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Biodiesel and the Vegawatt

Biodiesel, a replacement for petroleum diesel, is a transesterfied fatty acid that can be made from a variety of biological oil sources. Most Biodiesel today is made from virgin, food-grade soybean oil. Other popular seed oils for biodiesel production include corn, canola and rapeseed. There has been increasing work, due to the Food-to-Fuel debate, to develop biodiesel from plant oils that have already completed their primary work, such as used frying oil.

The economics of biodiesel rely heavily on federal incentives. Before the biodiesel boom in 2008, most restaurants were paying to have their waste oil removed. For a period of time, biodiesel producers turned the tables and were paying restaurants for their waste oil. Payments were typically in the 10-25¢ per gallon range. These payments for the raw waste oil made great sense when petroleum diesel cost $5.00 per gallon. However, the price of petroleum diesel quickly dropped, eliminating any profit margin for all but the largest biodiesel producers, driving many out of business. As a result, the commodity price for refined oil dropped. It is now cheaper for a biodiesel company to purchase refined oil from a rendering facility than to aggregate and refine oil themselves. Consequently, very few biodiesel companies are tempted into the waste oil retrieval service, and very few hauling companies are paying restaurants for their waste vegetable oil anymore.

The philosophy of biodiesel is to chemically alter the oil to make it appropriate for use in a standard diesel engine. A Vegawatt takes the alternate tack of modifying the diesel engine to utilize unmodified vegetable oil.

Bio-diesel production utilizes Methanol (a petroleum product) and Lye (Sodium Hydroxide, a hazardous caustic agent) to convert vegetable oil into a fuel similar to diesel fuel. Up to 25% of a bio-diesel batch is converted to glycerine. While glycerine is a common food sweetener, the glycerine produced from the biodiesel process is contaminated with methanol and lye, and must be disposed of as a hazardous waste, usually by burning. It is un-economical to remove the methanol and lye components from the glycerine to a level satisfactory to consider the glycerine a food-grade product.

Transportation of WVO for industrial production of bio-diesel is extensive and expensive. Restaurants pay a specialty hauler to remove their WVO. These haulers then sell the material to a rendering facility. Rendering plants are large industrial plants serving regions covering a radius of several hundred miles. Any

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oil traveling to a rendering plant may have already seen several hundred highway miles and several middlemen before arriving for processing. This transportation adds a significant amount to the oil's overall carbon footprint, and should be included in any calculation of the oil's original use cost.

After rendering, some oils are sold to bio-diesel producers, loaded back onto a class 8 truck, averaging 4 miles per gallon of diesel fuel, and shipped to the biodiesel plant where they undergo transesterfication into biodiesel. Additional energy, along with large amounts of process chemicals are utilized to convert the commodity oil into biodiesel. Glycerine, the waste product of the process, is usually burned on-site contributing only combustion emissions to the air.

Once the bio-diesel is produced, it is loaded back onto a class 8 truck, again burning diesel at a rate of 4 mpg, for transportation to wholesalers, who dilute the biodiesel with petroleum diesel and then transport the fuel to retail stations. The Rating system of B5, B10 and B20 represents the percent of biodiesel in the blend, (5%, 10% and 20% respectively). Once the fuel finds its way into a vehicle's fuel tank, it is utilized in an engine that can only obtain 30 - 35% efficiency.

Transportation of fuel for a Vegawatt system involves a kitchen worker and a bucket. The energy efficiency of a Vegawatt system is over 90%. The amount of energy embedded in transporting oil for a Vegawatt is less than that contained in one French fry. There are no liquid wastes. Any solid food particles suspended in the oil are caught in filters which at their end of life can be disposed of in an ordinary dumpster.

To summarize total cycle costs, biodiesel has high transportation costs, high embedded energy costs, a high carbon footprint, a reliance on petroleum as a necessary process chemical, and a low end-use efficiency. In stark contrast, the Vegawatt has zero embedded transportation cost, zero process chemicals and a very high end-use efficiency.

If our goal is to reduce our carbon footprint, why are we transporting and processing a chemical that is a perfectly good fuel right where it is?

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