

**DOCKETED**

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*Comment Received From: Joseph Degenfelder*  
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**Suggested CA Conference - Overview Advanced Biofuels Projects  
06-14-20**

*Additional submitted attachment is included below.*

Company, Product and target market	Technology/Readiness	Overall Ranking Commercial viability	Estimated GHG Impact
Fulcrum Bioenergy, Syncrude to be upgraded in West Coast refinery Nevada to California	Waste gasification/F-T Plant designed and about 85% built.	100% Under construction by Abengoa Engineering; cost over-runs cause minor delay 3 <sup>rd</sup> qtr 2020 startup Second project site in Gary, IN	CI (Carbon Intensity) of 25 gCO <sub>2</sub> e/MJ
DGE Trafalgar Project SPK Jet Fuel blend component Louisiana to California	Biomass gasify /F-T Upgrading: electrolysis of CO <sub>2</sub> to syngas using renewable energy FEL1 complete, FEL2 underway.	80% Project funding delayed by coronavirus. Will need initial investment for FEL2/3 and final design efforts.	CI of --20 gCO <sub>2</sub> e/MJ Potential for lower CI if CCS used
USA BioEnergy Renewable diesel and naphtha Arkansas to California	Biomass gasify/F-T Upgrading with CO <sub>2</sub> Capture and Storage CCS supervised DOE FEL1 complete,	40% Secured feed and off-take agreements for 15 years. CCS well to be drilled by DOE. Funding needed for FEL2/3 and construction	CI of --130 gCO <sub>2</sub> e/MJ CCS for all process gases and flue gasses greatly lowers CI of fuels
Neste USA Project Renewable diesel and naphtha California market	Used Cooking Oils - world biofuels leader	100% For feedstock Neste acquired Mahoney Environmental. Neste's estimated imports of 500 million gallons in 2020 require an investment in the U.S.	CI of 33-37 gCO <sub>2</sub> e/MJ depending on feedstock
Next Renewable Fuels, Renewable diesel and naphtha Oregon to California	Fatty Oil hydroprocessing tech supplier unknown	50% Challenges for feedstock availability	CI of 32 gCO <sub>2</sub> e/MJ ; 40-50 CI if Soy or Canola oils.
Phillips 66/REG, Renewable diesel Washington to California	Fatty Oil hydroprocessing developed process commercial	0% (project cancelled) Feedstock availability and permitting issues, project cancelled	CI of 34 gCO <sub>2</sub> e/MJ per California LCFS from UCO
LanzaTech Cellulosic ethanol to SPK Jet Fuel	Acetogenic bacteria conversion of syngas to ethanol; dehydration and oligomerization to hydrocarbon fuels.	50% Acetogenic bacteria conversion not commercial scale. August 2019 deal with Novo Holdings emphasis on non-fuel products. LanzaJet formed June 3, 2020 with All-Nippon Airlines, Mitsui and Suncor as investment partners.	No data but similar processes should produce fuel with <40 gCO <sub>2</sub> e/MJ dependent on process efficiency
Velocys Bayou Fuels Renewable Diesel and Naphtha UK program	Woody Biomass to hydrocarbon fuel using microchannel reactors. Includes CCS TRI Gasifier and syngas cleanup solid, Microchannel reactor	10% Velocys F-T technology has issues such as need for multiple reactors and frequent regeneration. Other technology aspects are viable. Low ranking influenced by failed Ashtabula, OH project and shutdown of Envia Energy JV with Waste Management, Inc. Altalto Immingham Ltd plan for UK is retrenchment.	Negative CI; No specific value Could be -100 gCO <sub>2</sub> e/MJ range.

Gevo, SPK jet fuel and isooctane gasoline blend component Minnesota to Airlines/California	Conversion corn sugar to isobutanol followed by dehydration, oligomerization and hydrotreating No large scale process	100% Production of major product, butanol, at LaVerne, MN plant Increased by two added ethanol plants started 2 <sup>nd</sup> qtr 2020. Unit for conversion to renewable SPK fuel at LaVerne to start In 2021. Deal to supply 10 million gals/year to Delta Airlines.	40 CI Conversion of butanol to hydrocarbon fuel is costly and energy consuming adding to CI of overall process
Northwest Advanced BioFuels SPK Jet Fuel Washington to California	Biomass gasify/F-T upgrading guarantee from ThyssenKrupp, Questions about slurry F-T reactor (Axens)	40% Early stage development without FEL2 cost estimates, questionable F-T technology selection. Support from Delta gives funds to progress engineering,	CI of 30 gCO <sub>2</sub> e/MJ Estimated CI based on similar processes. No published data. Without sequestration, CI will be high.
Red Rock Biofuels SPK jet fuel	Biomass gasify/F-T upgrading Gasifier not efficient Velocys F-T technology	5% Despite receiving bond funding, this project is suspect. Gasifier and F-T selections are not optimum and engineering done in- house. Construction delayed.	CI of 74 high for biofuels; only 20% reduction from fossil baseline due to high NG consumption for syngas.

Notes:

CCS Carbon Capture and Storage, a method for removing CO<sub>2</sub> from process streams and storage of CO<sub>2</sub> underground.

CI Carbon Intensity, the GHG emissions associated with production and use of a fuel.  
Fossil Fuel emissions are 95 grams of CO<sub>2</sub> equivalents (CO<sub>2</sub> + other GHG emissions per mega-Joule of energy content (gCO<sub>2</sub>e/MJ).  
1055.056 MJ is equivalent to 1,000 Btu.

FEL2/3 Front-End Loading, engineering terms for level of engineering and cost estimates.  
FEL2 produces fully designed chemical process with +/- 30% cost estimate for plant construction.  
FEL3 produces site specific engineering for building facility and +/- 5% cost estimate.

F-T Fischer-Tropsch syngas to hydrocarbon conversion technology.

Robert L. Freerks, VP Atlantic Greenfuels, LLC Submitted 24 February 2020 to US EPA

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