Feasibility study for the use of biofuel for the western rocklobster industry

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OBJECTIVES:

1. Analysis of fuel use by the Western Rock Lobster Industry including distribution, infrastructure and logistics.
2. Analysis of biofuel production possibilities for the Western Rock Lobster Industry including sources of raw materials, byproduct opportunities and logistics of manufacture, storage and distribution.
3. Technical and economic advantages and disadvantages for biofuel for the industry including appropriate fuel standards and engine warranty issues.
4. Potential business cases, possible business structures and sources of capital for the development of a biofuel industry serving the Western Rock Lobster Industry.

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OUTCOMES ACHIEVED TO DATE (boxed)

The major outcome of this project is a framework that will enable the Western Rocklobster Industry either individually or collectively to make informed decisions on the viability of using biodiesel as a fuel source for their boats

NON TECHNICAL SUMMARY

Rapidly rising fuel costs are of great concern to the Western Australian Rock Lobster Industry. Fuel costs have risen about 40% in the past three years and now represent approximately 30% of operating costs for boat owners. Fuel is the next largest cost after labour. Fuel prices are expected to continue to rise and there are no nearby technologies available to replace diesel – or biodiesel- in marine engines.

The Western Rock Lobster Council sought to examine a number of avenues to keep the industry profitable, and, recognizing the developments in biofuels in recent years and given the existence of agricultural industries nearby to the lobster boat anchorages, decided to seek an analysis of the potential for biofuels for the WA rock lobster industry.

The WRLC sought the assistance of The Kondinin Group, which has wide experience in analysis of rural and regionally based industries and are leaders in communication of technology changes to industry, to examine the potential for biofuels

Kondinin and the WRLC recognized that several business models needed to be investigated ranging from single boat owners making their own biodiesel, to consortia of several boatowners meeting the fuel demands of the group, to large regional manufacturing facilities meeting the fuel requirements of the whole industry. The project also examined within and between season supply and demand issues for fuel and raw material supplies as they affected the viability of a biofuels business.

The analysis of fuel use by the western rock lobster industry.
There was estimated to be 485 boats operating in the fishery in 2008. Each boat has an average fuel consumption of about 62,200 litres per annum. This equates to an annual fuel usage by the industry of 30.16 million litres,

The boats operate out of 16 ports from Kalbarri in the north to Augusta in the south.

Baileys Marine Fuels (Scott Bailey) is a major modern marine fuel distributor with facilities around Australia. Baileys are estimated to service 75-80 % of the western rock lobster fishing fleet. The balance of fuel is supplied by other significant operators such as the Two Rocks Marina facility and the Comen Ltd/Jurien Boatlifters facilities at Jurien and Cervantes. Several smaller suppliers meet needs at the minor anchorages.

Biofuel production possibilities for the Western Rock Lobster Industry including sources of raw materials, byproduct opportunities and logistics of manufacture, storage and distribution.
Biofuel is a generic term generally used to define biodiesel and bioethanol. Western Australian lobster boats are universally powered by diesel engines and therefore biodiesel was the only product considered in this project.

Biodiesel can be made from a range of oils and fats sourced from both plants and animals. The major raw materials available in Western Australia include Canola, mustard, tallow, used cooking oil and palm oil. The manufacturing process is quite simple and involves reacting the oil with methanol and a catalyst to produce biodiesel and glycerol. The extraction of oil from seeds such as canola results in the production of canola meal that is used as a feedstock by the livestock industry.

Biodiesel production can be carried out at scales from a single operator making fuel to meet the fuel needs of a lobster boat, to a local cooperative meeting the needs of several boat owners, to a large regional production plant providing fuel for the whole industry.

To meet the needs of a single boat would require feedstock of about 160 tonne of canola per annum to produce 60,000 litres of biodiesel along with about 96 tonnes of canola meal. It is estimated that the capital cost for this level of production would be between $30,000 and $70,000. This increases to $400,000 to $600,000 for a 10 boat consortium and to $16 to $24 million for an industrial plant sufficient to meet the needs of the whole industry.

Canola, the most likely raw material, is produced in the agricultural areas immediately adjacent to the coastal ports used by the rock lobster industry and therefore minimises the transport costs.

Technical and economic advantages and disadvantages for biofuel for the industry including appropriate fuel standards and engine warranty issues.

