Life Cycle Assessment (LCA) of Jatropha-based Rural Electrification

Case Study: Village Ranidhera, Chhattisgarh

Simon Gmünder (EMPA)

M. Classen, R. Zah (EMPA)

P. Mukherjee, S. Bhattacharjee (Winrock India)

EMPA

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Direktion für Entwicklung und Zusammenarbeit DEZA
Direction du développement et de la coopération DDC
Direzione dello sviluppo e della cooperazione DSC
Direcziun da svilup e da cooperaziun DSC

WINROCK INTERNATIONAL INDIA

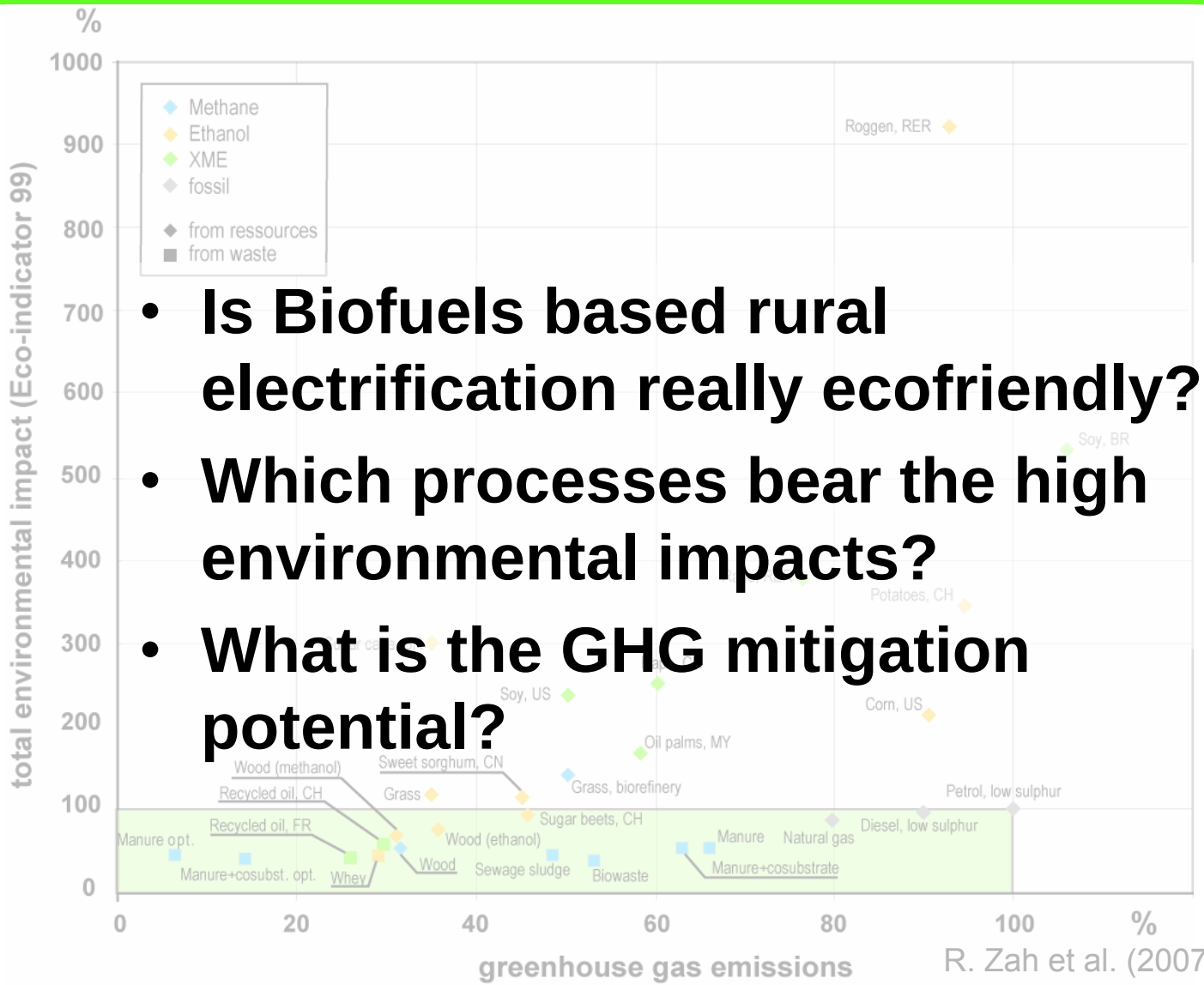
Introduction

- Various electrification projects
  → Various options (SPV, Hydro, Biomass, Grid, ...)
  but what is their impact on sustainability?

