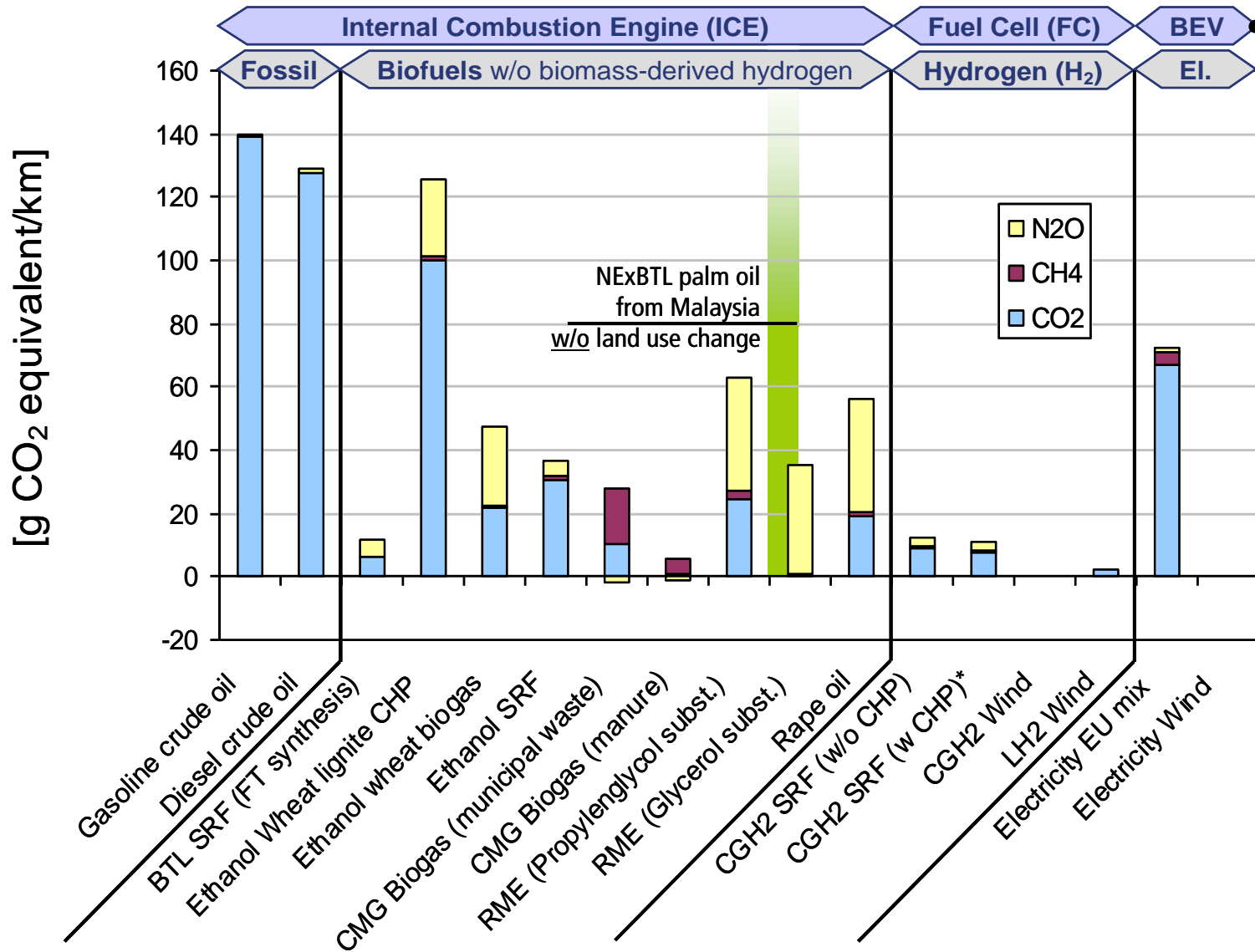


External process energy and **sea shipping** usually dominate particulate matter (PM), sulphur dioxide (SO₂) and nitrogen oxide (NO_x) emissions.

GHG emissions Well-to-Wheel w/o land use change



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Battery-electric low performance

