

Country Update
Biomass Gasification in the USA
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This report summarizes current commercial developments in biomass gasification for the USA, focusing on three high-profile projects that are in progress. The report was compiled from personal interviews and from information available on company and Department of Energy websites.

Red Rock Biofuels

Red Rock Biofuels (www.redrockbio.com) is constructing an advanced biofuels production facility in Lakeview, Oregon to convert 136,000 tons of woody biomass into 15 million gallons per year of biofuels including jet fuel and diesel. The feedstock is a mix of softwoods and forestry waste/slash materials plus pre-commercial thinnings. The feedstock will be obtained from non-federal land in southern Oregon and northern California in an economic draw radius from the plant. 70% of the annual feedstock requirement is under long-term contract.

Conversion to biofuels is a multi-step process involving feedstock receiving and processing, gasification and syngas cleanup, catalytic conversion to Fischer-Tropsch products, upgrading to fuel products and fuel distribution. The biomass gasification technology a steam reforming process licensed from TCG Global (www.tcgenenergy.com/gasification.htm). Syngas cleanup and conditioning, including tar removal, is being designed by Fluor.

Conversion of syngas to biofuels will be achieved using Fischer-Tropsch technology provided by Velocys and EFT, with upgrading achieved through hydrocracking and fractionation technology provided by Haldor Topsoe and others. Approximately 40% of the product will be Fischer-Tropsch jet fuel with an additional 40% diesel fuel. The remaining 20% is naphtha which will be sold for a gasoline blendstock. An offtake agreement for the jet fuel has been established with FedEx.

Red Rocks Biofuels broke ground on the Lakeview facility July 2018 and the plant is currently under construction. Completion is expected by mid-2020 with operations to begin later that year.



Construction progress, Red Rock Biofuels Lakeview facility.
(Source: 2019 DOE BETO Project Peer Review Update 5 March 2019)

Aematis/Lanzatech

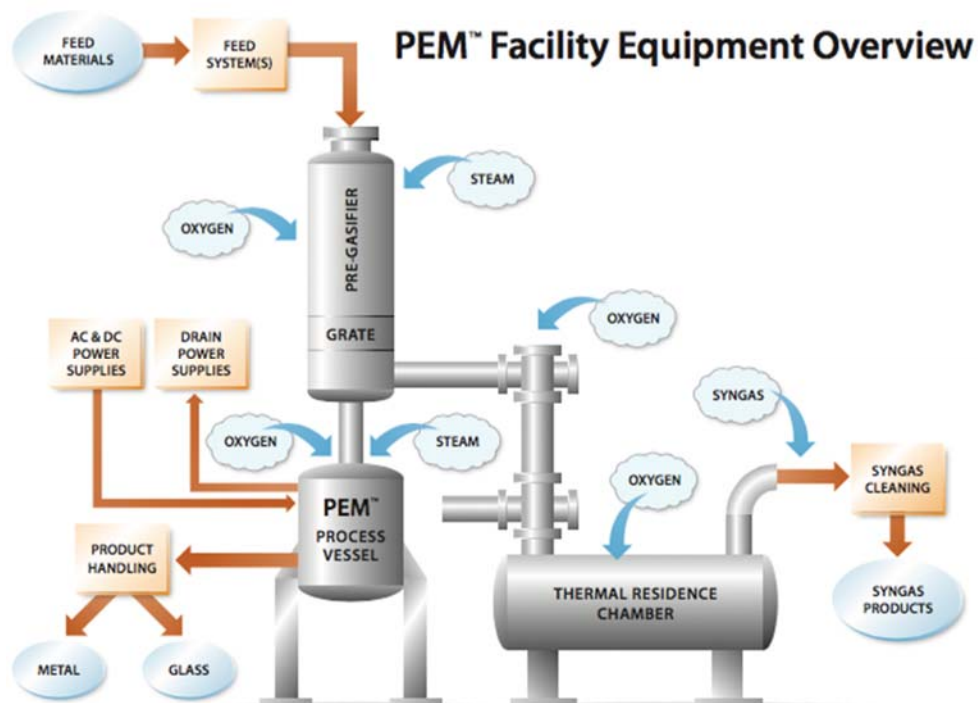
Aemetis is partnering with InEnTec and LanzaTech to build a new biofuels production facility that will produce up to 60 million gallons per year of ethanol. The plant will be located in Riverbank, California, roughly 150 km east of San Francisco.

Biomass feedstock is a combination of agricultural waste including waste from nut trees, forest waste, dairy waste and construction and demolition waste. The central California region has a significant almond and walnut industry that produces over a million tons of wood waste and nutshells per year.

Biomass will be converted to syngas through gasification using InEnTec's Plasma Enhanced Melter (PEM) technology (www.inentec.com). The PEM process involves several stages including a pregasifier responsible for about converting about 80% of the feedstock, the PEM process chamber in which a plasma arc maintains a molten environment that gasifies the remaining material, and a thermal residence chamber to improve conversion.

Syngas from the gasifier will be fed to LanzaTech's microbial fermentation technology to produce primarily ethanol (www.lanzatech.com). LanzaTech has demonstrated high conversion of industrial offgas and syngas using proprietary microbes. Production capacity at the Riverbank facility is expected to be about 12 million gallons of ethanol.

Aemetis is in the final stages of securing financing for the Riverbank biorefinery and expects construction to begin in 2020.



InEnTec PEM gasifier. (Source: www.inentec.com)

Fulcrum Bioenergy

Fulcrum Bioenergy's Sierra Biofuels plant near Reno, Nevada will convert approximately 200,000 tons per year of municipal solid waste into more than 10 million gallons of renewable synthetic crude oil through feedstock preprocessing, gasification and Fischer-Tropsch synthesis.

The Sierra Biofuels facility will use sorted municipal solid waste that has been pre-processed in an on-site feedstock processing facility (FPF) to remove inerts and ferrous and non-ferrous metals. The feedstock is said to be very heterogeneous, carbon-rich, and dry and consists largely of paper, cardboard, wood, carpet and other similar materials. The FPF is located adjacent to Waste Management's Lockwood Regional Landfill, one of the largest landfills in the Western U.S. The FPF is also within close proximity to the Sierra Biorefinery and has been in operation for several years.

The gasifier technology is ThermoChem Recovery International's indirectly heated fluidized bed steam reformer (www.tri-inc.net/steam-reforming-gasification). The gasifier specific to the Sierra Biofuels facility employs TRI's commercial biomass gasification technology with some minor modifications to accommodate for variation in energy content of the feed material. Syngas from the gasifier will be treated using Praxair's Hot Oxygen Burner (HOB) technology to partially oxidize hydrocarbons and tars in the syngas, thereby improving syngas quality and overall yield.

Fischer-Tropsch wax is the primary product for the Phase I development. The wax will be processed to jet fuel by Marathon in their Martinez, CA refinery. Additional unit operations are expected to be installed in a later phase to manufacture bio-jet fuel on-site.

The feedstock processing facility has been in operation since 2017. The Sierra plant is under construction and scheduled to come on-line in the first quarter of 2020 with fully operational status obtained by the second quarter of 2020.



Construction photos of Sierra Biofuels plant. (Source: Abengoa/LinkedIn)