- Focus on Bioenergy (Jatropha oil) vs. Diesel
  → **Environmental perspective:**
  → LCA methodology

A Goal & Scope
B Inventory
C Impact Assessment
D Interpretation

Project Goals

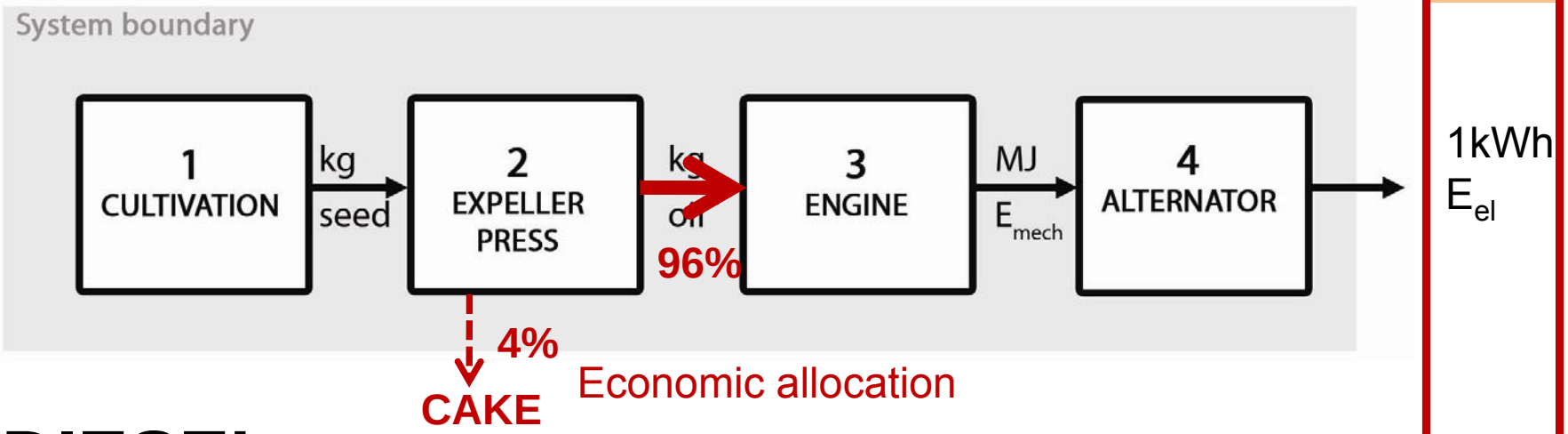


- **Is Biofuels based rural electrification really ecofriendly?**
- **Which processes bear the high environmental impacts?**
- **What is the GHG mitigation potential?**

