

Ecology of biofuels with a special view on the impacts to soil

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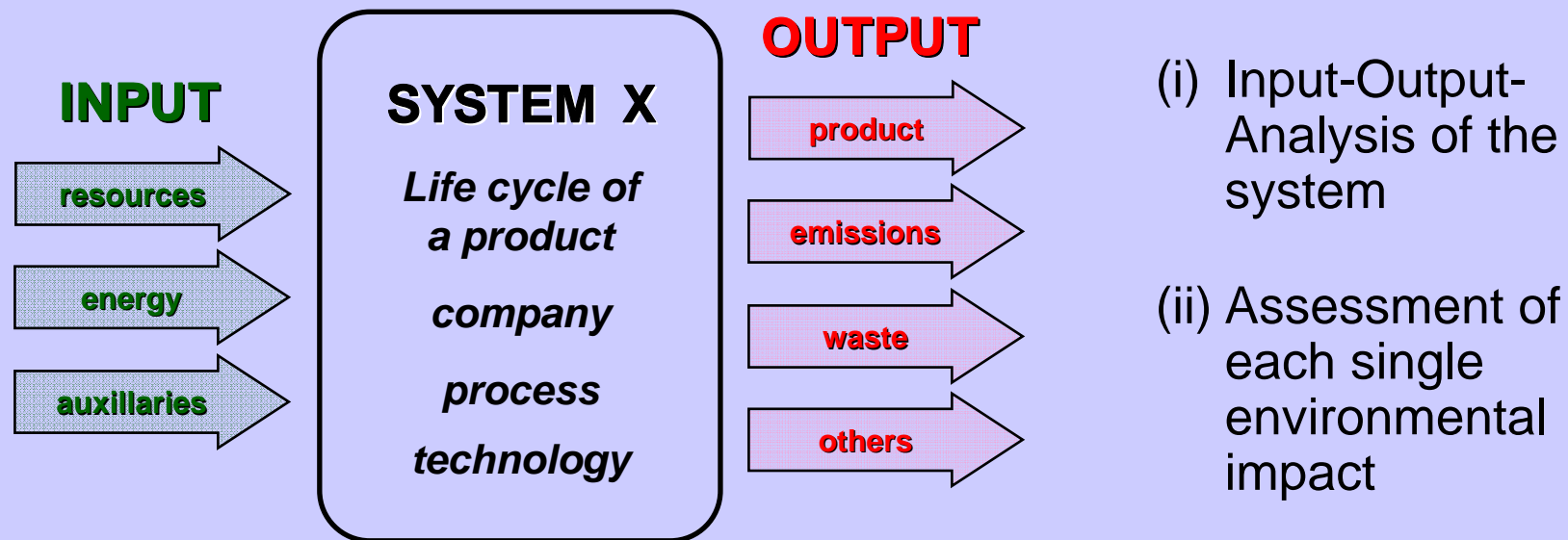


Environmental effects ...of and increase of biofuels ?



Method of Life Cycle Assessment (LCA)

- Life Cycle Assessment (LCA) is a method/tool for the estimation of the ecological effects that are connected with a product / with a service / with a process / with a technology / etc.
- Basic principle is a 2-step procedure with:

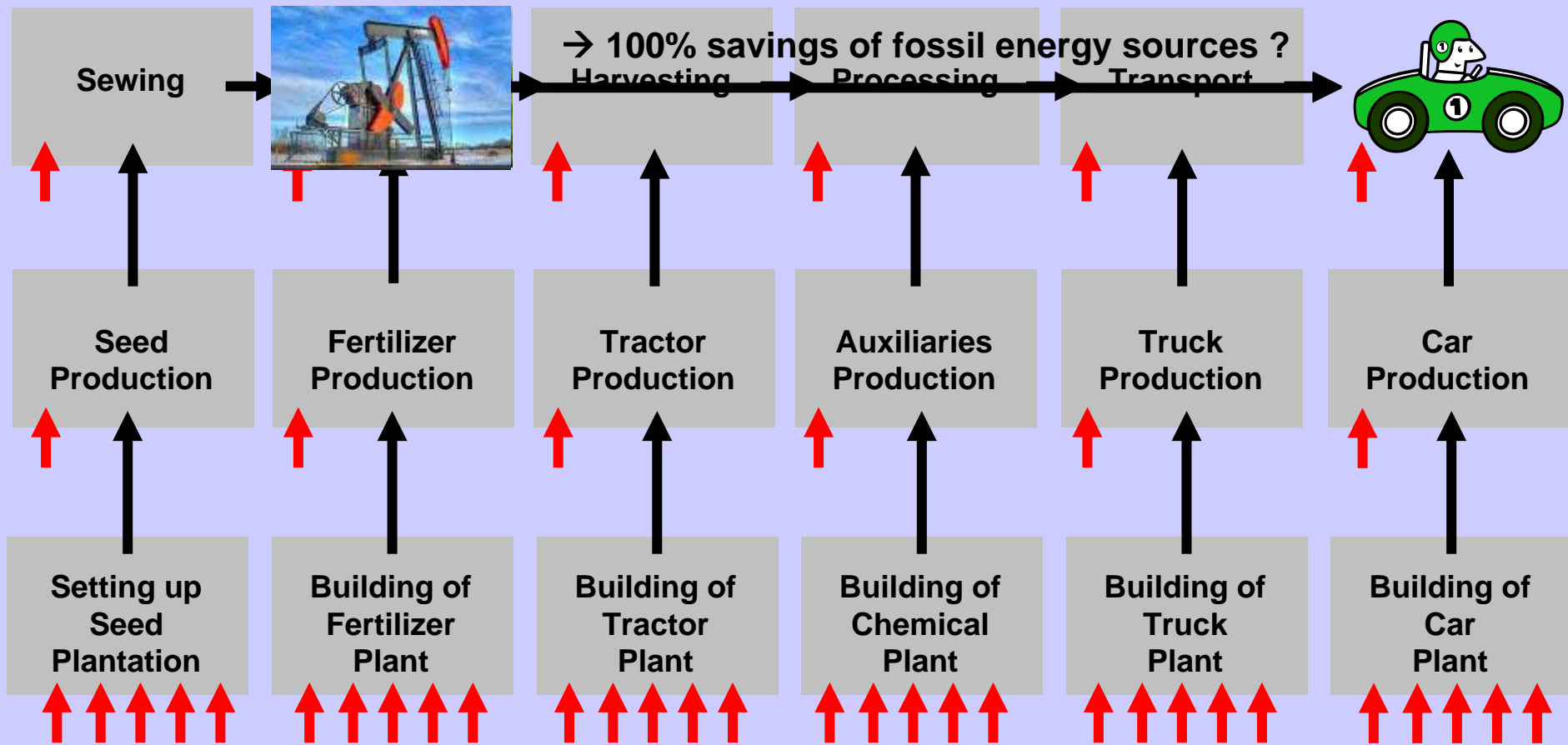


Why Life Cycle Assessment?

