Evaluating Distributed Biodiesel Production

By Joel B. Schumacher

In recent years, substantial increases in fuel prices have hit rural communities especially hard. Residents in these communities often have limited access to public transportation and must travel long distances to access shopping and medical care. Recent energy price increases have encouraged rural communities to evaluate energy conserving technologies and alternative energy production opportunities. Distributed small-scale biodiesel production has been touted as an environmentally-friendly, domestically-supplied energy source by many popular press articles. Rural communities now need the tools necessary to evaluate the viability of such projects.

What is Biodiesel?

Biodiesel is fuel produced by a chemical reaction between a vegetable oil, an alcohol and a catalyst such as sodium hydroxide or potassium hydroxide. Producing a gallon of biodiesel requires approximately one gallon of vegetable oil, 0.12 gallons of methanol and a small amount of catalyst. The biodiesel produced can be used in diesel engines without modification and, therefore, can be used by current diesel engine owners.

Economics of Biodiesel Production

The cost of vegetable oil accounts for over 80% of the total cost of producing biodiesel. Consequently, obtaining an affordable source of oil is critical for financially viable production. Oil can be obtained by purchasing it as virgin or recycled oil. A biodiesel producer can also process oilseeds as part of the larger biodiesel process to obtain oil. Recycled oil is often the cheapest option but may be available in only limited quantities, especially in rural areas.

Oilseed Production

Availability of vegetable oil is directly linked to the profitability of oilseed crops to farmers. In the U.S., biodiesel production has mainly utilized soybean oil although oils from canola, safflower, sunflower, flax, camelina and others are also technically viable. Yet recently, oilseed crops, excluding soybeans, have had difficulty competing with other crops such as wheat, barley and corn for farm land, due to financial considerations. For example, in 2008 U.S. planted acres of canola, flax, mustard, rapeseed, safflower, and sunflower were all less than in 2003.

Oilseed Processing

The availability of oilseed processing facilities is another important consideration. Commercial oilseed processors are well-established in parts of the country that have traditionally produced oilseed crops including but not limited to the Midwest. These operations process as little as two tons to more than 1,000 tons each day. Lower volume processors (generally less than 150 tons daily) tend to utilize mechanical extraction technology while larger volume processors utilize solvent extraction technologies.

Mechanical extraction requires relatively little capital investment, has few environmental concerns and is able to recover between 60 and 80 percent of oil contained in raw feedstocks. To illustrate, assuming a 75% recovery rate, if a processor starts with 100 pounds of canola (40 percent oil content) then approximately 30 pounds of oil will be recovered. About 65 pounds of meal will also be produced and five pounds of material will be lost due to a reduction in moisture content.

Solvent extraction technology requires substantial initial capital investments, environmental permits (mainly because solvents are used), and are able to achieve oil recovery rates of 99 percent or more. At that rate, if 100 pounds of canola is processed with this technology then 39.5 pounds of oil, 65.5 pounds of meal and similar moisture loss can be expected. Oil is more valuable than meal. Therefore, this type of operation increases revenues received by the processor.

Biodiesel producers may also be oilseed processors but many choose to buy oil from another processor. Regardless of ownership arrangements, reliable and affordable supplies of oil are required for multiple years for a biodiesel processor to be financially successful.

Biodiesel Production

Biodiesel production is relatively simple in many respects. It can be produced in almost any quantity, from laboratory demonstration processes to millions of gallons per year. Biodiesel for personal use is commonly produced in 20 to 200 gallon batches. Small-scale production requires more labor and more methanol than larger facilities. Small-scale equipment is relatively inexpensive and can be operated with minimal training. Even small commercial facilities are usually able to recover and reuse excess methanol, but these facilities still have higher labor costs than larger facilities.

Any commercial biodiesel production must satisfy fuel quality standards, which are defined by the American Society for Testing and Materials (ASTM) 6751. Producers need a fuel quality testing program to ensure their biodiesel meets these standards. Testing is costly and likely precludes commercial production of small amounts of fuel. For example, a $1,400 test completed on a 200 gallon batch of biodiesel adds $7 to the cost of each gallon but the same test performed on 2,000 gallon batch adds only $0.70 to each gallon. An appropriately designed quality assurance program is an integral

part of all successful biodiesel business plans but may currently be costlier for smaller producers.

Production Facility Considerations

Several issues affect the appropriate size of a production facility. The first is the availability of oil. If locally or regionally produced oilseeds are to be the main source of oil, then estimates of regional production are needed. An estimate of regional production requires estimates of acres that are part of an oilseed crop rotation, how often an oilseed crop is grown in the rotation (one out of three years is common), average crop yields, expected oil content, distance to processing plants and oil recovery rates of processing facilities.

Byproducts are another important factor in biodiesel production. Depending on the oilseed and the type of processing, between 65 and 85 percent of the raw seed will be turned into protein meal. Protein meal is generally used for livestock feed. Every 1,000 gallons of biodiesel produced also produces 100 to 150 gallons of glycerin, which can be refined for use in cosmetics or other applications. The availability of markets for these byproducts may help determine the size of a production facility.

A final major factor is the stability of government subsidies. Currently, numerous subsidies exist for biodiesel production, including a $1 per gallon blenders tax credit. Many are scheduled to expire between 2010 and 2014. Any business that receives approximately 20% of total revenue from some type of government program faces significant risk that future program funding may be reduced or eliminated.

Conclusion

Successful distributed biodiesel production requires a solid business plan that addresses the issues previously mentioned in this article and others unique to each locale. Producers and communities interested in exploring their biodiesel production opportunities may contact the Agricultural Marketing Policy Center (see below for contact information). Factors such as the profitability of oilseed production, availability of oilseed processing and biodiesel production facilities, the price of traditional energy sources, and the future of government programs will all help answer the question, "Is distributed biodiesel production a financially viable option?"

More information is available at:
Agricultural Marketing Policy Center
Montana State University
P.O. Box 172800
Bozeman MT 59717
Tel: (406) 994-4838
www.ampc.montana.edu/energyinformation.html

Biodiesel Cash Flow/Income Statement Worksheet
Available by download from the Agricultural Marketing Policy Center at Montana State University
http://www.ampc.montana.edu/energyinformation.html

Author's Picks for Further Reading:

University of Idaho
www.biodieseleducation.org
Excellent resource for small and medium-sized biodiesel producers.

U.S. Department of Energy Efficiency and Renewable Energy, "Alternative Fuels & Advanced Vehicles Data Center."
http://www.eere.energy.gov/afdc/fuels/biodiesel.html
Good resource providing general interest information and technical reports.

Biodiesel – The Official Site of the National Biodiesel Board
http://www.biodiesel.org/
Representing the biodiesel industry in the U.S.

About the Author

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