



3<sup>ème</sup> CONFERENCE INTERNATIONALE SUR LES BIOCARBURANTS EN AFRIQUE  
LES BIOCARBURANTS : QUELS POTENTIEL S POUR L'AFRIQUE

# Application of environmental Life Cycle Assessment in West Africa

## *Case study on Straight Jatropha Oil combustion for electricity generation in Mali*

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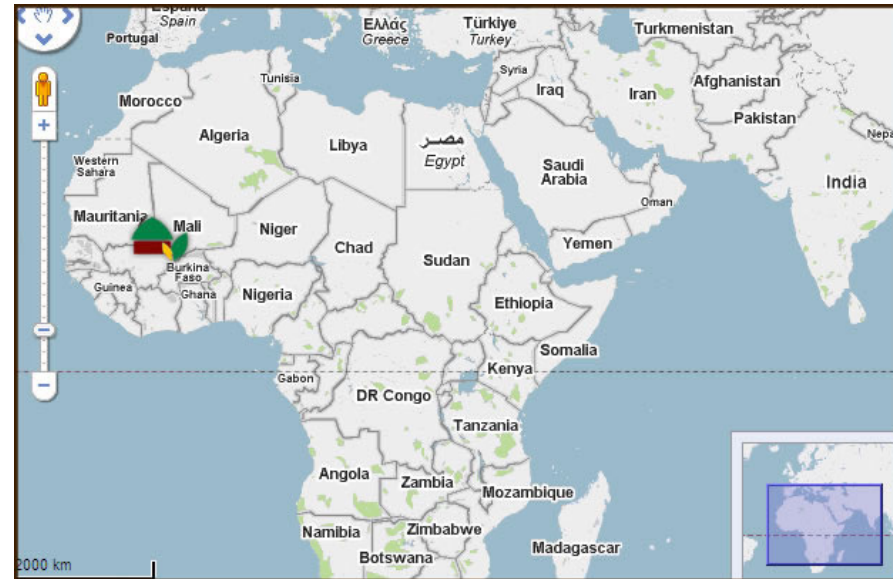
Session n°3 – Which project scales and which impacts?

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# Teriya Bugu and the “AEDR” NGO

- Teriya Bugu
  - Malian village on the Bani river bank
  - *Activities*: hotel, tourism centre, farming, renewable energies
- NGO “AEDR”
  - Mutual Aid Association for Rural Development
  - Set up since 1993



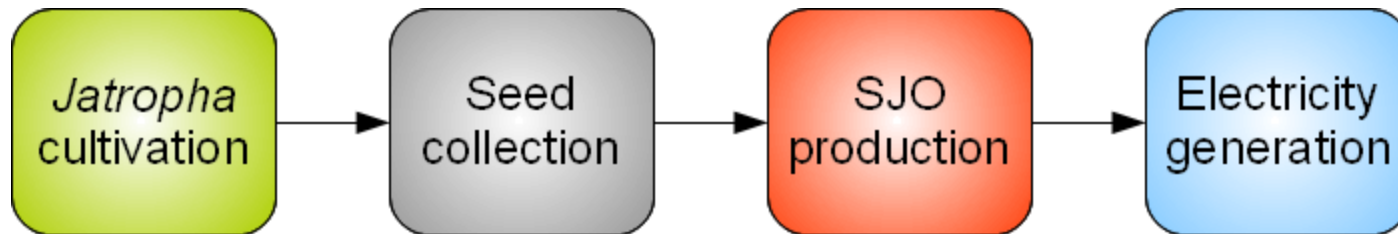
# Project for energy autonomy

- The *Jatropha* project
  - Experimental station since 2006
  - Promotion among local farmers
- Objective:
  - Straight *Jatropha* oil (SJO) to provide electricity to Teriya Bugu
  - Substitution for around 64,000 L of gasoil per year
- Study objective
  - Potential environmental benefits of the *Jatropha* project
  - Life Cycle Assessment (LCA) framework



