TECHNOLOGY AND EQUIPMENT FOR LIGNOCELLULOSIC WASTE CONVERSION TO BIOFUELS AND BIOPRODUCTS WITH HIGH ADDITIONAL VALUE

INTRODUCTION

The study examines the feasibility of biogas biorefineries as a sustainable platform for material and energy recycling. The hypothesis tested is the design of biogas plants within the biorefinery concept can be economically attractive without subsidies. The investigation considers various concepts of plantation and biorefineries, with differing substrate pretreatment methods and product processing technologies. Parametric models are developed for each concept, allowing a comparison of mass and energy balances, technical maturity, and economic feasibility. Analysis shows that all concepts except biogas upgrading are unfavorable with negative payback periods, while biogas upgrading still lacks investment appeal.

OBJECTIVES

- To create a general parametric model of biogas biorefinery enabling a comparative evaluation of mass and energy balances, technical maturity and design economics, including sensitivity analysis.
- To investigate an innovative technological setup treating lignocellulosic biomass in biorefinery concept to reach investment attractiveness without any subsidies.

CONCLUSIONS

- Original parametric models were created for individual model embodiment technologies, which enabled a comparative evaluation of mass and energy balances, technical maturity, and design economics.
- The dissertation refines the hypothesis that the design of BP in the biorefinery concept can achieve economic attractiveness without the implementation of subsidized product selling prices.
- Conventional BP showed that it could not be sustainable without subsidies. The electricity price is too low for economic feasibility. However, the production is well known, making the process more reliable and predominantly selectable.
- Biogas upgrade with current assumptions, free raw material mainly, showed the best sustainability, compared to the other concepts. The process is well known. However, the critical factor here is the price of biomethane.
- Intensified BP cannot be sustainable even having free raw material. Subsidies here play a crucial part. Also, the new pre-treatment method process cannot be completely reliable.
- Biogas-biogas biorefineries showed the worst sustainability. In addition, the value of dry fiber is low, which means selling price growth cannot be foreseen.
- Both biogas-biogas biorefineries showed their unsustainability. A crucial factor is the selling price of algae. The demand for biogas and algae should go up in the future, making this concept quite promising.