August 29, 2008

Committee Secretary
Senate Select Committee on Fuel and Energy
Department of the Senate
PO Box 6100
Parliament House
Canberra ACT 2600
Australia

Dear Sir/Madam,

In response to the call for submissions to the Senate Select Committee on Fuel and Energy, Energy Strategies Pty Ltd, in conjunction with Natural Fuel Ltd, have prepared the short submission attached.

While the terms of reference of the Committee are far reaching, this report seeks specifically to address only the following issues:

- The impact of higher diesel prices on grocery prices and agriculture;
- The potential impact of an emissions trading scheme on diesel products and prices;
- The role of alternative fuels to diesel, specifically the potential for Australian produced bio-diesel to provide renewable liquid fuels to critical industries including agriculture and transport and mining.

In the context of the above terms of reference, this submission provides information to the Committee on the opportunity for bio-diesel, refined from domestically grown inedible feedstocks to:

- deliver improvements in Australian energy security and assist avoid imports or refined petroleum products;
- provide options for diversification of liquid fuel supply and emissions reduction to critical economic sectors, a development that can also provide insurance against emission permits cost while allowing for expansion of diesel fuelled economic activity;
- develop new crops, opportunities and practices for Australian agriculture.

In the course of providing this information this submission explores the links between food prices and demand for bio-fuels. While this is not an issue specifically called up in the Committee's terms of reference, we crave the indulgence of the Committee to consider that this relationship is inextricably linked to one of the core issues being examined by the Committee, that of the impact of energy prices on food prices, and of energy prices on agriculture.

Should you wish for any clarification of any of the materials provided with this letter please feel free to contact the writer.

Further, for the information of the Committee, the Chairman of Natural Fuel Ltd, Mr Richard Selwood, would be happy to appear before the Committee at any time to provide further insight into these issues.

Regards,

Michael McCann
Director
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Energy Strategies

energy

Energy Security = Food Security

technology

A Submission to the Senate Select Committee on Fuel and Energy

Prepared By

Energy Strategies

In Association with Natural Fuels Ltd

August 2008

environment

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Energy Security = Food Security

For bibliographic purposes this report may be cited as: Energy Security = Food Security, Energy Strategies, Canberra.

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This report has been prepared in conjunction with **Natural Fuels Ltd**, an ASX listed company invested in biodiesel refining capacity in Australia and Singapore, and in extensive Jatropha curcus plantations as a source of long term sustainable feedstocks for biodiesel production. For further information on Natural Fuels Ltd go to http://www.naturalfuel.com.au/ or contact Dan Wallwork, Treasury and Risk Manager, Natural Fuels Ltd, ph. 61 8 9286 6788.

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1. Introduction

In March 2008 Energy Strategies was commissioned by Natural Fuel Ltd to assist in the development of a discussion paper that explored some of the issues facing the bio-diesel industry in Australia.

That paper, '*Biodiesel in Australia – Future Import or Sustainable Domestic Growth Industry*', was circulated widely to policy makers and industry analysts. In that paper the arguments in support of developing a strong Australian bio-diesel industry were explored, and the risks of allowing it to languish were articulated.

That paper asked quite specifically for policy makers and industry to first decide if bio-diesel has a place to play in the future of the Australian economy. If the answer to that question is yes, then the next exercise must be to focus on how to make bio-diesel production sustainable.

That paper focussed on how, as the costs of CO_2 emissions were bought to book via emissions permits, and in the absence of Australian bio-diesel supplies, mining and transport industries would very likely become importers of bio-diesel. In itself this is not a terrible result, although it would improve the Australian balance-of-payments, nor improve energy security.

However such a result would present an enormous lost opportunity for Australia to create its own, well managed sustainably run, bio-diesel industry. An industry that could assist the balance-of-payments, improve energy security, and provide diversification opportunities in Australian agriculture. Importantly this could be a domestic industry managed and regulated so as to avoid any negative social and environmental impacts of the bio-diesel industry, impacts that would be imposed on other nations which, as importers of bio-diesel, we would have little control over.

This paper, '*Energy Security = Food Security*' addresses different issues. This report was prepared in response to some of the terms of reference of the Senate Select Committee on Fuel and Energy which, while it has a wide brief, was directed to investigate the impact of high energy prices on food and grocery prices, on key industries such as agriculture, and to investigate the role of alternative fuels in the Australian economy.

These are important question. Energy costs and food costs, and to some extent food surpluses and the ability to distribute them, are intimately linked. Ultimately all mainstream agricultural production is reliant on plentiful energy supplies. It is the view of Natural Fuel Ltd that bio-diesel, sustainably produced and locally refined, has a potentially very significant role to play in energy security in Australia. Energy security is food security.