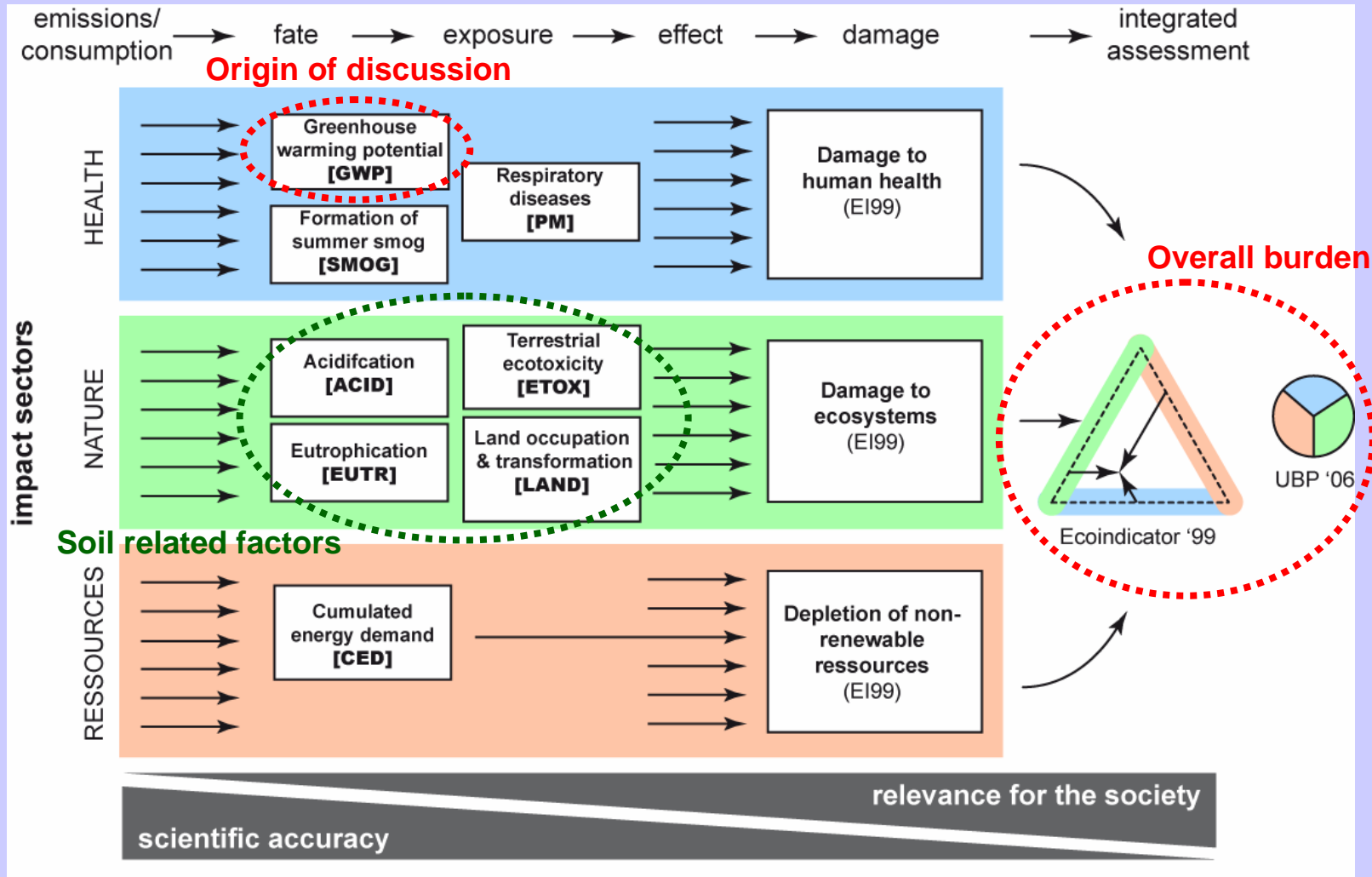
Example: Fossil Energy Demand of Biofuels



