

Alternative Fuels

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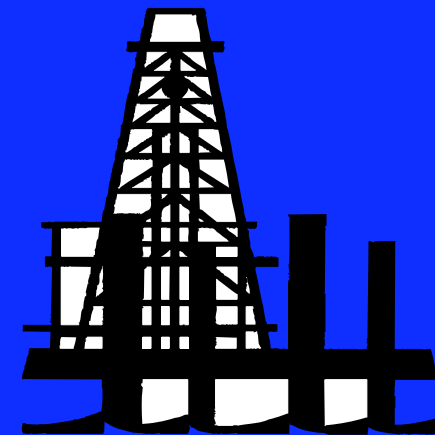
Extension Service

Goals of this Presentation

- Discuss energy situation the world faces
- Discuss Soy Biodiesel properties, advantages and disadvantages
- Understand Biodiesel and Ethanol blend terminology
- Discuss tax incentives and pricing of Soy Biodiesel blends
- Answer questions/dispel myths

Energy Picture for the United States & the World

- ✚ We currently import over 50% of our petroleum needs
- ✚ Energy consumption predicted to increase 40% to 54% between now and 2025 (~20 years) in the US and World, respectively.
- ✚ China and India will begin to consume large quantities of petroleum as they enter the world economic picture.
- ✚ *Without question, this amplifies the need for the US to produce our own energy supplies.*



Biodiesel & Energy Security



- Top 10 petroleum exporters
 - } Saudi Arabia
 - } Russia
 - } Norway
 - } Venezuela
 - } Iran
 - } United Arab Emirates
 - } Nigeria
 - } Kuwait
 - } Mexico
 - } Iraq

Cost of fuel

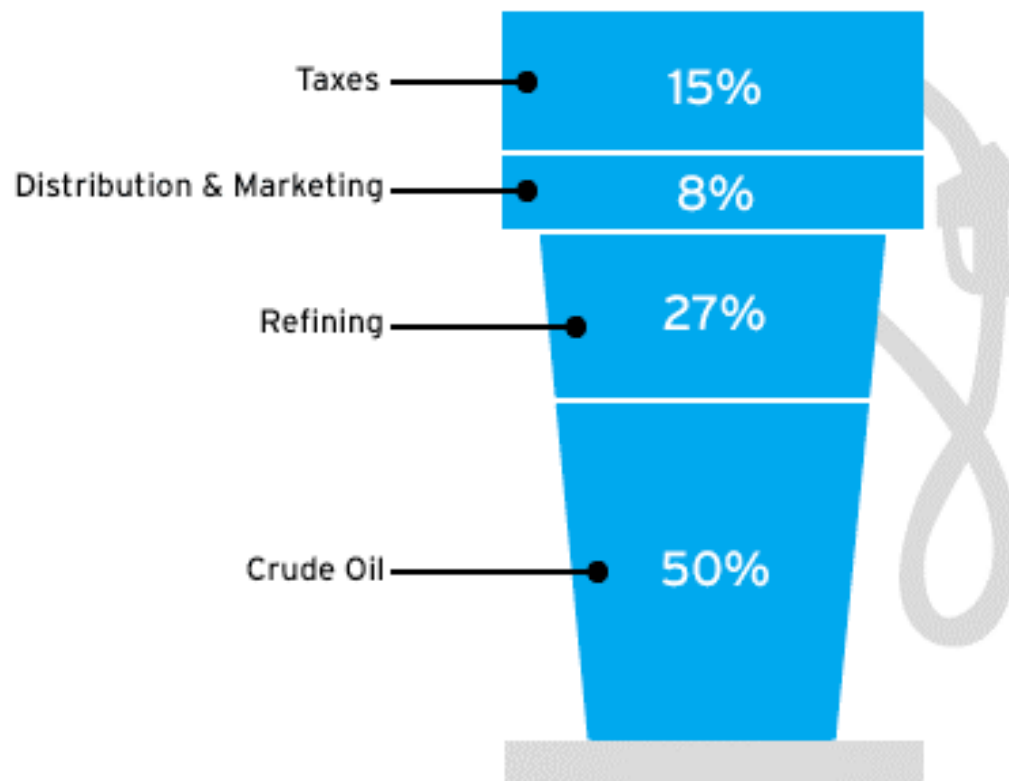
- 1 barrel = 42 gallons of oil
- \$60 a barrel = \$1.43/gallon of gasoline.
- Does not include costs of refining, transportation, wholesalers cost, taxes.

