

Comparative Techno-Economic Assessment and LCA of Selected Integrated Sugarcane-Based Biorefineries

Authors : Edgard Gnansounoua, Pavel Vaskan, Elia Ruiz Pachón

Abstract : This work addresses the economic and environmental performance of integrated biorefineries based on sugarcane juice and residues in the context of Brazil. We have considered four multiproduct scenarios; two from existing Brazilian sugar mills and the others from ethanol autonomous distilleries. They are integrated biorefineries producing first (1G) and second (2G) generation ethanol, sugar, molasses (for animal feed) and electricity. We show the results for the analysis and comparison of the different scenarios using a techno-economic value-based approach and LCA methodology. We have found that all the analysed scenarios show positive values of Climate change and Fossil depletion reduction as compared to the reference systems. However the scenario producing only ethanol shows less efficiency in Human toxicity, Freshwater ecotoxicity and Freshwater eutrophication impacts. The best economic configuration is provided by the scenario with the largest ethanol production. On the other hand, the best environmental performance is presented by the scenario with full integration sugar - 1G2G ethanol production. The integration of 2G based residues in a 1G ethanol production plant leads to positive environmental impacts compared to the conventional 1G industrial plant but proves to be more expensive.

Keywords : sugarcane, biorefinery, 1G/2G bioethanol integration, LCA, Brazil

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