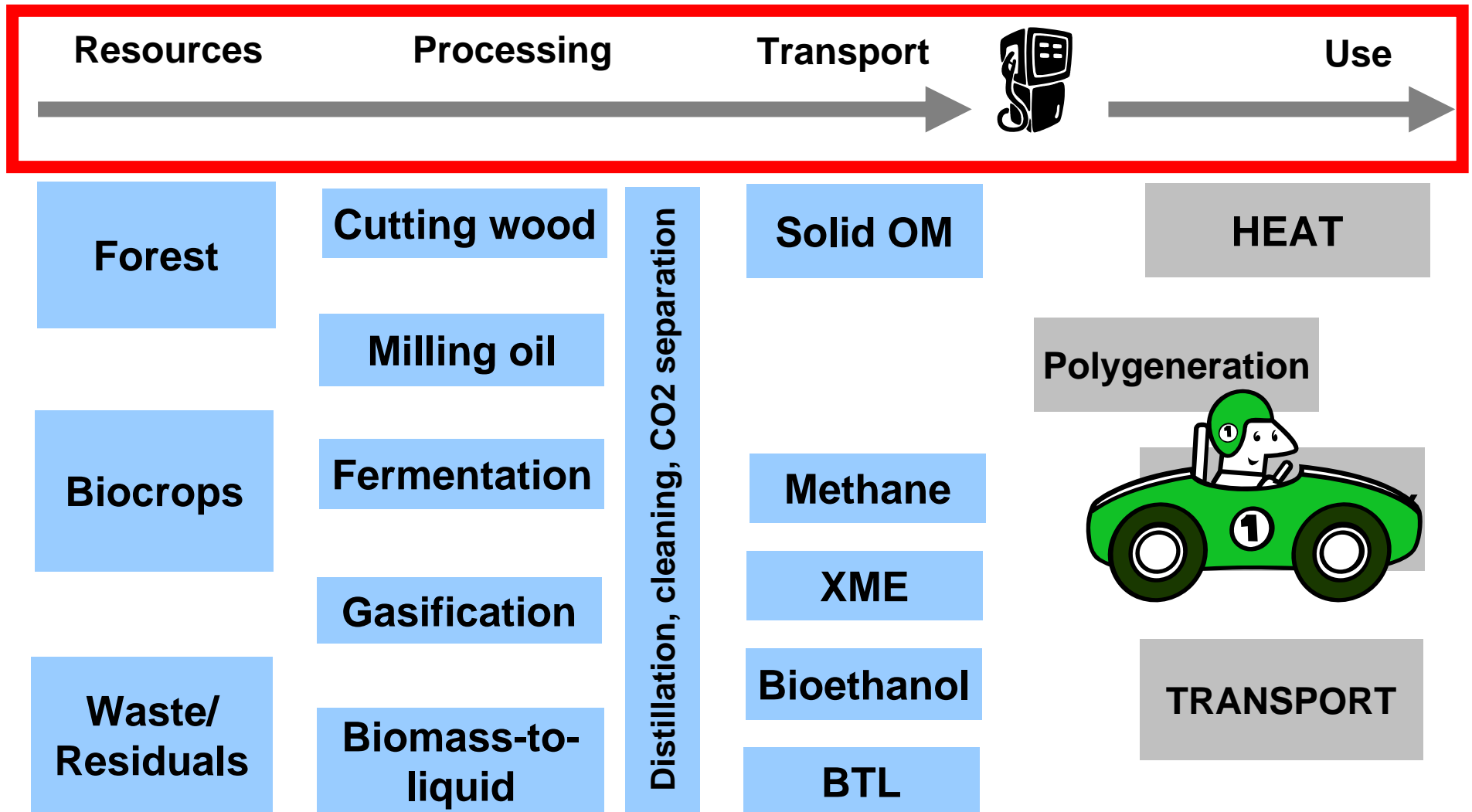
➔ Material flows
➔ Fossil Energy flows



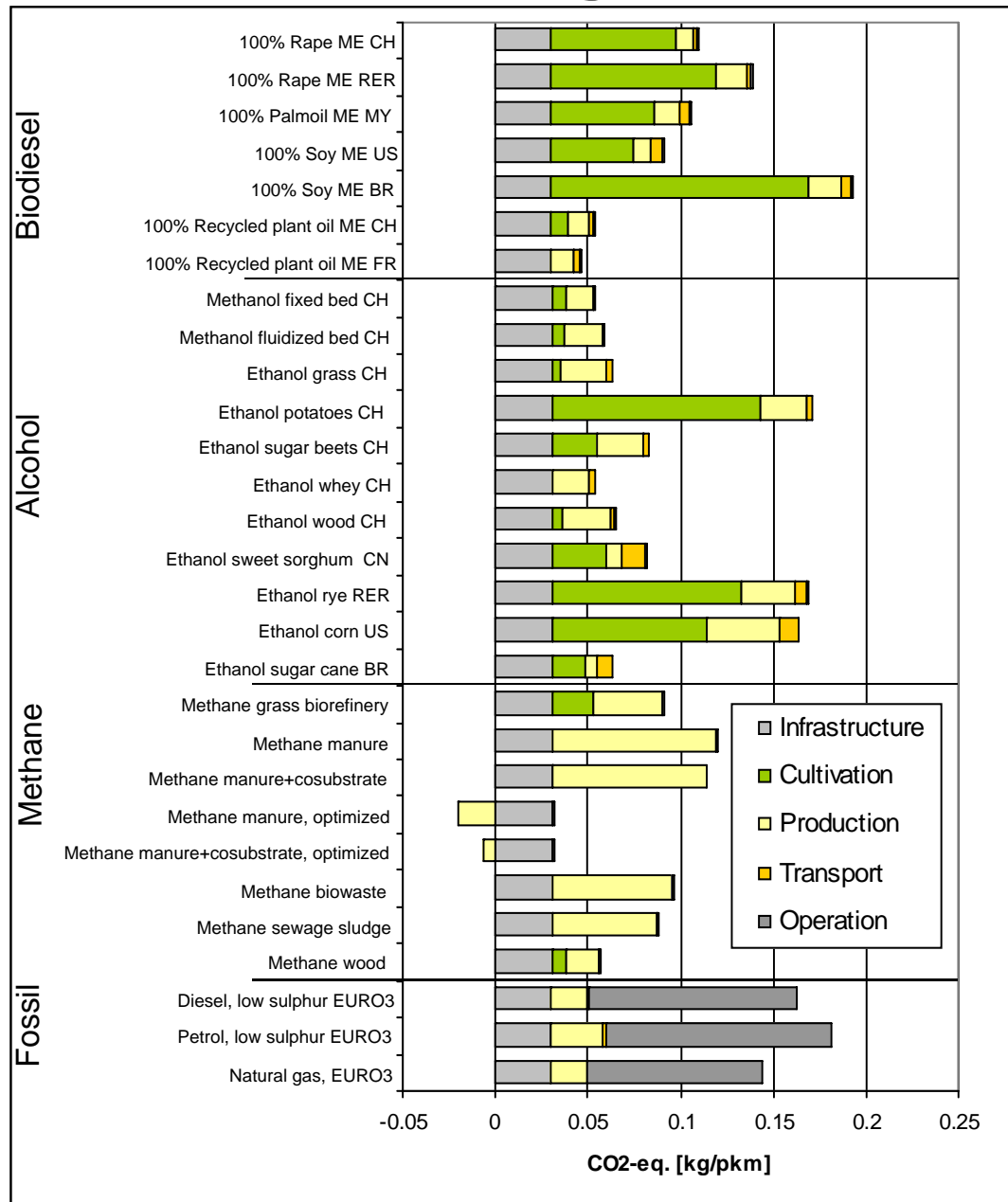
Assessment of Environmental Impacts



System boundaries



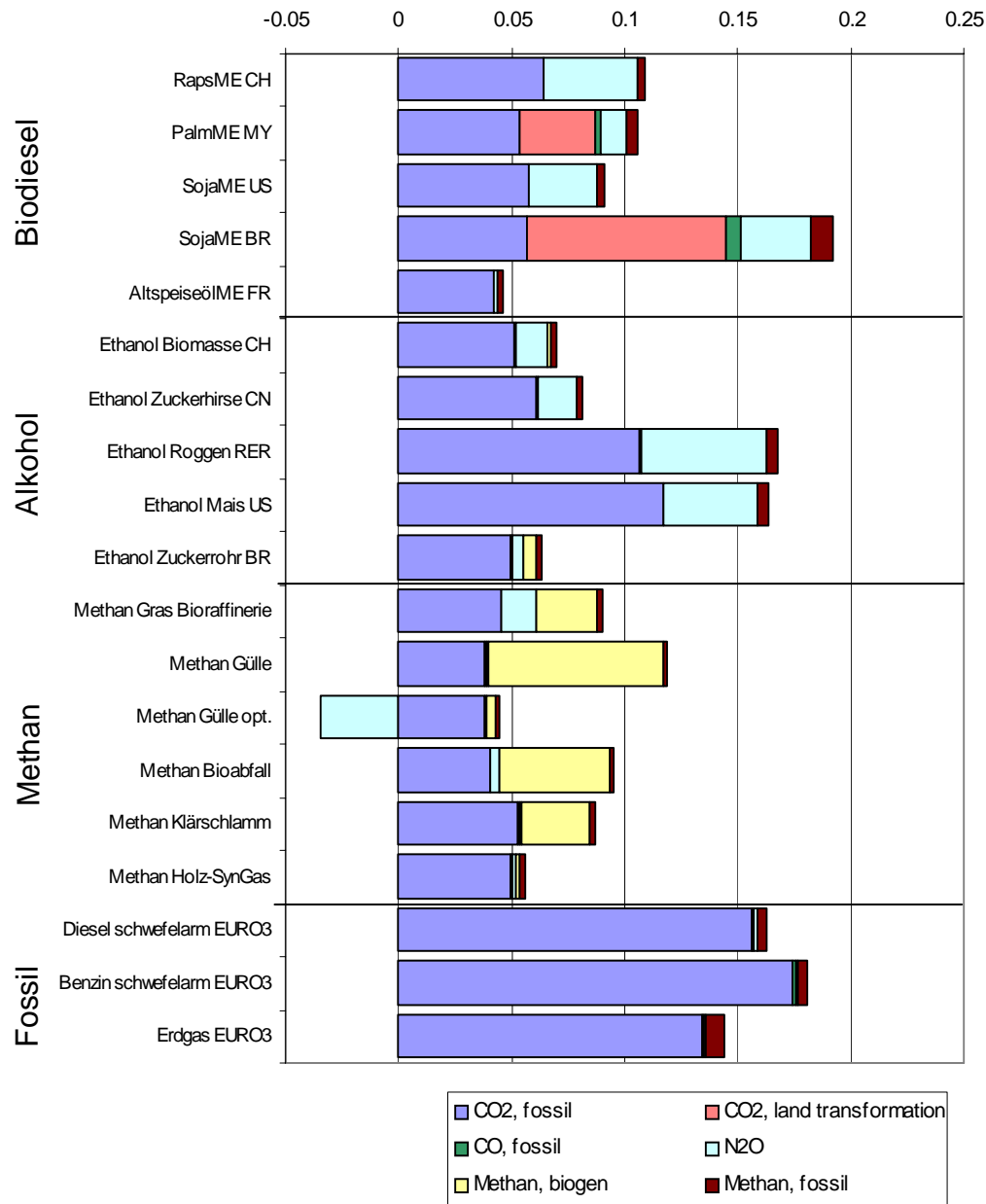
Global Warming Potential of Biofuels



- Big differences within each fuel type
- large impact due to agriculture activities
- Factor 8 among different cultivations (due to yield, fertilizer use, clear cut, N₂O emissions, ...)
- Methane: post-fermentation losses of Methane are relevant
- Transport < 10% share on overall global warming
- long-distance trucks could be substantial
- transport < processing < agriculture