While some industries come and go as technology changes and societies evolve, it would be sensible to contemplate the real import of the following quote attributed to Deng Xiaopeng during a debate on modernization of the Chinese economy.

"There is no such thing as a post-agricultural society."

2. Summary

- High and rising crude oil prices will continue to be a major factor inflating input prices to agriculture with resulting increases in the prices of food and groceries.
- The complete reliance of Australian agriculture, food production and distribution, on refined petroleum products, at this time of increasing uncertainty and costs of crude oil supplies, should be considered as an urgent and very considerable social, economic and structural risk.
- Australian demand for and dependence on diesel as the major energy source across a significant proportion of the economy is rising dramatically and has been growing strongly for all of the past decade.
- Bio-fuels are not all the same. Ethanol production is of no use to the major industrial and commercial fuel users in mining, transport and agriculture - because all heavy equipment uses diesel.
- Australian bio-diesel production capacity, supplied with a variety of sustainably produced feedstocks, is capable of providing real energy security for essential agriculture and transport sectors.
- The treatment of bio-diesel under the combined effect of Australian fuel standards and fuel excise laws effectively excludes it from the industrial user markets in anything greater than a 20% blend with mineral diesel, despite there being no material technical reason for this limitation.
- Unless a strong domestic bio-diesel industry is allowed to prosper, the advent of emissions trading will force liable parties, for whom the use of bio-diesel is one of the only alternatives to reduce emissions from their operations, to import bio-diesel from overseas refineries, and made from feedstocks, the impacts of which Australia will have no direct control over.
- Australian science and agriculture has the capacity to develop new crops and systems to provide sustainably grown and harvested feedstocks for bio-diesel.
- Several highly prospective sources of organic oils highly suitable for bio-diesel feedstocks are available that represent potentially important opportunities for Australian agriculture and for additional energy security in Australia. These prospects require active, focused research and analysis of all issues and obstacles to enable objective assessment of their merits for potential adoption in Australia.

3. Importance of Energy Prices for Food Prices

Increases in the price of crude oil have a direct impact on the price that individuals have to pay for groceries. Crude oil prices, and the prices of the products derived from it, have an inflationary impact on every step of the supply chain of food production and distribution that are obvious, while not being well quantified. These inflationary forces start at manufacture of fertilizers and other agricultural chemicals with a crude oil component, the transport of seed and soil conditioning materials to farms, the preparation and sowing of fields, to harvesting of crops, manufacture of packaging materials and final transport to consumer markets and shops.

While there is little detailed analysis on total inflationary pressure on retail food prices created by higher crude oil prices, a recent study by the World Bank Development Prospects Group concluded that, "higher energy and related costs increased export prices of major U.S. food commodities by about 15-20 percent between 2002 and 2007.[1]"

Some observers believe this estimate to be very modest. Notably for most of that period, 2002 – 2007, oil was trading at a fraction of today's prices. From the beginning of 2002 to the end of 2005 oil traded between US$25 and US$70 a barrel. From the beginning of 2006 to the end of 2007 oil traded between US$70 per barrel and US$90 per barrel. It is therefore obvious that food price increases created by higher oil prices will have accelerated in the latter part of the study period.

It is only since the end of the period which was the subject of the study that oil has breached the US$100 per barrel barrier. As such it would be safe to conclude that the inflationary pressure on food prices created by high oil prices is continuing to accelerate.

More recently the USDA estimated that for farmers in the US, diesel prices increased by 43% and fertilizer prices increased by 65%[2] between April 2007 and April 2008. This was a period during which oil prices continued to climb to previously unthinkable heights, rising from $US90 per barrel at the start of the year to breach US130 per barrel by the end of April 2008. While oil prices have since moderated slightly, and at time of writing appear to be settling around the US$115 per barrel mark, these medium term dramatic increases in input cost must continue to drive food and grocery prices higher.

In this environment, the total reliance of Australian agriculture on the continued supply of liquid fossil fuels required to keep food production at present levels, must be considered a considerable social, structural and economic risk, given the very high likelihood of rising crude oil prices in the years ahead. Combined with other factors that are driving demand for food higher, against countervailing influences that is making the production of crops riskier, and in some cases simply impossible, it is submitted that Australia needs to be actively considering all of the factors involved, and all options available for insuring

[1] "A Note on Rising Food Prices," Dr Donald Mitchell, World Bank Development Prospects Group, July 2008

[2] http://www.nass.usda.gov/Statistics_by_State/Wisconsin/Publications/Miscellaneous/prpaid.pdf

the continuation of a robust, profitable, highly productive and versatile agricultural sector that allows us to be such a large net food exporter, and such a significant contributor to global food security.

