

Summary/Abstract for Public Release

Production of Sustainable Aviation Fuels from Corn Stover via NREL's Deacetylation and Mechanical Refining Technology (SAFFiRE)

Mark Yancey, Principal Investigator
D3MAX LLC

This project, called SAFFiRE, will demonstrate reliable, low-GHG production of sustainable aviation fuels (SAF) from corn stover in a fully integrated, 10 tonne per day pilot-scale facility. Our novel process utilizes NREL's low temperature deacetylation and mechanical refining (DMR) pretreatment, enzymatic hydrolysis using Novozymes commercial hydrolytic enzymes, C5/C6 sugar fermentation to an intermediate ethanol product using commercial yeast from Lallemand, and LanzaJet's Alcohol-to-Jet (ATJ) process to convert the ethanol to SAF. In addition to the low cost, high titer, highly fermentable sugars produced in this reliable low-cost pretreatment, the valuable, non-condensed lignin produced will be recovered, dried, and pelletized for sale as fuel pellets or sold directly for upgrading.

Most of the proposed process utilizes well established unit operations, including corn stover comminution, biomass pulping, enzyme hydrolysis, yeast to ethanol fermentations, ethanol distillation, and the LanzaJet ethanol to SAF process. However, the DMR pretreatment, although technically proven at NREL at the small pre-pilot plant scale, will now be scaled up to the 10 tpd scale to generate the data needed to design demonstration and full commercial plants.

A critical and distinguishing feature of this project is co-location of the Gen 2 corn stover processing pilot plant on the site of an existing 50 mgd corn starch (Gen 1) ethanol plant. This co-location permits leveraging of utilities and skilled plant personnel for the smaller Gen 2 pilot plant, especially regarding electric power, process water, and low-pressure steam. Lincolnway Energy, a 60 mgd corn ethanol plant located in Nevada, Iowa will host our SAFFiRE project.

Preliminary LCA and TEA studies at NREL have indicated that the proposed SAFFiRE process could produce GHG reduction by as much as 84%. Moreover, estimates based on the current price of corn stover, cost of enzymes, SAFFiRE Capex and Opex, and the value of D3 RINs yield a Minimum Fuel Selling Price (MFSP) of about \$2.75/gallon SAF produced.

Pilot plants are normally not profitable. Without EERE funding it is unlikely that a private company would fund the proposed pilot project. EERE cost share will make the project more acceptable to the private sector given the risk/reward profile. EERE funding will also speed the time to market by funding the key step in technology deployment—fully integrated pilot testing. Successful pilot operation will incentivize private funding of a demonstration project and commercial projects.

The SAFFiRE process coupled with LanzaJet's Alcohol-to-Jet process could yield billion of gallons of low carbon SAF by 2040.