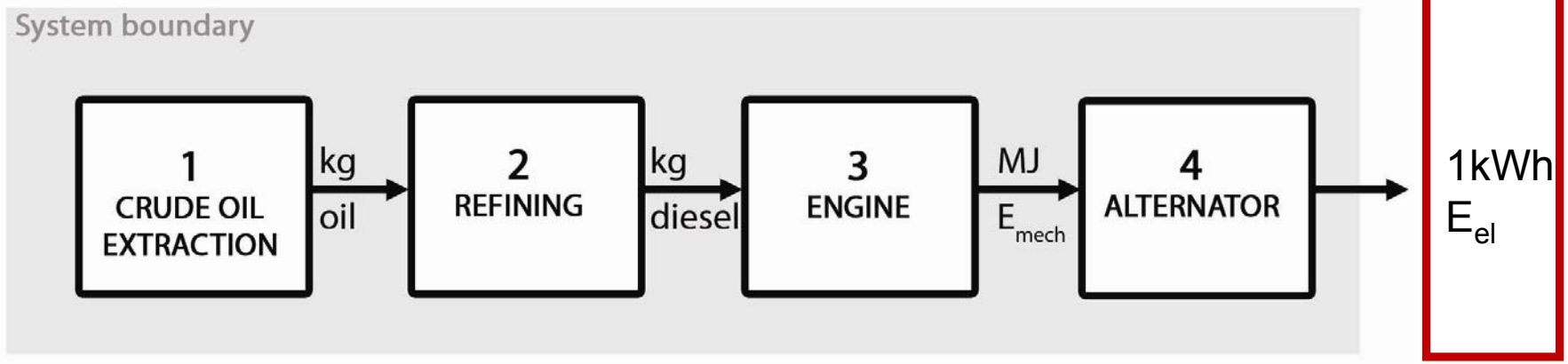
R. Zah et al. (2007)

