

Bamboo as an Alternative Sustainable Fuel. A Life Cycle Assessment

C. M. Daza (ECN)

J. Camargo (Universidad Tecnologica de Pereira)

X. Londono (Sociedad Colombiana del Bambu)

R. Diaz-Chavez (Imperial College London)

A. Hensen (ECN)

B. Verheggen (ECN)

L. Fryda (ECN)

July 2013

ECN-M--13-016



Bamboo as an Alternative Sustainable Fuel.

A Life Cycle Assessment

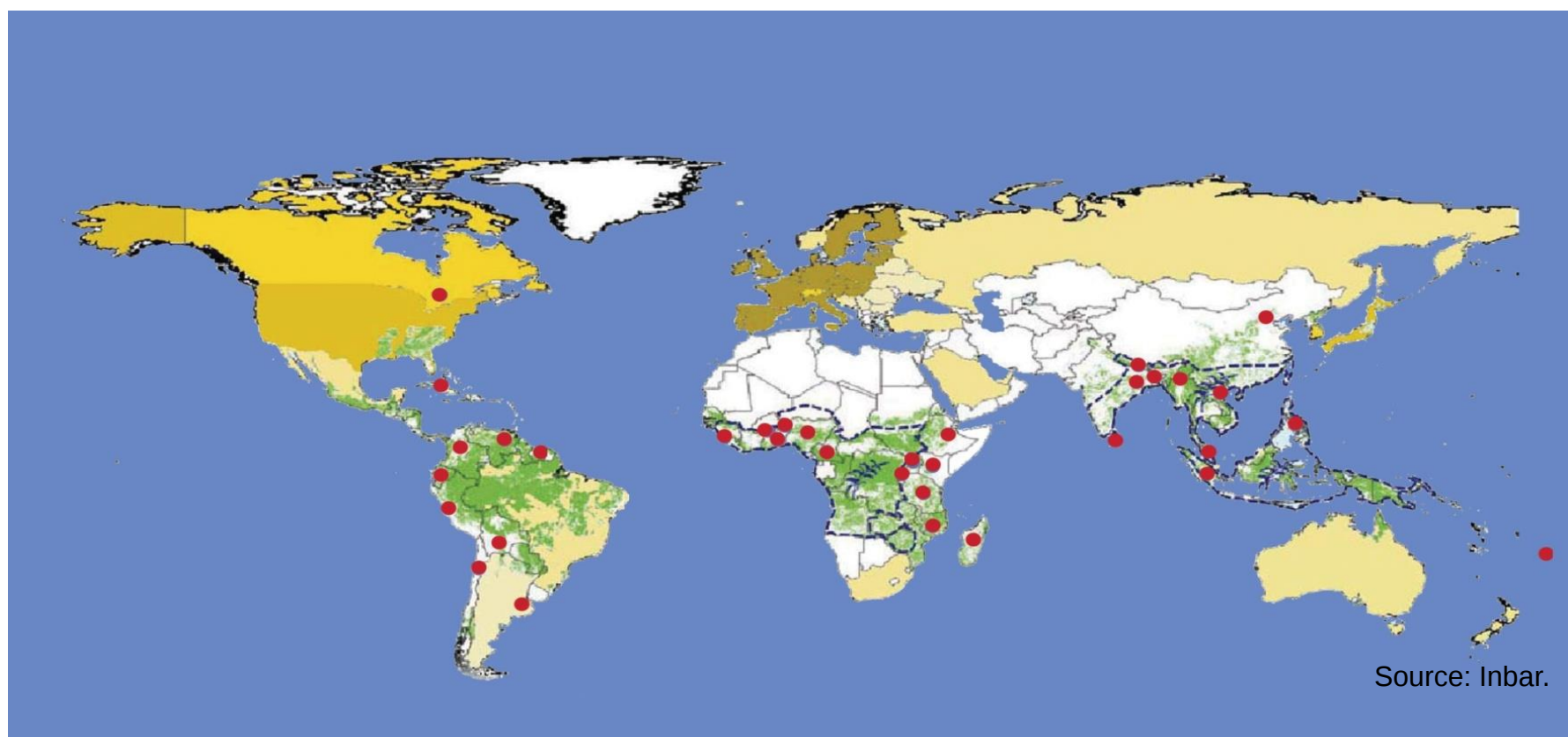
Authors

C. M. Daza¹, J. Camargo², X. Londono³, R. Diaz-Chavez⁴, A. Hensen¹, B. Verheggen¹, L. Fryda¹

Corresponding author; daza@ecn.nl

1. Bamboo

Bamboo is a potential sustainable biomass source for renewable heat and power production. As a resource it may total more than 36 million hectares worldwide. The techno-economic potential and sustainability as a feedstock for the bio-based economy differ according to the species, production location and cultivation practices (e.g. fertilizers application), etc.



