

Public Abstract

This project will scale Alder Energy's proprietary advanced pyrolysis oil (APO™) technology to convert 0.5 tonnes of biomass per day and produce sustainable aviation fuel (SAF) at <\$2.75 per gallon with negative carbon intensity from regen-ag Miscanthus. Alder Energy's APO technology addresses the challenge of 1st stage hydrotreater plugging with commercial fast pyrolysis oils by employing solvent fractionation to generate two process streams for downstream upgrading. The APO process separates lignin-derived phenolics into a hydrophobic APO phase with <1 wt% water content and 1.7x energy density of fast pyrolysis oil, while most of the reactive sugars, acids, and aldehydes are separated into the aqueous phase for separate processing. This allows APO to undergo continuous hydrotreating to produce 80% C-yield of liquid biofuel and yield >70 vol% SAF that meets initial ASTM Fast Track specs as a blend. We will evaluate regen-ag Miscanthus biomass as the feedstock, which has the potential to produce an additional >7 billion gallons of SAF with negative carbon intensity due to net carbon sequestered in the soil during cultivation. EERE funding is critical to derisk the scale-up of APO production with increasing volume and operation. This project will provide key data to baseline woody biomass APO performance against Miscanthus, and conduct hydrotreating with iterative SAF fuel property testing for meeting ASTM spec. Success will provide the data needed to accelerate APO-SAF commercialization.

To advance APO-SAF technology, our team brings together world-class expertise across the entire SAF value chain. Our expertise includes fast pyrolysis know-how by NREL and UOP, bio-oil fractionation technology by Alder Energy, regen-ag biomass field trials and carbon intensity quantification by UIUC, bio-oil hydrotreating and refinery integration expertise by NREL and UOP, SAF fuel property testing expertise by UDRI, techno-economic and life cycle analysis skillsets by NREL and UIUC, commercial and business aviation industry insight for SAF by ASCENT, CAAFI, United Airlines and Gulfstream, and ASTM SAF qualification and flight test capabilities by United Airlines and Boeing. As the capstone, if target metrics are successful, we will conduct the world's first carbon negative flight demonstration on APO-SAF produced from regen-ag Miscanthus. If realized, this technology will spur the creation of new U.S. jobs for decarbonized energy and regen agriculture.