Scope: Compared Systems

JATROPHA

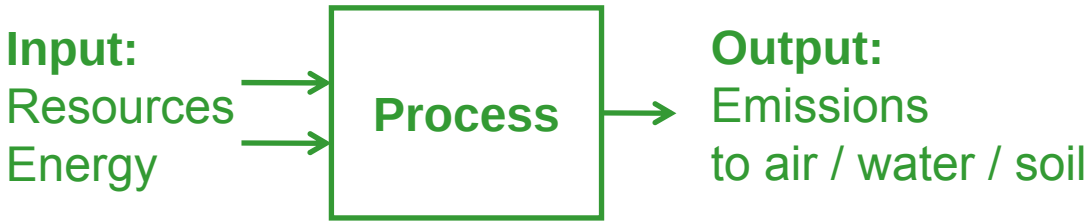


DIESEL



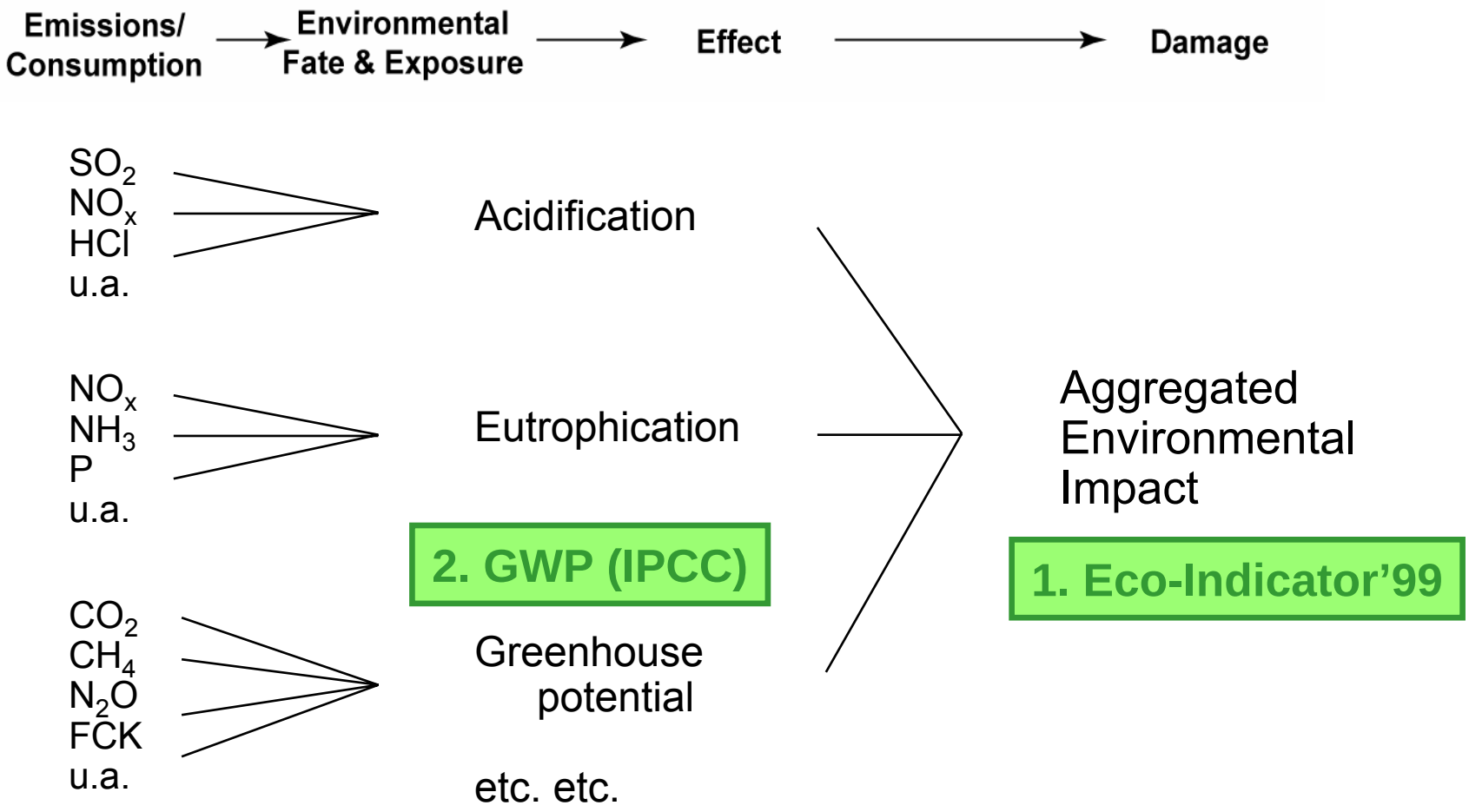
Inventory

- Exchanges with ecosphere



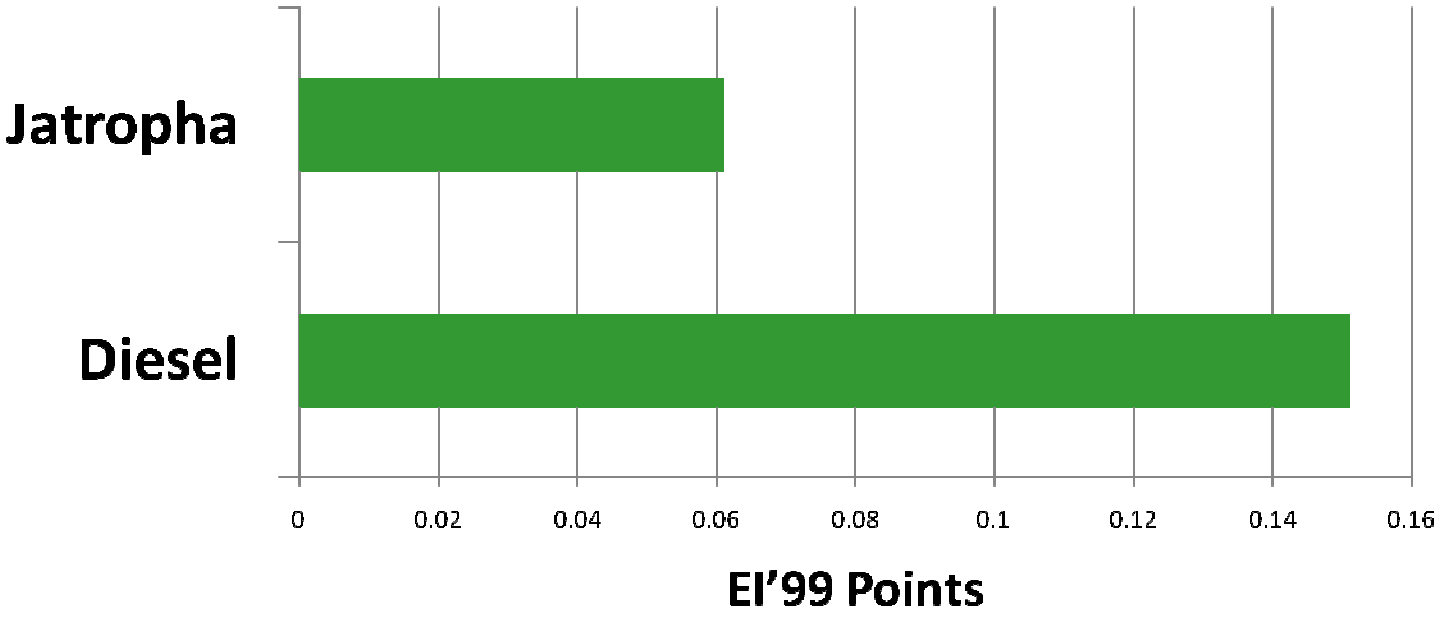
- Data from **pilot plant** (Ranidhera), **literature** & **ecoinvent** database

