

Foothills Bio-Energies

Introduction

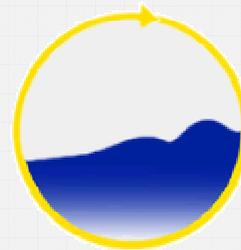
A new industry may be on the verge of flourishing in North Carolina's fertile business environment. Currently the state's largest producer of biofuel, Foothills Bio-Energies has positioned itself as more than a provider of fuel in the western part of the state - the company is also nurturing their growing industry by serving as a test bed for new biodiesel production technology.

Foothills is the epitome of innovation in the biodiesel industry in several ways. The company is located in a former adhesives facility that was largely equipped for storage and processing of chemicals. The company also uses local feedstock as their raw material, reducing transportation costs for raw materials and providing the maximum return to the local economy.

In addition to these operational innovations, the company is a significant contributor to the industry's growth on the whole. In partnership with Appalachian State University, Foothills is participating in a study to determine which feedstock oils are best suited to production and processing in the regional economy. The company has also provided a portion of their facility as a testing ground for a prototype technology that will be commercialized at a 66-million-gallon-per-year facility slated for Wilmington.

Company Profile

Foothills Bio-Energies was created in February 2006 "to pursue renewable, sustainable energy sources and to create economic development around these



Company Snapshot

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Current Operations

Based in Lenoir, NC – Caldwell County
Nameplate production capacity in excess of 5 million gallons per year
Produce ASTM-D6751 biodiesel

Overview

- Established in 2006 to produce biodiesel from local feedstocks
- Processing plant is retrofitted out-of-use furniture adhesives facility
- Biodiesel production began in Sept. 2006
- Entered partnership with Kreido Biofuels in April 2007, Inc. to add equipment for animal fat processing

Awards & Gants

NC Alternative Fuels Leadership Award in March 2007 from NC State Energy Office

Summary

Foothills Bio-Energies is a true local fuel supplier. The company's business model is based on a complete regional energy cycle where a local company uses local feedstocks to produce fuel for the local market.

sources in smaller, economically challenged communities.”¹

The Lenoir, N.C.-based company has a nameplate production capacity of about 5 million gallons per year, and produces biodiesel meeting the ASTM-D6751 specification approved for blending with petroleum diesel. Foothills’ first biodiesel batch was produced in September 2006.



Fig. 1 - Tanks of methanol and tubs of glycerin, the byproducts of biodiesel production, are stored in safer areas outside Foothills Bio-Energies before being removed by tanker or truck.

Source: Foothills Bio-Energies LLC

Foothills was designed around a ‘regional energy cycle’ model in which the company uses local crops to produce fuel that is sold in local gas stations. During development, the company used the resources of the Cooperative Extension Service to identify local sources of feedstock oils.

The company currently has partnerships with a locally owned distributor company as well as half-a-dozen distribution locations near Lenoir. Other distribution channels for the company include regional biofuels cooperatives, such as High

¹ Company Web site www.foothillsbio-energies.com

Country Biofuels which travels to Lenoir to fill a 1,400-gallon tanker truck.²

Most recently, in April 2007 a partnership was announced between Foothills and California-based Kreido Biofuels, Inc. (OTC-BB: KRBF) in which Foothills will serve as the test location for Kreido’s STT Biodiesel Processing Unit (BPU).³

Technology

Using Biodiesel

Biodiesel is a fuel with specific characteristics for use in diesel engines that is made from vegetable oils or animal fats instead of petroleum. Biodiesel can be sold in a 100% concentration (B100) or in a blend with other fuels, typically at a concentration of either 20% (B20) or 5% (B5).

Biodiesel is made from vegetable oil, but it is a far different material. Biodiesel that is legal for sale and distribution as a motor vehicle fuel must be produced to the ASTM-D6751 specification and be registered with the Environmental Protection Agency.

In concentrations of 20% or less, biodiesel typically requires few, if any, modifications to recently made diesel vehicles. To begin using neat biodiesel (B100) in a vehicle that has previously been fueled with petroleum diesel requires a few precautions such as changing the fuel filter more frequently until the fuel system is cleaned, and replacing any natural rubber parts. While neat biodiesel can react adversely to extremely cold

² Ianniello, Nick. "Biodiesel solves alternative fuel problems in Boone." *The Appalachian*. November 14, 2006.

³ Business Wire. "Foothills Bio-Energies Integrates Kreido Biofuels' STT Technology to Increase Plant Biodiesel Output." April 23, 2007. ABC-7 Chicago.

weather unless precautions are taken, biodiesel blends are viable year-round in North Carolina's climates.