3. Guadua angustifolia

- Woody bamboo species native to Latin America
- Fast growing:
 - 30 m in 6 months
 - 20-40 Ton/ha-year
- Excellent reforestation crop
- Easy to propagate
- Water table preserver
- Biodiversity preserver
- Carbon Sump
- Offers opportunities for rural development



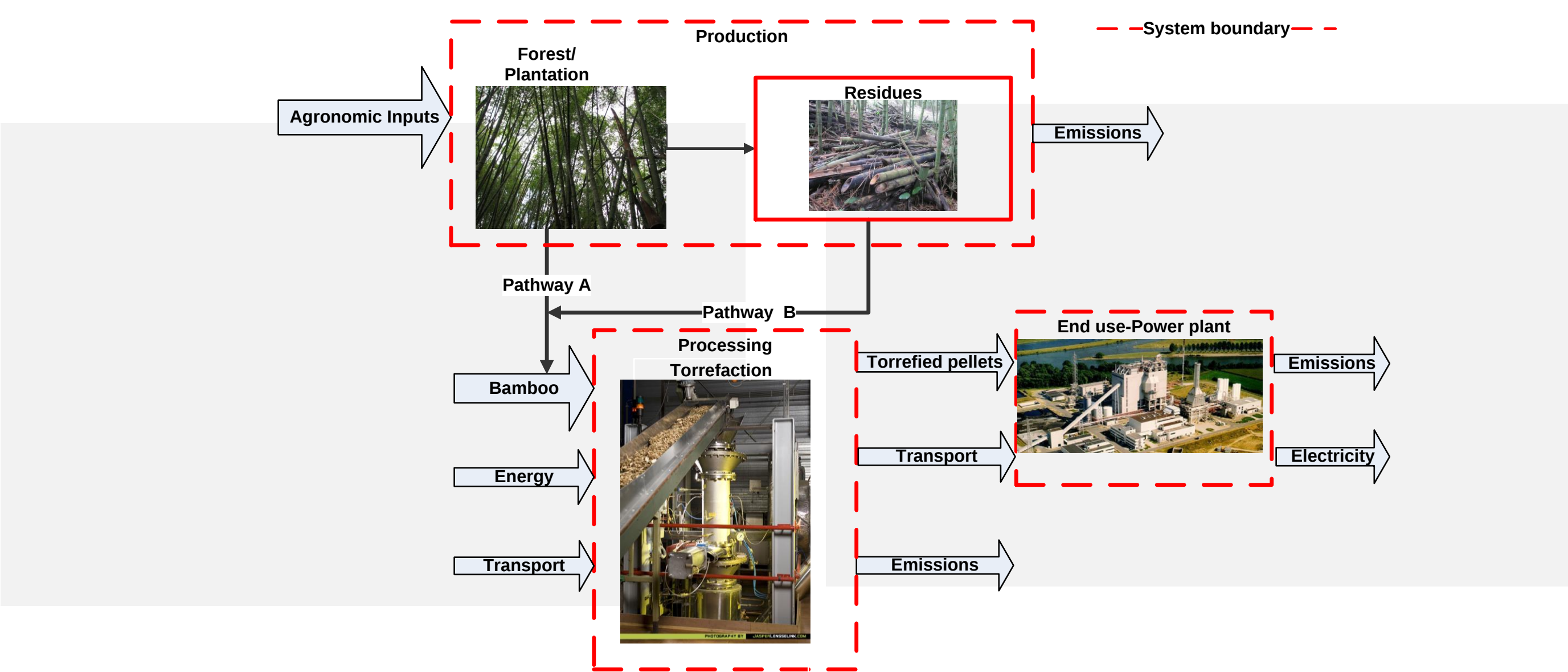
2. Objectives

- To assess the whole chain of bamboo cultivation & collection via torrefaction upgrading to application as biofuel for electricity production.
- To evaluate the reduction of greenhouse gas emissions (GHG) according to the EC recommendations for solid biomass and the certification system NTA8080.



4. Case Study Biomass Chain

- Torrefied bamboo-guadua exported from Colombia to The Netherlands.
- Biomass source: Forestry Stewardship Council (FSC) certified farms.