- Current crude oil price is ~ \$63.00/bbl
- Current gasoline price is ~ \$2.17/gal

WHAT WE PAY FOR IN A GALLON OF REGULAR GASOLINE

Source: American Petroleum Institute Date: September 2005

Retail Price: \$2.90/Gallon



Biodiesel is Not:

- Produced by adding fuel conditioners to vegetable oils
- Produced by other concoctions found on the internet
- Produced without removing glycerin

Biodiesel Standard ASTM D6751

Table 1: Summary of ASTM D 6751

Property	ASTM Method	Value	Unit
Flash Point	D93	130.0 min.	°C
Water & Sediment	D2709	0.050 max.	Vol. %
Carbon Residue (100% Sample)	D4530	0.050 max.	Wt. %
Sulfated Ash	D874	0.020 max.	Wt. %
Viscosity @ 40°C	D445	1.9 – 6.0	Cst
Sulfur	D5453	0.05 max.	Wt. %
Cetane Number	D613	47 min.	N/A
Cloud Point	D2500	Report	°C
Copper trip Corrosion	D130	No. 3 max.	N/A
Acid Number	D664	0.80 max.	Mg KOH/gm
Free Glycerin	D6584	0.020 max.	Wt. %
Total Glycerin	D6584	0.240 max.	Wt. %
Phosphorous Content	D4951	0.001 max.	Wt. %
Atmospheric Equivalent Temperature (90% Recovered)	D1160	360 max.	°C

Consequences of Impure Biodiesel

- Injectors coke with partially burned waxes and fats
- Engine loses power, becomes hard to start
- Fuel economy decreases
- Crankcase oil may gel like Jello when combination of glycerin, engine wear/blow-by, temperature, oil sump capacity, type of oil, hours of use and other factors converge.

Feed Stocks to Make Biodiesel

- Vegetable oils
 - Soybean
 - Cottonseed
 - Rapeseed
 - Canola
 - Peanut
 - Corn
 - Castor???
- Animal fats
 - Poultry
 - Fry oils
 - Fish
 - Beef
 - Pork

MS Commodity Potential

Table II-1. Mississippi Agricultural Commodities and Potential Biodiesel Production

Commodity	Production¹	Unit	Gallons of Biodiesel
Corn	50,050,000	bushels	4,062,500 ⁺
Soybeans	36,960,000	bushels	26,400,000 ⁺⁺
Rice	16,445,000	cwt	4,271,428 [*]
Cotton	2,396,000	bales	16,892,734 ^{**}
Sorghum	7,134,000	bushels	1,660,276
Broiler Production	4,078,400,000	pounds	52,966,234 [#]

¹Reference (MASS, 2002)

⁺One bushel of corn yields 1.6 pounds of corn oil (www.iowacorn.org)

⁺⁺One bushel of soybeans yields 1.4 gallons of biodiesel (USDA, 2002)

^{*}Assuming 10% bran is recovered from the rice paddy and bran contains 20% oil.

^{**}Assuming 60% cotton seeds are recovered during ginning and cotton seeds contain 18.85% oil.

[#]The rendering process generates 0.10 pounds of fat/lb of animal (Shumaker et al., 2000)

Except for corn and soybeans, it was assumed that 7.7 pounds of oil yields one gallon of biodiesel.

Soybean Yields

- 79.8% Meal = 44.6 lb/bu
- 17.8% Oil = 10.7 lb = 1.33 gal/bu
- 1 Acre @ 30 bu/ac = 40 gallons oil
- If all soybean oil produced in US were converted to biodiesel, it would supply about 12% of the trucking industry fuel needs.

