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# AMERICA'S ALTERNATIVE ENERGY SOURCES

## Biodiesel

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## *Current State of Biodiesel Industry*

### How Much is Used and Where?

Most of the world's diesel is currently derived from petroleum. As a renewable fuel source, it can be produced from a number of feedstocks, primarily those with high concentrations of plant oils. Soy represents the vast majority of the feedstock used in United States biodiesel. Both producers and consumers of biodiesel fuels typically reside near agricultural areas replete with soy crops.

Estimates for biodiesel production from the 65 existing plants in the United States hover around 75M gallons for 2005, up from about 25M gallons the previous year, and less than 2M gallons per year prior to 2000.[1] These plants were capable of producing as much as 395M gallons in 2005.[2] As of April 2006, fifty new biodiesel plants were under construction, and eight were expanding capacity, which would bring total U.S. production capacity to approximately 713.7M gallons per year.[3]

Rather than being used as a discrete fuel source, in the United States most biodiesel is blended with petroleum-based diesel at various concentrations, ranging from B2 (2% biodiesel) to B20 (20% biodiesel). Even with the recent dramatic expansion of production capacity, current infrastructure can only support an overall biodiesel blend of less than 1.5%.[4] In June 2006, the American Society of Testing and Materials has issued standard D6751-06,[5] which standardizes the B100 used for blending into conventional diesel fuels. Because of this, many vehicle manufacturers have agreed to include D6751-blended B5 as a valid alternative fuel for engine warranty purposes.[6]

## *Outlook for Biodiesel*

### Pros & Cons

Using biodiesel fuel has a number of benefits, beyond being a renewable resource. Soy biodiesel production helps to support crop prices. With another market for their crops, soy growers could rely less upon federal subsidies, and more on market economics. This could be done without significant adverse effect on food prices, using land that is currently left fallow under subsidy programs, combined with a reduction in soy exports.

Biodiesel when produced under strict ASTM and NCWM guidelines, also has the advantage of operating well in existing, unmodified diesel engines. Also, blends as low as B2 may even increase engine longevity by better lubricating it.[7]

Because B100 contains about 118,000 BTUs per gallon, compared to No. 2 (petroleum) diesel's 129,000 BTUs, theoretical engine performance and fuel economy would only diminish by about 8.65%,[8] and be nearly imperceptible in the lower blends. Net energy balance is also very favorable, at approximately +3.2, versus -0.83 for petroleum diesel.[9]

Other benefits to biodiesel include being more quickly biodegradable and less toxic than petroleum-based diesel,[10] and having no pungent odor when burned, due largely to its lack of sulfur content.[11]

In the United States, inconsistencies in biodiesel production, transportation, and storage practices have resulted in somewhat unpredictable chemical properties historically. While not volatile, these inconsistencies had the potential to reduce engine performance, and even damage engines. Because of this, U.S. vehicle manufacturers have been reticent to warrant the use of blends stronger than B5, creating a limit to demand, and precluding a more aggressive adoption curve.

As fuel blends approach B100, another problem arises. Biodiesel tends to "gel" at much higher temperatures than does conventional diesel. This dramatic state change can cause clogged fuel lines, filters, and injectors, ultimately destroying the engine. B100 can gel at temperatures above 32 degrees Fahrenheit,[12] making it impossible to use in much of the northern United States until a suitable stabilizing agent can be found.

Another disadvantage is U.S. public perception of diesel technology. Many view diesel-powered vehicles as loud, unrefined, odorous, toxic, and sluggish. While more recent technology has resolved these issues, public misinformation would be a significant obstacle to widespread adoption. Accordingly, early adopters have included agricultural, commercial truck, and governmental fleets (especially mass-transit busses), as well as enthusiasts, both environmental and Germanophile.