4. Other Causes of Food Price Rises

Not all of the observed increases in global food prices since late 2006 can be attributed to the rising cost of fossil fuels. In recent months a robust debate about other causes of food price rises has been underway around the world. A number of factors affecting food production, demand and supply are obviously all contributing in varying degrees including:

- Population growth and accelerating loss of peri-urban prime arable lands to urban and industrial expansion, combined with loss of productive rural lands to other factors including unsustainable farming practices, advance of deserts and changing rainfall patterns;
- Strong economic growth in the last decade, particularly in China and India, increasing the buying power and changing the diets of as much as one third of the planets population resulting in rising demand for dairy and meat products which is producing strong demand for livestock feed[3];
- Effects of adverse weather on crop yields, droughts in Australia and South Africa, flooding in cropping areas of the USA and eastern Europe, late frosts in China to name a few recent impacts;
- Economic subsidies, trade barriers and government policies.
- The inflationary effect of the explosion of investment funds seeking investments in commodities, increasing from something quite negligible in 2000 to an estimated US$200 Billion in 2007. For instance investment on the Chicago Board of Trade in grain and livestock futures alone increased from US$25B to US$65B between November 2007 and mid 2008. [4]
- The growth in additional new demand since 2001 for feedstocks for biofuels.

This last issue is briefly explored later in this submission.

[3] For instance In 1995 the Chinese population was 1.203 billion and average meat consumption was 25kg per capita. In 2007 Chinese population was 1.321 billion and average meat consumption was 53kg per capita. This is estimated to equate to a 200 Million metric tonne per year increase in demand for grain for livestock feed.

[4] AgResource Co./Bloomberg

5. The Impact of Emissions Trading on Fuel Prices

As Natural Fuel Ltd is a bio-diesel producer this section only discusses the potential impact of an emissions trading scheme on diesel prices.

Using the Australian Methodology for Estimating Greenhouse Gas Emissions and Sinks (2006) the combustion of 1 litre of Automotive Diesel Oil is calculated as being responsible for 2.698 kg CO_2e.

Thus if a litre of diesel was subject to the full price of carbon permits and those permits were costing $20 each ($20 per tonne of CO_2e), this would add approximately $0.054c to a litre of diesel. At $30 per emission permit the equivalent diesel price increase, if it were all passed through to the consumer, would be $0.081c per litre; thus at $30 per permit, and full costs passed through, the increase in costs of diesel as against *today's* terminal gate prices would be in the vicinity of 5.5%.

Particularly given the Government's current proposals in the Emissions Trading Green Paper that they will compensate fuel users of all sorts for every cent of fuel price increases created by the proposed emissions trading scheme it has to be said that, in our view, there is a far greater risk of much more significant increases in diesel prices in the next two years driven by higher crude oil prices, long prior to any possible commencement of emissions trading.

However, irrespective of the relative price impacts of emission permits in 2011 versus global crude oil prices in the interim, large diesel users in the mining and transport industries, who will be obligated as liable parties under the proposed emissions trading scheme, are already investigating ways to reduce their exposure to the cost of emission permits (which will rise as permit availability drops), and to rising fossil fuel prices (which will rise as crude oil availability declines)[5].

Many of them are arriving at the conclusion that one avenue available to ensure maintenance of present activity levels, or the ability to expand activity, while avoiding some of the impacts of emission permit costs, is to secure supplies of bio-diesel.

[5] A reasonable consensus on supply versus demand of crude oil supplies would suggest that, even as new sources may be found and bought to production, declining production from established fields, combined with increasing demand from developing economies and economies in transition will maintain a tight supply demand balance for years to come. The balance of probability is that supply shocks, whether physical or geo-political, will keep a skittish market bidding up future prices. This is likely to assist bring alternatives to market such as oil from tar sands and possibly coal-to-liquids. Unfortunately both those sources have far greater emissions intensity of production and are higher cost than traditional crude oil sources thus they are unlikely to provide sufficient lower cost additional supply to tip supply demand balance of oil into surplus. All forecasters including the IEA are forecasting tight demand supply balance and upward pressure on prices in the medium term. In a worst case scenario, if Saudi production for instance were to be significantly curtailed, very high prices are possible in the near to medium term.

6. Why Bio-diesel and not Ethanol?

While the media almost always refers to 'bio-fuels' in the broad, the fact is that there are profound differences between the applications for, and the economic and environmental implications of the ethanol and bio-diesel industries. We contend that policies in support of these fuels should be carefully and separately constructed on the basis of a clear understanding of these differences. To clarify the context of some of the issues raised here we have provided at Appendix 1 a comparison of some of the attributes of bio-diesel as compared to ethanol.