Soybean Facts

- Soybean oil amounts to about 50% of all vegetable oils world wide
- 100 Million gallons increase in use will increase price of soybeans by \$0.10 per bushel

Soybean Potential

- 3 Billion bushels per year US production
- ~ 4.2 billion gallons per year
- ~ 7.5% of yearly demand

Cottonseed Energy Potential

- 1 Ton yields 318 lb or 41.4 gallons of oil and 923 lb of meal
- <3 Bales per acre yields 1 Ton of seed
- No longer a premium oil
- High free fatty acids requires second step in processing
- High Heat Value for whole cottonseed is 9355 BTU/lb or equivalent of 145 gallons of diesel/ton

Evaluation of BioDiesel Production Costs

Note: Feedstock
represent ~75%
of total processing costs

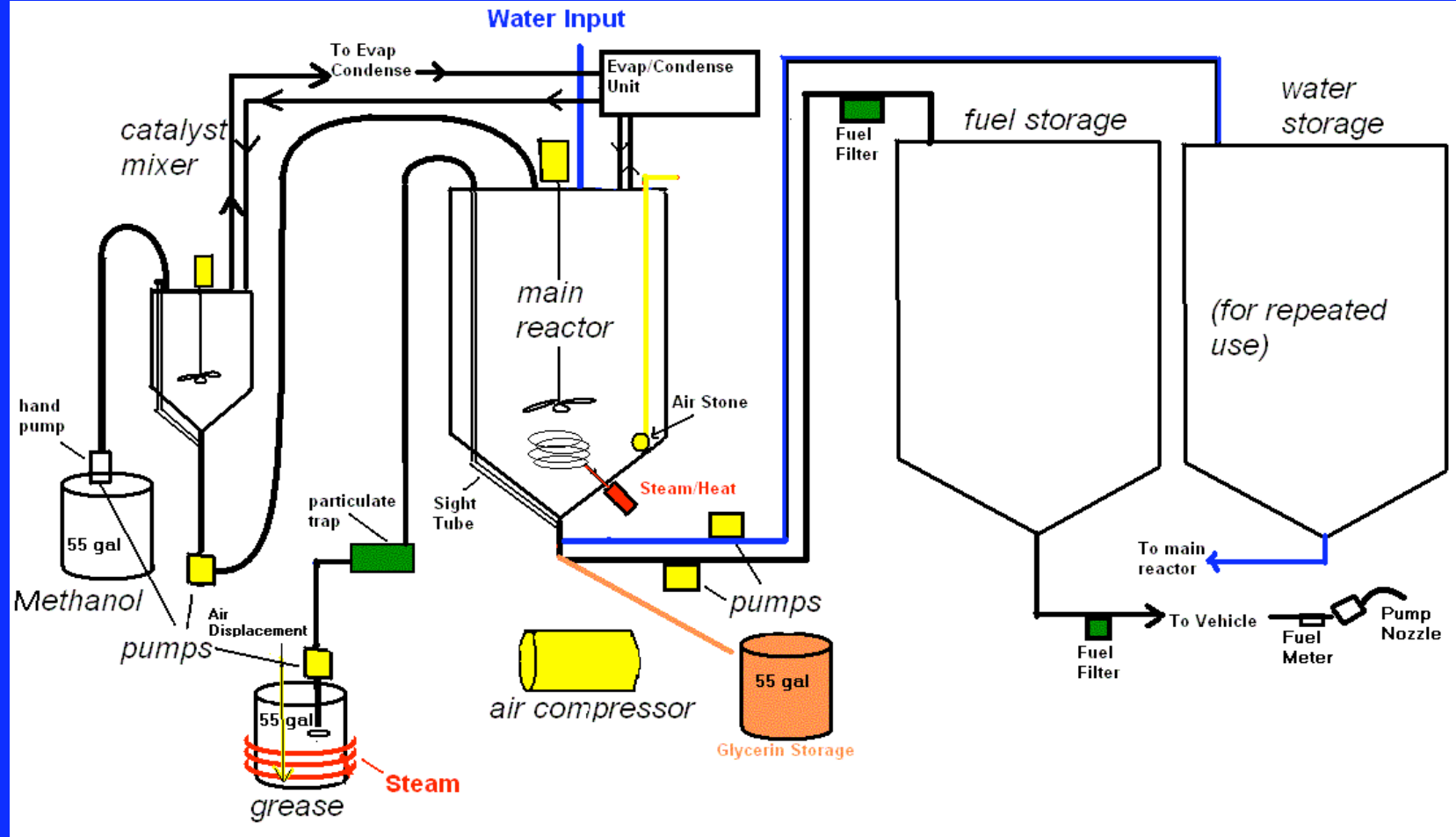
Soybean Oil
\$1.85/gal feedstock cost \$0.30/gal processing cost \$0.20/gal transportation cost \$0.15 “other” cost
= \$2.50/gal total cost



