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Large-Scale Biomass Gasification Technologies as a Sustainable Pathway for Reducing the LNG Value Chain Carbon Intensity

Lead author: Dr. Zaher El Zahab, Program Director – Gasification, GTI Energy

Biomass gasification holds promise as a sustainable pathway for reducing environmental impact in the liquified natural gas (LNG) value chain through the use of biogenic feedstocks. The main objective of this paper and presentation will be to provide the conference attendees with a basis from which they can understand the potential role for biomass gasification in reducing the carbon intensity of the LNG Value Chain and compare the leading technologies that are currently available to achieve this.

The integrated biomass gasification process starts with the biomass feedstock preparation. The prepared feedstock is then pressurized and fed into the gasifier where it is partially oxidized by oxygen to generate the amount of heat needed to drive the endothermic gasification reactions producing synthetic gas (syngas). The produced syngas then goes through a clean-up step to remove contaminants and fines and then enters a water gas shift (WGS) step to adjust the H2/CO molar ratio in the syngas stream to a value of ~3. The shifted syngas then enters an acid gas removal (AGR) step where the majority of carbon dioxide (CO2) and acid gases are captured. The syngas then proceeds to enter the methanation step for the production of biogenic synthetic natural gas (BioSNG) which can be subsequently liquified to yield the final BioLNG product.

It is important to highlight that biomass gasification would result in the BioLNG product having a negative carbon intensity if the CO2 captured in the AGR step is geologically stored; this is a carbon dioxide removal mechanism whereby atmospheric CO2 is biologically captured by biomass species and then the biomass is gasified into a syngas stream from which CO2 is captured and geologically stored. This highlights the key importance of biomass gasification in producing net negative products, enabling a pathway for the sales of carbon offset credits to help improve the overall BioLNG production cost.

The presentation will summarize various state-of-the-art biomass gasification technologies, and the key challenges associated with them. The presentation will then summarize recent research innovations that are targeted to mitigate said challenges to increase process reliability and reduce BioSNG production cost. The innovation topics to be discussed will focus mainly on biomass feedstock preparation; biomass feedstock feeding into gasifiers operating at high pressures; strategies to optimize the gasifier thermal efficiency; and syngas clean-up. The presentation will also discuss strategies for locating BioSNG production plants in locations suitable for geological CO2 storage as well as near existing natural gas transmission networks and pipelines that can deliver gas to LNG export terminals. A technoeconomic sensitivity analysis will be provided in the end to identify optimal scenarios under which the BioLNG can be produced at costs that are competitive with a fossil baseline.

To view the full technical programme, visit https://lng2026.com/technical-programme

This abstract will be presented during LNG2026 conference on 2-5 February in Doha, Qatar