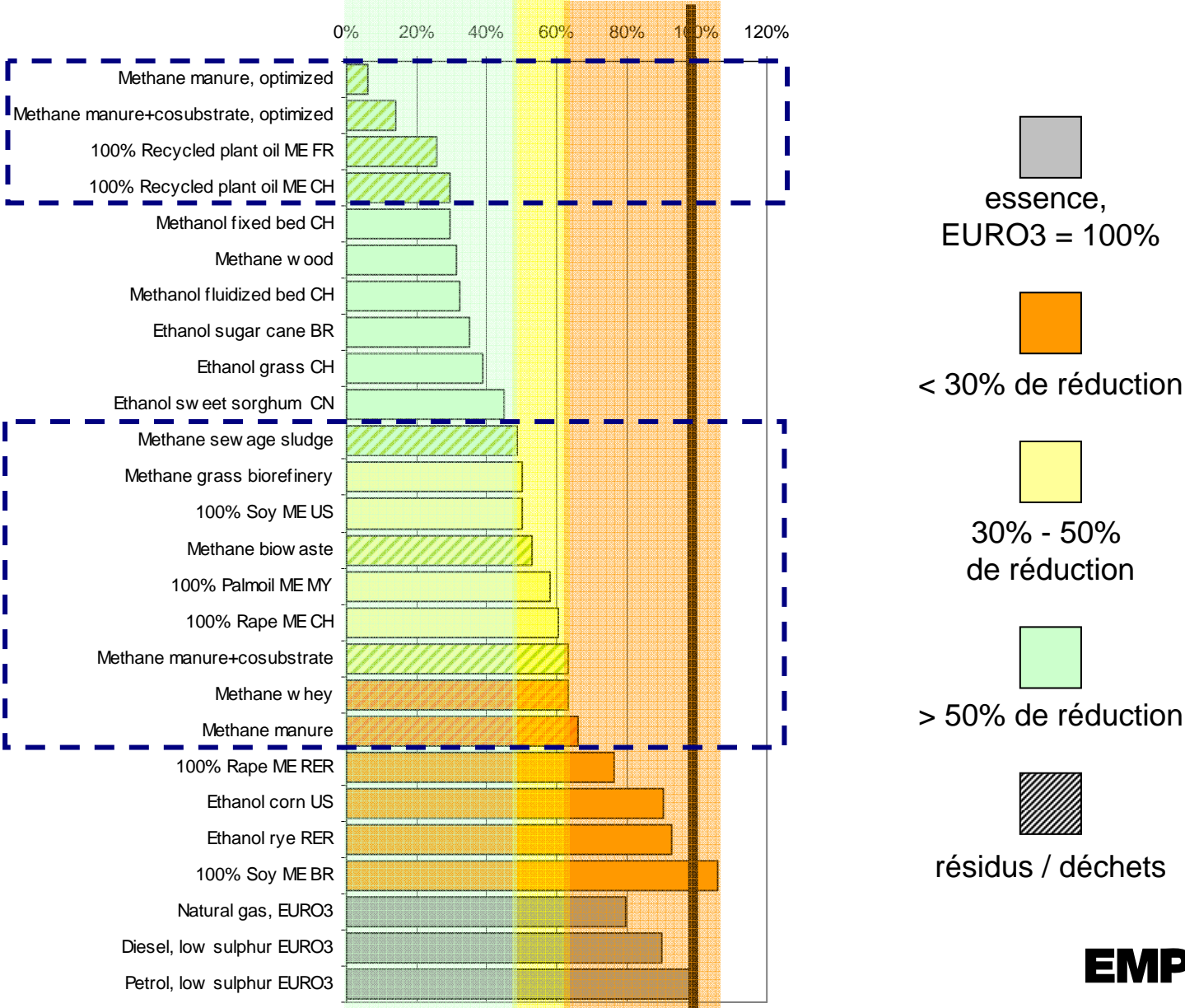


Global Warming Potential of Biofuels

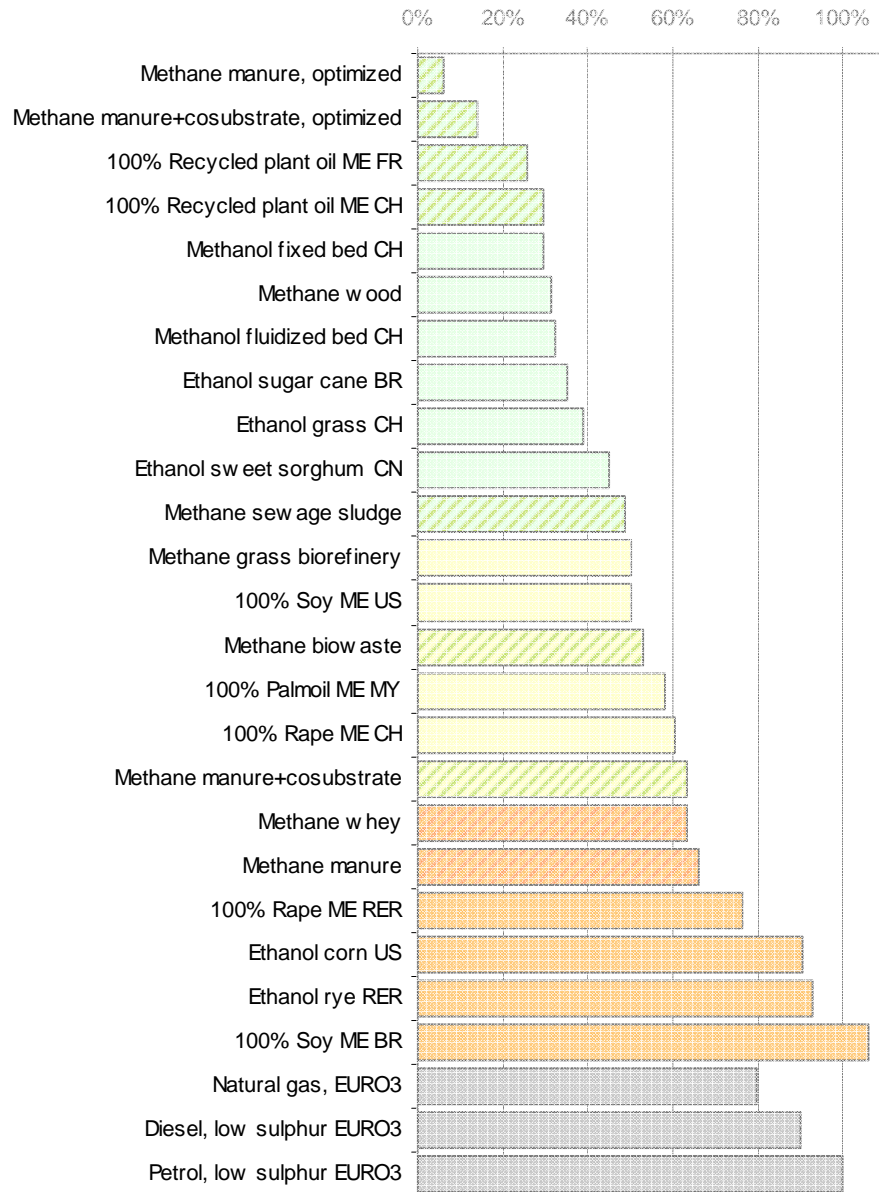


- GHG-Emissions are dominated by fossil CO2
- Clear cutting forests >50%
- N2O emissions from soils: up to 40%
- Production of biogas is dominated by Methane emissions