Animal Fat Rendering

- 0.1 lb of oil from each lb of chicken
- Soy oil = \$0.2258 /lb (May) Chicken fat = \$0.17 /lb
- Earth Fuels in Meridian is recovering fry oils
- Griffin Chemical will deliver bulk fry oil \$1.12/gal.

Processing Unit



Biodiesel Performance



- Similar to petroleum diesel
- Highest BTU content of any alternative fuel
- High cetane
 - } minimum cetane of 47
 - } higher than most #2 diesel

Biodiesel & Clean Air



- Safer to breathe
- Less offensive exhaust
- Reduces cancer-causing compounds by 80%–90%
| compared to petroleum diesel exhaust

Material Compatibility

- ✚ B100 may adversely affect some elastomers such as natural or nitrile rubbers over time
- ✚ Most elastomers used after 1993 are compatible with B100 (Viton, etc.)
- ✚ Blends (<B20) effect is less, or non-existent
 - 🌐 Normal monitoring of hoses and gaskets for leaks is sufficient with B20
- ✚ Biodiesel (B100) is a solvent--it may harm some painted surfaces – this is of concern only to distributors!

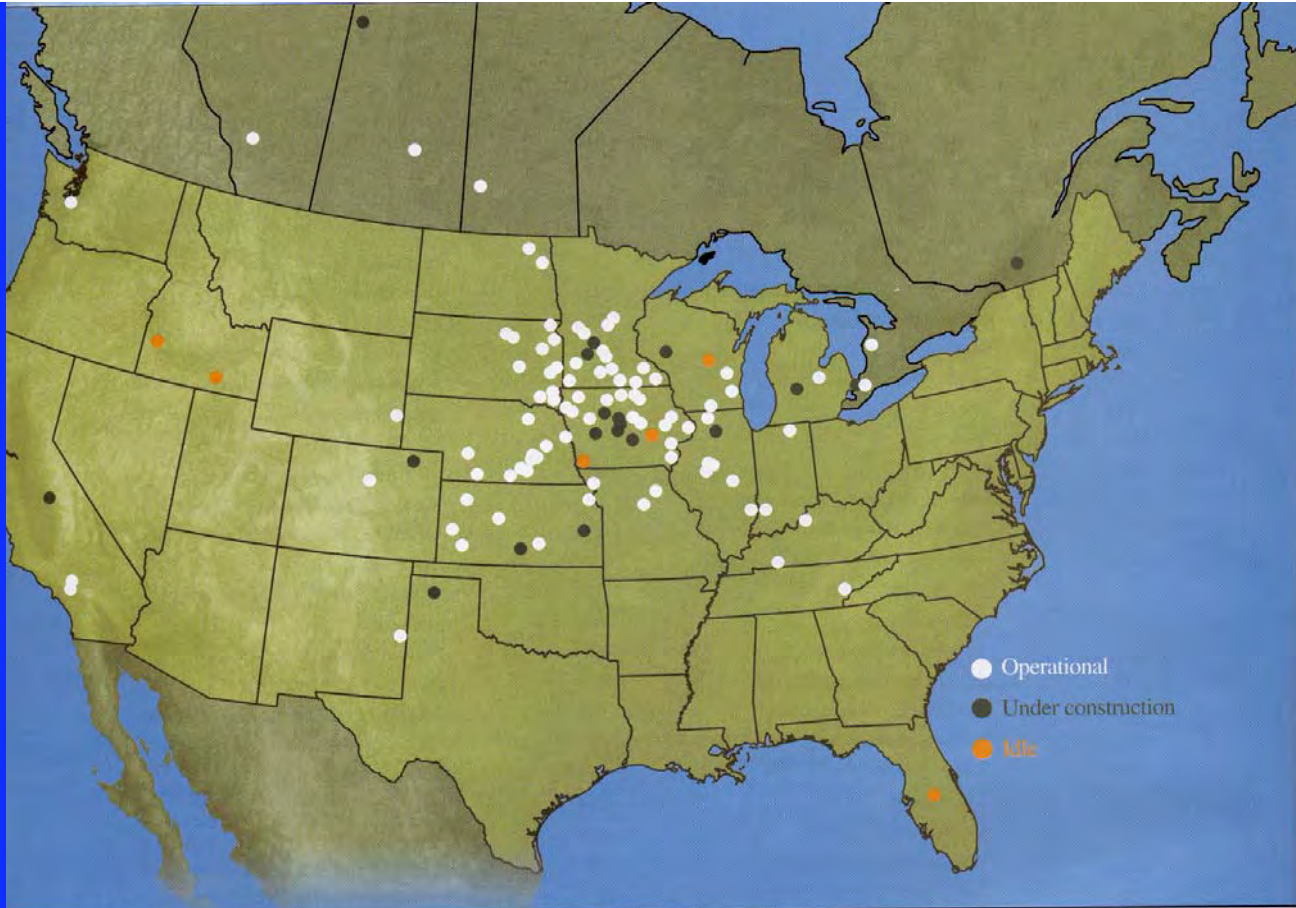
Biodiesel Compatibility

- Handling systems
 - Scale and rust
- Potential for water
- Tank slope
- Need for filling system filters

Bio fuel Incentives



- Effective in 2005
- Excise tax credit
 - } taken at blender level
 - } \$.01 per % blended for virgin Agricultural oils up to \$1.00/gal
- Non virgin oil (fry oils) \$0.50/gal credit.
- Small Producer (under 60,000 gal/yr) \$0.10/gal credit
- USDA CCC subsidy ~ \$0.50/gal



U.S. and Canada Fuel Ethanol Plant Map

Unlike biodiesel, ethanol is not a net energy gain process

Ethanol

- About 70% of the energy of gasoline
- All the corn in US would equal about 15% of gasoline use
- Raising CAFÉ standards by 10% would save 14 billion gallons of gasoline and cost about 1/3 what it cost to subsidize the equivalent amount of fuel ethanol

