

Ecological Assessment of Biofuels

1. Life Cycle Assessment
LCA as part of
Sustainability Analysis
2. Results of an LCA Study
3. Roundtable on
Sustainable Biofuels RSB

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UNIDO CEE Biofuels Workshop
Dubrovnik, 12/13 November 2007

RSB Roundtable on Sustainable Biofuels



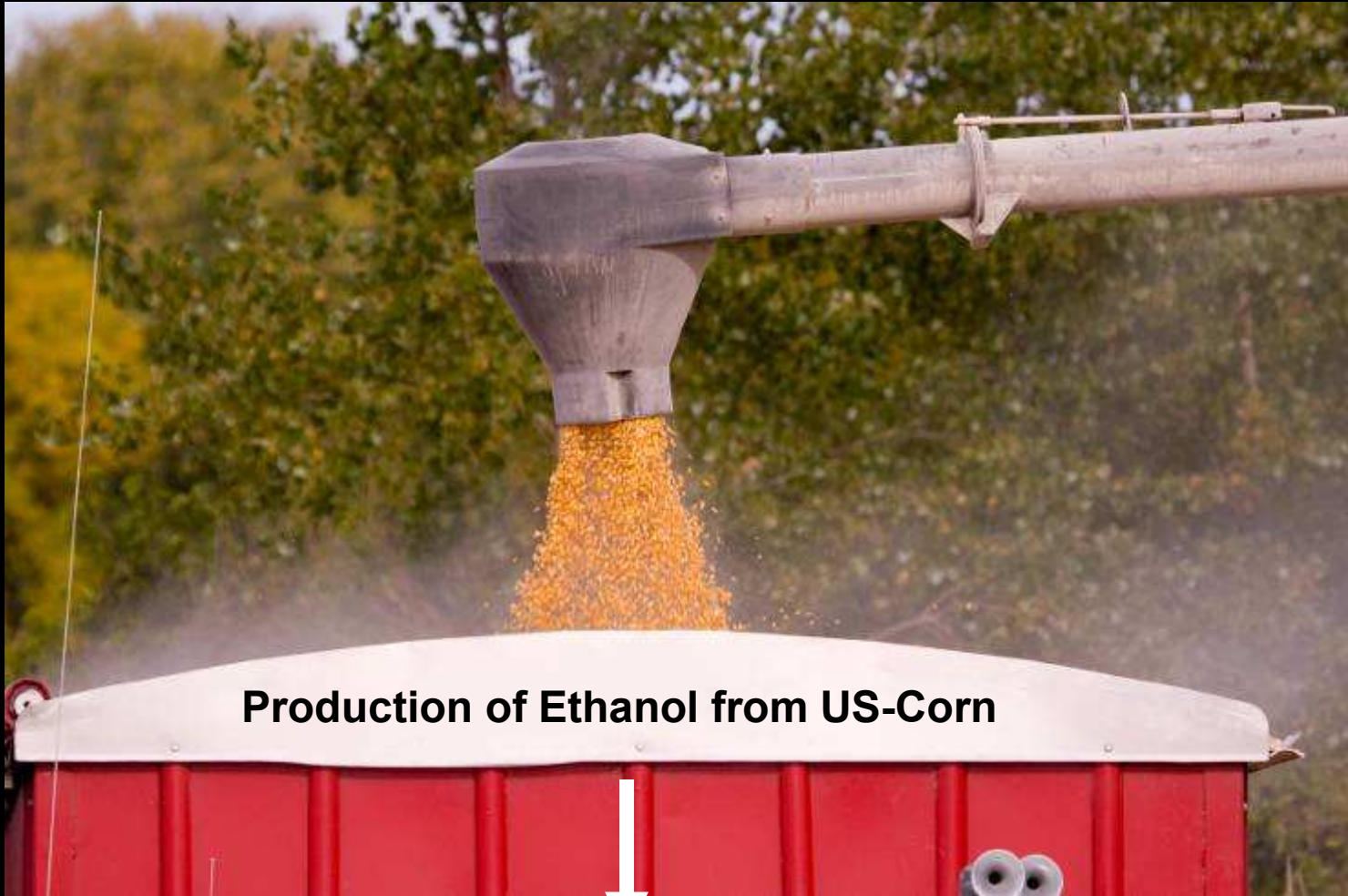
Materials Science & Technology



ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE



but...



Production of Ethanol from US-Corn

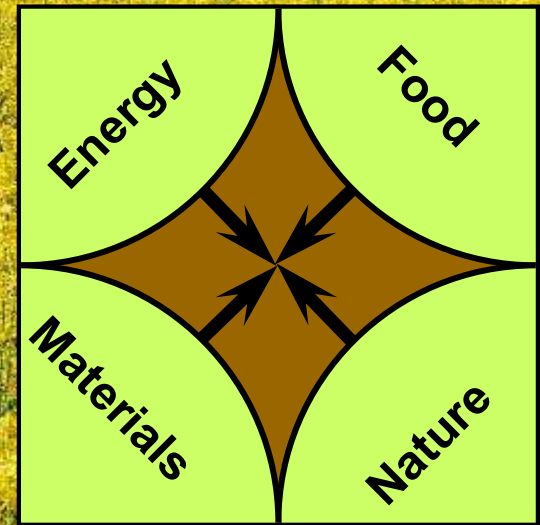


Massive increase of Tortilla price in Mexico



but...

**Land is needed
for the production
of biofuels**



but...



**Oilpalm plantations on
rain forest areas
in Malaysia und Indonesia**



**Massive loss of
species richness**



but...

**GHG-Emissions
from wood and soil**



**Forest clear-cuts in the Amazon region
for cultivating soy beans**



Swiss study about biofuels, background:

- Revision of the law about taxation of fuels (2007):
Tax reduction or exemption on environmentally friendly fuels

Criteria:

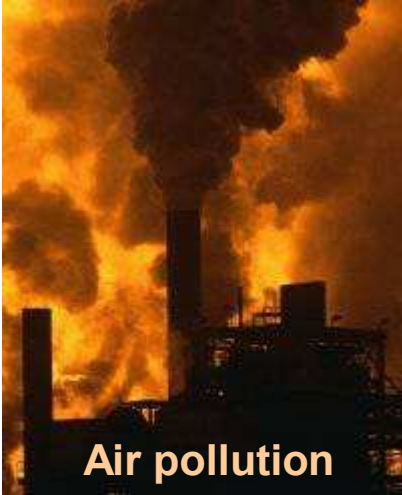
- „positive ecological overall balance“ -> Method: LCA
- „no negative social effects“ -> Method: ???
- Ministries for Energy, Environment and Agriculture commissioned a LCA study (according to ISO 14040) with broad stakeholder involvement

Proposal for enforcement rules of the law is in discussion.....

Environmental impacts of fuel production?

For fossil fuels

... and for biofuels



Why Life Cycle Assessment?