There are no technical disadvantages in the use of biodiesel compared to mineral diesel. Overall biodiesel provides large reductions in tailpipe emissions of total hydrocarbons (HC), Carbon monoxide and particulate matter. There is a slight rise in the undesirable green house gas nitrous oxides. Biodiesel is also considered to be more biodegradable than mineral diesel and therefore would be less harmful on the marine environment in the event of a fuel spill.

Biodiesel is only economic to produce if the cost of production is equal or less than the price of mineral diesel. The price of mineral diesel in Western Australia benchmarks against Singapore 'Gasoil 50 ppm Sulfur diesel'

The three main components impacting on the economics of biodiesel production are the price of canola (or other raw material), the price of canola meal and the Gasoil 50 price all of which vary over time. A canola price of $600 per tonne and a meal price of $400 per tonne equates to a biodiesel price of about 170 c/l.

For biodiesel to compete with mineral diesel it must conform with the Australian fuel standards. This is generally easily achieved particularly in the larger industrial plants.

One of the restrictions on the use of biodiesel is risk that it will void the manufacturers warranty on the engine. While some engine manufacturers are changing their attitudes towards biodiesel and their engine warranties it is essential that boatowners fully understand the implications of using biodiesel in their particular engine prior to doing so.

Potential business cases, possible business structures and sources of capital for the development of a biofuel industry serving the Western Rock Lobster Industry.

The business case for the production of biodiesel is based on the capital investment required, the technical feasibility of the process and the ongoing cost of production of biodiesel. The capital investment required for different sized plants is well understood and there is a lot of information available on it. The production process is also well understood and very feasible at a range of plant sizes. The third component, the cost of production, will remain the major factor determining the business case and will continue to depend on the relative differences in prices of the raw materials and how they relate to the ongoing price of mineral diesel. In the period of this project, December 2007 to November 2008 there has been great variation in the price of all three components with a period where biodiesel could compete to a period where it was very uncompetitive. Continued large movements in the prices of these components will make it extremely difficult to invest in biodiesel production with any degree of certainty.

This project provides a detailed framework that will enable the western rock lobster industry to continually assess the feasibility of substituting biodiesel for mineral diesel into the future.

KEYWORDS: biodiesel, western rocklobster.

Acknowledgments

We thank Dexter Davies, Stephen Gill, Alice Hurlbatt and Andrew Winzer of the Western Rock Lobster Council for their advice and encouragement during the course of the project. The lobster industry of Western Australia through public meetings and individual contacts provided valuable reality checks as the project proceeded. The Western Australian biofuels industry was generous with detailed information about biofuel production. The staff of the FRDC were always helpful and constructive when we required clarification of the way forward during the execution of the project. Catriona Nicholls and Megan Hele of the Kondinin Group are acknowledged for their talented contribution to editing and layout of the report.

Background

The project was developed following discussions with the Western Rocklobster Council and their desire to understand the potential role of biofuels in their industry.

Currently many industries with a large reliance on fossil fuels are evaluating the opportunities for the use of biofuels.

The Western Rocklobster industry has a number of possible advantages in relation to the use of biofuels. The industry operates along the Western Australian coast immediately adjacent to the agricultural region. This region has the capacity to produce oilseed crops such as Canola and Mustard. The region also runs a large number of livestock (cattle and sheep) that can very effectively utilise the byproducts resulting from the production of biodiesel.

The Western Rocklobster Industry is well organised and has the potential to provide a discrete and dedicated market for biofuels. The ability to have a guaranteed market at an agreed price could be a key component of any business case for the development of a production plant.

Need

The potential role for biofuels in the Western Rocklobster industry was identified by the Board of the Western Rocklobster Council following their analysis of the costs structures of the industry and through discussions with their constituents who were keen for the Council to investigate possible alternative fuel supplies for the industry. Given the escalation in fuels costs and governments moving towards emission controls, possible mandated biofuels elements in transport industries, carbon credits and a desire for industries to aspire to carbon neutrality the project had strong support from the industry.

The Western Rocklobster industry is facing cost and returns challenges. Catch predictions are low for the next three years. This along with currency movements is likely to reduce the income of fishers in the future. Fuel prices have risen sharply, particularly diesel fuel, and forward projections in the medium and long term suggest continuing increases. Greenhouse gas abatement is becoming central to government planning and future policies and could impact severely on industries where fuel is a major part of the their cost profile. Currently fuel represents approximately 30% of the operating costs of the fishing business. Governments may mandate fuel emission limits, or require that they be offset through credit arrangements and they may mandate biofuel use levels in transport fuels. Biofuels have the potential to play a part in relieving cost, emission and fuel source pressures in the future. The Western Rocklobster Industry needs to understand the opportunities that biofuels offer it. There is much general and often misleading information available on biofuels. There is a need to examine the potential for biofuels in a dispassionate and objective way, specifically in relation to the Western Rocklobster Industry so that the industry can take informed decisions about the possible role biofuels might have in the future of the industry.

