

Fulcrum's \$200 million pick: Abengoa for EPC contractor of first MSW-to-jet fuel project in the US

Jim Lane

The historic performance guarantee that's at the centerpiece of the deal; the partnership that could lead to eight projects; Cathay Pacific, Waste Management and the US Navy in the mix.

In California, Fulcrum BioEnergy has selected Abengoa to build the first biorefinery using gasification technology to convert municipal solid waste into syncrude that will be upgraded into jet fuel. The contract is worth approximately \$200 million.

Abengoa will be responsible for the turnkey execution of the plant including engineering, design and construction as well as a participating significantly in the development of the project. This project is expected to generate more than 500 jobs during the construction phase and 100 more jobs during plant operation. The biorefinery is located in the Tahoe-Reno Industrial Center, approximately 20 miles east of Reno, Nevada. The Sierra BioFuels Plant is scheduled to begin commercial operations in 2017 with the production of more than 10 million gallons of renewable transportation fuel.

The fuel produced at Fulcrum's plants will reduce greenhouse gas emissions by more than 80% compared to traditional petroleum fuel helping companies achieve sustainability goals without increasing costs. With a true zero-cost MSW feedstock supply, Fulcrum BioEnergy will produce a new source of refined oil products at a lower cost than the same petroleum products and with positive sustainability attributes.

The Fulcrum Sierra BioFuels project was awarded a \$70 million grant from the U.S. Department of Defense to fund a portion of the construction of the Sierra BioFuels Plant. And it has executed a conditional commitment with the U.S. Department of Agriculture for a \$105 million loan guarantee of project debt for the

Sierra BioFuels Plant, and is working through project due diligence with its lender of record, Bank of America.

The process risk and historic performance guarantees

At the heart of the agreement is an historic set of guarantees from Abengoa on cost, schedule and performance — especially since the core processes include separate waste-gasification technology licensed by Fulcrum in a partnership with ThermoChem Recovery, and a Fischer-Tropsch technology for conversion of syngas to diesel and jet fuel, licensed by Fulcrum in partnership with Emerging Fuels Technology.

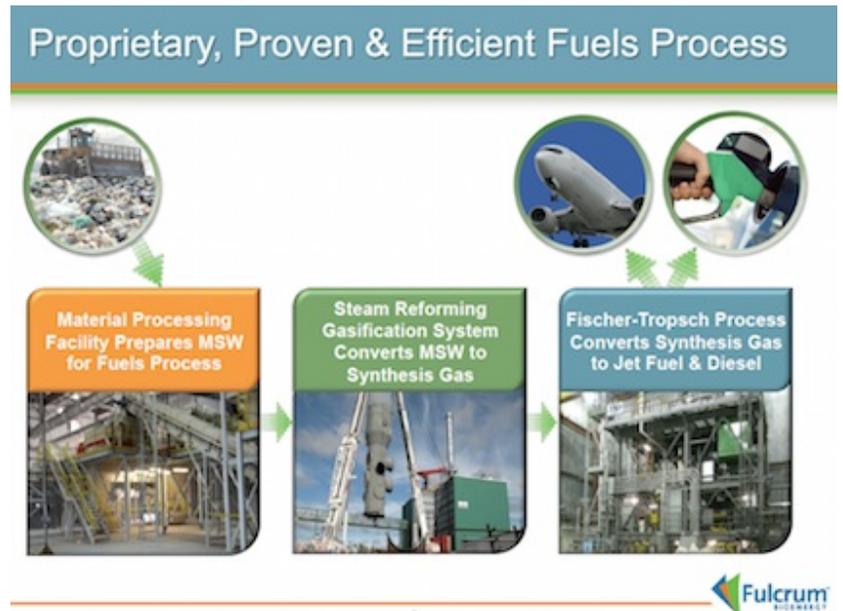
Technology Guaranteed Performance

- 120-Day Continuous Integrated MSW-to-Fuels Test Required by Project Lender
- Test Confirmed the Performance and Reliability of Fulcrum's Process
- Fuel ASTM Certified
- Completed Full FEED for Sierra
- Secured Fixed-Price, Performance Guaranteed EPC Contract



“Abengoa are wrapping TRI in this project and our technology,” noted TRI’s Dave Newport, also attending the BDC spring meeting. “Obviously, we have terms with them, but they are providing a complete wrap including around our technology.”

“Abengoa’s MSW project in Spain was really not that big a factor for us,” said Fulcrum VP Ted Knietsche, speaking at the Bioenergy Deployment Consortium spring meeting in Denver, Colorado. “We have been working hard to get them comfortable with our process. They are sharing some construction and operational risk with the project, with us.”