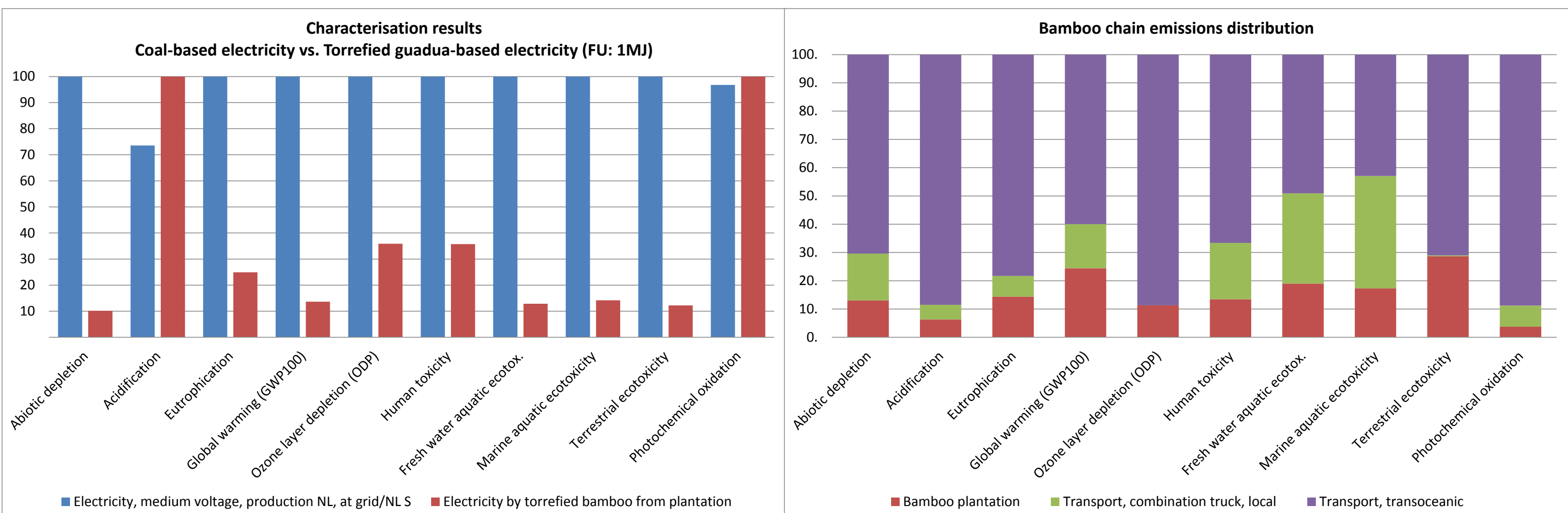


5. Sustainability Certification: FSC vs NTA8080

Sustainability criteria included	FSC	NTA8080
Biodiversity	Yes	Yes
GHG	No	Yes
Environment	Yes	Yes
Social	Yes	Yes

6. Life Cycle Assessment LCA

- GHG emissions accounting methodology follows: NTA 8080/81 and EC recommendations for solid biomass (COM 2010).
- Reference coal-based electricity: 198 gr CO₂ eq/MJ
- Torrefied guadua-based electricity: 26 gr CO₂ eq/MJ



Conclusion

- When compared to coal-based electricity, the use of torrefied bamboo-guadua as solid fuel results in a reduction of greenhouse gases emissions above 70%.
- When including emissions saving from carbon accumulation and potential bonus for restoring of degraded land, the GHG emissions reduction would be increased.
- Besides GHG emissions reduction, the bamboo chain has the potential to comply with the additional sustainability criteria from the certification system NTA8080.

Acknowledgements

This work forms part of the project “Torrefied bamboo pellets for sustainable biomass import from Colombia” which is partly financed by NL Agency under the subsidy scheme Sustainable Biomass Import.

¹ECN Biomass and Energy Efficiency, P.O. Box 1, 1755 ZG Petten, The Netherlands.
²Universidad Tecnológica de Pereira, Pereira, Colombia.
³Sociedad Colombiana del Bambu, Armenia, Colombia.
⁴Imperial College London, London, UK.

ECN

Westerduinweg 3
1755 LE Petten
The Netherlands

P.O. Box 1
1755 LG Petten
The Netherlands

T +31 88 515 4949
F +31 88 515 8338
info@ecn.nl
www.ecn.nl

