



FACT SHEET

JULY 2007

NOT ALL BIOFUELS ARE CREATED EQUAL

Writing recently on the Editorial pages of *The Washington Post*, University of Minnesota plant biologist David Tilman made the point that "not all biofuels are created equal." Tilman is one of the leading researchers on the productivity of renewable biomass feedstocks for cellulosic ethanol and the relative sustainability and efficiency of biofuels production practices. His work on the comparative productivity of diverse stands of perennial native grasses for biomass was featured on the cover of *Science* magazine in December 2006.

Needless to say, lay persons, not to mention many well informed advocates, are scratching their heads these days about whether biofuels are good or bad; or maybe somewhere in between. And if there is no simple black and white answer to the question, how does one discern and discriminate in favor of the most sustainable and ecologically friendly biofuels, particularly from a public policy makers' vantage point. Because if congress or state legislatures are offering millions or billions of dollars for "alternative" fuels, it could turn out that the money is as accessible to inefficient and unsustainably produced conventional corn ethanol fuel as to much more efficient and ecologically benign biofuels with higher net energy and greenhouse gas benefits. Even worse, the subsidies could underwrite deforestation in rainforests that result in a net increase in greenhouse gas pollution of the atmosphere.

One of the first concerns that comes up in critically analyzing biofuels is whether or not one must invest so much fossil fuel into its production that by the end of the day you have not gained a whole lot of new energy.

Net Energy

While people often generalize about bio, here is where you can find significant, sometimes dramatic contrasts between particular biofuels. Corn ethanol does not have the same net energy or greenhouse gas numbers as would cellulosic ethanol or biodiesel from low input camelina. So, it is dangerous to make any kind of categorical statement about the net energy of biofuels.

Recent analysis by Argonne National laboratory, including examination of 22 studies performed over the last two decades, concluded that even though the biofuels production cycle burns fossil fuels in growing, transportation, and manufacture, the end products provide more renewable energy than the amount of fossil fuel energy consumed. Argonne calculated that one unit of corn ethanol energy delivered at the pump requires 0.74 units of fossil energy. By contrast, because energy is needed to process petroleum, it takes 1.23 units of fossil energy to deliver

1 unit of gasoline at the pump. That makes conventional corn ethanol approximately 60% more efficient from a net energy standpoint than petroleum gasoline. Cellulosic ethanol based on switchgrass has an even better energy balance. Delivering 1.00 unit of cellulosic ethanol energy at the pump takes only 0.10 units of fossil energy. [SOURCE: Michael Wang, *An Update of Energy and Greenhouse Gas Impacts of Fuel Ethanol*, Argonne National Laboratory, February 2005.]

It is not possible to generalize about conventional ethanol from corn. Newer, more efficient ethanol plants, using wind energy or biomass for process energy would generate much less greenhouse gases and consume far less water than would some of the older plants, or ones using coal to fire the process. Likewise, farming practices for the production of the corn will be a significant factor, as would the drying and shipping of the distiller's grains byproducts of the ethanol process, as opposed to onsite consumption of wet grains.

WORC

220 S. 27th Street, Suite B, Billings, MT 59101
(406)252-9672 (406)252-1092 FAX
billings@worc.org www.worc.org

As noted, the biggest gains in ethanol will come when cellulosic ethanol technologies are fully commercial. Currently Congress and state legislatures are offering incentives to stimulate cellulosic and other biomass conversion technologies. (Note: Public investments in advancing cellulosic ethanol go much further and faster than coal to liquids technologies. For the price of one commercial coal to liquids plant (\$6.6 billion), Congress could build over 66 cellulosic ethanol plants around the country producing 1/3 more liquid fuels. Moreover, second generation cellulosic ethanol plants would cost even less.)

For biodiesel, a comprehensive analysis of lifecycle net energy and greenhouse gas effects was conducted in 1998 in a partnership between the U.S. Dept. of Agriculture and the National Renewable Energy Laboratory. Its concludes that biodiesel made from soybeans offers dramatic savings – using 70% less fossil energy than its petroleum counterpart. Again, lower input oilseed crops, grown in conservation rotations with small grains, should produce even better results than fairly intensive soybean farming practices.

- Biodiesel yields 3.2 units of fuel product energy for every unit of fossil energy consumed in its life cycle.
- Biodiesel reduces net emissions of CO₂ by 78.45% compared to petroleum diesel. For B20, a blend of 20% B100 and 80% conventional petroleum diesel, CO₂ emissions from urban buses drop 15.66%.

In August, 2005, David Morris of the Institute for Local Self-Reliance published a detailed analysis of the biofuels net energy debate. He made some important points:

- Some of the most widely cited studies that show net energy losses for corn ethanol have failed to factor in the energy value of the feed byproducts. They have also stretched far backward in calculating energy inputs, as in, for instance, incorporating the energy inputs in manufacturing the farm equipment and the food eaten by the farmers; but failing to factor into their equations the scrap metal value of the equipment.
- Studies showing net energy losses looked at twenty-year old technologies. Morris says: “In 1980, the short empirical answer to this question [Is there a net energy loss?] was yes. In 1990, because of improved efficiencies by both farmer and ethanol manufacturer, the answer was probably

not. In 2005 the answer is clearly no.” The net energy discussion looks backwards, not forwards. Instead of focusing on the efficiencies of the best farmers and the newest facilities and a strategy to make these efficiencies the overall industry and agriculture average, the studies present averages largely reflective of the efficiencies of ethanol facilities that are 20 years old, Morris asserts. In 1980 total energy use was about 69,000 Btus per gallon [of ethanol produced]. Today it is closer to 35,000 Btus. Today, those who invest in ethanol facilities can receive performance guarantees from engineering firms for a thermal efficiency in the low 30,000 Btus per gallon and an electricity efficiency of about 0.76 kWh per gallon.

No single biofuel is a silver bullet. Biofuels only make sense as a complement to a much broader policy commitment to public transportation, fuel efficiency standards and plug in hybrid technologies.

While conventional corn ethanol is not as bad as has been portrayed, it is seen by many as an important bridge to more sustainable biofuels, such as cellulosic ethanol and biodiesel.

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Congress is moving to accelerate energy independence and reduce greenhouse gas pollution in the atmosphere by establishing an ambitious Renewable Fuel Standard (RFS) of 36 billion gallons per year by 2022. The RFS would cap conventional corn ethanol at 15 billion gallons per year. WORC supports the RFS and is working:

- To ensure that biomass produced for biofuels will be done in an environmentally sustainable way.
- To encourage ownership of biofuels production will remain largely in the rural community.
- To limit the RFS for advanced biofuels only to those that result in at least 50% lifecycle reduction in greenhouse gases, and set a cap on the amount of conventional corn ethanol that can be incorporated into the RFS.
- To fund and conduct studies to insure that biofuels production is not causing harm to important diverse ecosystems and the productivity of agricultural lands.