



# Fueling the future with biofuels

## U.S. Regulatory Environment

In pursuit of energy security, lower carbon fuels, and rural development opportunities, the U.S. government provides the regulatory framework necessary to develop a scaled and sustainable cellulosic biofuels industry. The Renewable Fuel Standard 2 (RFS 2) creates a robust and carefully considered regulatory structure for the development of various types of advanced biofuels, including cellulosic biofuels. By 2022, the RFS 2 requires the blending of 16 billion gallons of cellulosic biofuels, which would represent nearly 10% of the U.S. gasoline supply. In addition, the RFS 2's requirements for environmental performance ensure that the next generation of biofuels achieves at least a 60% reduction in greenhouse gas (GHG) emissions compared to gasoline.

## Feedstocks

Ethanol will be produced from feedstocks such as energy cane and energy grasses using proprietary technology. Energy grasses contain large amounts of energy in the "sugars" held in their cell walls. These sugars can be difficult to extract, but using new advanced technologies it is possible to convert the sugars into liquid fuel. This means higher volumes of fuel produced from each tonne of feedstock, and each acre of land, compared to current-generation biofuel feedstocks like corn and other advanced biofuel feedstocks such as agricultural wastes.

High-yield energy grasses can produce an estimated 1,000 to 2,000 gallons of biofuel per acre, compared with approximately 400 to 500 gallons per acre from corn and 150 to 200 gallons per acre from agricultural wastes. Energy grasses can be grown on lower quality agricultural land - land that is not well suited to growing food crops economically.



## Fueling the future with biofuels

BP has announced that it will make a strategic acquisition of Verenium Corporation's biofuels business. The transaction will enable BP to advance its objective to produce advanced cellulosic ethanol in the US through the development of low cost, low carbon, sustainable biofuels at scale using proprietary technologies.

A diverse energy mix is important to future U.S. energy security. In growing a material U.S. biofuels business, BP will contribute to energy security by providing low-carbon biofuels to the transport sector. BP will also create new jobs in the construction and operation of biofuel facilities. In addition jobs will be created in the agricultural sector, particularly in the south eastern states where climatic conditions support the production of biomass such as energy cane at the scale required to supply large-scale, commercial biofuel production facilities.



beyond petroleum

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## A strategic acquisition

BP is committed to building a large-scale biofuels production business with a technology platform based on the biological conversion of sugars to biofuels using sustainable, low cost feedstocks. The company is producing Brazilian sugarcane ethanol, is accelerating the commercialization of bio-isobutanol as an advanced biofuel, and is developing the technology to convert sugars to biodiesel. It is also building a world-class ethanol plant in the UK. A significant strand of the company's strategy is building an industry-leading cellulosic ethanol business in the US.

The acquisition of Verenium Corporation's biofuels business will give BP access to proprietary biomass-to-ethanol conversion technologies, a leading edge research and development (R&D) capability and a biofuels demonstration facility necessary to advance the company's cellulosic ethanol strategy. This capability will initially be focused on supporting BP's strategic goal to build its US-based cellulosic ethanol business, and will enable BP to integrate other proprietary biofuel technologies through R&D and scale-up in the future.

The acquisition reinforces BP's position as one of the few global biofuels companies with an integrated end-to-end capability, from R&D through commercialization to distribution and blending.

## Key facts of the acquisition

BP will acquire Verenium Corporation's lignocellulosic biofuels assets for US\$98.3m. BP and Verenium have been partners in



The 1.4 million-gallon-per-year demonstration facility at Jennings, Louisiana

cellulosic-ethanol technology development since 2008. As a result of the acquisition, BP will be able to accelerate its program to develop and commercially deploy a fully integrated lignocellulosic process technology platform.

Upon completion of the transaction, BP will:

- Acquire purpose-built bioscience R&D facilities in San Diego, California.
- Acquire intellectual property related to proprietary cellulosic biofuels R&D and conversion technology.

- Acquire a 1.4 million-gallon-per-year demonstration facility in Jennings, Louisiana.
- Become the sole owner of Galaxy Biofuels LLC, the joint technology development company formed by BP and Verenium in 2008, which holds the parties' jointly developed intellectual property (IP).
- Become the sole owner of Vercipia Biofuels, a joint venture between BP and Verenium which is commercializing proprietary technology for cellulosic ethanol production.

## Research and Development Capability

BP will acquire world-class research facilities in San Diego, California, where leading scientists and technologists are generating innovations in the biofuels industry. The expertise of such personnel in the areas of enzymology, synthetic biology, fermentation, characterization and bioprocess engineering provide the foundation needed for BP to deliver an economically viable process for cellulosic ethanol production. These skills and track-record in process innovation and experimentation complement BP's capabilities in engineering, project management and technology deployment.

BP will be the sole owner of intellectual property directly related to the cellulosic biofuel technology currently being tested at the Jennings demonstration plant. The San Diego-based R&D personnel also have strong IP management expertise in bioscience disciplines.

The importance of bioscience, not only to BP's biofuels business but also to the company as a whole, is evidenced by the appointment of a BP Group Chief Bioscientist in 2010 and the investment of US\$500 million over ten years in the Energy Biosciences Institute (EBI). The EBI and San Diego laboratories will be truly complementary, the former primarily conducting early stage R&D on a wide range of long-term targets, while the latter will focus on industrial R&D, developing and commercializing specific biofuels manufacturing processes.

## Proving the technology

By developing a robust technology package and proving it at scale, BP will have the capability to deploy the technology package at commercial facilities for use in biofuel production in the US market. To support this objective, BP will acquire a 1.4 million-gallon-per-year (40 ton/day feedstock) demonstration facility in Jennings, Louisiana. The facility includes integrated enzyme manufacturing, fermentation facilities and an analytical laboratory.

BP has previously worked with Verenium at the Jennings demonstration facility to scale up and optimize process technologies for commercialization. The facility may also play

a critical role in the development and scale up of BP's future biofuel technology platforms.

## Commercialization

BP will become the 100% owner of Vercipia Biofuels, based in Tampa, Florida. Vercipia is advancing next-generation biofuels through the development and commercialization of cellulosic ethanol. Vercipia will utilize dedicated energy canes and grasses, both abundant biomass feedstocks, in conjunction with BP's proprietary, novel enzymatic conversion technology.

Vercipia is currently progressing the design and engineering required to develop one of the first commercial-scale cellulosic ethanol facilities in the US, located in Highlands County, Florida. The company has entered into a long-term agreement with Lykes Bros., Inc, a well-known, family-owned Florida agricultural business, to provide the land for producing the energy grasses needed for conversion to biofuel. The facility is expected to produce up to 36 million gallons of cellulosic ethanol per year and provide the region with approximately 140 permanent jobs once commercial operations begin and estimated 400-600 jobs during construction. In addition, more than 100 jobs will be created through the agricultural activity associated with the facility.

The estimated construction cost is between US\$250 and US\$300 million. Construction is expected to start in 2011 with commercial cellulosic ethanol production commencing in 2013.

## BP's integrated approach to the biofuels value chain

	Agronomy	Agriculture at scale	Conversion technology	Demonstration scale	Project management	Commercialization at scale	Fuel Markets
BP and partners	✓	✓	✓	✓	✓	✓	✓
Acquired from Verenium	✓		✓	✓			