

TRANSPORTATION FUELS FROM LOUISIANA BIOMASS

by
David McGee, P.E.
Bryan Crouch, Engineer

Transportation energy accounts for almost 30% of total energy usage in the United States. Almost all transportation energy comes from fuels derived from petroleum, much of which is imported from other countries. Energy security and environmental concerns provide the impetus to displace petroleum based fuels. Ethanol and biodiesel provide alternatives to petroleum based fuels, can be produced from renewable domestic resources and have environmental benefits. Louisiana has a diverse resource base which could be exploited to produce ethanol and biodiesel. Economics aside, the following tables are an estimate of the amount of biofuel that could be reasonably produced from crops and waste products that are currently being produced in Louisiana. These estimates are then compared to the gasoline and diesel sales in Louisiana (which approximate consumption). Note, that for food crops and municipal solid waste (MSW), the calculations assume the entire resource is used for biofuel production.

Table 1. Ethanol from Sugarcane and Grains

Crop	2005 Total Production ¹	Ethanol Conversion Factor ²	Ethanol (gallons)
Sugarcane	11,339,065 tons	18 gal./ton	204,103,170
Corn	44,227,116 bushels	2.7 gal./bu.	119,413,213
Grain Sorghum	6,106,071 cwt.	4.65 gal./cwt.	28,393,230
Oats	311,422 bushels	0.9203 gal./bu.	286,602
Wheat	5,985,589 bushels	2.483 gal./bu.	14,862,217
Total			367,058,433

Table 2. Ethanol from Biomass

Biomass	2005 Total Production (tons)	Ethanol Conversion Factor ² (gal./ton)	Ethanol (gallons)
Forest Residues ³	872,000	60	52,320,000
Mill Residue ³	1,943,000	60	116,580,000
Urban Wood Waste ³	753,870	60	45,232,200
Hay ¹	551,531	60	33,091,860
CRP Energy Crop ⁴	1,170,000	60	70,200,000
Bagasse ⁵	1,417,400	60	85,044,000
Municipal Solid Waste ⁶	1,843,009	60	110,580,540
Total			513,048,600

Table 3. Biodiesel from Oil Crops

Crop	Total Production (lbs.)	Percent Oil ²	Oil Weight (lbs.)	Oil Volume ⁸ (gal.)	Biodiesel ⁹ (gallons)
Cotton Seed ¹	846,650,088	13	110,064,511	15,502,044	12,401,635
Soybeans ¹	1,938,967,200	14	271,455,408	38,233,156	30,586,525
Sunflowers ¹	252,299	32	80,736	11,371	9,097
Corn ¹	2,476,718,496	2.77	68,605,102	9,662,690	7,730,152
Rice ¹	3,197,297,100	1.8	57,551,348	8,105,824	6,484,659
Waste Cooking Oil/Grease ⁷				8,400,000	6,720,000
Total					63,932,068

Table 4. Gasoline and Diesel Consumption in Louisiana

Motor Fuel	Louisiana Motor Fuel Sales ¹⁰ 2005		Potential Biofuel Production from Louisiana Resources		Potential Energy Contribution Percentage
	Gallons	Trillion Btu	Gallons	Trillion Btu	
Gasoline	2,367,718,500	293.6			
Ethanol			880,107,033	73.9	25.2
No. 2 Diesel	1,103,232,000	143.4			
Biodiesel			63,932,068	7.7	5.3
Total		437.0		81.6	18.7

These estimates show that Louisiana could produce 18.7% of its transportation energy needs from biofuels produced from Louisiana resources if the entire crop production is utilized for biofuel production, one-half of the Conservation Reserve Program (CRP) land is utilized for energy crop production, and all of the cellulosic component of MSW is converted to ethanol. Additional steps, not included in this estimate, which could be taken to increase the resource available for biofuel production, include substituting higher biomass yield crops for lower yield crops, and utilizing additional land for energy crop production.

Cost is the main hindrance to the use of renewable resources to produce transportation fuels, not just the cost of the renewable resource itself, but also the cost of transporting it and producing fuel from it. The fundamental reason it costs more to produce fuel from renewable resources than from crude oil, is that crude oil has a much greater energy density. Crude oil is, however, not renewable, and over time will increase in price as the supply becomes more limited. New technology and mass production will decrease the price of renewable fuels.

Notes:

1. Production figures published by the LSU AgCenter.
2. Figures used here were deemed to be in the mid-range of commonly published figures for each category.
3. Production figures from 1999 Oak Ridge National Laboratory study.
4. According to the USDA, there are 390,000 acres of CRP land in Louisiana. CRP land is highly erodible, and as such, owners are encouraged to maintain a vegetative cover to prevent erosion. Switch grass and/or energy cane are high yield energy crops and would be suitable to grow on much CRP land. The figure used here is not actual production, but an estimate based on converting one-half (195,000 acres) of the land in the CRP to grow switch grass with a yield of 6 tons/acre.
5. Bagasse production estimated at 15% of sugar cane production. Figure used here represents one-half of bagasse production. Approximately one-half of bagasse is used for process heat.
6. Includes the whole of MSW components from paper and paperboard, wood, and food and miscellaneous organic waste. Approximately one-half of MSW from these categories is currently used for other purposes.
7. Production figure estimated from conversation with Griffin Industries. Griffin Industries is a major recycler of food industry waste, and collect a major portion of the waste cooking oil/grease in Louisiana.
8. Vegetable oil is approximately 7.1 lbs./gal.
9. Biodiesel yield is approximately 80% of oil yield.
10. Figures published by Energy Information Administration.