Producing Biodiesel

Biodiesel is produced through a chemical reaction, called transesterification, which turns plant oils or animal fats into fuel for a diesel engine. In a simple reaction, the fats and oils are reacted with an alcohol – Foothills uses methanol – under low-temperature heat.



Fig. 2 - A Foothills technician opens the hatch on one of the facility's reactors.
Source: Foothills Bio-Energies LLC

Biodiesel is typically produced in large batches in order to ensure quality fuel production. To speed up each batch's reacting time a catalyst such as either sodium or potassium hydroxide is added.

Each reaction produces both biodiesel and glycerin, an unrefined raw material that is widely used. The reaction also allows for the capture and reuse of the alcohol and catalyst.

In Foothills' traditional reactors, the three ingredients – oils/fats, methanol, hydroxide catalyst – are mixed and warmed to 60°C. About 20%-25% of the mixture is methanol.

After the initial reaction, the glycerin by-product is drained from the bottom of the

tank and packaged for shipment to a Charlotte processing facility. Meanwhile, technicians filter the biodiesel before it is moved into the processing tank to be prepared for shipment.⁴

The most dangerous aspect of biodiesel production is handling the methanol, a highly flammable alcohol, according to Foothills owner Randy Dellinger. The Foothills facility, however, was designed to handle methanol and that for more than 40 years methanol was a main ingredient in the facility's production of adhesives for the furniture industry.⁵

Prototype Testing

Kreido Biofuels, Inc. announced a partnership with Foothills Bio-Energies in April 2007, and in October 2007 announced the first successful processing of pork fat feedstock into ASTM biodiesel.⁶

The one-million-gallon-per-year (MGY) prototype version of Kreido's patented 'spinning-tube-in-tube' (STT®) biodiesel processing unit (BPU) was installed at Foothills' facility in preparation for Kreido's planned expansion to a nameplate production capacity of 100 MGY by the end of 2008 – nearly 2/3 of which is slated to be installed at a Wilmington, N.C. plant to provide the company with access to a deepwater port.⁷

Kreido's technology is based on a modular 30-gallon production unit, and is intended to increase the reaction speed by

⁴ Fuller, Bethany. "Town, residents embroiled in fuel fight." Statesville Record and Landmark. August 25, 2007.

⁵ Ibid.

⁶ Business Wire. "Kreido Biofuels Expands Program for Flagship Biodiesel Plant and Successfully Tests Animal Fat Feedstock." October 9, 2007.

⁷ Ibid.

up to three orders of magnitude, and provide enhanced yields from real-time quality controls of the reaction process.⁸

In their one-year deal, Kreido will operate their BPU in order to demonstrate the multi-feedstock capability of their technology, refine operating procedures, and to train personnel in operating procedures for their planned 2 commercial-scale facilities anticipated to be completed in 2008.

“This pilot plant allows us to collect objective results and processing data that we can use to expand the promotion, commercialization and licensing of Kreido’s STT® technology,” states Phil Lichtenberger, Kreido Biofuels’ Senior Vice President.⁹

Markets and Growth

Biodiesel is a desirable fuel for both its high energy balance and its lower emission profile compared to petroleum diesel. Every gallon of biodiesel provides 3.2 times the amount of energy required to produce it. Although biodiesel emits slightly increased levels of nitrogen oxides (NOx), it offers substantial decreases in particulate matter, carbon monoxide, and hydrocarbons. Biodiesel is also a domestic fuel that reduces our dependence on imported oil.¹⁰

Biodiesel has found footholds where ethanol has been unable to prosper. This is in part due to the wide array of feedstock oils and fats that includes everything from

virgin vegetable oils to animal fat and even waste fryer oil from restaurants. For instance, according to the Alternative Fuels Data Center Station Locator, only 13 North Carolina gas stations offered a blend of 85% ethanol while 62 offered biodiesel. This disparity in biofuel availability is due largely to the proliferation of local cooperatives producing and distributing biodiesel in their local area – a grassroots development phenomenon not viable in the production of ethanol.