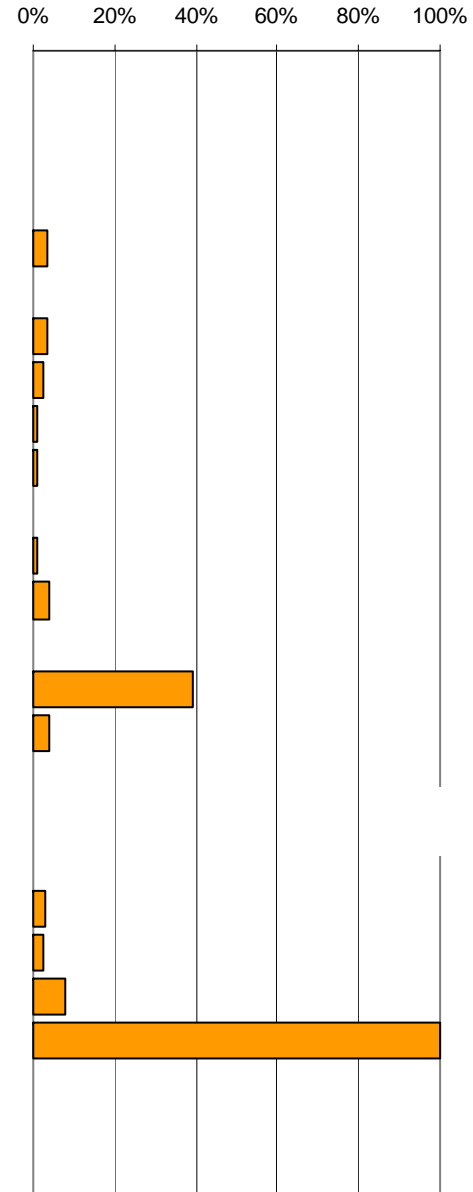
Ranking „Global Warming Potential“



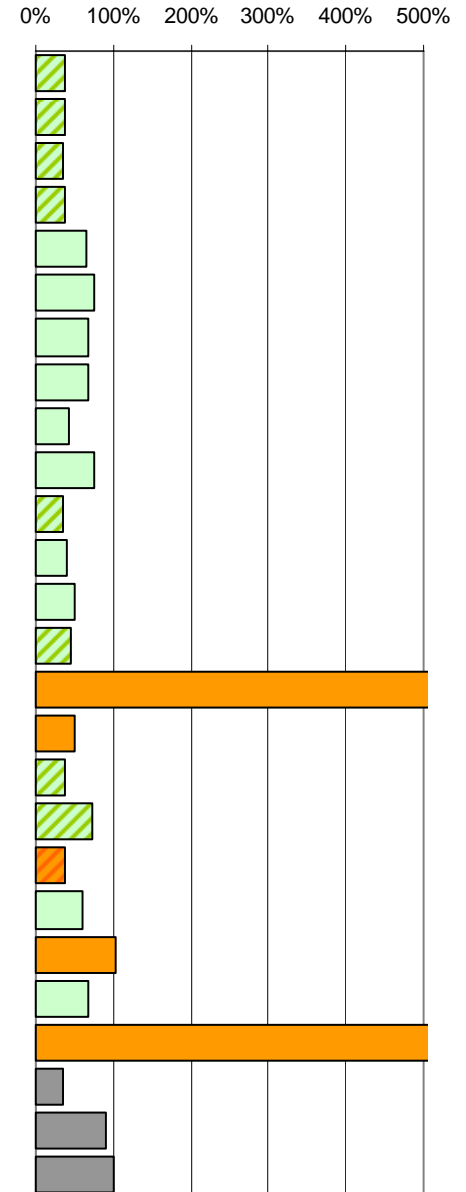
Soil-related Results



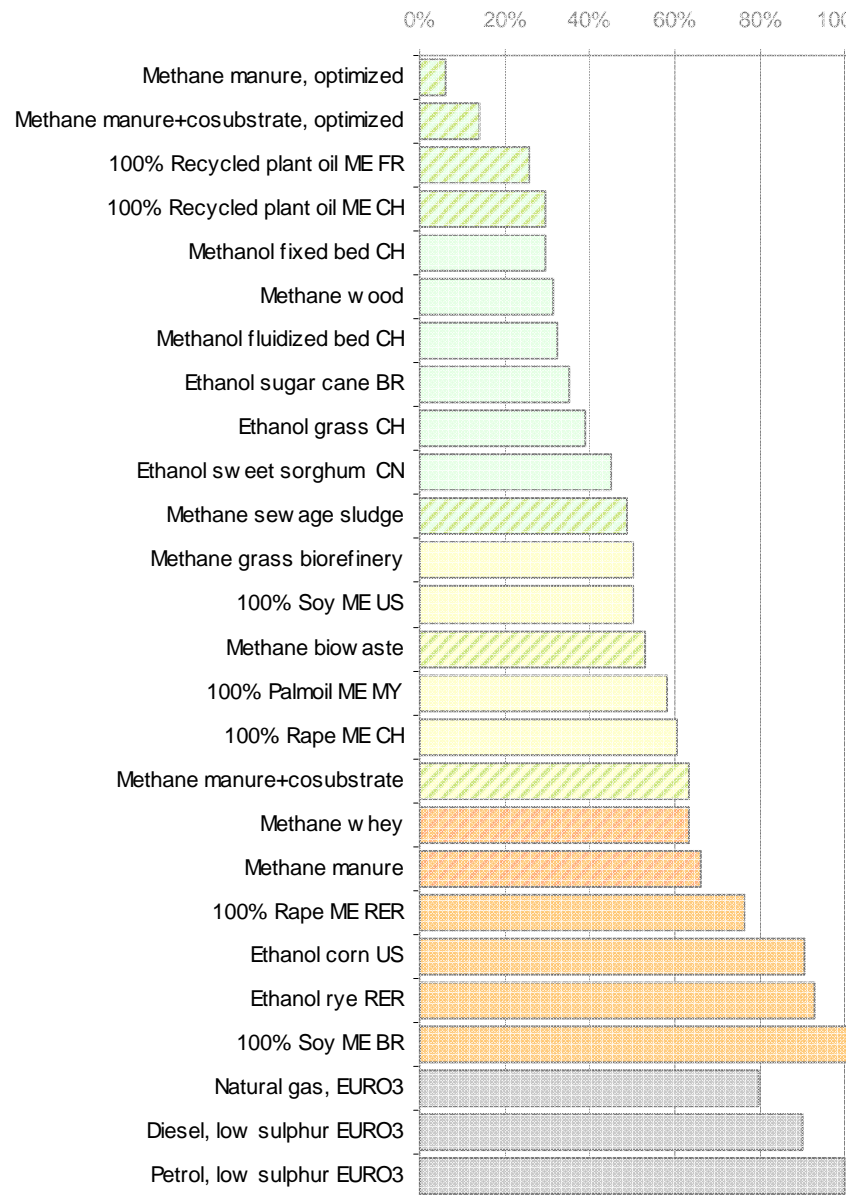
Land-Use



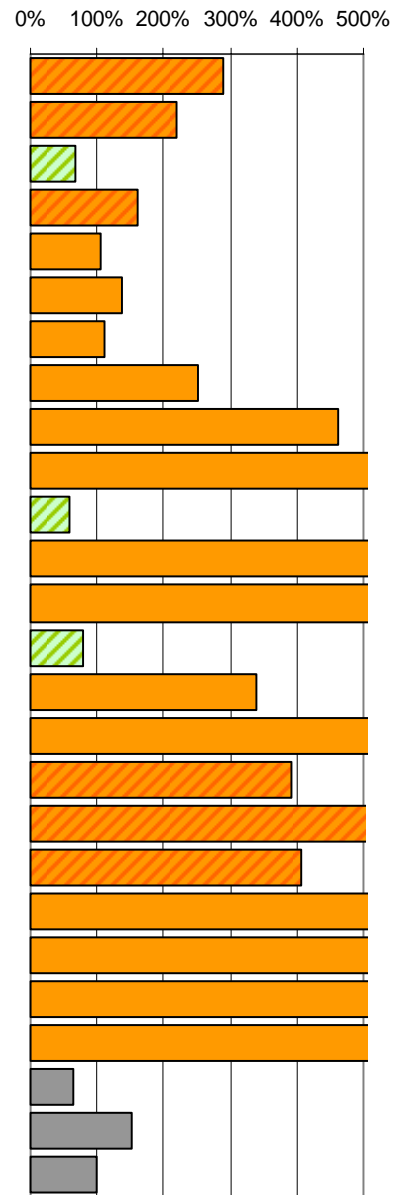
Ecotoxicity



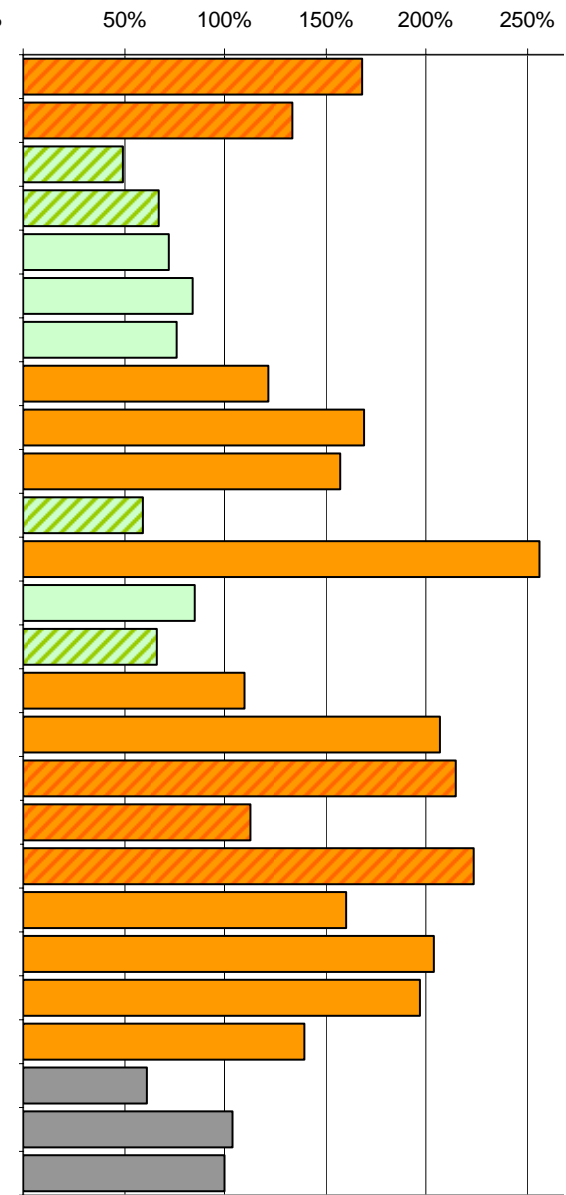
Soil-related Results



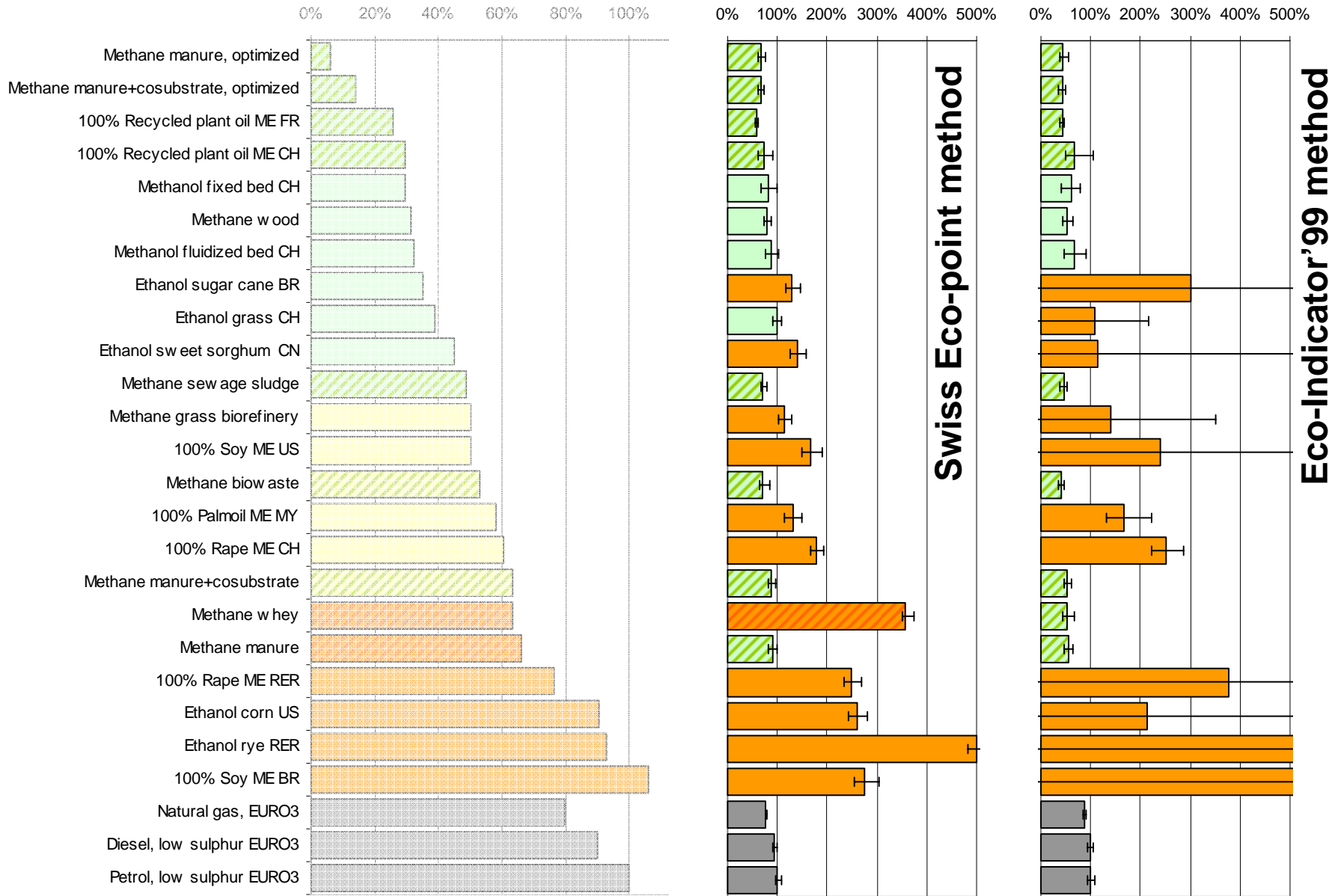
Eutrophication



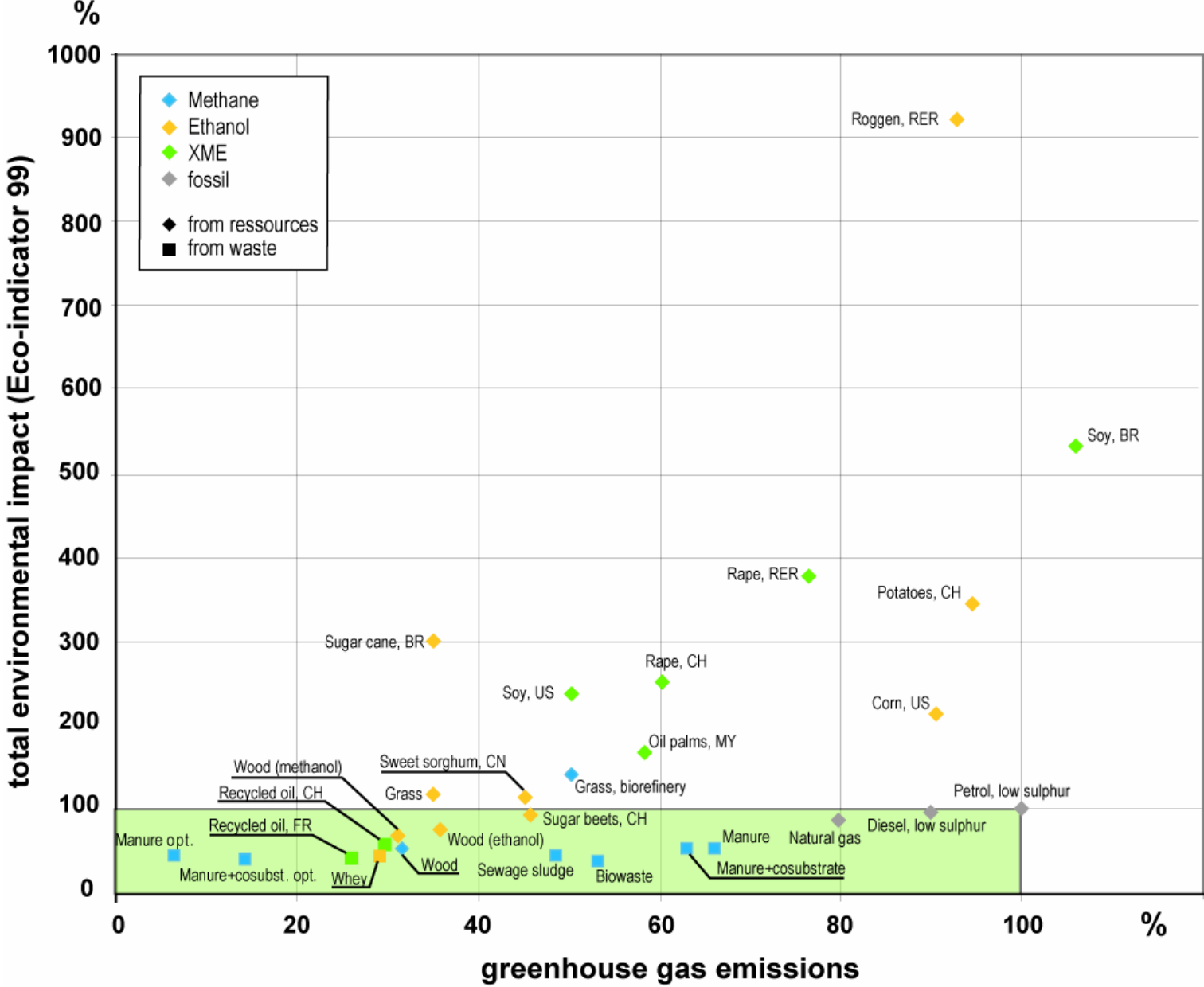
Acidification



Ranking „Overall Environmental Burden“