### Barriers and Incentives

Likely the biggest barriers to the widespread adoption of biodiesel are its production cost and limited supplies of feedstocks. Soy-based biodiesel currently costs about four times as much to produce as does petroleum-based diesel.[13] New technologies, such as "micro-reactors," could reduce costs in the future by speeding the production process.[14] However, even with an efficient production process, current estimates indicate that using the entire U.S. soy crop as a fuel input, would not replace more than about 6% of the diesel fuel consumed each year, let alone replace any gasoline as a fuel source.[15]

In 2004, Pennsylvania passed the "Alternative Fuels Incentive Bill," which will subsidize five cents per gallon for up to 12.5M barrels per year.[16] This has already encouraged local firms to begin building biodiesel infrastructure in the state. Worley & Obetz, for example, was granted $175,000 to plan for a new biodiesel production facility, [17] and also opened the first biodiesel injection-blending facility on the East Coast in Middletown, PA.[18]

Biodiesel blended at the Independence Biofuels facility will be produced at Keystone Biofuels in Shiremanstown, PA, which began operation of its million gallon per year biodiesel production facility in January 2006. With the help of a First Industries Fund loan guarantee, Keystone plans to expand production to 5-7M gallons per year by December 2006. Fed by virgin oil from soy grown and crushed at Wenger Feeds in Rheems, PA, among other nearby facilities, [19] this supply chain highlights the efficiency of de-centralized energy production. The process from soy crop to fuel pump takes place within a 30 mile radius of the distributor.

## *Recommendations*

Based upon the current state of the technology, it seems unlikely that biodiesel will be much more than a "fuel additive" for a long time, precluding it being classified a viable alternative fuel in its own right. In so far as low-concentration blends are used to mitigate dependence upon petroleum diesel, support the local soy farmer, enhance engine lubrication, and lower sulfur dioxide emissions in existing fleets, it will be a step in the right direction.

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[1] National Biodiesel Board – Biodiesel Production Graph. http://www.biodiesel.org/pdf_files/fuelfactsheets/Production_Graph_Slide.pdf

[2] National Biodiesel Board – Commercial Biodiesel Production Plants. April 28, 2006. http://www.biodiesel.org/buyingbiodiesel/producers_marketers/ProducersMap-Existing.pdf

[3] National Biodiesel Board – Biodiesel Production Plants Under Construction or Expansion. April 28, 2006. http://www.biodiesel.org/buyingbiodiesel/producers_marketers/ProducersMap-Construction.pdf

[4] U.S. DOE EIA – Prime Suppliers Sales Volumes. August 12, 2006. http://tonto.eia.doe.gov/dnav/pet/pet_cons_prim_dcu_nus_a.htm Dividing current biodiesel production (at maximum capacities) by annual No. 2 diesel sales volume results in a <1.5% biodiesel blend.

[5] National Biodiesel Board – Biodiesel Specifications fact sheet. http://www.nbb.org/pdf_files/fuelfactsheets/BDSpec.PDF

[6] National Biodiesel Board – Standards and Warranties fact sheet. http://www.nbb.org/resources/fuelfactsheets/standards_and_warranties.shtm

[7] Nationl Biodiesel Board – Lubricity fact sheet. http://www.nbb.org/pdf_files/fuelfactsheets/Lubricity.PDF

[8] National Biodiesel Board – Energy content fact sheet. http://www.biodiesel.org/pdf_files/fuelfactsheets/BTU_Content_Final_Oct2005.pdf

[9] U.S. DOE EERE – An Overview of Biodiesel and Petroleum Diesel Life Cycles. May 1998. http://devafdc.nrel.gov/pdfs/3812.pdf

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[13] U.S. DOE – Biodiesel Performance, Costs, and Use. http://www.eia.doe.gov/oiaf/analysispaper/biodiesel/
[14] Oregon State University - Tiny Microreactor For Biodiesel Production Could Aid Farmers, Nation. February 20, 2006. http://oregonstate.edu/dept/ncs/newsarch/2006/Feb06/microreactors.htm
**[15]** University of Minnesota - Ethanol fuel presents a corn-undrum. http://www1.umn.edu/umnnews/Feature_Stories/Ethanol_fuel_presents_a_cornundrum.html
[16] Biodiesel Magazine – Pennsylvania Law Creates Biodiesel Fund. December 2004. http://www.biodieselmagazine.com/article.jsp?article_id=588
[17] Biodiesel Magazine – Worley & Obetz Receives Planning Grant. August/September 2005. http://www.biodieselmagazine.com/article.jsp?article_id=363
[18] Green Car Congress – Independence Biofuels Opens Pennsylvania Injection-Blending Facility. October 28, 2005. http://www.greencarcongress.com/2005/10/independence_bi.html
[19] PA DOA – Local Entrepreneur Fueled by Agricultural Industry. June 2006. http://www.agriculture.state.pa.us/agriculture/cwp/view.asp?a=390&q=139863