energrow

Driving Veggie or: How I learned to Stop Worrying and Love the Bean

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Global climate change and renewable energies are on the forefront of just about everyone's agenda these days. Although there are a plethora of potential alternatives, not all are created equal, especially when you consider the cost of operation, performance, and environmental impact. The name of the game is low cost - high efficiency, for which there is a clear winner: Energrow and SVO.

When considering the local on-farm energy demands, one cannot ignore the huge role that diesel engines play in daily operations. A typical 200 acre farm can burn through 10 000L of fuel oil in a year, excluding additional loads such as electrical generator operation. This provides a huge potential for improvement, both in the net "environmental efficiency" as well as the end cost to the farmer. Enter the world of biofuels.

Not all biofuels are created equal. In the realm of diesel substitutes there are two primary distinctions: biodiesel (or biomass based methyl esters) and SVO (or Straight Vegetable Oil). The prior is a further refinement of the latter, requiring additional production equipment and controls, but little to no vehicle modifications. In both situations, final fuel quality is of paramount importance, which each having its own unique and internationally recognized standards. The major hurtle that must be met by these triglyceride fuels is the willingness of the fuel to polymerize when subjected to the heat of a combustion engine. Biodiesel gets around this issue by removing the glycerol from the base stock through a substitution process called transesterification. This requires the addition of a substitutive alcohol (methanol) as well as a catalyst to a reaction chamber, along with several post processes to clean the final fuel. Energrow solves this problem by understanding the fundamental chemistry at play, and supplying a superior base stock that is low enough in unsaturated oil to meet the *RK-Qualitatsstandard* for oil as a fuel.

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This low content of double bonds results in an oil that has a lower tendency to “dry”, and therefore is manageable as a fuel directly.

Biofuels typically see a power output loss compared to diesel for the same fuel consumption. This is due primarily to the difference in power density (BTU/L) of the fuels. The impact is minor, however, with losses in the range of 5-10%. The effects are often not noticed by the end user as the engine will have the tendency to compensate with additional fueling. Preliminary dynomometer tests conducted on a converted Energrow tractor prove positive, with no net power loss on a PTO test. The 5-10% fuel consumption increase is more than compensated by the difference in fuel costs, as off road diesel retails for $0.75+/L while the Energrow system can produce SVO at $0.40-0.50/L. Biodiesel prices fluctuate in and around the cost of diesel, depending on the base stock used and the production losses in the particular refining system.

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Although the incremental implementation costs of SVO is higher (each vehicle must be converted, unlike biodiesel), this equates to a very minor increase over the life of the vehicle, in the range of $0.06-0.07/L.

Cost and complexity aside, people are often interested in the net environmental impact of a potential “green” alternative. This falls in to two major categories: the efficiency of the system in terms of energy input for energy converted, and greenhouse gases emitted in the use and processing of the fuel. It is these two measures that constitute the environmental merit of the solution. For a starting point, 1 megajoule (0.28 kwh) of petroleum diesel emits 87g of CO2 from processing and consumption. The energy balance of petroleum processing results in a system efficiency of 79%. This indicates that there is an energy loss of 21% in the extracting and refining process. Biodiesel, however, emits 25g of CO^2 per 1 megajoule of energy produced at an efficiency of 71%. Although a major breakthrough in terms of greenhouse gas emissions, current technologies leave something to be desired in terms of wastefulness. Energrow’s SVO system results in approximately 40% less greenhouse gas emissions (15g CO^2 per 1 megajoule) than biodiesel, and a system efficiency of 80% on the raw product alone. When you consider local use of the meal byproduct, this efficiency jumps to 99.5% due to a reclaiming of the energy “lost” to the meal. The disparity between the two biofuels stems from the energy and chemical processing required in the modification of SVO to biodiesel. The gains over petrodiesel stem from the “free” energy input of the sun into the crops, something that is not available to mining-style operations. *(as a side note, the input and output energies include all activities and modifiers involved in growing and processing seed into fuel, although the transportation penalty was been removed as this analysis assumes on site storage and processing)*

As the world marches forward with green technologies, we must not forget that these solutions have to make sense in our day to day activities. Many of the proposed alternatives have relatively low life cycle efficiencies, making them wasteful on a global scale. If we want to make a positive impact, why not start locally with solutions that will benefit both our environment and our pocket book?

- Nicholas Leja