

Project Title: Ultra-low Sulfur Winterized Diesel

Applicant: LanzaTech Inc

Principal Investigator: Dr. Richard Rosin, Director of Catalytic Conversion Technology

Major Participants: Pacific Northwest National Laboratory

Project Objectives

Develop and optimize a process for making low-sulfur drop-in renewable diesel fuel with superior low temperature performance from biomass-based ethanol.

Project Description

LanzaTech and PNNL will collaborate to develop and validate a robust, flexible Alcohol-to-Diesel (ATD) process for producing drop-in renewable diesel fuel from biomass-derived ethanol. By using an ethanol intermediate, the ATD process will enable renewable diesel to be produced from any ethanol that meets customer and application requirements. This feedstock flexibility will allow a commercial ATD refinery to minimize the cost of production by selecting the lowest-cost ethanol source that satisfies the needs of each market. Synthetic paraffinic diesel from the ATD process will be a drop-in diesel fuel, fully compatible with existing fueling infrastructure and engines, suitable for use in each target market at any blend level. The life cycle GHG reductions of the SPD fuel are expected to be 60% or higher, depending upon the source of ethanol feedstock.

The ATD process will yield a synthetic paraffinic diesel with low-sulfur content and superior low temperature performance. PNNL will conduct the R&D necessary to understand the relationships among catalyst/process parameters and diesel product characteristics, to enable diesel properties to be tuned to match the specifications for each diesel application. The technology will be validated through production of hundreds of gallons of synthetic paraffinic diesel and engine testing.

Project Impacts

This project will increase the supply of clean, low carbon, renewable diesel for transportation and stationary applications. The contributions of diesel combustion to air pollution have gained global attention in recent years. In fact, in April 2018, the International Maritime Organization adopted new regulations designed to address the emission of air pollutants from ships, including both greenhouse gases and sulfur dioxide. However, diesel will remain the fuel of choice for marine and heavy duty road transport, even with electrification of light duty vehicles.

Increasingly stringent fuel quality standards, such as the IMO regulations discussed above, are creating demand for low sulfur diesel. At the same time, the market for low carbon, renewable diesel from non-food feedstocks is growing, driven by sustainability and carbon reduction objectives, as well as renewable fuel mandates. However, the supply of renewable diesel is currently constrained by the availability of non-food lipid feedstocks for established hydrotreating routes.

By expanding the pool of renewable diesel feedstocks to encompass any source of ethanol, such as agriculture and forestry residues, energy crops, municipal waste, and other non-food feedstocks, this project will provide the technology required to meet the need for clean diesel fuel from acceptable biomass sources. The result will be a cost-effective route to drop-in renewable diesel that is ready for rapid commercialization and widespread deployment using domestic biomass resources.