

Useful Information about Conventional and Alternative Fuels and Their Feedstocks

Feedstocks

		Crude Oil	Corn	Crop Residue	Forest/Mill Residue	Energy Crops
Daily US Production	(million barrels/day)	5.746 ⁽¹⁾	-	-	-	-
Annual US Production	(million tons)	318	252 ^(2, b)	-	-	-
Estimated Availability	(million tons)	-	-	382 ⁽³⁾	1200 ⁽³⁾	159 ⁽³⁾
Wholesale Market Prices (1992-2002)	(\$/barrel)	\$10.80 - \$38.20 ⁽⁴⁾	-	-	-	-
	(\$/bushel)	-	\$1.82 - \$3.24 ⁽²⁾	-	-	-
	(\$/dry ton)	-	\$76 - \$137 ^(k)	-	-	-
Estimated Delivered Cost	(\$/dry ton)	-	-	≥\$40 ⁽⁵⁾	≥\$20 ⁽⁵⁾	≥\$40 ⁽⁵⁾
Energy Content Compared to Crude Oil		-	42% ^{(6) (7)}	40% ^{(8) (6)}	46% ^{(8) (6)}	39% ^{(8) (6)}
Total Sugar Content	(pounds sugar/pound feed)	-	0.81 ^(2, s)	0.64 ^(9, i) (stover)	0.66 ^(9, i) (wood)	0.62 ^(9, i) (switchgrass)

Products

		Gasoline	Ethanol	Hydrogen	Diesel	Biodiesel	
Annual US Production	(million gallons)	135,517 ⁽¹⁰⁾	2,810 ⁽¹¹⁾	1,805 billion scf ^(12, l)	36,667 ^(13, e)	25 ^(14, m)	
Wholesale Market Price	(\$/gallon)	\$0.30 - \$1.20 ⁽¹⁵⁾	\$0.90 - \$1.80 ⁽¹⁶⁾	\$0.60 - \$1.20/kg	\$0.30 - \$1.20 ⁽¹⁷⁾	\$1.25 - \$2.25 ⁽¹⁸⁾	
Energy Content Compared to Gasoline or Diesel		-	66% ^(19, a)	279% ^(19, d)	-	90% ⁽²⁰⁾	
Current Technology			Enzymatic hydrolysis of corn w/ fermentation	Steam reforming of natural gas	Oil refining	Soybean oil or yellow grease transesterification	
	Average Yields	Oil refining	0.59 bbl/bbl crude oil ^(10, o)	2.5 - 2.7 gal/bushel corn ^(2, 11)	0.34 kg/ kg natural gas ^(21, q)	0.16 bbl/bbl crude oil ^(10, p)	1.4 gal/bushel soy ⁽²²⁾
	Theoretical Yields	(gallons/wet ton)	164 ^(f)	89 - 96 ^(b)	-	44 ^(f)	47 ^(g)
Life Cycle Fossil Energy Ratio (LHV basis)	(Fuel energy / fossil energy consumed)	-	124 gal/dry ton	0.50 kg/ kg natural gas ⁽ⁿ⁾	-	49 gal/wet ton ^(h)	
Future Technology		0.83:1 ⁽²³⁾	1.34:1 ⁽²⁴⁾	0.66:1 ⁽²¹⁾	0.83:1 ⁽²³⁾	3.2:1 ⁽²⁵⁾	
	Theoretical Yields		Enzymatic hydrolysis of biomass w/ fermentation	Gasification of wood/steam methane reforming	-	Higher oil content seeds or greases	
	Life Cycle Fossil Energy Ratio (LHV basis)	(per ton)	-	98 gallon (dry stover) ^(26, c)	155 kg (dry wood) ^(27, r)	-	109 gallon (wet ton seeds) ⁽ⁱ⁾
	(Fuel energy / fossil energy consumed)	-	4.6:1 (stover) ⁽²⁸⁾	14-29:1 (wood) ⁽²³⁾	-	-	

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Notes

- a. Using Lower Heating Value (LHV) and BTU per gallon values
- b. Based on 56 wet pounds per bushel corn
- c. Stover is a crop residue. Compositions vary considerably due to a multitude of factors. This yield is based on the stover sugar content listed in the feedstock section above.
- d. Using LHV and BTU per pound values. Used 18,500 BTU per pound for gasoline because it was the middle of the range given
- e. Sum of on-hwy diesel and off-hwy diesel for 2002
- f. 6.6 barrels per ton for crude oil, 42 gallons per barrel
- g. 60 pounds per bushel soy
- h. Assuming 18% oil content in soybeans and 0.88 specific gravity for biodiesel
- i. Assuming 40% oil content in seeds like rape seed or mustard seed
- j. 1 lb of 6-carbon polymer yields 1.11 lb of glucose, 1 lb of 5-carbon polymer yields 1.136 lb of 5 carbon sugar
- k. 16% moisture in corn
- l. Includes captive, merchant, liquid and by-product hydrogen for the U.S.
- m. 2001 biodiesel consumption
- n. 16 kg of CH₄ can produce 8 kg of H₂
- o. From diagram 2 in reference report, motor gasoline divided by crude oil refinery input
- p. Annual US diesel production divided by crude oil refinery input from diagram 2 in reference report
- q. Plant size divided by natural gas consumed, converted to kg H₂ per kg natural gas
- r. Wood (forest or mill residue). From chemical equation in reference, yield is 2.07 mole of H₂ per mole of wood with CH_{1.47}O_{0.67} molecular formula
- s. Corn is 61% starch, 16% water (from seed drawing on reference). 1 lb of starch yields 1.11 lb of sugar

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