The Fulcrum project

In 2014, Fulcrum successfully completed integrated demonstration testing, at scale, of its waste to fuels process. Fuel produced from the demonstration plant meets ASTM requirements for use as commercial or military jet and diesel fuels. Fulcrum’s technology success has been reviewed and confirmed by numerous third parties including independent engineers, the U.S. Department of Agriculture and the U.S. Department of Defense.

In 2014, the company also secured the necessary project debt and equity financing to begin construction of the Sierra BioFuels Plant. Fulcrum has secured sufficient MSW feedstock to support its large growth program to construct and operate plants across North America.

The underlying technologies

Gasification System

Fulcrum BioEnergy has licensed a highly efficient and economic gasification system from ThermoChem Recovery International for the conversion of the prepared MSW feedstock to syngas. During the gasification process, the MSW feedstock rapidly heats up upon entry into the steam-reforming reactor and almost immediately converts to syngas. The syngas is then cleaned to safely remove any contaminants before being converted to liquid fuels.

Fischer-Tropsch Process

The company will utilize a conventional Fischer-Tropsch process that has been commercially operational at projects around the world for several decades. In the FT process, the clean syngas is processed through a fixed-bed tubular reactor where it reacts with a proprietary catalyst to form FT syncrude. The FT syncrude can then be upgraded to jet fuel and diesel that can be sold directly into the existing transportation market with no engine modifications.

The Cathay Pacific relationship

MSW – A Strategic Feedstock

Ideal Feedstock



- Large Volumes, Ideal Locations
- Established Infrastructure
- Carbon-Rich Feedstock Ideal for Biofuel Production
- Predictable Cost
- No Competing Uses
- Resolves Waste Disposal Problems

Last August, Cathay Pacific Airways announced that it is the first airline investor in Fulcrum BioEnergy as part of the airline's biofuel strategy and to help it achieve a target of carbon-neutral growth from 2020. Cathay Pacific, which also has an option for further investment, has also negotiated a long-term supply agreement with Fulcrum for an initial 375 million US gallons of sustainable aviation fuel over 10 years (representing on an annual basis approximately 2% of the airline's current fuel consumption) that meets all the airline's technical requirements and specifications.

Fulcrum plans to commence construction of its first commercial plant later this year and to build large scale, waste-to-renewable jet fuel plants at multiple locations, including locations strategic to the Cathay Pacific network, primarily in North America.

Potential for expansion

Knietsche said that, when the project hits its performance milestones, expansion of the partnership to other projects is definitely in the cards. "For now, we are all 100% focused on this project, but clearly we have other projects in stages of development given our growth goals, and if the relationship goes well, we are eager to work with them." Despite Abengoa's worldwide project capabilities, Knietsche said that Fulcrum, at this time, is focused on project opportunities in the US and Canada.

In partnership with Waste Connections and strategic investor Waste Management, Fulcrum has secured sufficient MSW feedstock to support its large growth program to construct and operate plants across North America. With the first phase of construction underway on the Sierra BioFuels Plant, Fulcrum is advancing development activities on seven more projects. These first eight projects are expected to have the cumulative capacity to produce more than 300 million gallons per year of syncrude, jet fuel and diesel at plants across North America.

More about Abengoa

Abengoa has been present in the US for more than a decade, shown in the development of Abengoa's landmark projects; such as Solana and Mojave, both thermosolar plants with 280 MW each located in Phoenix and California; the 200 MW photovoltaic plant located in California; the water supply project in San Antonio, Texas; and Hugoton, one of the first plants producing second generation bioethanol from biomass for commercial operation, located in Kansas.

Business Partners With Aligned Interests

Strong, Strategic Relationships



Program to 300 Million Gallons per Year

- Technology and Process Easily Replicated at Larger Plants
- Sufficient Quantities of MSW Feedstock Secured for Fulcrum's Development Program
- Established Customers



In April 2013, Abengoa Abengoa began operations at their waste-to-energy demonstration plant in Salamanca. The plant has a capacity to treat 25,000 tons of MSW, from which up to 1.5 million liters of bioethanol will be produced for use as fuel.

In October 2014, Abengoa Bioenergy officially opened the world's largest cellulosic biorefinery in Hugoton. The second generation cellulosic ethanol plant in Hugoton, Kansas, located about 90 miles southwest of Dodge City finished construction in mid-August and began producing cellulosic ethanol at the end of September with the capacity to produce up to 25 million gallons per year. The refinery's nameplate capacity makes it, for the time being, the world's largest cellulosic biofuels facility, topping the 21 million gallon capacity of the GranBio facility in Alagoas, Brazil. By utilizing residual biomass solids from the ethanol conversion process, the plant generates 21 megawatts (MW) of electricity – enough to power itself and provide 4-5 megawatts of renewable power to the local Stevens County community.