Example: Fossil Energy Demand of Biofuels

Fossil fuel → **Biofuel**



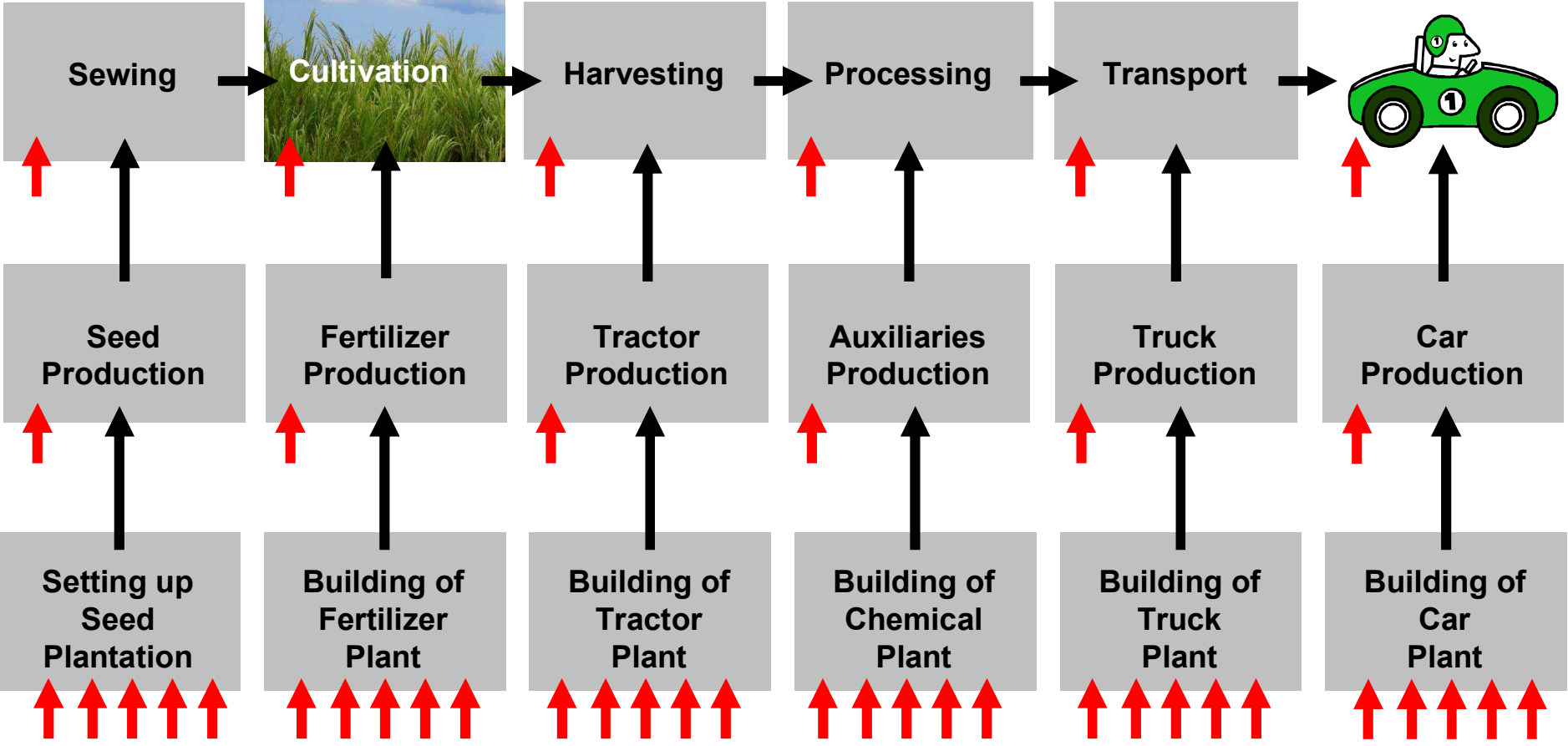
On a first approach

→ 100% savings of fossil energy sources

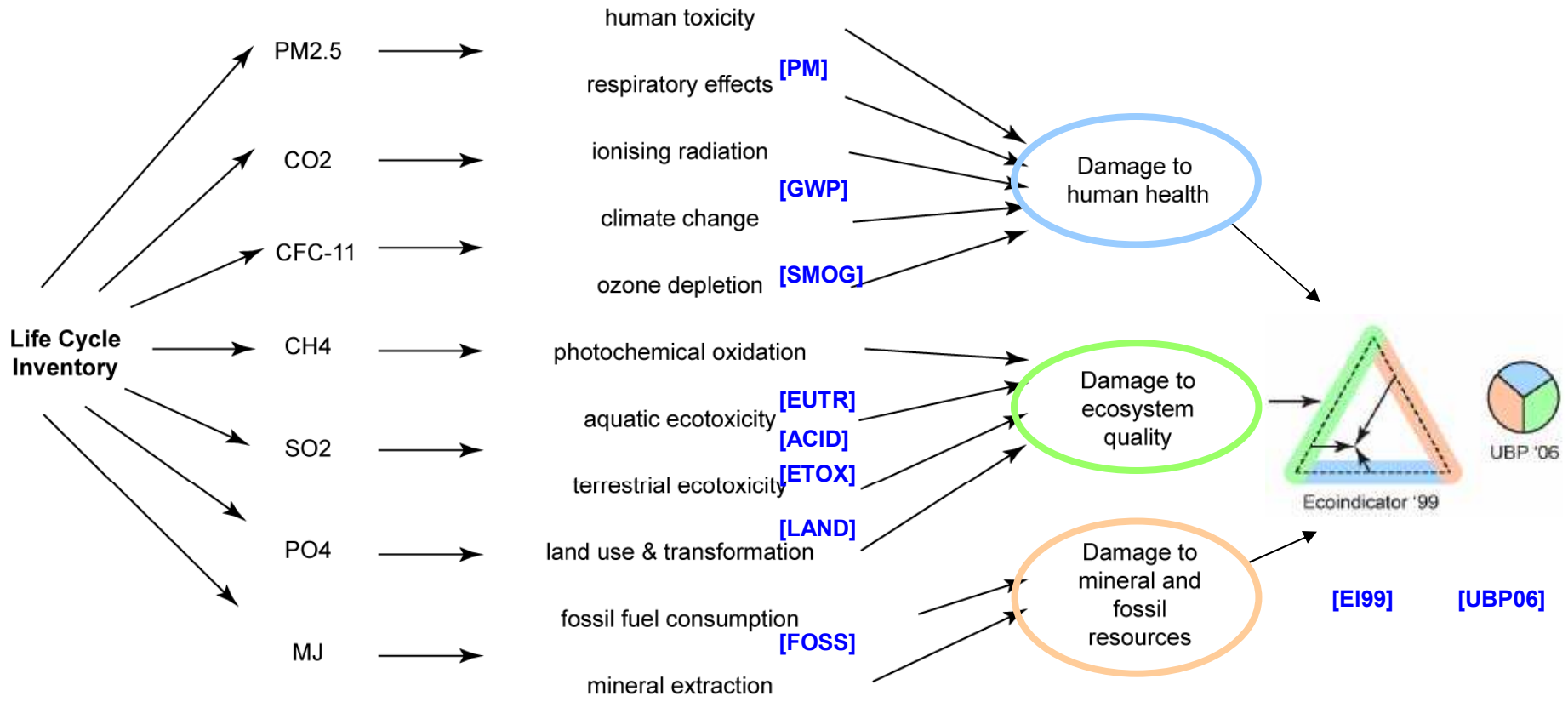
Example: Fossil Energy Demand of Biofuels



➔ Material flows
➔ Fossil Energy flows

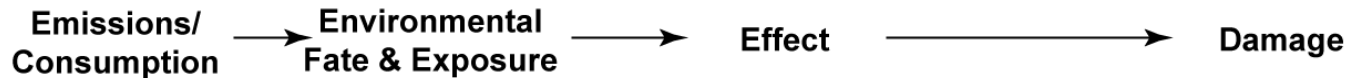


Methodology of Life Cycle Assessment



Midpoint-Indicators

Overall-Indicator:



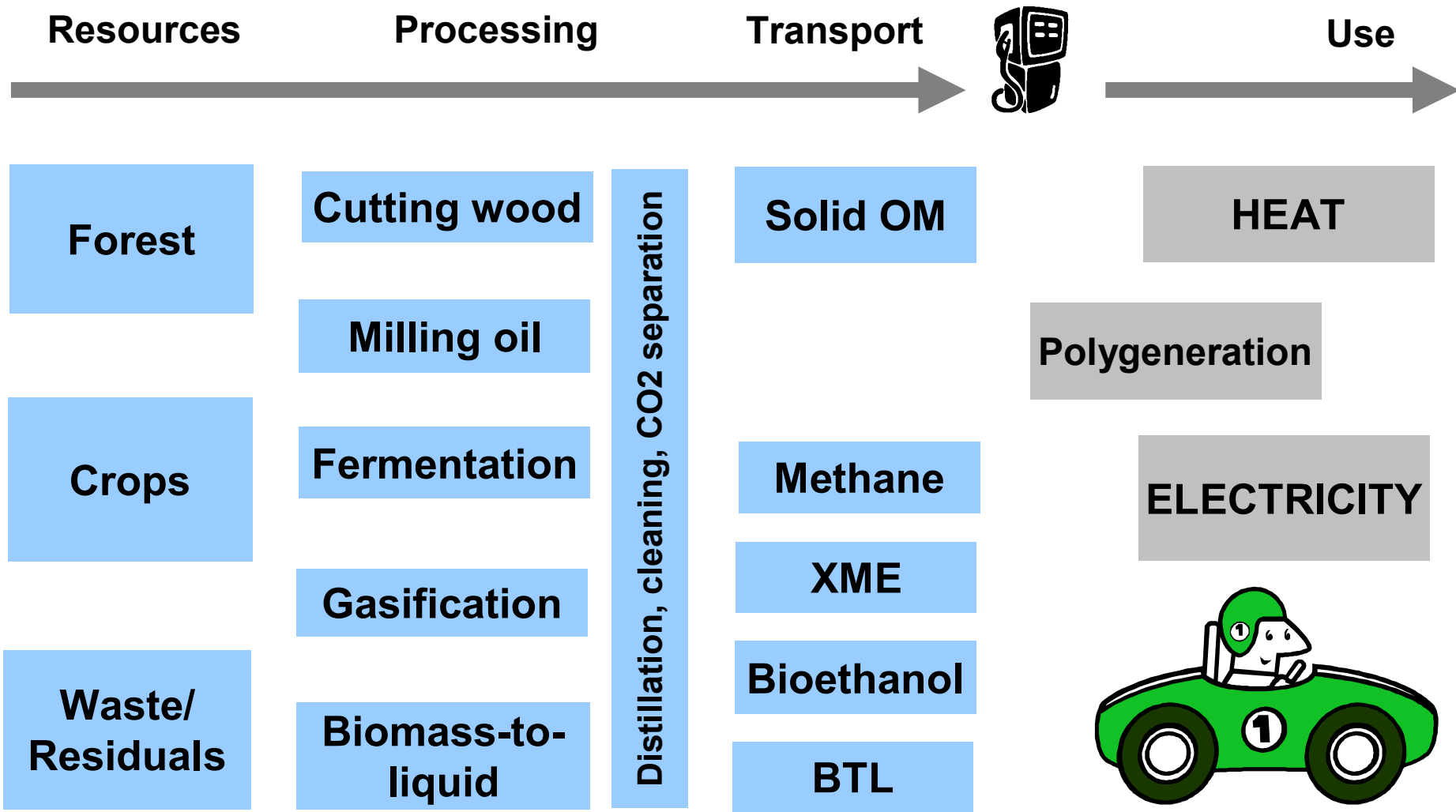
Environmental burden as one only number
-> 'Ecobalance'

Scientific accuracy

Relevance for the society

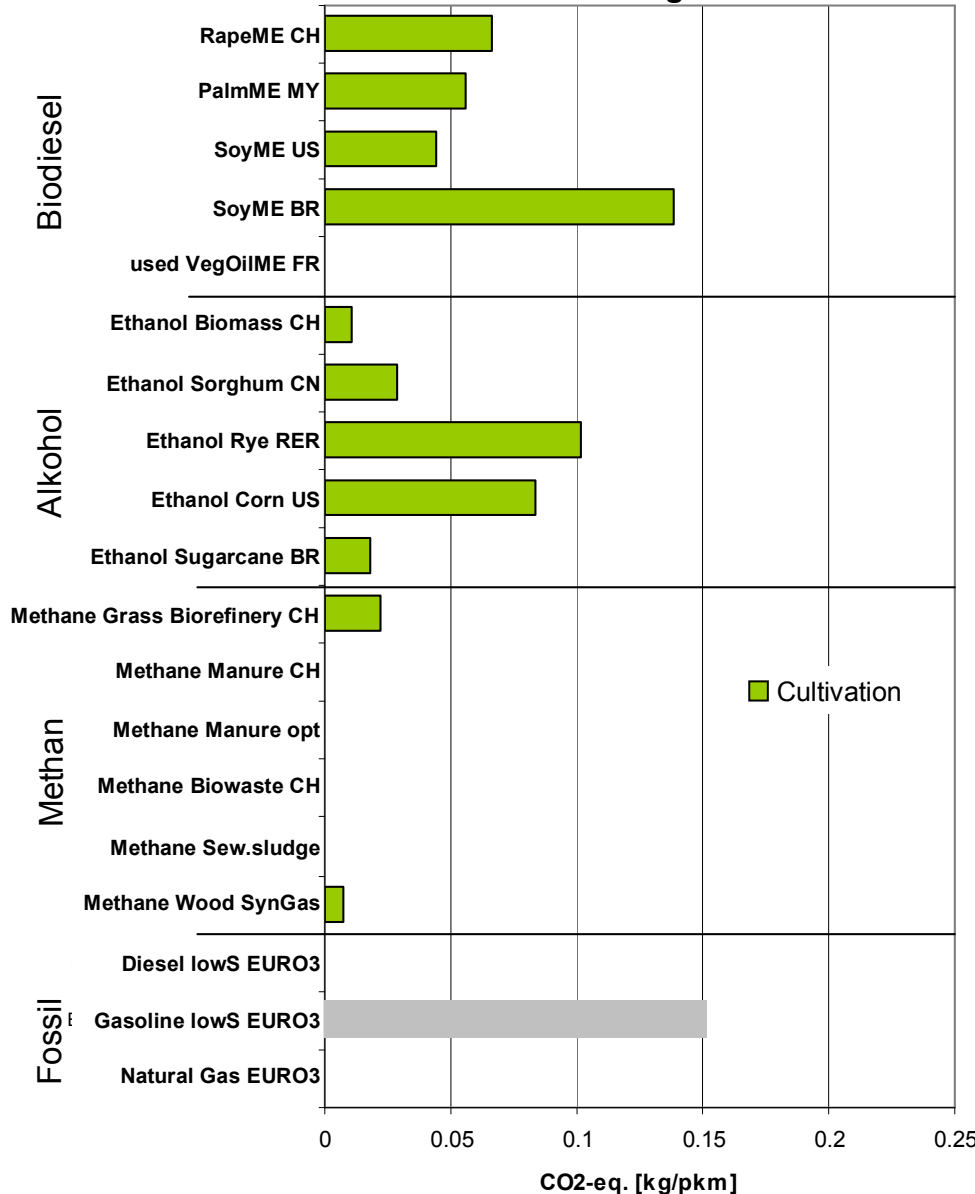


Bioenergy pathways





Global Warming Potential



- Waste feedstock has no environmental footprint
- Large differences among different feedstocks
- Factor of 8:
 - Yield / ha
 - Intensity of fertilizer use and mechanical activities
 - Emissions of N2O
 - Forest clear-cuts