US Ethanol Production

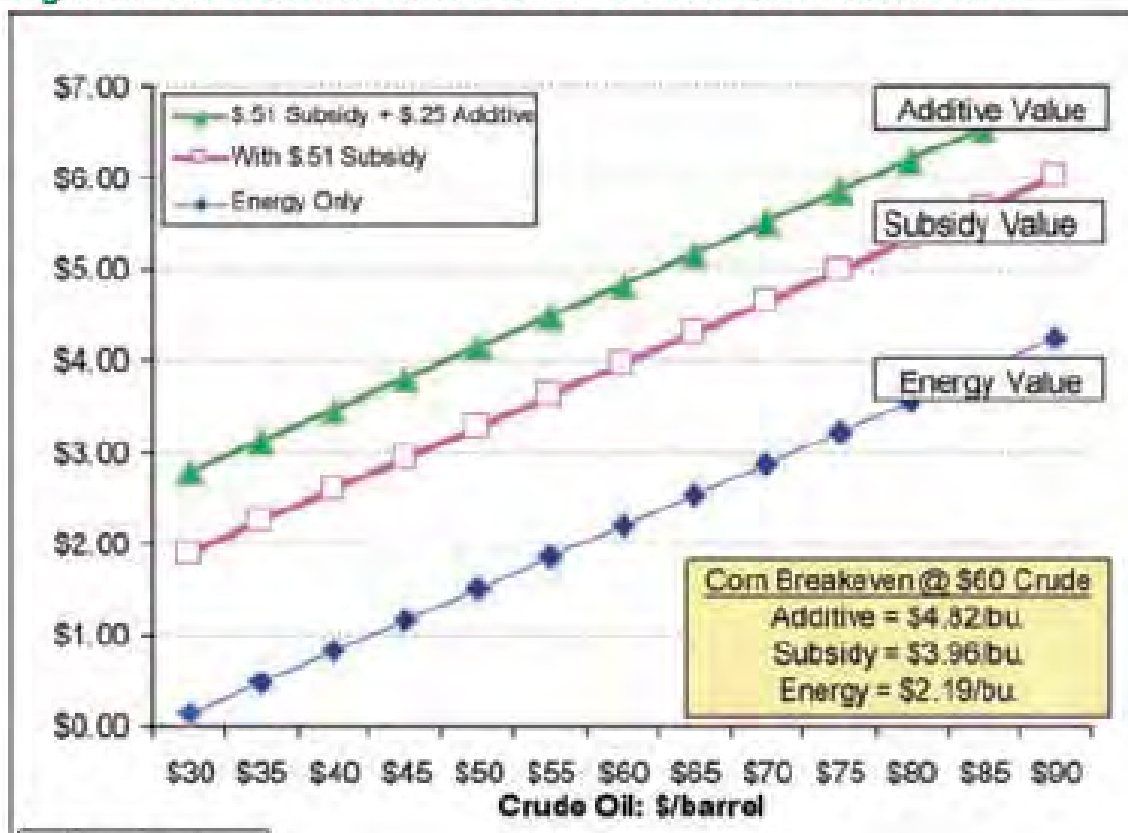
Year	Ethanol Prod. (Billion gallons/yr)	Grain Used (Billion bushels/yr)
1997	1.3	.500
1998	1.4	.538
1999	1.47	.565
2000	1.63	.627
2001	1.77	.681
2002	2.13	.819
2003	2.81	1.077
2004	3.4	1.220
2005	3.9	1.400
May 2006	4.5	1.600
Projected 2010	7-9	3.200

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Fueling America Through Renewable Resources

Economics of Ethanol

Figure 1. Corn Breakeven Price for Ethanol: November 2006 Estimated Costs



Markets for DDG's from Ethanol

- Cattle
- Swine
- Poultry
- Fish



Use of Dry Distillers' Grains with Solubles by Poultry

Todd Applegate and Layi Adeola, Department of Animal Sciences
Purdue University



stry.

Table 1.

Bird Category	Total Consumption	Theoretical DDGS Use (tons)		
	Feed (tons)	5% of Diet	7.5% of Diet	10% of Diet
<i>Broiler</i>	222,640	11,132	16,698	22,264
<i>Turkey male</i>	368,280	18,414	27,621	36,828
<i>Turkey female (light)</i>	60,915	3,046	4,569	6,092
<i>Turkey female (heavy)</i>	32,185	1,609	2,414	3,219
<i>Duck</i>	72,774	3,639	5,458	7,277
<i>Pullet to 13 wk</i>	94,152	4,708	7,061	9,415
<i>Pullet 13 to 20</i>	31,911	1,596	2,393	3,191