Basic Principles



Elements after EN ISO 14044

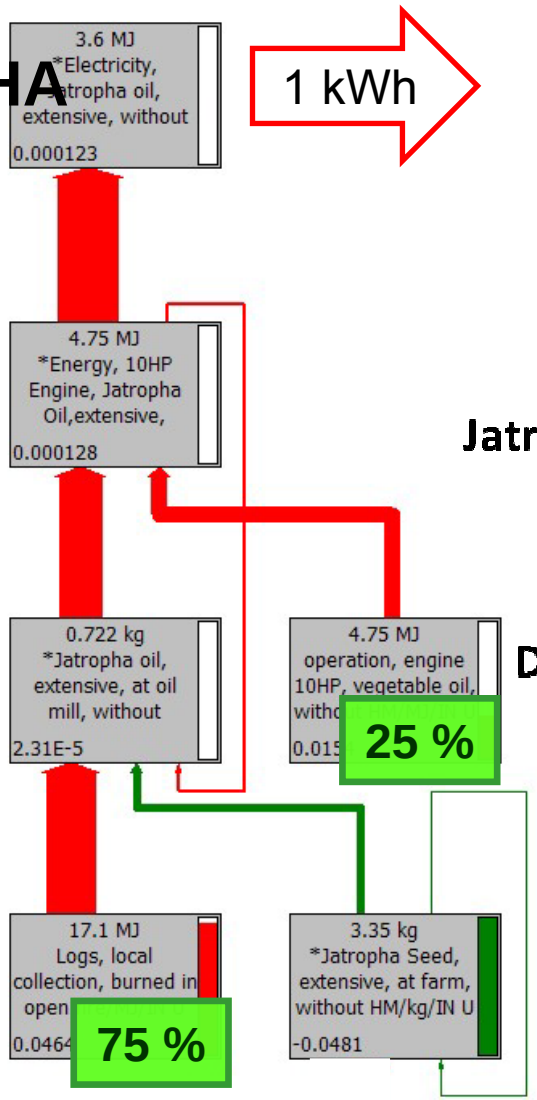
Total Env. Impact (EI'99)

