Gasification and syngas potential for biomass and waste feedstocks

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Biomass and waste resources can provide sustainable energy and hydrocarbon sources, supporting efforts to reduce emissions and improve resource efficiency. The feasibility of using these resources depends on factors such as feedstock type, availability, and distance to the point of use, which influence both logistics and the choice of conversion technology.

Gasification is a thermochemical process that converts carbon-based materials into syngas under controlled oxygen or steam conditions at high temperatures. This process can accommodate a wide range of feedstocks, including agricultural residues, forestry by-products, biosolids, municipal solid waste and other industrial and construction wastes. The resulting syngas, mainly composed of CO and H_2, can be used in two main ways:

- Direct energy use: For example, syngas can replace natural gas in high-temperature industrial processes such as iron and steelmaking, aluminium and alumina refining, and cement and lime production.
- Fuel and chemical production: Syngas can be upgraded to low-carbon fuels such as sustainable liquid fuels (including SAF) through Fischer–Tropsch synthesis, alcohol-to-jet pathways, or other catalytic conversion and refining processes.

This presentation will discuss recent studies at CSIRO Energy on the use of gasification technologies and pathways for conversion of biomass and waste feedstocks for industrial energy substitution and sustainable fuels production in Australia.