- Driving distance
- Refueling time

Ludwig-Bölkow-Systemtechnik GmbH, 2010

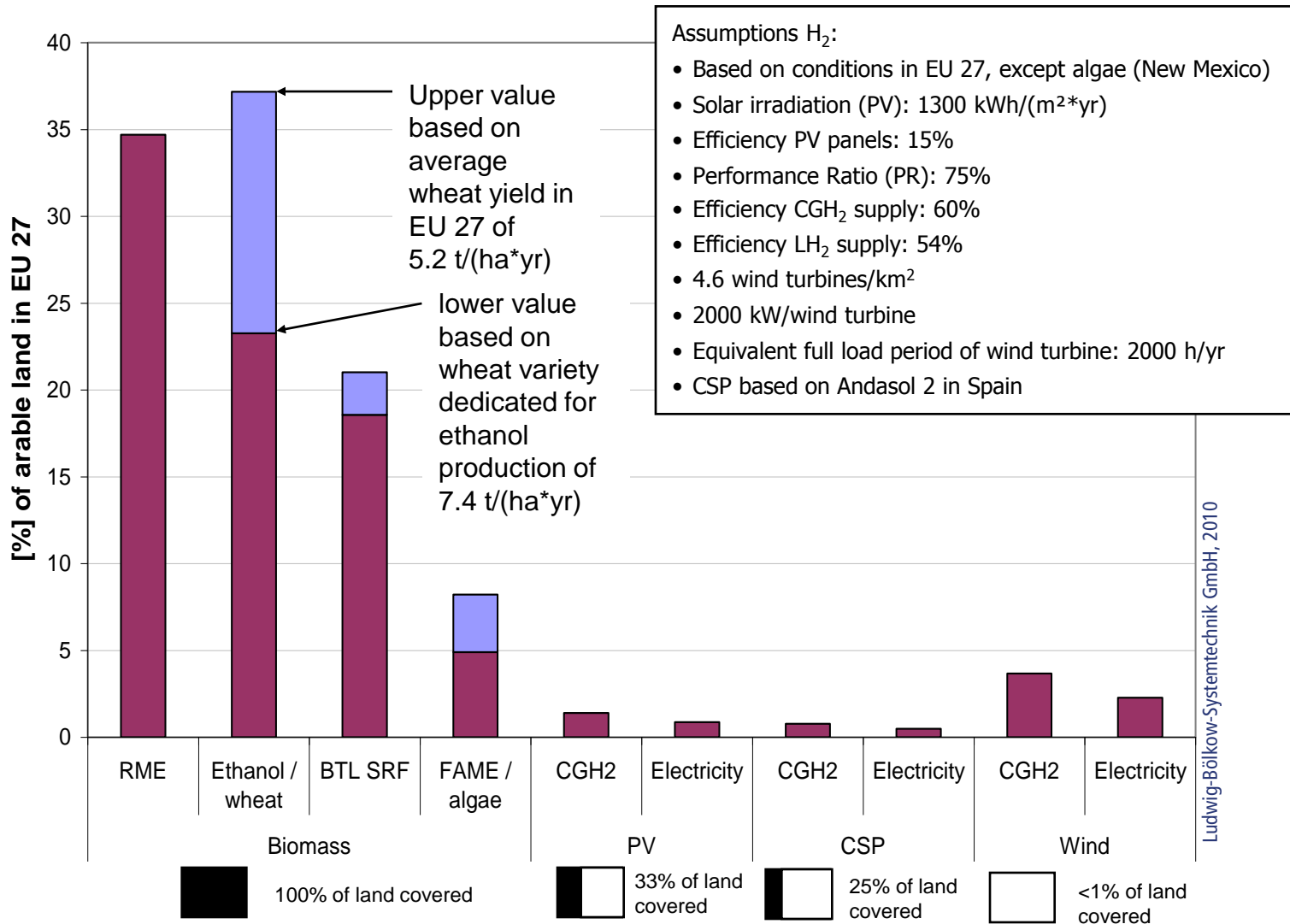
Reference vehicle: VW Golf
SRF: Short rotation forestry
GHG: Greenhouse Gas
Sources: JEC 2008, LBST
E3database