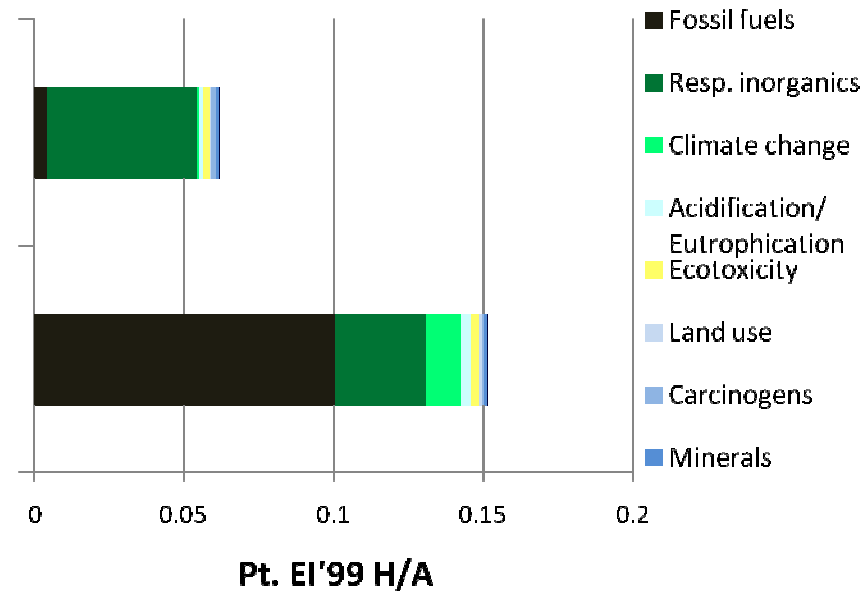


Total environmental impact is **2.5 times lower**!

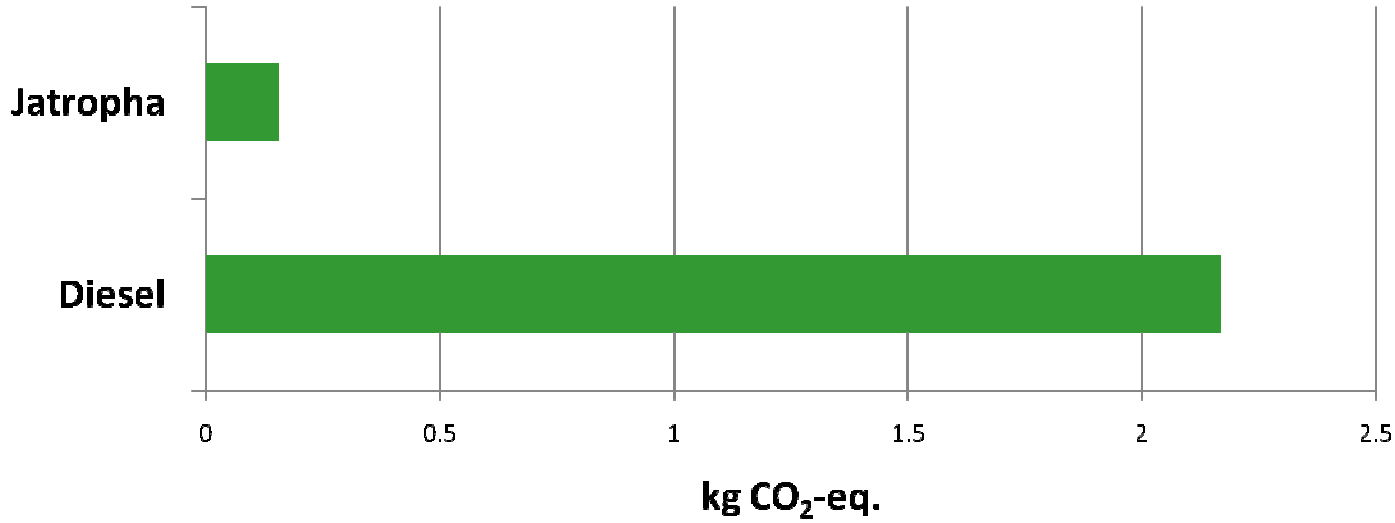
Total Env. Impact (EI'99)