Resources

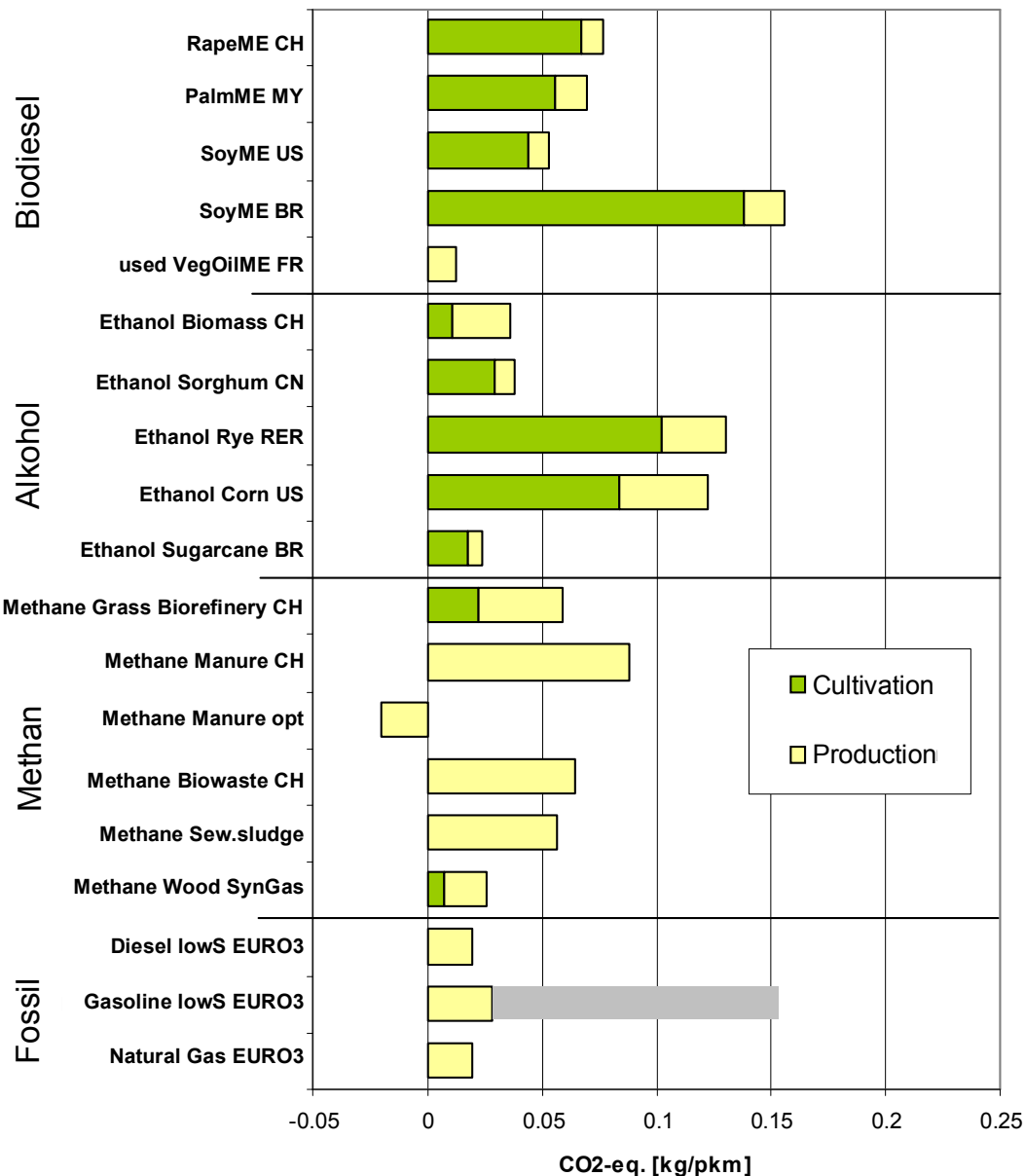
Processing

Transport



Use

Global Warming Potential

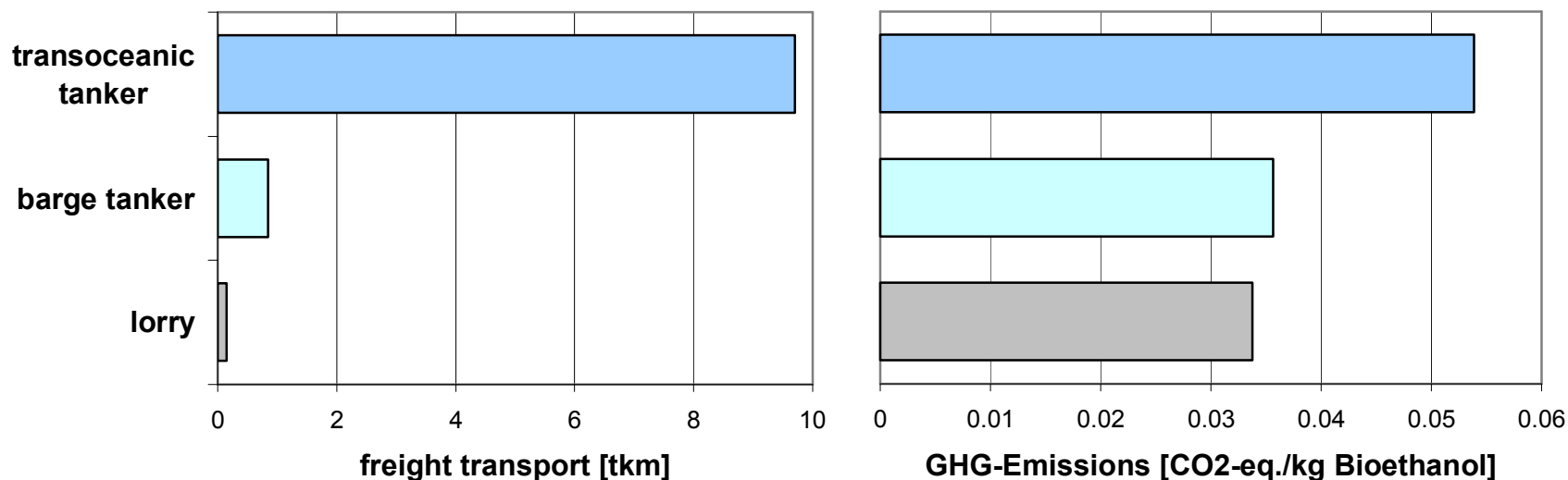


- Biodiesel: production is simple and impacts are low
- Ethanol: varying intensities
- Methane: methane loss is highly relevant
- In general: processing < feedstock supply



The relevance of fuel transport?

