BP COMMITS $BILLIONS TO BIOFUEL DEVELOPMENT AND PRODUCTION

by Bob Brooks

A BP executive was quoted recently that biofuels are obtained from "renewable wells" which is an oil man's way of saying we are drilling for energy as usual but for different raw material. Key to the favorable outlook for BP biofuels is not only "renewable well" drilling but also the firm's complete vertical integration from production of the raw material through all stages up to and including retail sale of fuel at BP's 10,750 filling stations including 5600 with diesel pumps . A spokesman for BP indicates the company wide program investment has been $2 billion since 2006 and currently involves over 4000 employees worldwide of which approximately 300 are part of the domestic U.S. development program.

Based on information supplied by BP spokesmen and published sources, BP's biofuel program is focused on cellulosic raw material in the form of high yield energy grasses that grow to a height of 12 to 15 ft with ethanol yield/acre 4-5 times greater than corn ethanol. The grasses can be harvested annually on a rotation basis coordinated with fuel processing plant production schedules. Cultivation is planned in southern U.S.; harvested with essentially conventional agricultural equipment . The perennial energy grasses have modest requirements for both water and fertilizer. Replanting is needed only every 7-8 years.

BP biofuels initial focus is very strategic – low cost feedstocks, converted via biological fermentation that starts with ethanol then targeted at butanol as an important molecule. Butanol, unlike ethanol, has energy content per gallon close to gasoline, can be added at a higher percentage in gasoline (at least 16%) without engine modification and can be blended with gasoline for shipment via pipeline. The BP/DuPont joint venture, Butamax, is an essential part of the butanol program.

BP's first large scale biofuel production will begin later this year in a $400 million plant in Kent, UK. In this one case, plant input is 1.1 million tons/yr of locally grown wheat harvested from East Yorkshire and Lincolnshire for planned output of 500,000 tons/yr of animal feed and 420 million liters/yr of ethanol with production to be converted later to butanol. The UK firm is named Vivergo Fuels; a joint venture of BP, British Sugar and DuPont.

Verenium became a key part of the BP biofuels program when Verenium's ligonocellulosic assets were acquired by BP in 2010 for $98.3 million. (Verenium's entire biofuel business has since been acquired by BP). Verenium's unique developments in the field of enzymatic bioprocesses replace inefficient, often harsh chemical processes vital to BP's energy grasess based alcohol production. Verenium assets include a large scale demonstration plant in Louisiana from which production systems for grasses to ethanol have evolved. Also acquired is Verenium's global technology center in San Diego and a project in Florida.

BP's first energy grasses conversion to ethanol facility at scale in the U.S. will be named Highlands Ethanol in Highlands County, Florida which is being constructed at a cost in excess of $400 million for initial output of 36 million/gal/yr of ethanol with about 200 employees for operation of the facility and 600 to 800 contractor employees during construction.

To date, 3500 acres of the planned 20,000 acre farm including roads and ditches have been constructed with 1500 acres planted this year. More will be constructed and planted next year. BP Biofuels will break ground on the conversion facility in 2012 with construction to take about 2 years. Subsequent plants are planned for label capacity of 72 million/gal/yr. Lignocellulosic conversion of C5

and C6 sugars to ethanol is said to provide about 60% reduction in greenhouse gas emissions when used in cars as fuel which compares with 18-29% reduction with corn ethanol.

The energy grasses for Highlands Ethanol will be grown by BP Biofuels on land leased from Lykes Brothers, an experienced Florida agricultural firm. BP Biofuels will plant, cultivate and harvest the 20,000 acres of unique grasses. Larger facilities are targeted to receive energy grasses raw material from up to 50,000 acres each. Farmer grower Agreements will be considered by BP Biofuels for its future farms in addition to leasing and growing themselves. It is indicated that energy grasses crop yields per acre/yr are expected to be favorable across the southern Gulf States which have vast land areas, warm temperatures, plenty of sun and sufficient rainfall.

As part of BP Biofuels evolving plan to become a major producer of new fuel from "renewable wells", are ongoing efforts to move the biofuel technology forward. One aspect of this is contract work by Mendel Technology which has worked with BP to find additional energy grass varieties one of which may be "miscanthus" said to provide superior greenhouse gas reductions and soil health with fertility, water holding, high temperature, and biodiversity advantages.

Another part of BP's biofuel future has been contracted to Royal DSM which has been tasked to find a optimum way to make diesel fuel from plant sugars.

BP's energy grasses based fuel business suggests a long list of possible implications in the U.S, one of which is the question of the degree to which southern states may seek to attract new industry and related jobs by supporting land access for energy grasses cultivation and processing. Another is the enormous pressure from the U.S. military for domestic source biofuel for national security reasons. This, of course, hinges on diesel and Jet-A fuel production as potential follow on products from BP's energy grasses sugar technology.

The implications of a potentially very large new source of U.S. domestic, low carbon fuel financed by a World class energy company willing to invest heavily in biofuels, is enormous, to say the least. If the planned Florida processing plant achieves its ethanol label capacity of 36 million/gal/yr with energy grasses from 20,000 acres, this translates into yield rate of 1800 gal/acre which is above the high side of reported industry cellulosic ethanol data. Further gain in grasses growth rate and shortened harvesting cycle time would add even more value to the project.

Following ethanol and butanol, success with energy grasses conversion into petroleum fuel alternatives would further enhance BP's ability to meet U.S. energy objectives.

(Not discussed in this report is BP's large, established investment in Brazilian sugar cane sourced fuel. Ethanol yield per acre/yr from sugar cane is less than half the ethanol yield from energy grasses planned for the U.S., hence is a somewhat different subject).