ALBERTA INNOVATES

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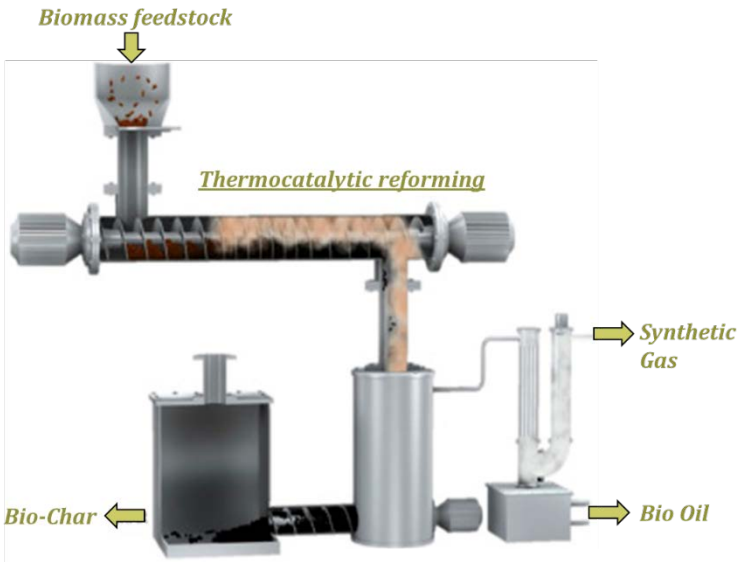
BIOENERGY & CIRCULAR ECONOMY - RENEWABLE FUELS

Biobattery – Decentralized Production of Fuel from Forest and Agricultural Waste

Several production technologies transform biomass into bio-oil by pyrolysis, the heating of material in the absence of oxygen. However, conventional pyrolysis technologies produce low quality bio-oil and are mostly being developed for large-scale centralized facilities. The project, led by Dr. Amit Kumar, is a pilot-scale assessment of the "biobattery" concept. The biobattery is based on the patented thermo-catalytic reforming (TCR®) technology, developed at the Fraunhofer Institute, Germany, to produce higher quality bio-oil, char, and gases. The pilot evaluated intermediate pyrolysis of woodchips and straw biomass to produce biojet fuel and char for power generation. This project will help commercialize the use of forest and agricultural residue, diversify Alberta's economy and reduce greenhouse gas emissions.



Picture courtesy: Fraunhofer Institute

FUNDING DETAILS

RECIPIENT:
University of Alberta

PARTNERS:
Ministry of Economic Development and Trade, AI, WestJet, Fraunhofer Institute, Future Energy Systems – Canada First Research Excellence Fund, U of A

TOTAL BUDGET:
$2,527,000

AI FUNDING:
$300,000

PROJECT DATES:
DEC 2016 – MAR 2021

PROJECT TRL:
Start: 5
End: 7

APPLICATION

The core of the biobattery concept is the thermo-catalytic reforming (TCR®) technology for intermediate pyrolysis with a post-reforming stage to convert biomass into high-quality bio-oil, syngas, and char. The key focus of this research project is to help address the challenges with the bio-oil produced from conventional pyrolysis. This technology has potential as a small-scale system for decentralized deployment. The resulting bio-oil product can be used for energy in the oil sands and power sectors, or further co-processed with crude oil to produce liquid biofuels, including biojet fuel for the aviation industry.

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PROJECT GOALS

- Demonstrate feasibility of TCR technologies at pre-commercial scale in Alberta
- Generate experimental results from laboratory-scale and pilot-scale units using various feedstock materials, such as forestry waste and agriculture waste, to produce bio-oil, gas, and char.
- Explore the opportunity for biojet fuel production.
- Develop models for a commercial-scale unit.
- Assess the risks by demonstrating TCR technology for Alberta-based feedstocks.

BENEFITS TO ALBERTA

This project is critical for Alberta's energy industry and municipalities, which are looking for ways to reduce their carbon footprint.

- This project may lead to many economic benefits including: development of a new fuel source; increased local revenues; local employment and skills development related to the integration of biomass processing and supply, operation, maintenance and operating support services; and the development of alternative transportation fuel sources from biomass to offset fossil fuel-based liquid fuels and associated GHGs.
- This project also encourages greater renewable fuels and chemicals production and provide new market opportunities for agricultural producers and rural communities, which will help diversify Alberta's energy industry and create jobs provincially and nationally.

2 Publications

6 Students Trained

11.1 kt/yr Future GHGs Reduced

CURRENT STATUS

Completed March 2021. The process modelling of TCR technology was successfully validated with published results. The laboratory scale TCR unit (2 kg biomass/hr) consistently yielded high quality gases, bio-oil and biochar from both wood and straw biomass. Pilot scale unit (30 kg biomass/hr) installation and operation were delayed due to the COVID pandemic. Ongoing work will conclude with a final report to all partners.