- Example: Transport of Bioethanol Brasil -> CH



- Differences of 10x in transport distances
- → marginal differences in GWP

Resources

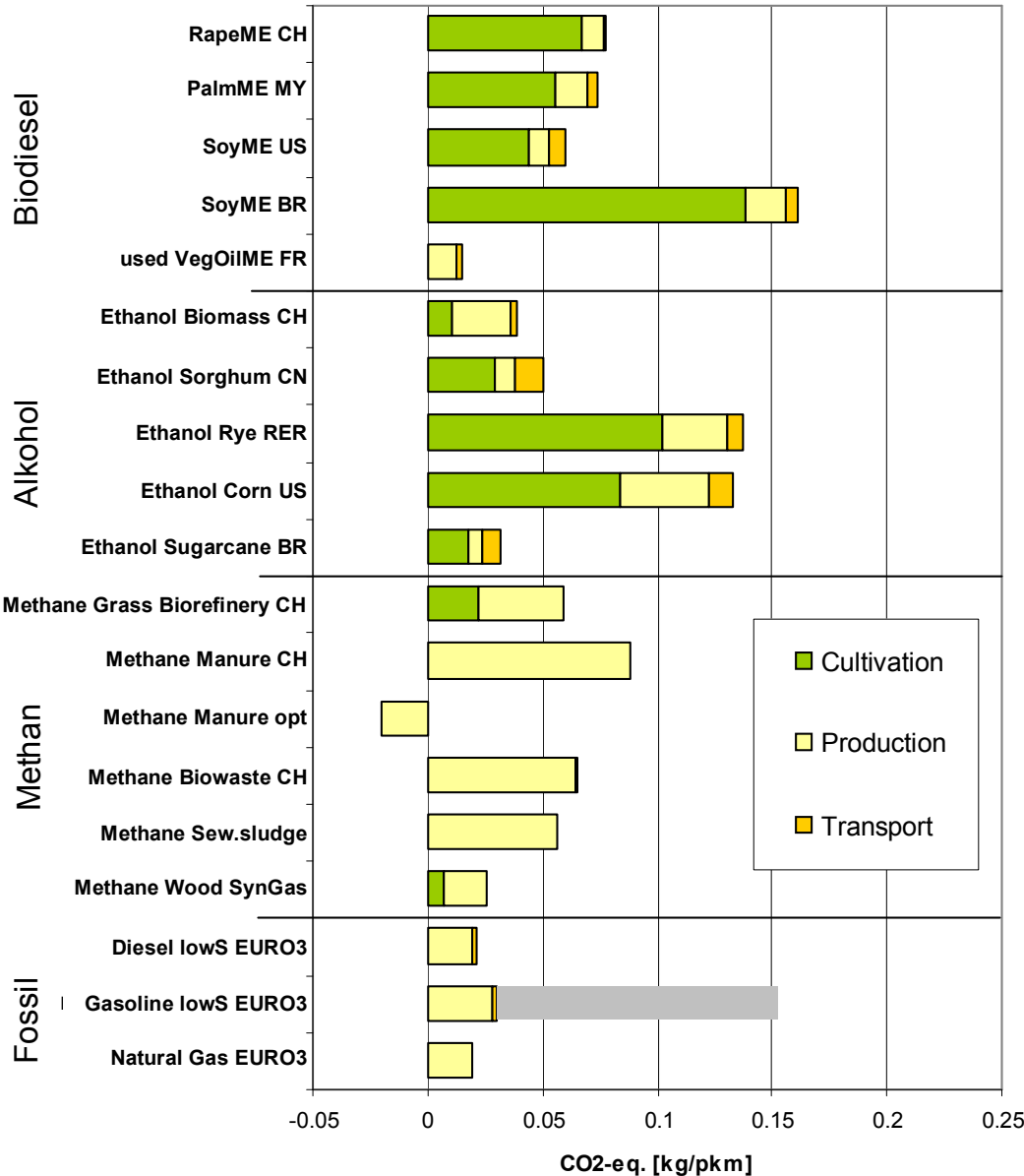
Processing

Transport



Use

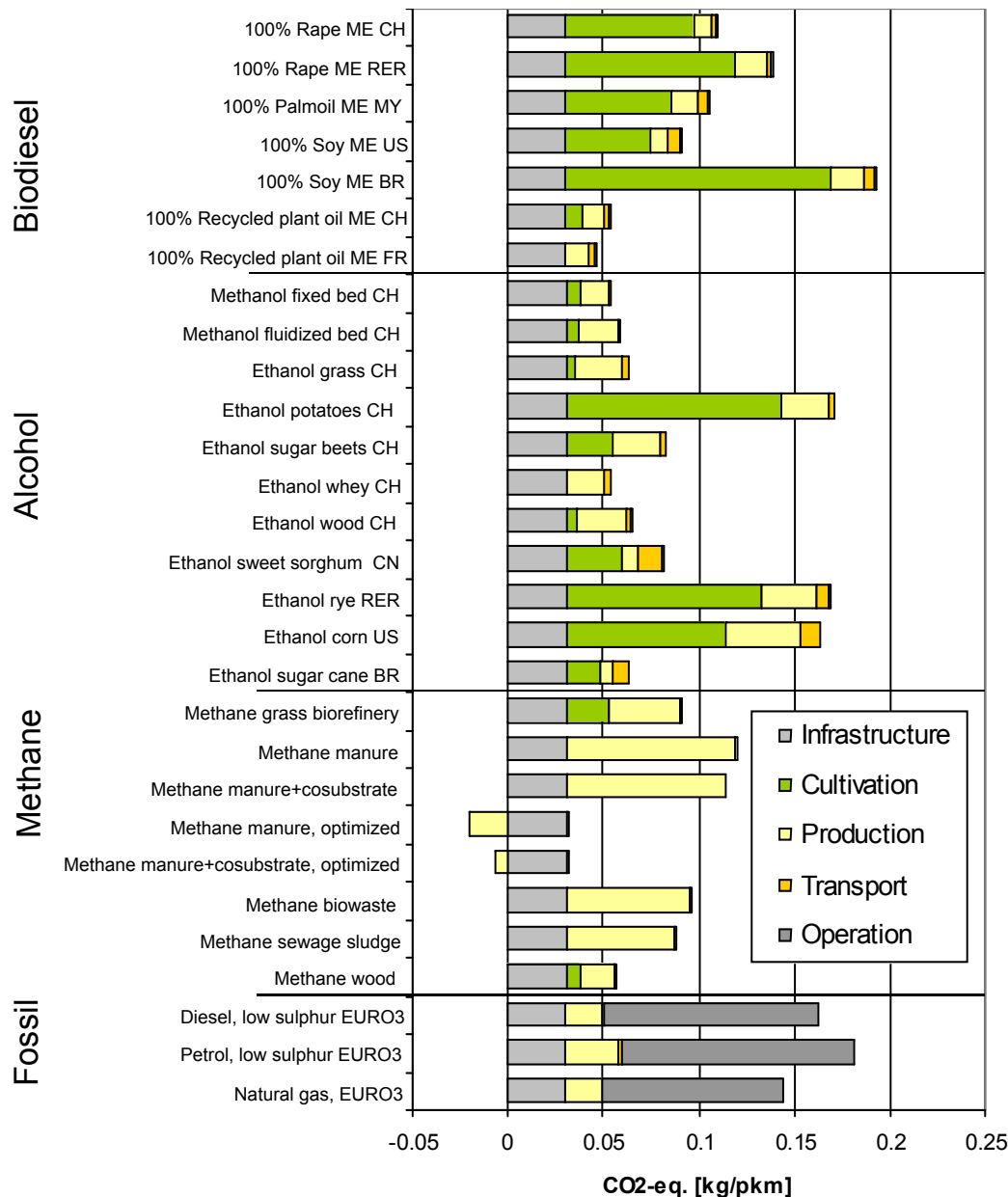
Global Warming Potential



- Transport of fuels: < 10% of GWP
- Transport < Processing < Supply of feedstock



Global Warming Potential CO2-eq.