Objectives

1. Analysis of fuel use by the Western Rocklobster Industry including distribution infrastructure and logistics
2. Analysis of biofuel production possibilities for the Western Rocklobster Industry including sources of raw materials, byproduct opportunities and logistics of manufacture, storage and distribution.
3. Technical and economic advantages and disadvantages of biofuels for the industry including appropriate fuel standards and engine warranty issues.
4. Potential business cases, possible business structures and sources of capital for the development of a biofuel industry serving the Western Rocklobster Industry.

The only significant change to the objectives related to objective 4 where it was considered the best way to look at the business case opportunities was to examine 3 levels of biofuel production ranging from a single boat operator, a consortium of 10 boats and an industry scale production facility. For each of these scenarios the level of capital investment and the operating costs were estimated. This in turn provided an indicative cost of production per litre of biodiesel that could then be compared that being paid by fishers for mineral diesel. Given the diversity of these different scenarios and range of factors that could impact on them it was not considered appropriate to try and develop specific business cases, business structures and funding sources as all of these would vary greatly with each of the individual situations.

Methods

Although the objective of this project related to the use of biofuels for the Western Rocklobster Industry the boats used in the industry are universally powered by diesel engines and therefore this was the main focus of the research and subsequent feasibility study.

The method used to produce the detailed feasibility study included the following components

1. Review of technical and scientific literature

A comprehensive review of a wide range of technical and scientific literature was carried out. The topics reviewed related to all aspects of biodiesel production including:

- The world and Australian biodiesel industry
- Raw materials including algae
- Byproducts and their use
- Fuel standards
- Engine performance and warranties
- Government regulation and assistance
- Environmental issues
- Occupational, health and safety issues

2. A review of studies and reports.

A range of studies and reports were reviewed. These included reports that specifically related to:

- The Western Rocklobster Industry

- Feasibility studies for the production of biodiesel

3. Consultation with the Rocklobster industry

Detailed interviews were carried out with a number of Rocklobster fishers to understand in detail their fuel requirements and use.

4. Economic Analysis

The economic information obtained through the above research and review was used to develop predicted production costs for biodiesel under 3 scenarios using the most widely available raw material being canola. The 3 scenarios examined were:

- A single boat owner
- A consortium of 10 boat owners
- An industry production facility

The output of this analysis was the development of simple tools for the comparison of biodiesel production with mineral diesel for a range of prices of canola, canola meal and mineral diesel the three components that impact on viability of biodiesel production.

5. Preparation of detailed feasibility study

All of the information was compiled into a detailed feasibility report. The report was designed and edited to produce a final document that presents complex technical information in a format that is clear and simple and easy to understand. A copy of the feasibility study is attached to this report as an appendix.

Results/Discussion

The key findings and outcomes of this project are detailed in the executive summary of the feasibility study and are as follows

Executive Summary –Synthesis and Key Messages

- The Western Australian rock lobster fleet, 490 boats, uses about 30 million litres of diesel fuel annually. Use pattern is uneven given that the industry operates from November 15 to June 30 and there are peak demand months usually December and March. An average boat uses about 60,000 litres of fuel per year, constituting about 30% of production costs. Fuel costs have been rising rapidly causing great concern in the fleet.

- The fuel demand is spread across 22 anchorages. The fleet divides into A, B and C zones with roughly half the boats in the northern A and B zones, and half in the southern C zone. The A (Abrolhos) zone is supplied from Geraldton by tanker boats.

- Biodiesel is used in various ratios with mineral diesel fuel. For example B20 is 20% biodiesel: 80% diesel. At present most biodiesel is sold as B5, B10 and B20. These levels are widely accepted around the world in road transport. Although B100 is being used there has been some resistance to moving to that level until more experience is gained with its use. To fuel the WA lobster fleet at the different ratios would require

the following amounts of biodiesel: B5 =1.5 ML, B10=3 ML, B20=6 ML and B100 =30 ML (as outlined in the first point above).