# Electricity generation systems

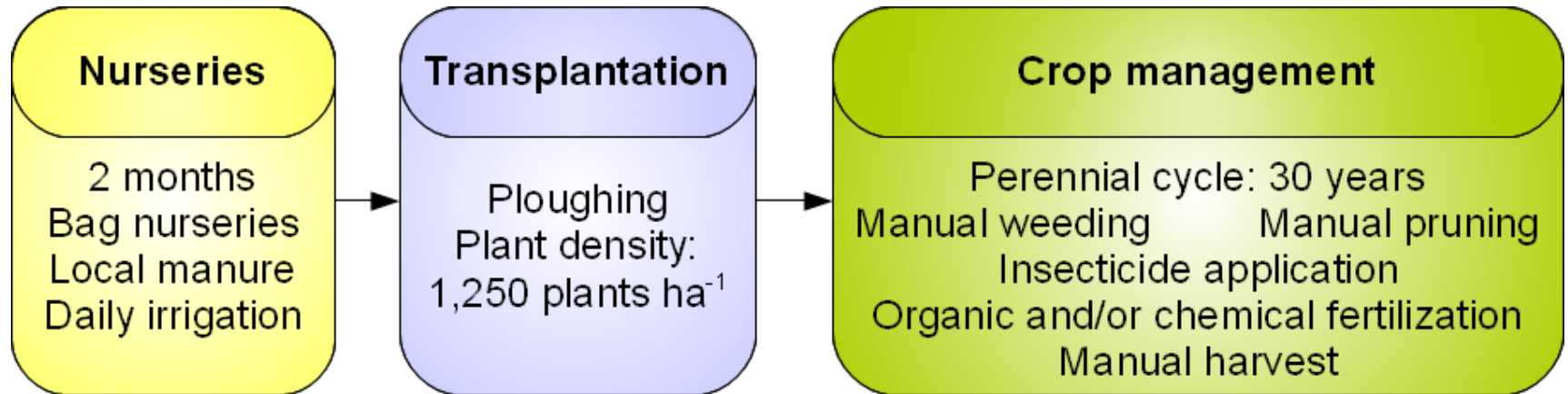
- *Reference system*: gasoil combustion
- *Alternative systems*: SJO combustion



- Data sources
  - Experimental data from Teriya Bugu
  - Prospective assumptions
  - Generic data from LCA databases