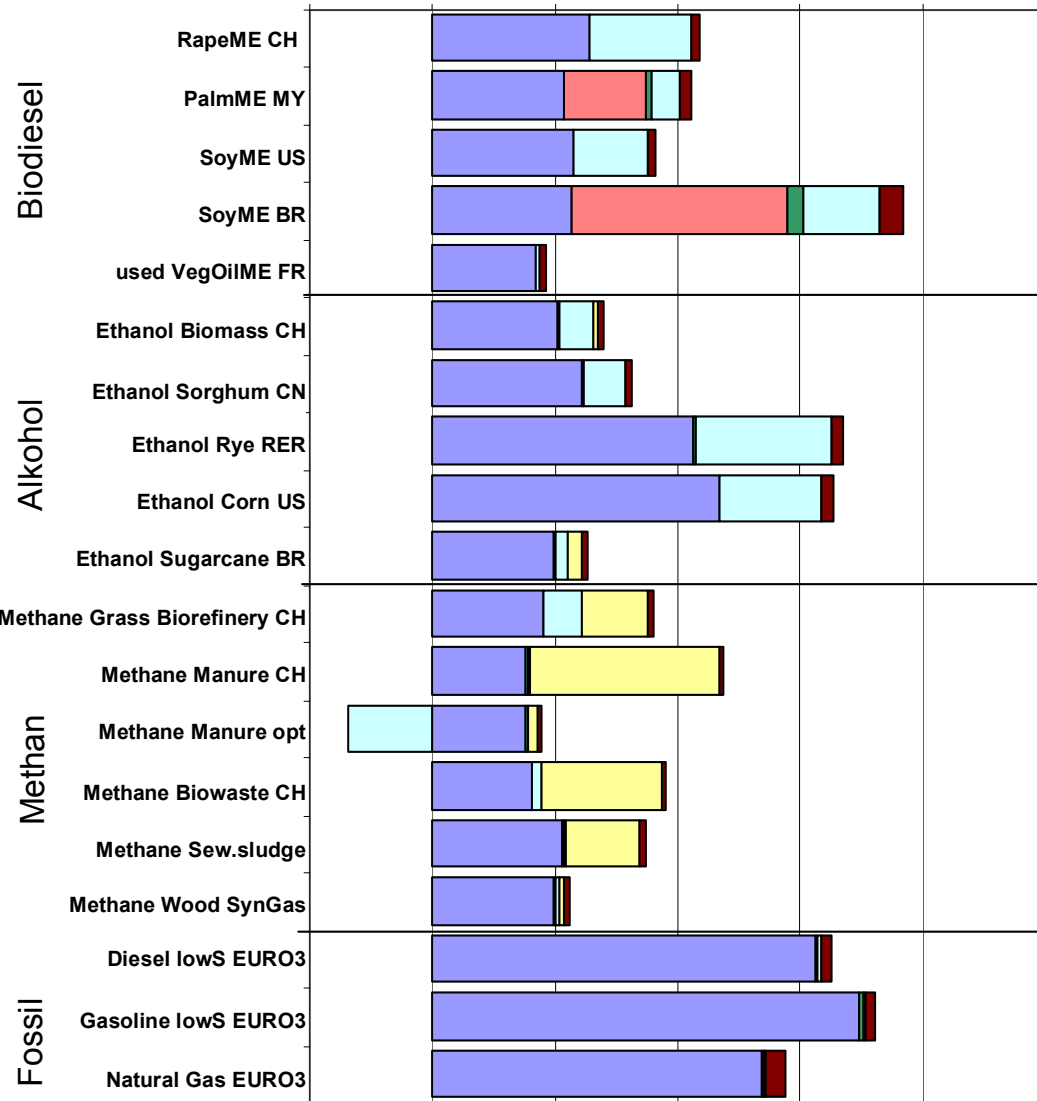


Total chain from cultivation to use

- GHG-reductions from 0% to 90%
- Largest impact from agriculture -> land use
- In every fuel class there are good and bad pathways
- Best agricultural feedstock: sugar cane BR
- Best overall chain: methane from manure with coverage

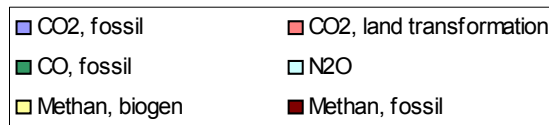
Global Warming Potential kg CO₂-eq. per pkm

-0.05 0 0.05 0.1 0.15 0.2 0.25



Contribution distinction for the whole chain

- GHG-Emissions are dominated by fossil CO₂
- Clear cutting forests up to 50%
- N₂O emissions from soils: up to 40%
- Production of biogas is dominated by Methane emissions



Not only Greenhousegas matters

GHG

selected midpoint indicators

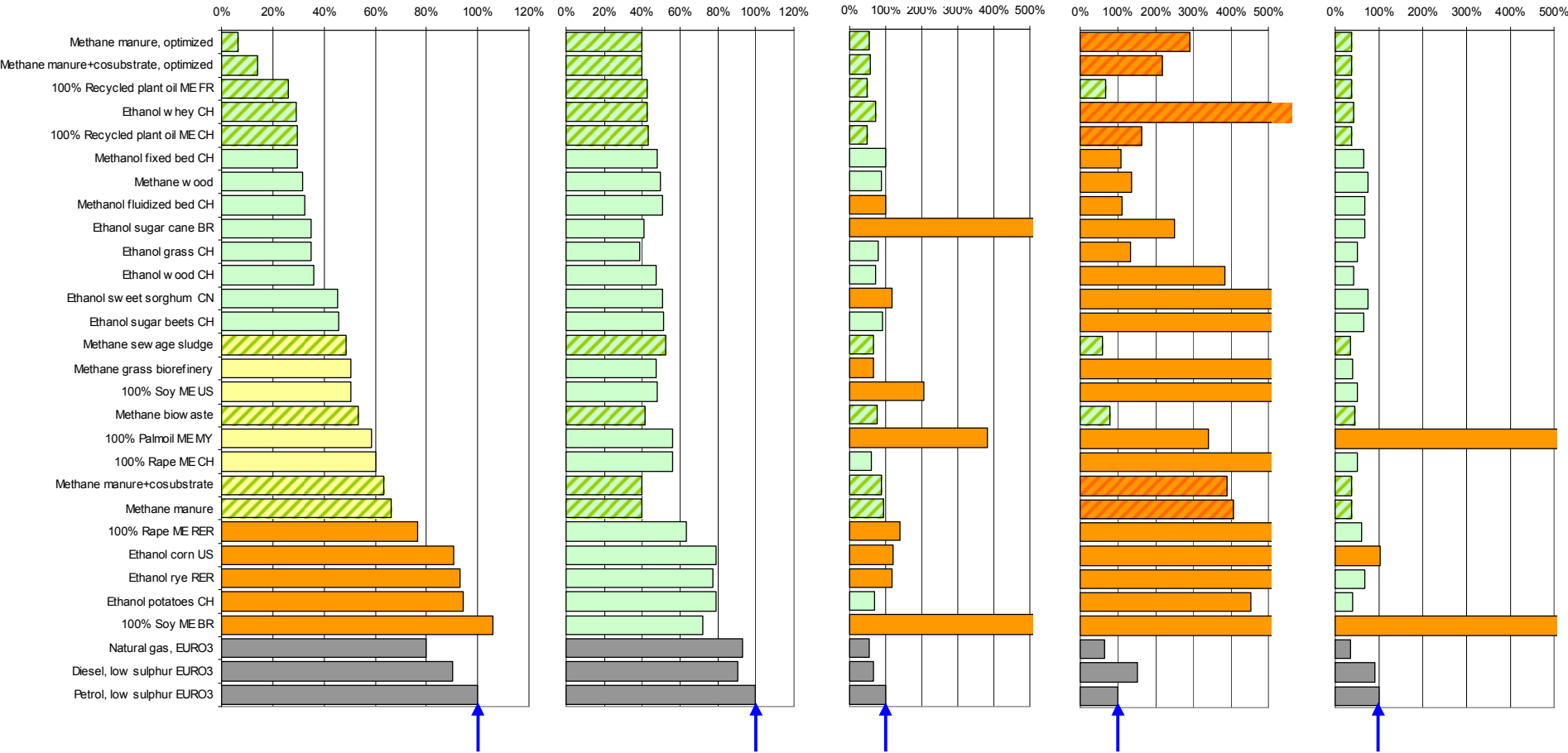
Greenhousegas CO₂-eq.

