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Study of the environmental impacts of the insertion of preconditioning by fast pyrolysis in biomass energy supply chains



Timber harvesting in Amazonia generates a significant amount of waste: in the Brazilian state of Pará, for 2.5 million m³ of sawn timber produced in 2010, 4 million m³ of waste was generated. That biomass, now little regarded, could be a valuable input for an energy generation industry; but, given wood's low energy density and how scattered the resource is (in Pará, forestry operations take place in more than a thousand sawmills), the distances over which transport is feasible are limited, for economic and environmental reasons. This makes the undertaking a difficult one. Fast pyrolysis, a process of biomass preconditioning resulting in a liquid fuel known as pyrolysis oil or bio-oil, can significantly enhance the energy/mass ratio of the wood waste, so reducing the cost of transport. As bio-oils are liquid fuels, homogeneous and pure, they afford more recovery possibilities than raw biomass: co-refining with petroleum feedstocks; combustion in boilers, diesel engines, and extraction of molecules for simultaneous chemical upgrading.

The work of the UR "Biomass & Energy" (CIRAD), in collaboration with the University of Brasília (UnB) and the Brazilian Forest Service, aims to quantify, by means of an LCA, the environmental benefits of the incorporation of fast pyrolysis into biomass supply chains. The ultimate goal is to determine the contexts where fast pyrolysis is most relevant and most favours the emergence of a biomass-based energy production process, and to optimize the environmental benefits of the use of sawmill waste. This work is being undertaken as part of a doctoral programme co-supervised by CIRAD and UnB and the research project Multi-resource Adaptation to Gasification (AMAZON), co-funded by ANR, France / Conselho Nacional de Desenvolvimento Científico e Tecnológico, Brazil.

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At present a number of different tools may be used for these assessments (LCA, material flow analysis, inputoutput analysis, exergy, emergy, ecological footprint, environmental risk analysis). Of these, LCA has been identified as a potentially promising tool for local decision support. However, LCA is originally a product/service oriented approach. It has been proposed that the scale of the systems under review be expanded by incorporating an analysis of territorial systems. To date, no studies have been done for one entire territory. This may be explained by the presence of certain methodological obstacles: (i) definition of functional unit(s) and reference flow, (ii) selection of system boundaries, (iii) system modelling, and (iv) development of appropriate local decision support indicators. Accordingly, recommendations will be made on how to adapt the LCA methodological framework to the environmental assessment of whole territories. The work proposed by the thesis will be applied to the study of land use scenarios within the territory of Thau Lagoon (France).

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