Sustainable Aviation Fuel from Cellulosic Ethanol

Oak Ridge National Laboratory (ORNL) and Gevo Inc. PI: Andrew Sutton Ph.D. (ORNL)

Objectives: ORNL and Gevo Inc. aim to partner in order to mature a single-step process that converts ethanol to olefins that can be readily converted to sustainable aviation fuel (SAF). The project will develop industrially relevant catalyst formulations and test catalyst pellets in a 100 g reactor that will inform computational models capable of predicting reactor performance at larger scale. In conjunction with technoeconomic models and lifecycle assessments, this will provide relevant data to de-risk further scale-up and commercialization.

Description: The project will scale up the single-step ORNL ethanol to C_{3+} olefins (ETO) unit operation from lab scale to a 100g catalyst bed (~ 300x increase) in conjunction with Gevo such that the overall ethanol to jet (ETJ) process can be more readily implemented at an industrial scale. We aim to produce SAF blending components by coupling the enhanced ETO process with downstream processing, which includes separation, oligomerization, and hydrogenation steps. The end goal will be to develop 1) a high-fidelity model of a 100 kg pilot reactor with data supplied from ORNLs Modeling Informed Pre-pilot Scale-up (MIPS) capability with industrially relevant catalyst to derisk the further commercializion of this technology 2) commercial scale-up ready catalyst formulations and recipes, and 3) an overall process model to convert ethanol into liquid hydrocarbons that includes ORNL's ETO unit operation.

Impacts: This project proposes to advance the single-step ethanol to olefins (ETO) technology, including catalyst preparation, to a pilot-ready status (i.e. from TRL 3, its current state, to the end stages of TRL 5, pre-pilot). To generate technoeconomic models of the complete ETJ process that are sufficiently accurate to inform commercialization timelines, this project also proposes to develop the specific downstream processing and conversion steps necessary to prepare SAF from the unique ETO product mixture.