Non-renewable Energy

Smog

Eutrophication

Ecotoxicity



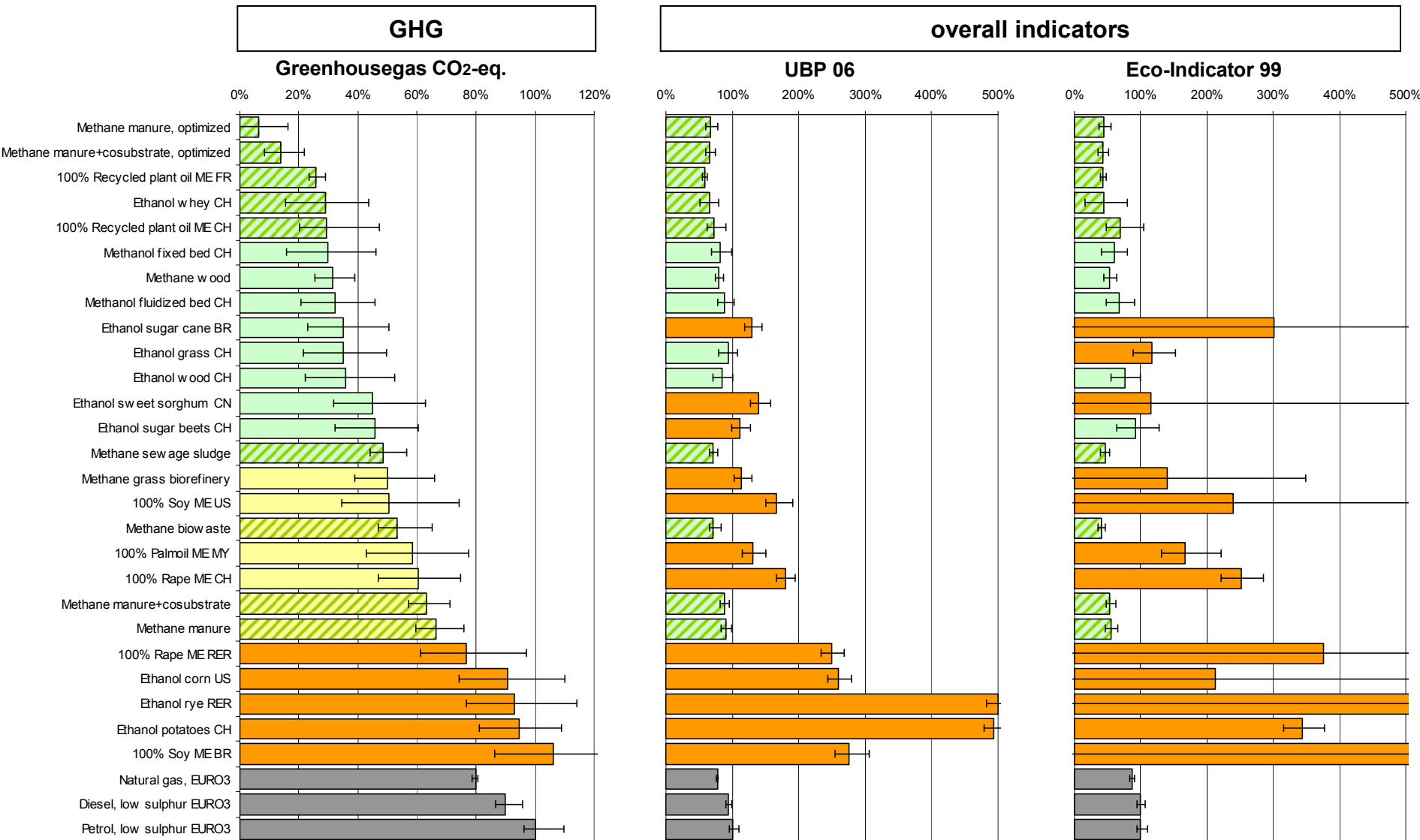
Petrol = reference 100%

green = better than petrol

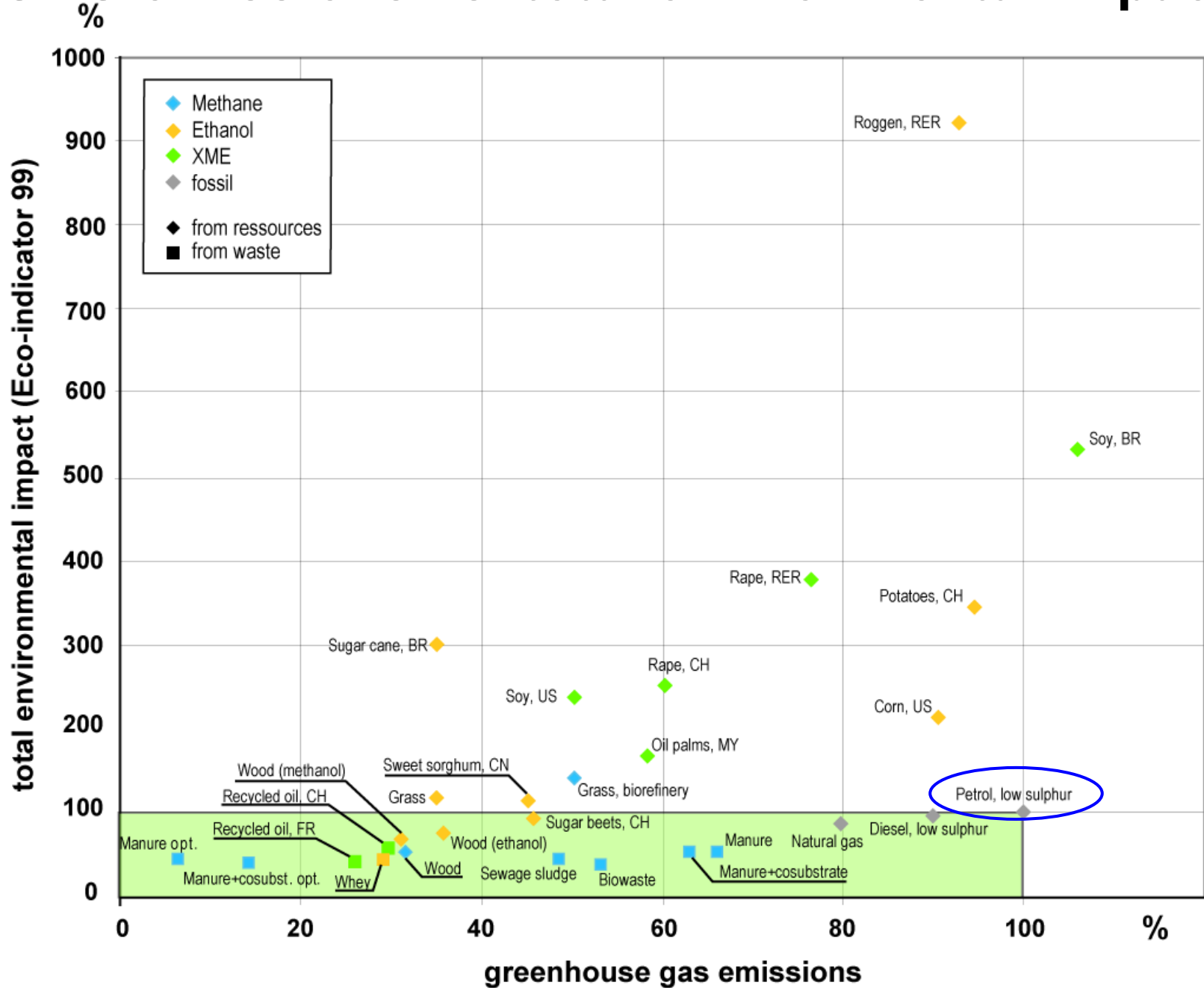
red = worse than petrol



Not only Greenhousegas matters



GHG emissions vs. total environmental impact



Roundtable on Sustainable Biofuels RSB

International multi-stakeholder initiative to coordinate and develop principles and criteria for sustainable biofuels production

Secretariat:

Energy Center, EPFL

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<http://EnergyCenter.epfl.ch/Biofuels>

www.bioenergywiki.net

Bioenergy
Wiki



Structure

- **Steering Board members:**
include WWF, BP, Shell, National Wildlife Fed, FSC, Petrobras, Mali Folkecenter, Univ. Cal Berkeley, TERI India, Toyota, UNEP
- **Chair:** Mr Claude Martin
(former CEO of WWF)
- **Secretariat** based at EPFL. Coordination of the RSB.
- **Four Working Groups + Expert Panels** to make recommendations to the Steering Board. 142 participants from international organisations, NGOs, private sector and academic institutions

The 4 Working Groups

- **Greenhouse gases efficiency**: Validation of a reliable method to measure GHG balance on a Life Cycle perspective. About 80 members + 1 Expert Advisory Group
- **Environment**: Definition of principles and criteria that ensure biofuels to be a clean alternative (conservation, maintenance of soil, water and air sustainability, ensuring best practices in the use of technologies). More than 120 members + Expert panels on each topics to be covered
