A techno-economic assessment for optimizing methanol production for maritime transport in Sweden

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Abstract:
The maritime transport sector is currently highly dependent on oil-based fuels. International regulations enforce tight limits regarding NO_x emissions from the exhaust gases and maximum sulphur content in the fuel, enhancing the sector interest towards the development of cleaner alternative fuels. A transition to biomass-based liquid fuels is of interest as a common solution for reducing pollutant emissions and for CO_2 emissions mitigation. In this paper, a case study on Sweden analyses the potential of methanol production, using gasification of woody residues from sawmills to cover domestic and international maritime energy demand. Methanol seems to be a promising alternative to heavy and light fossil oils as maritime fuel, and sawmills residues are an abundant resource in Sweden. The study considers the entire methanol production chain, starting by assessing the availability of sawmill by-products and ending with the energy demand of final users, identified as the Swedish ports. The analysis considers two scenarios until year 2035, assuming different share of energy demand covered by methanol. When considering the production and use of biofuels, the cost for transportation of the feedstock and the final product have a great impact on the final cost. An optimization model is used to locate the methanol production plants, so to minimize the cost of the production chain. Four possible plant sizes are considered, 100, 200, 300 and 400 MW of biomass fuel thermal input. The production plant is modelled to determine the material and energy streams involved in the process and to obtain the cost and efficiency of producing methanol at the synthesis plant. The results include the final methanol cost and an estimation of the CO_2 emissions reduction potential from replacing oil fuels with methanol for the assumed scenarios.

Keywords:
Gasification, Maritime Transport, Methanol, Sweden, Woody Biomass.