# Jatropha system description (1/3)

- *Jatropha* cultivation

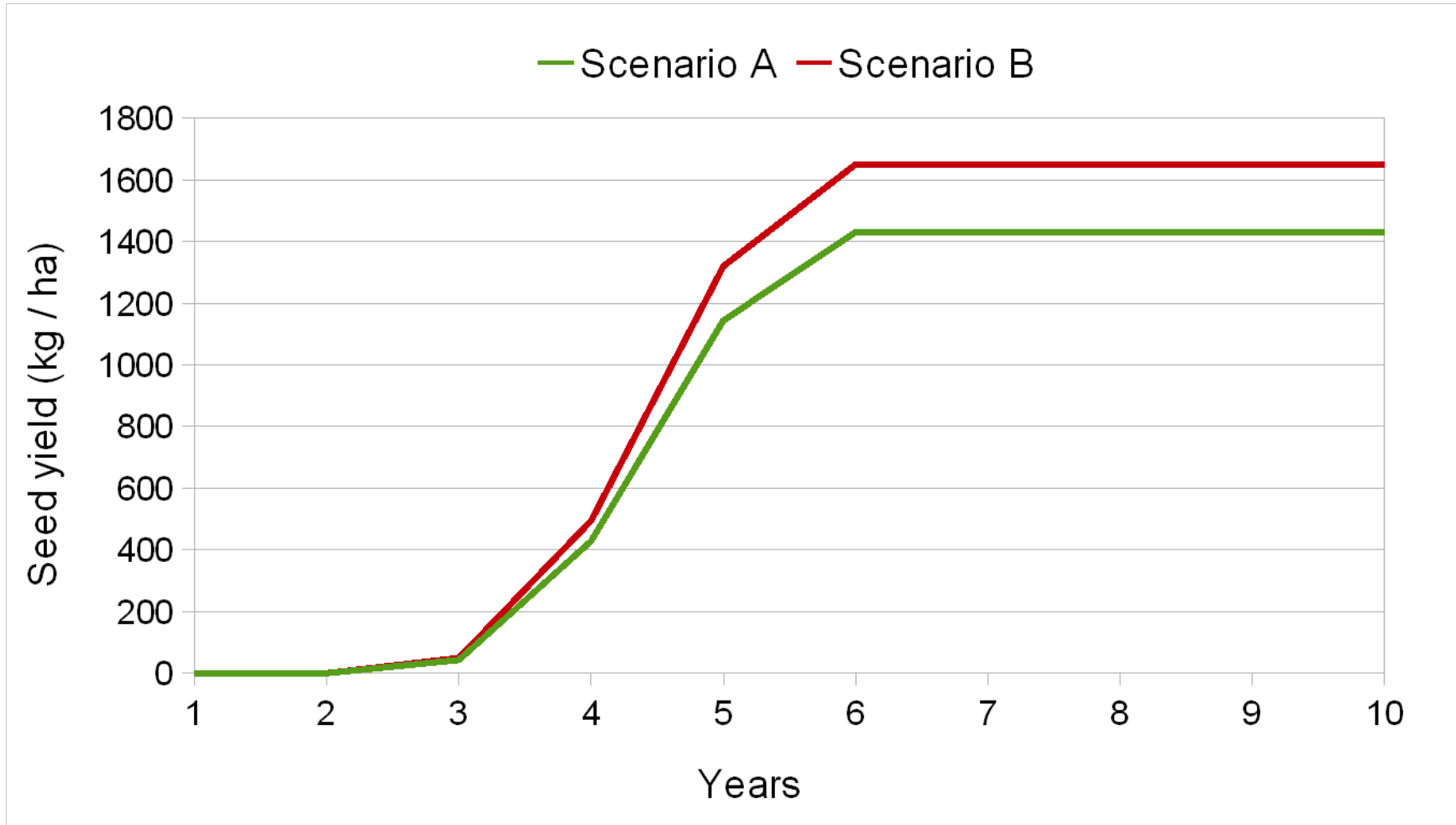


- Two fertilization scenarios

	Years 1-5	Years 6-30
<b>Scenario A</b>	No fertilization	Organic: Jatropha seedcake
<b>Scenario B</b>	Chemical: 125 kg ha <sup>-1</sup> yr <sup>-1</sup> (N-P-K: 16-26-12)	Organic: Jatropha seedcake Chemical: 100 kg ha <sup>-1</sup> yr <sup>-1</sup> (N-P-K: 13-44-0)