* Excess heat from gasifier and gas engine is fed into a district heating grid

Land requirement to provide 10% transport fuel



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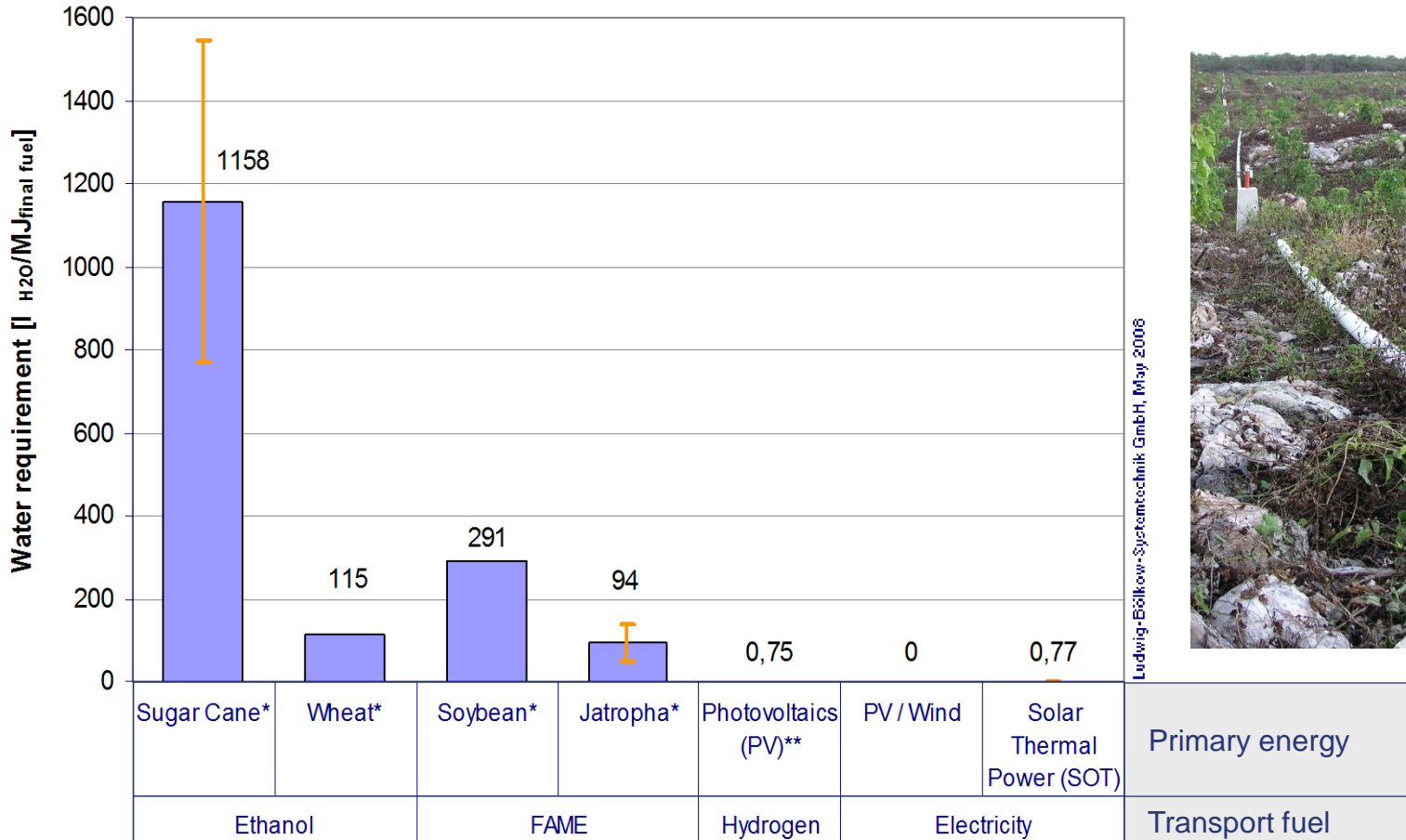
PV: Photovoltaics
CSP: Concentrated Solar Power

Water Intensity of Transportation Fuels

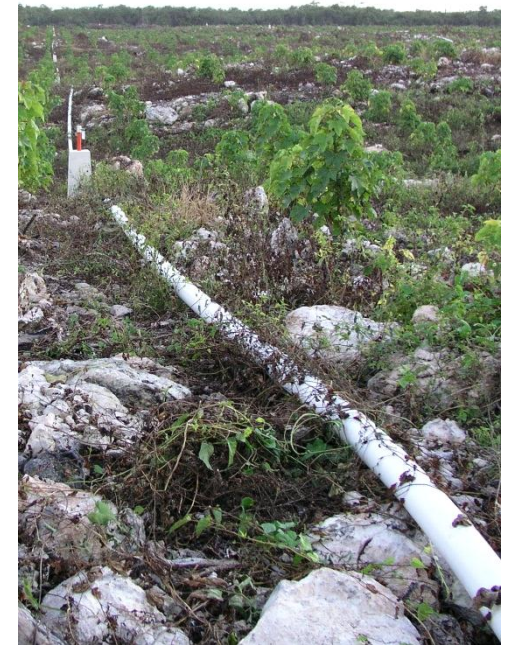


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- Net water requirements are subject to local climatic conditions and yield expectations



Ludwig-Bölkow-Systemtechnik GmbH, May 2008



Spray irrigation

* Cultivation of the energy crops

** Water for hydrogen production via electrolysis

Key Environmental Sustainability Issues



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- **Short rotation forestry (BTL, Lignocellulosic Ethanol)**
 - Loss of bound carbon through land-use change
 - Soil quantity (humus balance)
 - Use of genetically modified plants (GMOs)
 - Monoculture (migration routes and ecosystem services)
 - **Oil crops (Jatropha, Camelina, ...)**
 - Loss of bound carbon through land-use change
 - Soil quantity (humus balance) and quality (compaction)
 - Water availability and quality (nitrogen and pesticide washing-off)
 - Monoculture (migration routes and ecosystem services)
 - **Algae**
 - Water availability and quality
 - GMOs in connected/open systems
- ⇒ **Sustainability performance is significantly project sensitive, especially with regard to new processes and geographies.**

Biodiversity

- Most relevant with biomass cultivation (interaction of ecosystems)
- Major issues are endangered species, invasive species, monoculture, and habitat patterns

Social

- Land ownership
- Labour sourcing, health and safety
- Potentially aggravating inequality through wealth distribution and gender preferences

Local Economy

- Benefits may be great through regular, paid labour (direct and indirect)
- Subsistence economies threatened?
- Vulnerability from market domination

⇒ Comprehensive assessments required beyond the scope of single projects.

⇒ Mandatory social criteria beyond WHO/ILO may be challenged via WTO/GATT.

Thank you!



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