Overall Burden vs Global Warming Potential



Conclusions

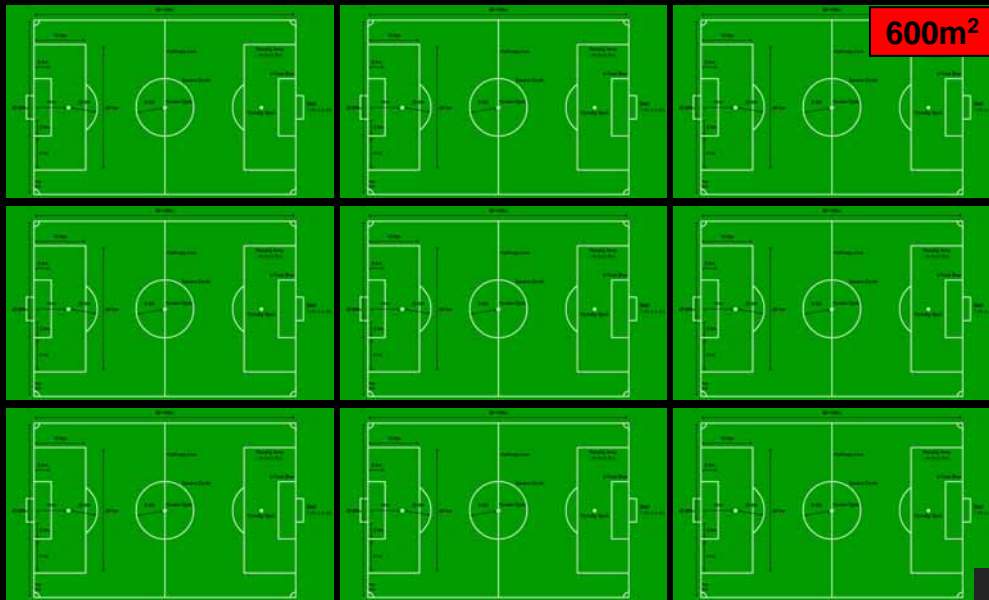
- A number of biofuels allow a reduction of greenhouse gas emissions by $> 50\%$
- BUT, only a few of these biofuels reach the level of fossil fuels with respect to an overall environmental assessment
- The environmental impacts could significantly reduced when applying specific measures:
 - e.g., methan pathway: reduction of methan loss
 - e.g. tropical agriculture: reduction of pressure on forests

Outlook: Change of engine technology

Resulting land-use for 500'000 km of driving ...

(i) ... when Biofuel driven

(ii) ... when Electric driven



Usual PV-panels

600m² on farmers roof

80'000 kWh_{el}/a

Electric Car 1.7 l_{eq}/100km



Best energy plants = 50'000 kWh/ha*a
9 football fields (7 ha)
with a usual car, consuming 7.5 l/100km

... merci pour votre attention!



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