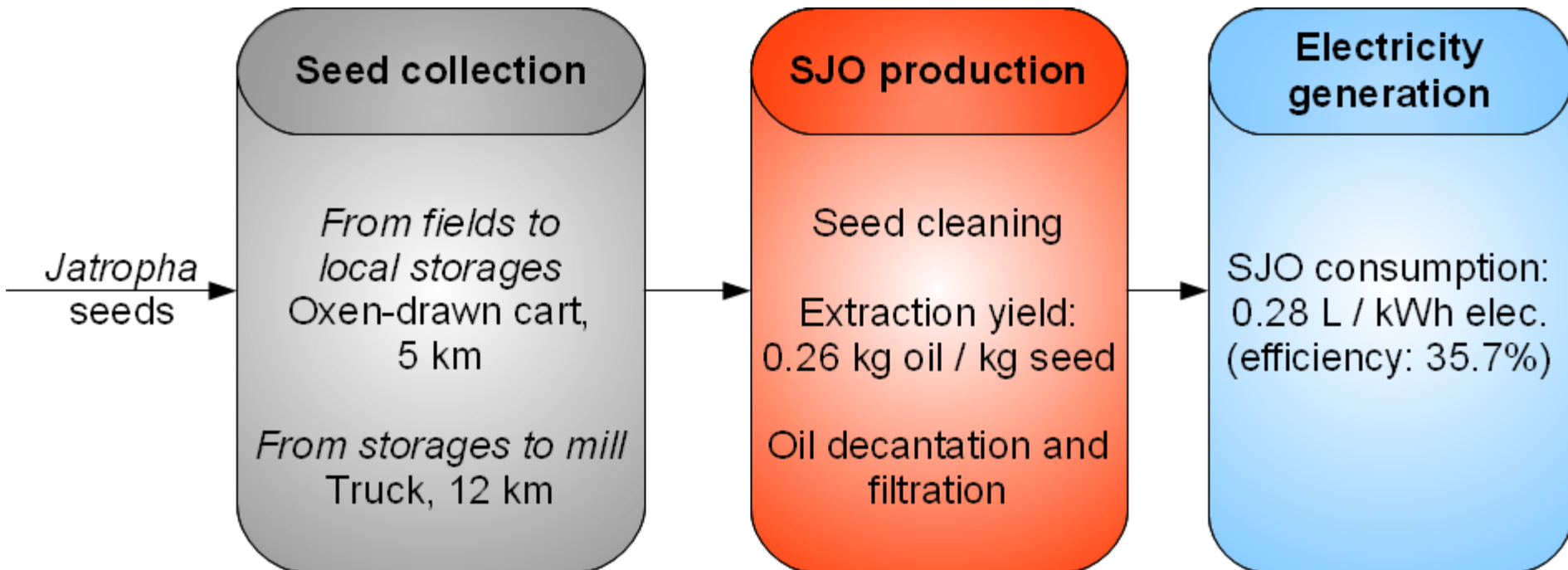
# Jatropha system description (2/3)

- *Jatropha* seed yield



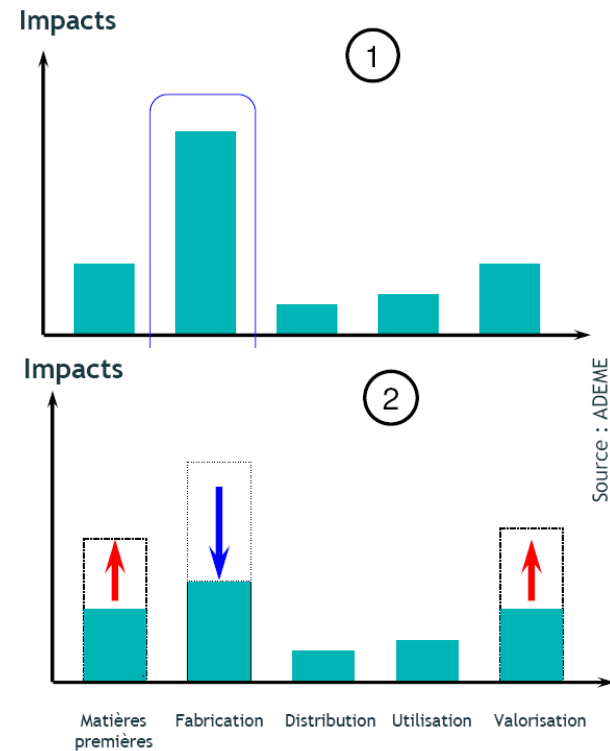
# Jatropha system description (3/3)

