



IEA Bioenergy
Technology Collaboration Programme



USA Country Update

IEA - T33 Meeting

Robert M. Baldwin

National Renewable Energy Laboratory

Golden, Colorado USA

June 3, 2021

The IEA Bioenergy Technology Collaboration Programme (TCP) is organised under the auspices of the International Energy Agency (IEA) but is functionally and legally autonomous. Views, findings and publications of the IEA Bioenergy TCP do not necessarily represent the views or policies of the IEA Secretariat or its individual member countries.

Technology Collaboration Programme

by **iea**

Updates on Commercialization Activities

- Fulcrum Sierra Biofuels
- Red Rock Bio
- Other commercialization activities
- Comments

Fulcrum Bioenergy/Sierra Biofuels

Reno, Nevada

Fulcrum Bioenergy/Sierra Biofuels: (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 under construction
 - a) MSW feedstock/TRI indirectly heated fluid bed steam reforming gasifier
 - b) Johnson Matthey DAVY™/BP fixed-bed FT
 - c) Start-up in Q1 2021 => Q3
- 3) Recently pivoted from jet fuel to FT wax
 - a) Off-take with Marathon Oil Co., Wax to be refined by Marathon
 - i. Uncertain where as Martinez, CA is being converted to renewable diesel facility
 - 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

Fulcrum BioEnergy/Sierra Biofuels

Plant Construction Activities, Late 2020



Red Rock Bio

Lakeview, Oregon

- Pathway: gasification to Fischer-Tropsch Jet Fuel
- Technology providers
 - Gasification: TCG Global
 - FT technology: Velocys and Emerging Fuels Technology
 - Parallel FT trains
 - Hydroprocessing: Haldor Topsoe
- Feedstock: forest residue (166,000 dry tons per year)
- Products: cellulosic renewable jet, diesel, and naphtha fuels
- Offtakes: Southwest Airlines, FedEx Express
- First commercial project status
 - Capacity: 15 MGY
 - Anticipated construction completion: Q4 2022

Red Rock Biofuels Construction Progress



Other Commercialization Activities

Aries Clean Energy

- Downdraft gasifier for biochar and syngas-to-power applications
- Fluid bed gasifier for production of syngas
- Projects
 - 1) Linden, NJ; fluidized bed gasification of bio-solids (Linden Roselle Sewerage Authority)
 - Processing 430 TPD biosolids; 22 TPD biochar and power
 - Construction underway; operational in Q1 2021
 - 2) Holloway Bioenergy; Lost Hills, CA
 - Aries down-draft gasifier; Ag wastes from California's Central Valley
 - 165 TPD ag waste feedstock producing 86MWe/D and 5,000 TPY biochar
 - Operational Q3 2021
 - 3) Lebanon, TN
 - Aries down-draft gasifier; wood wastes and bio-solids diverted from landfill
 - 420KWe/D and biochar
 - Operational since 2017

Sierra Energy

- DoD project (Ft. Hunter Liggett, CA; Army base)
- Gasifier: FastOx technology; blast furnace design (~2,200 °C)
- 'Commercial' project underway to produce FT liquids and power
 - Basically a waste minimization project
 - 20 MTD military waste + woody biomass
 - 500 KWhe electricity
 - 1 BBL/D FT diesel fuel

Other Pre-Commercialization Activities

Frontline BioEnergy

- Pressurized fluid bed (10 Bar)
- Air or oxygen with steam (TarFreeGas®; PMFreeGas®)
- Projects
 - San Joaquin Renewables; San Joaquin, CA
 - RNG from Ag wastes
 - 15 million gallon-equivalents of RNG
 - Engineering in progress; approvals for injection in existing pipelines received

SunGas Renewables

- Spinoff from GTI
- Pressurized fluid bed technology
- Incorporates catalytic tar reforming technology from Andritz and Haldor-Topsoe
- Several projects in advanced stages of engineering
 - RNG
 - Liquid biofuels
 - Advanced power cycle
 - Hydrogen (further behind)

Gas Technology Institute

- DOE project for decontamination and preprocessing of non-recyclable MSW
- DOE/EPRI project for net-zero emission application of U-GAS for biomass/coal blended feedstock

Closing Thoughts

- 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 => ethanol => LanzaJet, Vertimass
 - Pyrolysis
 - Arrested anaerobic digestion (volatile fatty acids upgrading)
- New Administration focused on implications of renewable energy
 - “Environmental Justice” important
 - Diversity and inclusion now part of government policy
- DOE has issued a roadmap to stand up 4-5 operating biofuels demonstration plants (each at ~1M GPY) by 2030

Thanks for your attention!

Robert M. Baldwin
National Renewable Energy Laboratory
Golden, CO 80401 USA
robert.baldwin@nrel.gov



www.ieabioenergy.com