



U.S. BIOFUEL INDUSTRY

AND OPPORTUNITIES FOR LOUISIANA AGRICULTURE

January 2009

What are biofuels?

The term biofuels generally refers to any fuel, in a solid, liquid or gas form that is made from the breakdown or decay of a biological feedstock source. Since most biofuels are made from biological-based feedstocks, these fuels are also referred to as renewable fuels; that is, the feedstock can be planted and produced on a continual, renewing basis. Some biofuels also can be produced from nonplant feedstocks, such as animal fats. These biofuels are also referred to as renewable fuels because they can be produced from renewable feedstock sources. The category of renewable energy, however, also includes geothermal energy, hydro energy, solar energy and wind energy.

What biofuels are currently being produced in the United States?

Two basic biofuels are currently produced in the United States: bioethanol and biodiesel. Ethanol (ethyl alcohol) is produced from petrochemical feedstocks, such as ethylene, and is also produced biologically by fermenting sugars with yeast. Diesel is commonly made as a distillate from petroleum fuel oil. Both of these fuels, however, can be produced from biological feedstocks, hence the terms bioethanol and biodiesel.

What feedstocks are currently being used to produce biofuels?

Bioethanol is currently being produced from a wide variety of starch-based and sugar-based feedstocks including sugarcane, sugar beets, molasses, corn and wheat. The majority of bioethanol made in the United States today is made from corn using conventional fermentation technologies. Biodiesel is currently being produced from feedstocks such as vegetable oils and animal fats.

How much biofuels is currently being produced in the United States?

The production level and market for bioethanol is much more developed in the United States than for biodiesel. This is the result of several factors, including feedstock availability and logistics, as well as consumer demand for alternative fuels. In 2006, U.S. production of biodiesel was 250.0 million gallons, while production of bioethanol exceeded 4.8 billion gallons.

Year	Biodiesel Production (million gallons)	Bioethanol Production (million gallons)
1999	0.5	1,470.0
2000	2.0	1,630.0
2001	5.0	1,770.0
2002	15.0	2,130.0
2003	20.0	2,800.0
2004	25.0	3,400.0
2005	75.0	3,904.0
2006	250.0	4,855.0
2007	450.0	6,500.0

Data sources: National Biodiesel Board and Renewable Fuels Association.

What are some challenges facing current biofuel production methods?

Currently, two basic challenges confront the production of biofuel, particularly ethanol, in the United States. First is the food-versus-fuel argument, which basically states that food commodities, specifically corn and wheat, should not be used as feedstocks for biofuel production, but rather should be used for food production. The second basic challenge facing the biofuel industry is one of efficiency. This challenge addresses the issue of whether current biofuel production technologies result in the most efficient use of land resources for biofuel production. In other words, can a new biofuel production technology be developed that results in a greater volume of biofuel produced per acre of land devoted to feedstock production. This "second generation" biofuel production technology is called cellulosic production and is the focus of a considerable amount of research and development throughout the United States.

What is cellulosic ethanol production?

While ethanol can be produced from the fermentation of starches in grains such as corn, grain sorghum and wheat, as well as from the sugars in crops such as sugarcane or sugar beets, it also can be produced from cellulose. Plant material contains cellulose, hemicellulose and lignin. Cellulose is the main component of the cell walls of plants. It is the most common organic compound on earth and is available from a wide variety of plant-based feedstocks. The process of breaking down cellulose in plants to convert it to sugars that can be converted to ethanol is more difficult than corn-based ethanol technologies. This process, however, greatly expands the potential feedstocks that could be used for ethanol production.

What is biomass?

Biomass is the general term for any plant-based feedstock that would be used to produce ethanol by the cellulosic production technology. In terms of ethanol production, biomass specifically refers to agricultural crop and forestry plant material that would serve as a cellulosic ethanol feedstock. A biofuel facility producing ethanol by way of cellulosic technology would not be limited to a single agricultural feedstock, but could utilize a wide variety of feedstocks, assuming that those feedstocks can be processed and pretreated to a condition suitable for conversion to ethanol.

What is Louisiana's comparative advantage in cellulosic biofuel feedstock production?

Unlike corn-based ethanol production, which utilizes the same feedstock and production process throughout the United States, the development of a cellulosic ethanol production industry in the United States will be more regionalized, focusing on the specific comparative advantage of local feedstock production. As a result, primary cellulosic ethanol feedstocks in one area of the country will be vastly different than in another area. Since the entire plant biomass would be used as biofuel feedstock, the primary criteria in a given area or state will be to identify what high-tonnage feedstocks can be grown with the least production expense per unit. Louisiana has a comparative advantage in that the extended growing season here allows for the possibility of producing a much wider variety of potential feedstock crops.

What feedstock crops can be produced in Louisiana with existing farm equipment and producer expertise?

A desired characteristic of a cellulosic feedstock crop to be successfully grown in Louisiana would be one that could utilize existing farm equipment as well as producer expertise. Sugarcane producers in Louisiana already have the necessary equipment and expertise to produce, harvest and haul a heavy tonnage biomass

crop. The forestry industry in the state is another example of equipment and expertise already available to produce biomass feedstock. These advantages of existing equipment and production expertise help shorten the time required to develop a cellulosic ethanol industry in the state.

What "new" feedstock crops are most adaptable to production in Louisiana?

To be economically efficient, cellulosic ethanol production requires the ability to produce a high tonnage per acre feedstock crop as inexpensively as possible. A wide variety of "new," nontraditional agricultural crops offer great potential for production. Such crops include high-fiber sugarcane, sweet sorghum, switchgrass and miscanthus for bioethanol production and sunflowers, mustard and camelina.

What research is currently being conducted by the LSU AgCenter in cellulosic biofuels?

The LSU AgCenter is currently conducting a wide variety of research projects in feedstock development and evaluation as well as feedstock processing and bioenergy production. Research in feedstock development and evaluation includes research on feedstock production in Louisiana of ethanol feedstocks, such as switchgrass, high-fiber sugarcane, sweet sorghum, miscanthus and sweet potatoes, plus biodiesel feedstocks such as perennial oilseed crops, tung oil and Chinese tallow. Research in feedstock processing and bioenergy production includes research on chemical conversion of biomass into industrially useful compounds, liquefaction of biomass into phenol alternatives, nanomaterials fabricated from cellulosic biomass, use of rice bran to produce biodiesel, gasification technologies and the development of integrated technologies to convert lignocellulosic feedstocks into ethanol and other high-value products.

Author

Michael E. Salassi, Professor
Department of Agricultural Economics & Agribusiness

Visit our Web site:
www.lsuagcenter.com

Louisiana State University Agricultural Center
William B. Richardson, Chancellor
Louisiana Agricultural Experiment Station
David J. Boethel, Vice Chancellor and Director
Louisiana Cooperative Extension Service
Paul D. Coreil, Vice Chancellor and Director
January 2009

Issued in furtherance of Cooperative Extension work, Acts of Congress of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. The Louisiana Cooperative Extension Service provides equal opportunities in programs and employment.