- Seed transport and transformation



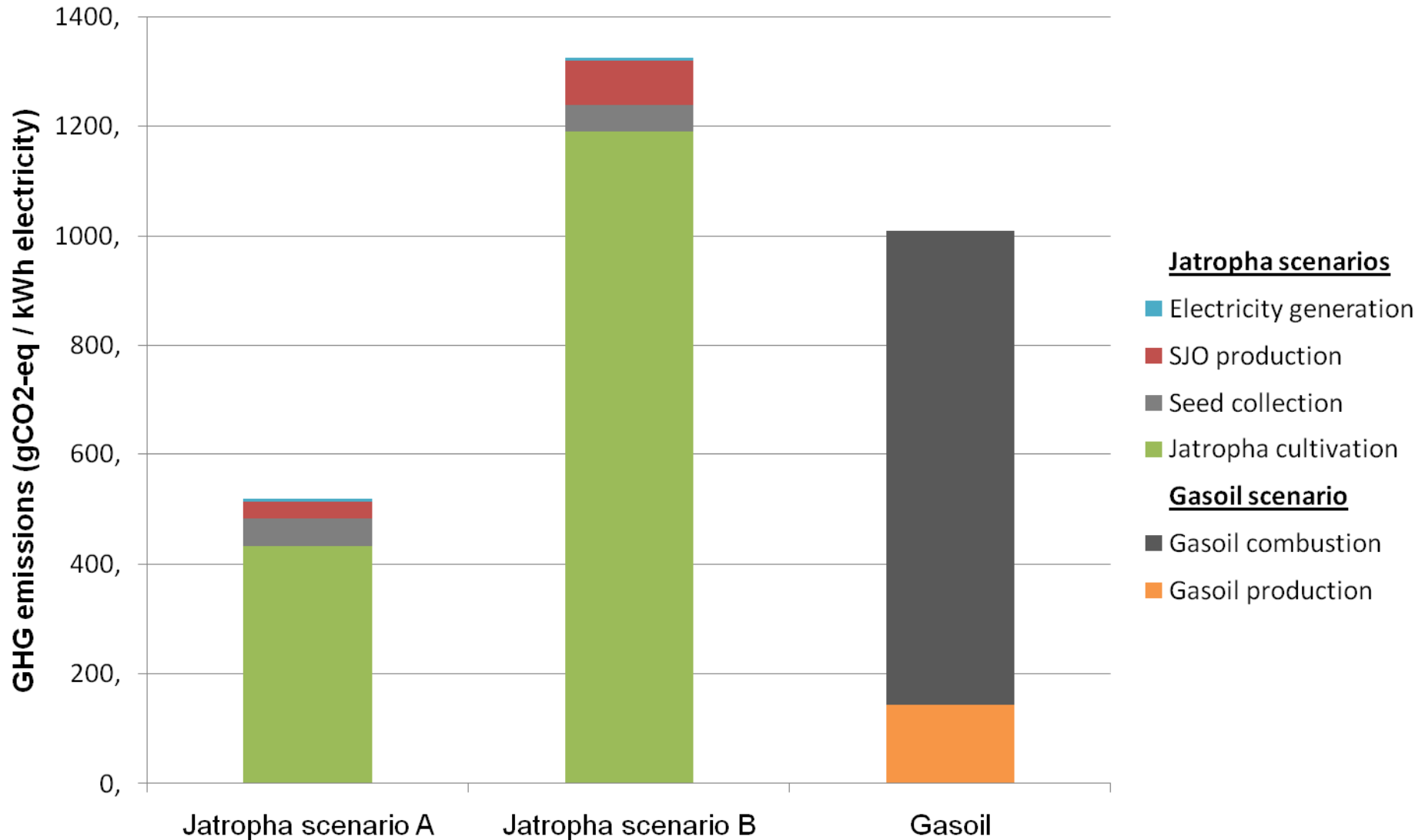
# Life Cycle Assessment

- LCA methodology
  - Environmental evaluation of a product
  - Aims at identifying pollution transfers
    - Between production steps
    - Between environmental issues
- Tools and methods for this work
  - Software: SimaPro<sup>©</sup>
  - Impact Assessment methods: ReCiPe / Impact 2002+
- Functional Unit
  - 1 kWh of electricity out of the generator

