



IEA Bioenergy
Technology Collaboration Programme



USA Country Update

IEA - T33 Meeting

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Technology Collaboration Programme

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Updates on Commercialization Activities

- Fulcrum Sierra Biofuels
- Red Rock Bio
- Other commercialization activities
- Comments on the political environment

Fulcrum Bioenergy/Sierra Biofuels



Fulcrum Bioenergy/Sierra Biofuels, Reno NV: (11MM GPY)

- 1) MRF operational since 2016; at landfill 10 miles from biorefinery
 - a) 350,000 tons per year raw MSW => 175,000 tons per year prepared MSW
 - b) 20 TPH throughput
- 2) Gasification/FT
 - a) MSW feedstock/TRI indirectly heated fluid bed steam reforming gasifier
 - b) Johnson Matthey DAVY™/BP fixed-bed FT
- 3) Phase I is for Fischer-Tropsch wax
 - a) Wax to be refined by Marathon
 - b) Other offtakers include United and Cathay Pacific, BP Air, World Fuels
 - c) FT jet fuel capability to be added in Phase II
- 4) Plant is 'full scale'; scale up (3X) planned with parallel trains
 - a) 12 new projects currently planned/underway
- 5) Status: Plan now undergoing start-up operations

Feedstock – Sorted MSW



Fulcrum BioEnergy/Sierra Biofuels

Plant Construction Activities, Late 2020



Red Rock Bio

Red Rock Bio, Lakeview, OR (15MM GPY)

- 1) Gasification to Fischer-Tropsch Jet Fuel
- 2) Technology providers
 - a) Gasification: TCG Global
 - b) FT technology: Velocys and Emerging Fuels Technology
 - Parallel FT trains
 - c) Hydroprocessing: Haldor Topsøe
- 3) Feedstock: forest residue (166,000 dry tons per year)
- 4) Products: SAF, diesel, and naphtha
- 5) Offtakes: Southwest Airlines, FedEx
- 6) Status: anticipated construction completion; Q4 2022



Red Rock Biofuels Construction Progress



Other Commercialization Activities

San Joaquin Renewables; San Joaquin, CA

- Gasifier: Frontline BioEnergy RNG
 - Pressurized fluid bed (10 Bar)
 - Air or oxygen with steam (TarFreeGas[®]; PMFreeGas[®])
- Feedstock: Ag wastes
- Product: RNG (15 million gallon-equivalents)
- Status: engineering in progress; approvals for injection in existing pipelines received



Mote

- Gasifier: SunGas Renewables
 - Pressurized fluid bed (10 Bar) with CCS
- Feedstock: Ag residues
- Product: low-carbon Hydrogen
- Status: initial stages of project planning



Other Commercialization Activities

Arbor Renewable Gas, Beaumont TX

- Gasifier: SunGas Renewables
 - MTG: Haldor Topsøe
- Feedstock: woody biomass
- Product: 1,000 BPD renewable gasoline (MTG)
- Status: Commercial production in 2024



TOPSOE

MaderaGas, Houston TX

- Gasifier: SunGas Renewables (with CCS)
- Feedstock: woody biomass, 100,000 TPY each train
- Product: RNG; 5 production trains => 5B SCFY RNG
- Status: construction on first train in 2023; operational in 2024



Other Commercialization Activities

Velocys, Natchez MS and Immingham UK

- Velocys microchannel FT reactor
- Feedstock: woody biomass (Natchez); MSW (Immingham)
- Product: 35M GPY sustainable aviation fuel (Natchez); 20M GPY (Immingham)
- Status
 - Immingham: planning underway – start-up in 2027; BA fuel offtaker
 - Natchez Bayou Fuels: engineering underway – start-up in 2027; SouthWest Airlines fuel offtaker



USA Bioenergy – Texas Renewable Fuels

- Gasification + Fischer-Tropsch
- Feedstock: woody biomass
- Product: SAF, renewable diesel, naphtha
- Status: Planning underway for first biorefinery in Bon Wier, Texas



Other Commercialization Activities

Lanzatech

- Gasifier: Sekisui (Japan), Ankur (India)
- Feedstock: biomass, MSW
- Product: bio-ethanol and other oxygenates
- Status: developmental work in progress



Aries Clean Energy

- Gasifier: Fluid bed and downdraft gasifiers for syngas production
- Feedstocks: ag waste and bio-solids
- Products: biochar and power
- Status: 3 projects operational (NJ, CA, TN)



Sierra Energy; Ft. Hunter Liggett, CA

- Gasifier: FastOx technology; blast furnace design (~2,200 °C)
- Feedstock: 20 MTD military waste + woody biomass
- Product: 500 KWhe electricity + 1 BBL/D FT diesel fuel
- Status: operational



The Political Climate

- DOE: Liquid transportation biofuels coming back on the table
 - Sustainability: >70% life-cycle GHG reduction
 - Very strong emphasis on waste carbon feedstocks, SAF, and marine diesel products
 - Variety of SAF pathways under development (in addition to Fulcrum and RRB)
 - gasification => LanzaJet, Vertimass
 - Pyrolysis => Alder Energy
 - Arrested anaerobic digestion (volatile fatty acids upgrading) => Alder Energy
- Infrastructure bill (\$1.2T) has large investments in hydrogen
 - Nothing specific called out for biomass
- DOE has issued a roadmap to stand up 4-5 operating biofuels demonstration plants (each at ~1M GPY) by 2030
 - 3B GPY SAF is target by 2030 (BioEnergy Technology Office)

Thanks for your attention!

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