- Biodiesel can be made by mixing a plant or animal oil source such as locally-available canola oil or tallow with methanol and a small amount of sodium or potassium hydroxide as a catalyst. Biodiesel and glycerol are formed in the process and separated into two streams. Glycerol is sold to offset costs.

- Biodiesel production from canola grown in the agricultural hinterland from the Western Australian rock lobster fishery is technically feasible and relatively straightforward. Its success will be driven by economic rather than technical factors.

- The economics of production depend upon three main drivers a) the cost of mineral diesel b) the cost at which biodiesel could be manufactured and delivered to the jetty and c) the cost of the feedstock used to produce the biodiesel.

- The profitability of a biodiesel manufacturing operation shifts constantly as the relativities between the major drivers change. This report uses sensitivity analyses to assess the impact of the main drivers at various price levels on the viability of the operation.

- The price of diesel at rock lobster anchorages in Western Australia is driven by the price of Singapore Gasoil 50 (diesel) which provides the basis for diesel costing in Australia on an import parity basis while the price of Gasoil 50 itself closely follows the Tapis crude oil price. The Gasoil 50 price generates Terminal Gate Prices (TGP) in Australia which change daily. Added to the TGP are wholesaler and retailer margins, transport costs and sometimes wharfage charges to give a jetty side price for lobster boat owners.

- A range of other feedstocks are on the horizon. Oil bearing tree crops are under development in Western Australia which while showing some early promise are at least a decade away from being available in commercial quantities. These include *Moringa oleifera* and *Pongamia pinnata*. Both are of tropical/subtropical origin. Biodiesel from algae is also a possibility and Western Australia may have some comparative advantages for its production, but, again, many technical and economic issues need to be addressed and it also is at least a decade away from large commercial quantities being available.

- Given the relatively small supplies of tallow available, the seed of canola crops is the main option to provide the raw material oil to go into a biofuel plant. The seed is about 42% oil, and extraction is usually around 35%. Canola is well adapted and widely grown in Western Australia. A closely related crop, *Juncea* canola, is being developed which may make a contribution in the future. The animal fat tallow may make a contribution if it is available at a competitive price, though supplies are limited in Western Australia and mostly tied up. Palm oil imports from Asia could provide an option in some circumstances but there are environmental concerns about its production.

- To fuel the WA rock lobster fleet with oil from canola would require, at 35% oil extraction (equivalent to 380 litres of oil/tonne of canola seed) about 80,000 tonnes of

canola. That could be grown on 80,000 hectares at a yield of 1 tonne/hectare. The region inland from the rock lobster fishery already grows in excess of that amount.

- The price a biodiesel producer would have to pay for canola seed he sources for biofuel production from a canola farmer would depend upon the price the farmer could get at his farm gate from competitors. The competitors are the export market in shiploads and local canola seed crushers (which is a relatively small industry). The price of canola moves around with world demand.

- The biodiesel producer would have the option of buying the canola seed then going through a two stage process of crushing the seed to extract the oil and then converting the oil in a biodiesel production plant, or buying in canola oil from a separate crushing plant as oil ready to go into the biodiesel plant.

- Where a biodiesel producer buys seed for crushing he would produce about 380 litres of oil/tonne of seed crushed. In addition he would produce about 650 kg of meal. The meal is a valuable source of protein for livestock and established markets for it exist. The price of meal moves through time, and the price he can achieve for the meal to offset costs will have a significant effect on the viability of the operation.

- Production of biodiesel is a fairly straightforward process that can be carried out at scales from a 'backyard' producer meeting his own needs, to a large industrial plant capable of producing sufficient fuel to meet the entire 30 ML needs of the WA rock lobster fleet. This report examines three scales of production a) a single boat owner meeting the 60 KL needs of his boat b) a consortium of 10 boat owners coming together to supply their own needs of 600 KL and c) a large industrial plant producing 30 ML fuel for the entire fleet.

- While the capital investment required for the 3 scales of production ranges from about $50,000 for the single operator to about $20 million for the industrial production plant the capital cost per litre is similar being 11 cents/litre for the single operator and the ten boat consortium and 8 cents/litre for the industrial plant.

- At canola seed and meal prices of $650/tonne and $400/tonne respectively the expected cost of production of biodiesel is 138 cents/litre for the single operator, 135 cents/litre for the ten boat consortium and 132 cents/litre for the industrial plant.