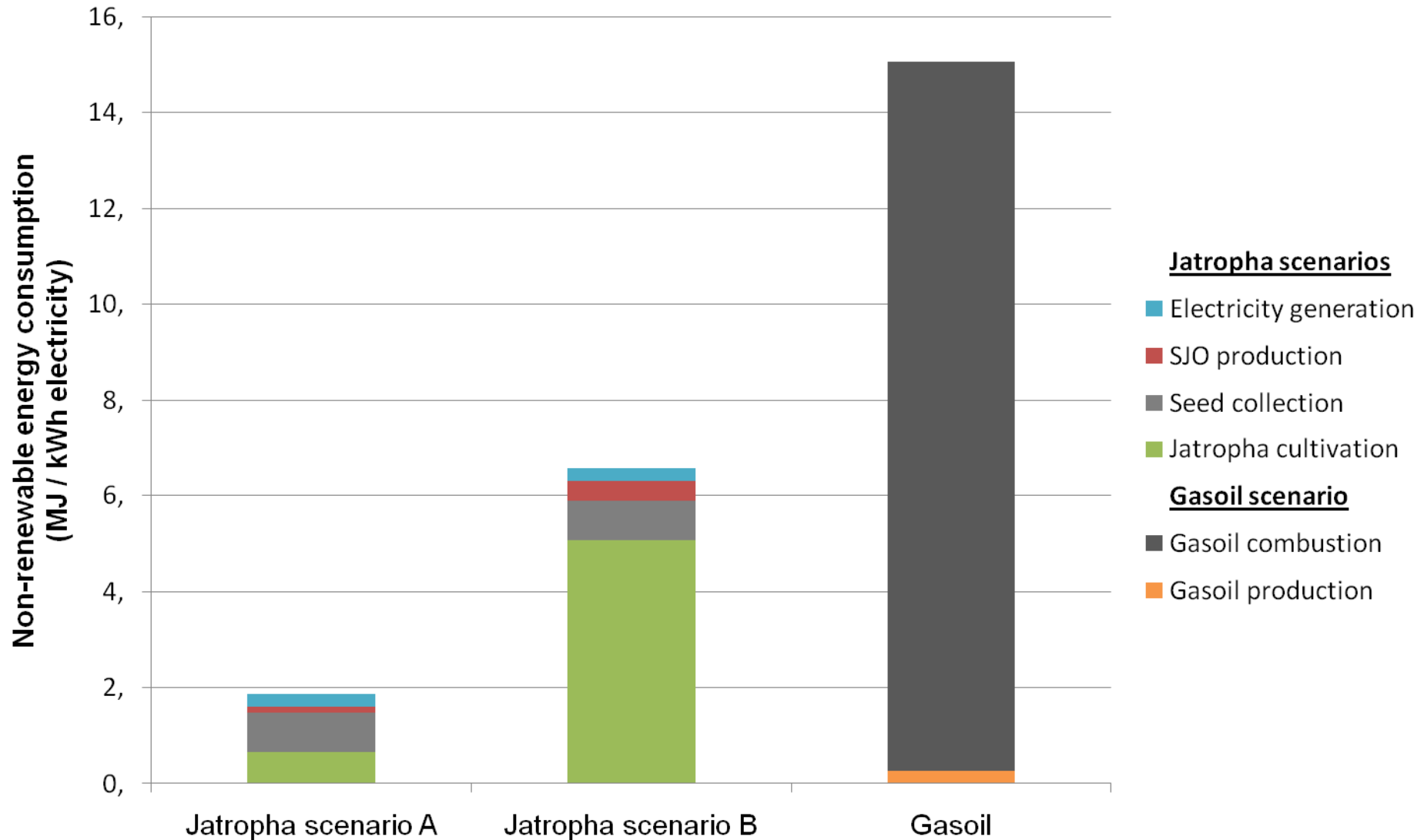




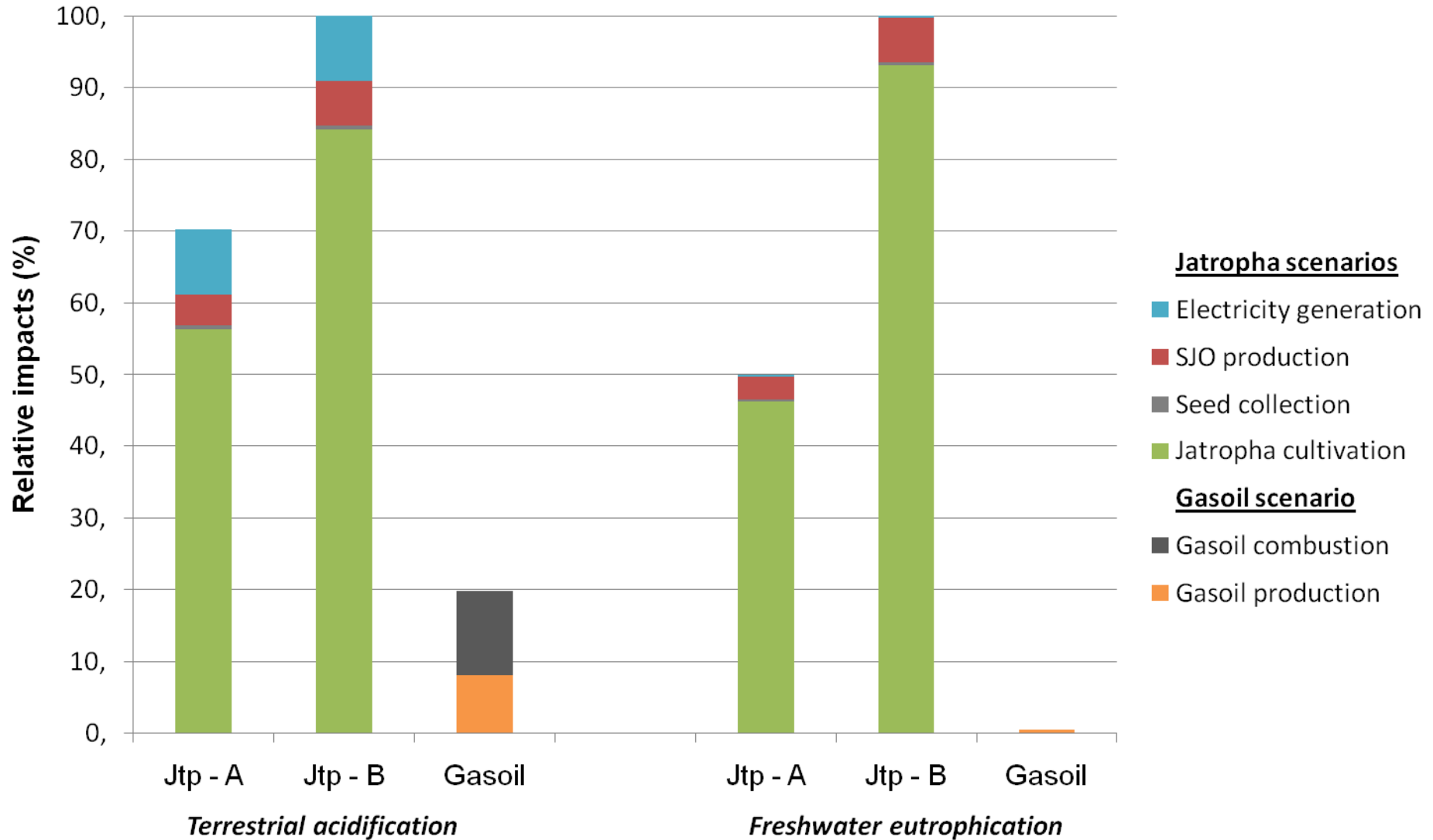
# Global impact: Climate change



# Global impact: Energy consumption



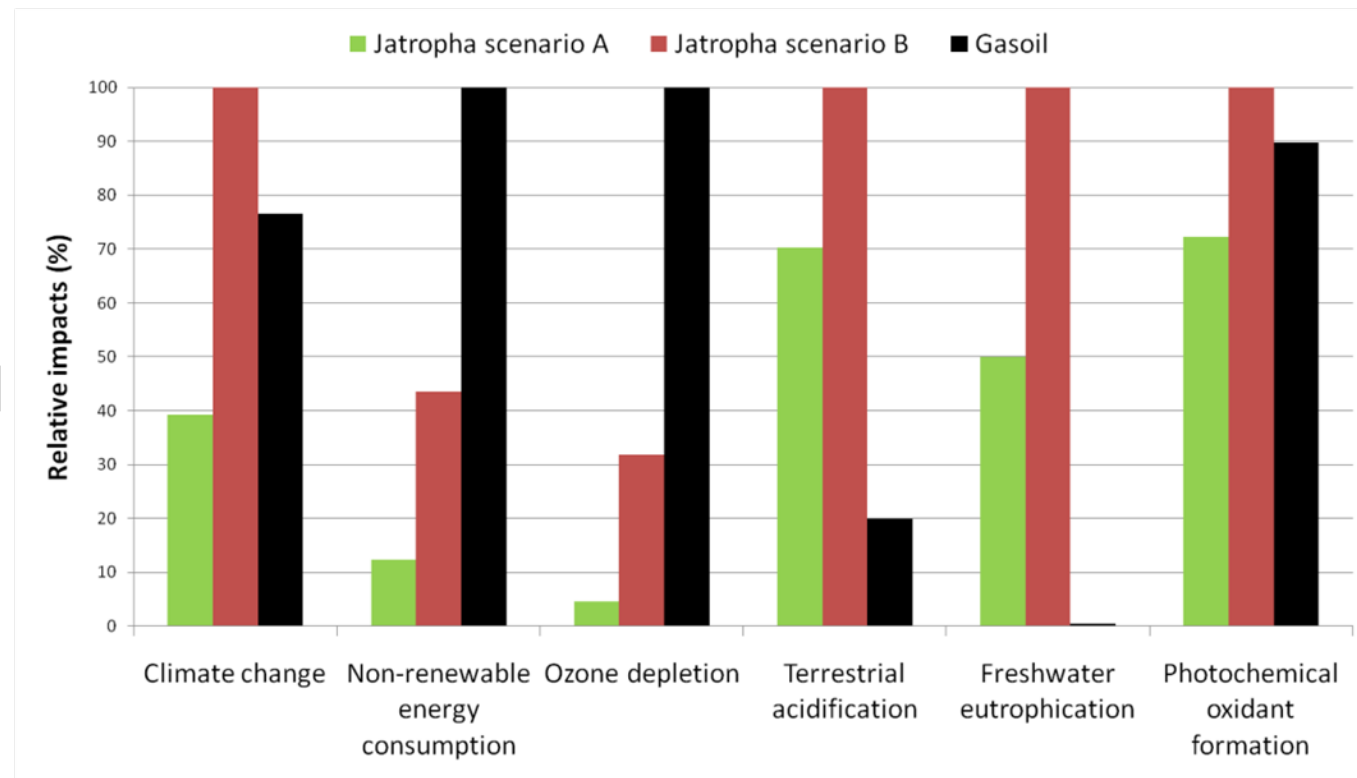
# Regional impacts




# Other impacts

- Other impacts considered
  - *Ozone depletion*: similar to energy consumption
  - *Photochemical oxidant formation*: not conclusive

- Impacts not considered
  - Toxicity and ecotoxicity issues



# LCA of *Jatropha*-based systems

- Major role of **fertilization** (chemical or organic)
  - *Scenario A*: environmental benefits compared to gasoil reference for global impacts
  - *Scenario B*: no compensation due to higher seed yield
  -  The economical point of view should be different
- Uncertainties and gaps in knowledge
  - Yield responses to fertilizer inputs
  - Soil emission models for fertilizer application
  - Potential improvements in the *Jatropha* cropping system

# Challenges for LCA application in Africa

- Mid-term perspectives
  - Development of specific databases for **background processes and supply chains**
  - Relevant integration of **human and animal labour**: an ethical, social and environmental issue
  - Development of crucial indicators: **water use**
- Long-term perspectives
  - Adaptation of existing **impact assessment methods for regional and local impacts** to tropical conditions
  - Development of crucial indicators: **biodiversity, land use**



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# Thank you!

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