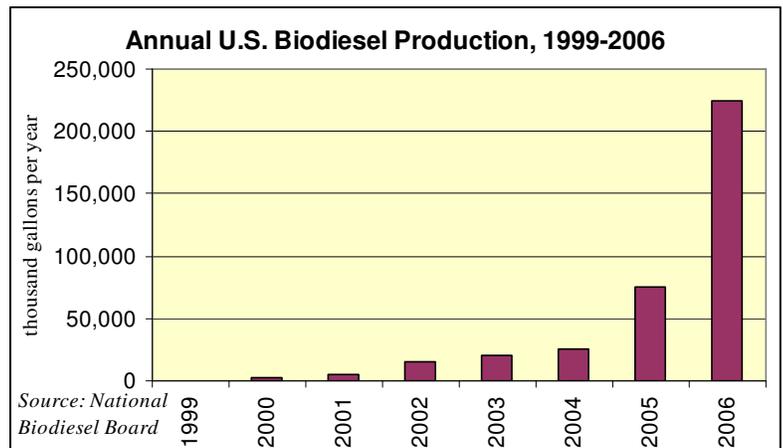


Fig. 3 – U.S. Annual Biodiesel Production, 1999-2006
Source: National Biodiesel Board

Industry Development

Currently, North Carolina has 10 commercial-scale biodiesel production facilities with an annual nameplate capacity projected to be over 25 million gallons per year at the end of 2007 – equivalent to about 2.5% of low-sulfur diesel consumed in the state during 2006.¹¹

⁸ Company Web site. www.kreido.com/stt.htm

⁹ Business Wire. "Foothills Bio-Energies Integrates Kreido Biofuels' STT Technology to Increase Plant Biodiesel Output." April 23, 2007. ABC-7 Chicago.

¹⁰ U.S. Department of Energy, Alternative Fuels Data Center

¹¹ National Biodiesel Board – Existing Producers

Supporting a thriving local fuel industry requires simultaneous development of the entire value chain from feedstock cultivation to employee training and distribution infrastructure. To support the industry growth, Central Carolina Community College in Pittsboro has

that can be claimed for installing alternative fuels refueling facilities. An excise tax credit is also available from the IRS for producers/blenders of biodiesel in amounts that vary with the biodiesel blend concentration.¹⁵

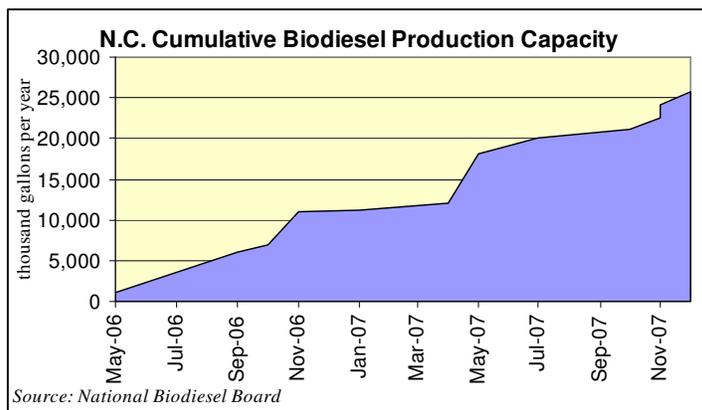


Fig. 4 – Biodiesel Production Capacity in N.C.
Source: National Biodiesel Board

received over \$140,000 in BioNetwork grants to facilitate curricula development specifically for biodiesel production, and the school will begin offering a biofuels associates degree in Fall 2008.

Other support for the industry is provided via incentives. Biofuels producers in North Carolina may claim the Alternative Fuel Production Tax Credit for up to 25% of the cost of a biodiesel production facility.¹² Starting in January 2008 biodiesel producers may also claim a tax credit equal to excise tax paid by the producer.¹³ A federal tax credit for biodiesel producers with less than 60 million gallons is available that entitles producers to claim 10-cents per gallon on their first 15-million gallons.¹⁴

To support the infrastructure development essential for successful market penetration of biofuels, the IRS offers a 30% credit

N.C. Development Assets

Biodiesel industry development in the state was spurred on by local groups seeking access to this renewable fuel. As these initiatives expanded the industry became established, and the state will soon have an official biofuels-specific college degree.

The potential to use animal fat as a feedstock for biodiesel could add considerable value to

the state's swine producers as well as biodiesel producers. A 2006 report from the Nebraska Soybean Association estimated the cost of processing animal fat into biodiesel to be 25% lower than the cost of using soy oil.

Many of the state's out-of-service facilities may be capable of handling biodiesel production, just as Foothills was established in a facility formerly occupied by Southeastern Adhesives which closed after the decline in furniture manufacturing in the country. Foothills' future expansion plans include adding additional storage tanks and securing access to the rail spur adjacent to the facility. Other companies, such as Kreido, which plan large-volume production place a premium value on facilities that are both near bulk transportation access such as a port or rail spur, and near a substantial supply of low-cost feedstock material.

¹² North Carolina General Statutes 105-129.16D

¹³ North Carolina General Statutes 105 129.16F

¹⁴ N.C. Solar Center Clean Transportation Program

¹⁵ U.S. Department of Energy Alternative Fuels Data Center "Federal Incentives and Laws."