- The cost of biodiesel produced is very sensitive to the price of canola rising by 13 cents/litre for each $50/tonne increase in the price of canola. The increase drops to about 6 cents/litre when the price of canola meal is tied to the price of canola.

- At current spot prices (first week of July, 2008) of $730/tonne and $500/tonne for canola and canola meal the estimated cost of biodiesel is 131 cents/litre. The retail price for mineral diesel is 185 cents/litre and therefore the price of diesel for fishermen (185 less GST less 38.1 cents – fuel excise) is 130 cents/litre. At these prices the production of biodiesel from canola is a very competitive option for fishermen.

- Biodiesel has significant environmental advantages over fossil based diesel. It produces less net green house gases and less particulates in emissions and it is more biodegradable and less harmful in spillage situations.

- Engine manufacturers differ in their attitudes to biodiesel. Most of the larger manufacturers endorse biodiesel at varying levels up to B20. Acceptance of higher levels in blends and across manufacturers is growing as governments in some countries mandate use of biofuel in the fuel mix and the world community grows more aware of carbon related issues.

- Biodiesel for sale must meet the Australian biodiesel standard set by government, as this is a requirement if excise rebates are to be claimed. The excise and tax regimes relating to biodiesel are complex and changing however lobster boat owners receive full rebate of excise as off road primary producers and GST tax allowance as an input tax. This simplifies the comparisons between the two fuel sources in this report.

- Anyone contemplating biodiesel production will need to comply with a range of Local, State and Australian government approval and operating requirements as biofuel production is viewed as an industrial process.

- Biodiesel production is an industrial process handling several input and output materials that are considered hazardous and require Material Safety Data Sheets. However they are not unduly hazardous if handled with normal care. Occupational health requirements must be met.

Full details of the feasibility study are provided in Appendix 3.

Benefits and adoption

All participants of the Western Rocklobster industry will benefit from this study. It provides them both individually and collectively with a framework to assess the viability and competitiveness of biodiesel production on an ongoing basis. The feasibility study will also provide other groups and individuals in the community with an interest in the production of biodiesel specific information on when biodiesel production for the Rocklobster industry might be a viable business opportunity.

The adoption of biodiesel by the Rocklobster industry will always be dependent on the relative prices of mineral diesel, and the raw materials used and the byproducts produced in the manufacture of biodiesel.

Further development

There is no immediate further development required on this topic at the moment. Both the technology required and the economic comparison are now well documented and any decision to adopt the production of biodiesel will be made on an economic basis. The economic parameters impacting on that decision will continue to change over time and therefore there are likely to be periods when biodiesel production is a viable alternative and periods when it is not.

Planned outcomes

The outputs of this project have delivered the planned outcomes of this project. The feasibility study produced has addressed the key issues identified in the original project submission.

Conclusion

Biodiesel production to fuel the Western Australian Rock Lobster fishing fleet is a viable proposition from a technical standpoint. The economic viability of such an initiative will depend upon the relative prices of several components, dominated by the prevailing mineral diesel price, the price at which the oil used to make the biodiesel enters the production system, and if the production plant is crushing canola or a similar oilseed to obtain vegetable oil, the price that can be obtained for the canola meal produced as a co-product.

Other factors of lesser impact but still important given the fine margins involved are the returns from glycerol sales, the capital cost of the plant, the cost of methanol and the cost of labour.

The production of biodiesel could operate at scales from a single boat owner, through consortia of boat owners to large industrial plants fuelling the whole industry and perhaps other local diesel users.

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The following provides a bibliography of the technical and scientific information reviewed as part of this project. Some of the material is referred to in the text of the feasibility report and the remainder is provided for information.

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Appendix 1

Intellectual Property

There is no specific intellectual property that has a commercial value arising from this project. Much of the information is already in the public domain and this project has adapted to the particular characteristics of the Western Rocklobster Industry.

Appendix 2

Staff

The following staff were engaged on this project.

Kondinin Group

Dr William Ryan	Chief Executive Officer (Dr Ryan stepped down as CEO on May 2, 2008 and completed his involvement in this project on a contract basis)
Megan Hele	Graphic Designer
Peta Temple	Publishing Services Manager
Belinda Nolan	Finance Manager

Contract staff

Professor Mick Poole

Appendix 3

Other Material

A copy in full of the feasibility study produced from this project entitled *Western Australian Rock Lobster Biofuel Study*.