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Biodiesel for the Wheatbelt Feasibility Report

Executive Summary

This study considers technical details and financial implications associated with manufacturing biodiesel in Western Australia. It is prepared for members of the Western Australian Wheatbelt community who may be considering biodiesel manufacture.

Energy

Varying amounts of energy are required every day by all living organisms. People have aggressively developed massive energy harvesting and use systems for industrial, lifestyle and entertainment purposes, mainly during the 20th century.

A key component of these systems is the internal combustion engine which uses liquid fuels. Current predictions are that the liquid fuels mineral diesel and petrol, both produced from "fossil oil" will run into short supply within the next twenty to fifty years. Meaning that in 150 to 200 years man will have largely exhausted this geologically ancient form of stored energy.

Therefore it should be no surprise that "renewable" energy sources are rapidly growing in popularity. They include plant and animal "oils", fibre, hydro, wind, solar and radioactive sources. Each form of energy has a price based on supply and demand and provides a finite amount of energy. The main focus of this report is to consider the liquid fuel known as biodiesel which can be produced from plant and animal oils and fats.

Biodiesel

Biodiesel can be "combusted" readily in existing diesel engines. In most cases no adaptation of the existing diesel engine is required although filters may need to be changed more regularly. It is important to know the properties of the biodiesel especially its viscosity at lower ambient temperatures.

Biodiesel is considered by many as a superior fuel to mineral diesel as:
- Greenhouse gas emissions are lower than for mineral diesel.
- It is carbon neutral.
- It has greater "lubricity" than low sulphur mineral diesel, thus increasing engine life.
- It is more biodegradable than mineral diesel.

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The key steps in producing biodiesel are "growing", "oil extraction" and "reacting" methanol with oil to manufacture biodiesel. There appear few impediments to manufacturing and using biodiesel in WA. The main consideration is price.

Biodiesel has been available in Europe and the United States for a number of years. In 2004 an estimated 25 million gallons (114 million litres (L)) of biodiesel was sold in the USA. Global consumption, estimated at 3 million L in 2005, appears to be rising rapidly.

Commercial production and importation of biodiesel has commenced in Western Australia (WA). It could be purchased in a 20% (B20) blend from at least seven service stations in Perth in April 2006. Biodiesel can be made at home; many websites explain how to make it and also supply the equipment.

Feedstocks (raw materials) for biodiesel include canola, soy and palm oil, used cooking oil and animal fats (tallow). Many plant oils can be feedstock with the decision based on price, availability and characteristics of the final product. Currently it appears that palm oil may be preferred in Asia, soy in the Americas and rapeseed (canola) oil in Europe.

Feedstock selection is likely to become more sophisticated. For example, feedstocks with a higher percentage of saturated fatty acids (e.g. tallow, coconut and palm oil) produce more energy per unit but have a lower viscosity at lower temperatures. Oils with higher monounsaturated fatty acid content (e.g. canola and olive oil) flow more readily at lower temperatures. Hence winter and summer biodiesel are possible refinements potentially made from varying ratios of canola and palm oil.

Supply and demand

If WA had to meet its current demand for diesel fuel purely from canola oil grown in WA then approximately 4 million hectares of land would be required. This rough estimate demonstrates the impact that biofuels demand could have on the oilseeds industry. This is around ten times more than the area sown each year for the past five years in WA.

For farmers, off road biodiesel is still reported to cost around 100 cents per litre (c/L) delivered to farms (farmers do not pay fuel excise for off road use). Others in rural WA were paying ~150 c/L at service stations in May 2006.

Planning and risk

It is essential that biodiesel manufacturing proponents carry out thorough "due diligence" studies to determine their own cost of production and risks.

Risk factors include world fossil oil price variations [ABARE predicted a medium term world fossil oil price around US$47 per barrel (bbl)]. Past oil shocks have seen prices ease in the medium term with the 1980's oil shock followed by over 20 years of fossil oil prices around US$20 bbl. Generally the long term trend appears to be strongly upwards.

Another risk is biodiesel feedstock (raw materials) price. Canola price already appears to have risen as a result of demand by fuel manufacturers. By-product (e.g. canola meal and glycerol) prices should be realistic and consider the effect of increasing supply on price. Canola meal price could be linked to the price for feed lupin (~$160/t, May 06).

All labour and equipment costs, including storage and handling, should be included in business plans. This should include the opportunity cost of canola if it is the proposed feedstock.

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Taxation risk also exists. Currently manufacturers can claim a cleaner fuels grant equal to the excise on fuel of 38.14 c/L for biodiesel and ethanol. Between 2011 and 2015 the grant will decrease to 19.043c/L for biodiesel and 25.643c/L for ethanol. The 2006 Fuel Tax bill has altered taxation on Biofuels. Manufacturers generally believe this has reduced their potential income. Tax changes are a key risk for all fuels.