- **Social**: Definition of principles and criteria ensuring that biofuel channels are in accordance with WTO rules and prove beneficial for local livelihood and national economies. 75 members + Expert panels
- **Implementation**: Validation/adjustment of the principles and criteria against field reality and through pilot projects. 75 members + field partnerships

Working Progress

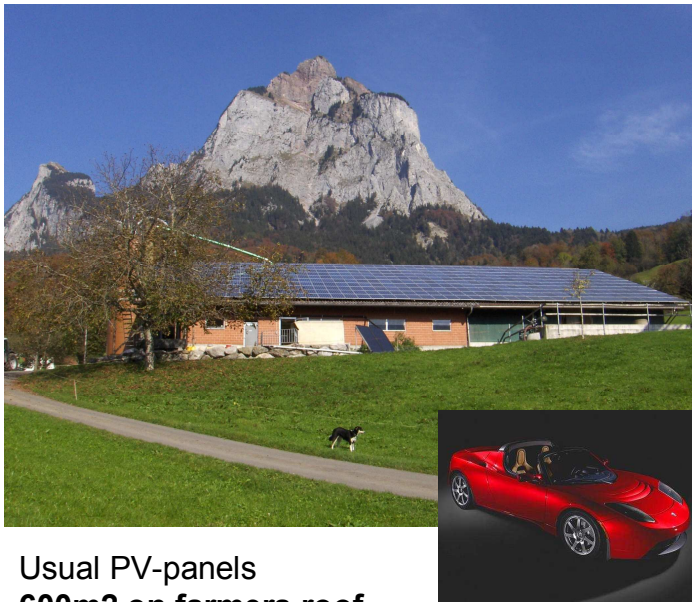
2nd round of working group consultation finished:

- Draft of principles exists (www.bioenergywiki.net)
- Consensus on principles by end of 2007
- By May/June 2008, good draft of criteria
- Mid 2008 next steps defined
Pilot projects started



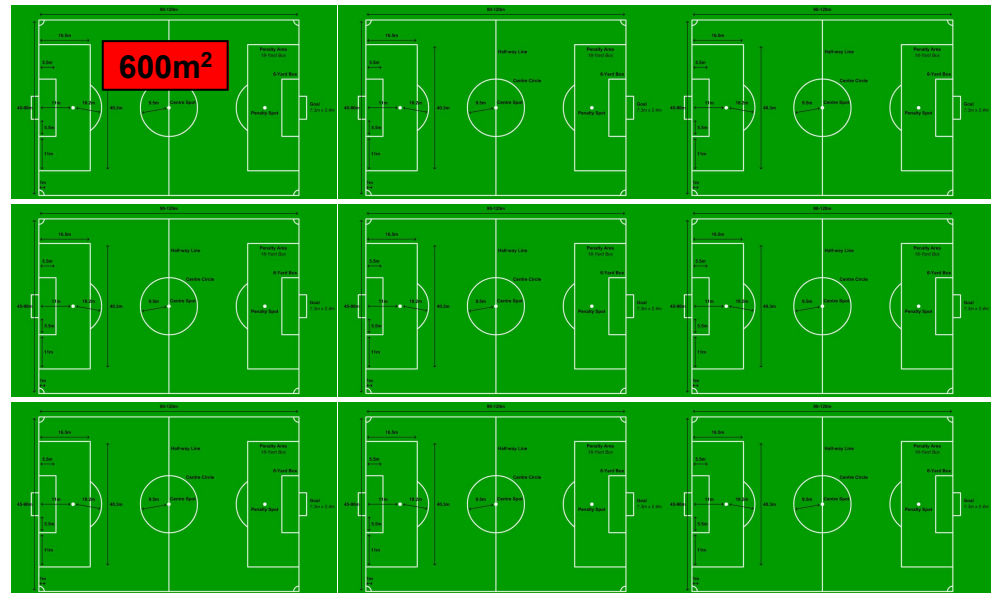
Some final thoughts...

- 800 mio. car owners <-> 800 mio. people undernourished
FOOD FOR FUEL?
- Many negative examples (e.g. palm oil Malaysia), first positive examples (e.g. Fair-Trade Biodiesel from Brazilian soy oil)
- International guidelines are necessary: RSB Roundtable on Sustainable Biofuels, IRGC International Risk Governance Council, IEA International Energy Agency, European Union OECD etc.
- There are MUCH better ways to use solar energy



Usual PV-panels
600m² on farmers roof
 80'000 kWh_{el}/a

Electric Car 1.7 l_{eq}/100km -> **500'000 km**



Best energy plants = 50'000 kWh/ha*a
9 football fields (7 ha)
 Usual car 7.5 l/100km -> **500'000 km**

Thanks for your attention !



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www.empa.ch/tsl

executive summary of LCA-study

Technology and Society Lab @ EMPA Switzerland



www.bioenergywiki.net/index.php/Roundtable_on_Sustainable_Biofuels