<i>Laying hen</i>	892,178	44,609	66,913	89,218
Total per year	1,775,034	88,752	133,128	177,503
Total per week		1,707	2,560	3,414
Total per day		243	365	486



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Fueling America Through Renewable Resources

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THE GREAT ALT-FUEL RALLY

It takes five barrels of crude oil to produce enough gasoline (nearly 97 gal.) to power a Honda Civic from New York to California. So how do the alternative fuels that may gradually reduce America's dependence on foreign oil stack up against the mileage and convenience of the filling-station stalwart? Here's a reality check.

RAW MATERIALS CONSUMED	FUEL NEEDED	FUEL COST	PRICE	ECONOMY
4.5 barrels of crude oil	90.9 GAL	\$212.70	\$2.34/GAL	33 MPG
53 bushels of corn and a half-barrel of crude oil	176 GAL	\$425	\$2.41/GAL	17 MPG
18,190 cu. ft. of natural gas and a half-barrel of crude oil	214 GAL	\$619	\$2.89/GAL	14 MPG
16 5-gal. jugs of used vegetable oil	68.2 GAL	\$231	\$3.40/GAL	44 MPG
10,650 cu. ft. of natural gas	88 GGE*	\$110	\$1.25/GGE	34 MPGGE
About 1 ton of coal	16.4 GGE	\$60	\$3.66/GGE	202 MPGGE
16,000 cu. ft. of hydrogen	73 GGE	\$804	\$11/GGE	41 MPGGE