Guarantee of supply is seen as important by the State and farmers. Knowing how biodiesel technology is applied and being ready to produce from efficient operating units, when economic conditions are positive, is an advisable risk management strategy. However, we have been dependant on mineral diesel from Asia and centralized Australian plants for many years now.

Price

The "cost price" of biodiesel depends mainly on the cost of the feedstock and the capital cost of equipment. Price and market access for by-products such as canola meal and glycerol are also important. The cost of methanol and the availability of skilled, knowledgeable labour are relatively less significant, but are critical requirements.

Summary chart for Scenarios 1 to 4	**Plant Design Capacity**		**Contract Crush**	**Buy Oil Hire Plant**
	350 kL/yr	**50kL/yr**	**50 kL/yr**	**50 kL/yr**
Interest rate	8.50%	8.50%	8.50%	
Depreciation rate	15%	15%	15%	
Maintenance	5%	5%	5%	
Capital Costs	$385,500	$163,000	$87,500	
Price of Canola used $/t	$405	$405	$405.00	
Annual Operating c/L of Biodiesel Produced				
Capital (dep & int)	43	83	45	11
Contract crush			22	
transport to & from contract crusher			12	6
electricity to run plant	1	2	2	2
Feedstock canola oil (opportunity cost)	82	82	67	82
Methanol	19	19	19	19
Catalyst	1	1	1	1
Labour	4	4	1	1
Plant hire	0	0	0	15
	150	**190**	**169**	**138**

Based on this investigation, a cost effective method to produce biodiesel in the wheatbelt could be to purchase tanker loads of canola oil (~25kL) and convert this to biodiesel in a hired plant. This method could result in a cost price of biodiesel in the order of 90 c/L from tallow*, 110 c/L from palm oil* and 135 c/L from canola oil. *[*Palm oil and tallow as feedstocks in small plants in the wheatbelt requires further investigation to ascertain suitability.]* The biodiesel from canola price is based on an oil price of 82 c/L (assumes a canola grain price of $405/t at May 16, 2006). Glycerol is assumed to have no value.

Should the price of canola grain drop to a low of $280/t then the cost price of biodiesel produced by the above method could reduce to **95 c/L from canola oil** while a canola grain price of $500/t could result in biodiesel costing **154 c/L from canola oil**. This range demonstrates the spread and the subsequent risk of varying canola grain price.

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Reported costs of production of biodiesel from canola vary markedly. It is very important to fully consider the details of each costing in order to assess its applicability to other situations. Proponents need to ensure that all items are included.

As part of this study we designed and priced two small scale manufacturing scenarios based on industry advice and experience including the Department of Agriculture & Food's learning from their small biodiesel demonstration plant. One scenario assumed a total production of 50 kL/year and the other 350 kL/year. Both would operate four times per year using grain stored on farm. All equipment including buildings, silos, second hand storage tanks, electrical controls, crushers and degumming machines would be purchased. No equipment would be assumed to be on hand or at no cost. Assuming a canola price of $405/t and a meal price of $160/t the 50kL plant could produce biodiesel at a cost of 190 c/L and the 350kL plant at 150 c/L.

Cheaper feedstocks such as tallow or recycled cooking oils are not likely to be available in large enough quantities for many new operations. The reported cost of production from palm oil in large plants producing in excess of 50 mega litres (ML)/year varies from 58 c/L to 75 c/L. Biodiesel is now being sold in a B20 blend from Gull Petroleum service stations in WA at just under the price of mineral diesel or will be exported.

Conclusions

Biodiesel is an important fuel option for rural and urban WA. It is relatively easy to manufacture, is renewable and has better lubricating and environmental properties than mineral diesel. Volumes of feedstock required are extremely large.

Biodiesel can be made from a very large range of plant and animal oils including palm, soy, canola and tallow. Used cooking oils (UCO) and tallow are cheaper feedstocks but already appear fully committed. Biodiesel from canola does not yet appear cheaper than mineral diesel for farmers, based on off road mineral diesel price of around $1/L and a world canola price of A$405/t.

Palm oil needs to be more fully considered as a feedstock as it is ~30 c/L cheaper than canola oil. Biodiesel made in large plants (e.g. 150 ML/year) from palm oil has a lower cost of production than biodiesel made in small plants (e.g. <1 ML/year). Efficient, large scale biodiesel manufacturing plants in WA or Asia may out-compete smaller, local operations even after the distributors and resellers margins are added. Tax changes in 2006 appear to favour this conclusion.

The biofuels "environment" is rapidly changing with predictions appearing to substantially underestimate the level of interest and activity. New technology and efficiency, along with changing market factors such as world fossil oil price, feedstock price and taxation arrangements will alter the economic scenario of biodiesel production.

Proponents should do their own sums diligently. Whether proposing an on farm or a cooperative biodiesel plant. They should carefully detail all input costs and by-product income and use the opportunity cost of canola in their decision making.

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