Florida Energy Systems Consortium

University of South Florida

Feasibility, Sustainability and Economic Analysis of Solar Assisted Biomass Conversion

(Final Report)

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Description: The main deterrent for commercialization of biomass conversion processes is the cost of conversion; particularly the need to sacrifice as much as 30% of the energy content in the biomass for the thermo chemical conversion step. We want to research and develop the concept to use solar thermal energy from concentrating units to provide energy for the biomass gasification step. We also propose to evaluate the sustainability of such a process.

Overall Objective: The overall objective is to conduct a theoretical analysis of solar assisted thermo chemical conversion of biomass from the point of view of energy efficiency, economic feasibility, environmental impact, and long term sustainability of renewable energy production.

Budget: $45,238
Universities: USF

Executive Summary

The overall objective is to conduct a theoretical analysis of thermo chemical conversion of biomass with and without solar energy from the point of view of energy efficiency, economic feasibility, environmental impact, and long term sustainability of renewable energy production.

We completed process design and economic analysis of the thermochemical conversion of biomass to liquids with and without solar energy. It was found that the capital cost of the solar energy collection system is a significant factor in the economics of the process. The cost of solar thermal systems will have to be reduced before solar assisted biomass gasification can become feasible.

Based on economic analysis, the goal of LCA has been shifted to compare different feedstocks and processes because solar assisted biomass conversion is not economically feasible. In this study, a comparative LCA has been developed to evaluate the environmental impacts associated with different energy products via different routes across the whole life of algal and lignocellulosic bioenergy. Results were compared per energy basis, the production of 1 million BTU of energy products. It was found that cultivated algae biomass feedstock has much higher environmental impacts compared with lignocellulosic biomass feedstock from forestation and agriculture byproducts. It was also concluded that thermochemical gasification and FTS process showed higher efficiency when converting biomass to bioenergy.