Fuel Type	Vehicle	Price	Economy
Gasoline	2006 HONDA CIVIC	\$212.70	33 MPG
E85/Ethanol	2005 TAURUS FFV	\$425	17 MPG
Methanol	1998 TAURUS M85 FFV	\$619	14 MPG
Biodiesel	2006 GOLF TDI	\$231	44 MPG
Compressed Natural Gas	2005 CIVIC GX	\$110	34 MPGGE
Electricity	1997 HONDA EV PLUS	\$60	202 MPGGE
Hydrogen Fuel Cell	GM HY-WIRE	\$804	41 MPGGE

*Gallon of Gasoline Equivalent

We picked cars for this virtual cross-country trip to be as close in size and weight as possible. To compare the alternative fuels, we measured their energy content in gallon of gas equivalents (GGE)—the amount of fuel with the same energy content as a gallon of gasoline.

HONDA CIVIC is the benchmark for all the vehicles in our virtual comparison. It burns regular 87-octane gasoline (available on every corner)—even if it's not always cheap.

E85/Ethanol CURRENT TAURUS FFV burns 85% ethanol and 15% gasoline. (The gas gets the engine started on cold days.) The fuel gives about 15% less mileage than regular gasoline, but burns cleanly and reduces pollution.

Methanol MID-90s TAURUS M85 FFV burns 85% methanol in a limited number of stations, and also is some dedicated to slow BTU content of methanol means 35% fewer miles per gallon. Made from natural gas, methanol burns cleanly.

Biodiesel VW GOLF AND NEW BEETLE TDI are the mileage champs of all conventional cars, sipping diesel fuel at a miserly rate. And they get about 44 mpg. VW only recommends B5. B20 would lower the cost of the trip to less than \$183.

Compressed Natural Gas HONDA CIVIC GX can be refueled at home—as could any CNG vehicle—with a home compressor. But crossing the country in a dedicated CNG car would be tough. There aren't a lot of CNG stations, and many are for fleet use only.

Electricity LATE-90s HONDA EV PLUS got about 100 highway miles on a nearly full charge of 20 kilowatt-hours (kwh). The vehicle's NiMH battery pack had a total capacity of 26.5 kwh. Electrics do better in traffic, thanks to regenerative braking.

Hydrogen Fuel Cell HY-WIRE CONCEPT uses compressed hydrogen, which costs about 10 times as much as gasoline, although the DOE projects prices will drop to \$10/GGE by 2012. The technology will double vehicle range by raising tank pressure to 10,000 psi.

INFORMATION DESIGN BY AGUSTIN CHUNG
ILLUSTRATIONS BY JIXEL QUEEN

2006 HONDA CIVIC

2005 TAURUS FFV

1998 TAURUS M85 FFV

2006 GOLF TDI

2005 CIVIC GX

1997 HONDA EV PLUS

GM HY-WIRE

Mississippi Alternative Energy Facilities

- Biodiesel Fuels of MS, Inc., Meridian, MS
- Alabama Biodiesel Corp., Moundville, AL
- West Central Cooperative/Transmontaigne/Peter Cremer North America, Ralston, IA/Greenville, MS, Cincinnati, OH
- North Mississippi Biodiesel, New Albany,
- Scott Petroleum, Greenville, biodiesel*
- Ergon Inc./Bungee, Vicksburg, ethanol**
- Tri States Petroleum, Houston, biodiesel
- Others permitted

Becoming Energy Self Sufficient

- Bio Fuels
- Conservation
 - Carpool
 - Mass transit
 - More efficient vehicles
- More efficient shipping
 - Improved rail, waterways, containerization
- Localized Processing
- Coal, Nuclear

Has Agriculture Done Its Part?

- More productive equipment
- Genetically engineered crops
- Reduced tillage
- Reduced pesticide use
- Higher yields
- Biodiesel research Soybeans

Thanks

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