JATROPHA





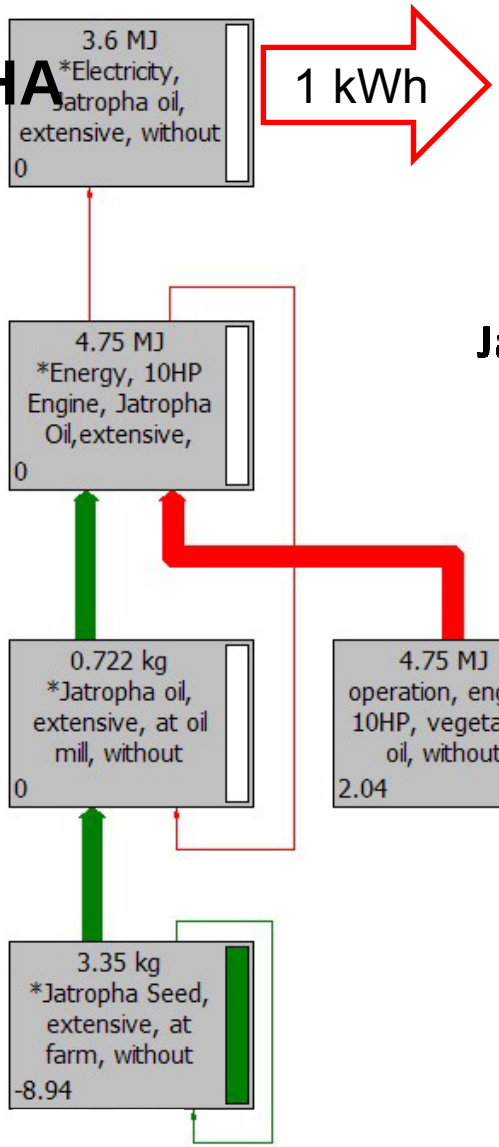
GWP 100a (IPCC)

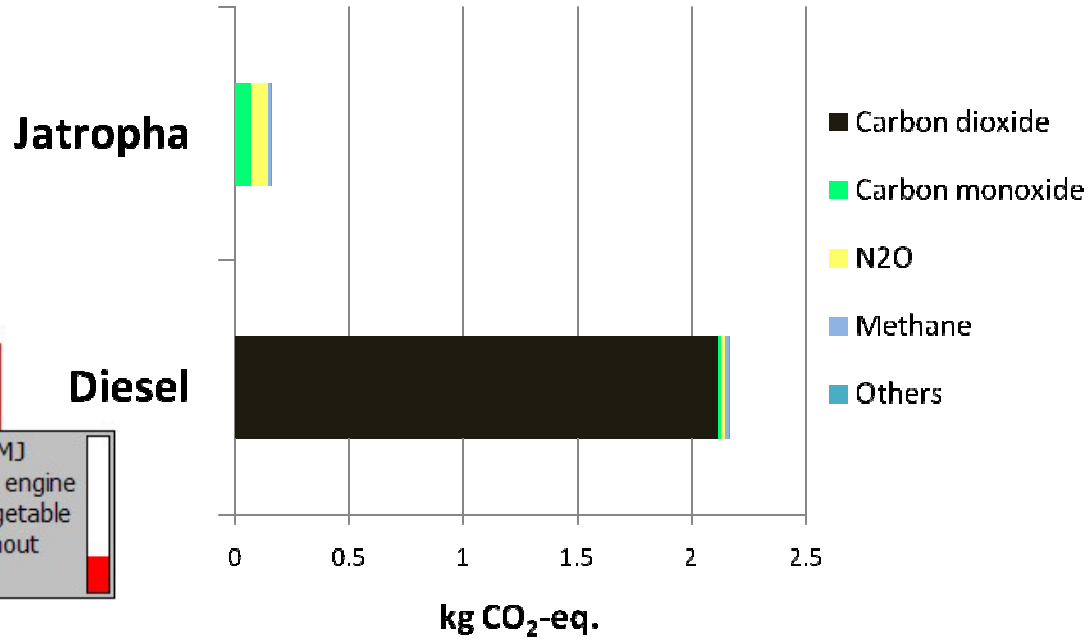


- Total GHG emissions are **14 times lower**!
- Savings of **2kg CO_2-eq. per kWh!**

GWP 100a (IPCC)

JATROPHA





Interpretation

- Lower total environmental Impact of Jatropha

- Wood burning & Emission of Engine high impact

  → System design: Alternative Expeller Process

  Particle filter

- 2kg CO_2–eq. savings

  → 5000 INR per village (550 INR per ton CO_2) **Results might be different for Biodiesel!**

Outlook

- Improve data gaps on Jatropha cultivation
  → yield, landuse impacts, water use impact ...
- Comparison with other systems
  → SPV, gasification, grid, ...
- Integration of Socio-economic dimension
  → crucial for decision making!

Results will be available in April:

Simon.Gmuender@empa.com

!

Thank you