One of the most important points in terms of the economic relevance of these two fuel types is simply that industry in general, and particularly ***mining, transport and agriculture use diesel***. For these pillars of the economy, ethanol has no useful application[6].

Further, all heavy diesel-fuelled machinery can use bio-diesel with no changes to the machinery required. Unlike the other so-called 'alternative fuels' of CNG, LPG, and LNG, there is no requirement to refit diesel fuelled machinery to consume bio-diesel, making it quite simply the most cost effective fuel switching option for enterprises. As well as being the cheapest fuel switching option, bio-diesel under a 'Scope 1' analysis of emissions, has zero net greenhouse emissions at the point of combustion, thus providing users with an immediate option for expanding economic activity, using existing plant and equipment, without incurring any further liabilities under an emission trading scheme.

Of course for agriculture, which at least until 2015 is unlikely to be included in any emissions trading regime, bio-diesel represents a different opportunity. Firstly, should bio-diesel be treated equally with diesel under the fuel tax regime, bio-diesel would have the slightly favorable price differential equivalent at least to the cost that emission permits impose on diesel. However this price signal is almost entirely obscured at present by fuel excise and Australian fuel standard imposed limitations that effectively cap use of bio-diesel by commercial users at a 20% blend of bio-diesel in 80% mineral diesel.

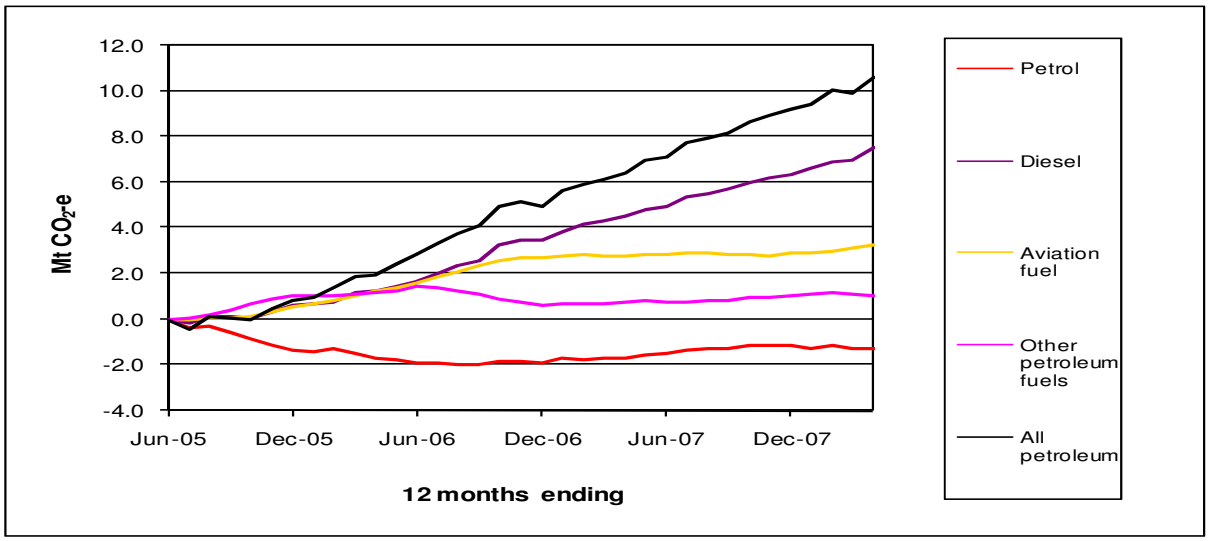
Secondly bio-diesel presents a significant opportunity for agriculture to both produce feedstocks for domestic bio-diesel producers, as well as get directly involved in the production process with significant benefits for energy security in agriculture.

Finally it must be noted that diesel consumption in Australia is skyrocketing. Growing diesel consumption in Australia is one of the primary engines of growth for national greenhouse gas emissions. The following two charts, prepared by Energy Strategies Pty Ltd as part of an ongoing process of monitoring trends in Australian greenhouse gas emissions, show the strong growth in combustion of diesel as compared to other petroleum products.

[6] Why Diesel not Electricity? - It must also be said that the numerous companies developing the many types of alternative vehicles, such as hybrid vehicles and electric vehicles have generated a great deal of media coverage to the extent that some less informed commentators have suggested that the whole issue of liquid fuels will soon be a thing of the past. These innovations are laudable but it is extremely unlikely that there will be any number of electric tractors or harvesters on our wheat fields, or long haul container trucks or hybrid 240 tonne dump trucks operating any time soon. Diesel demand is not going to be reduced because apartment dwellers can plug in their two seater city car.

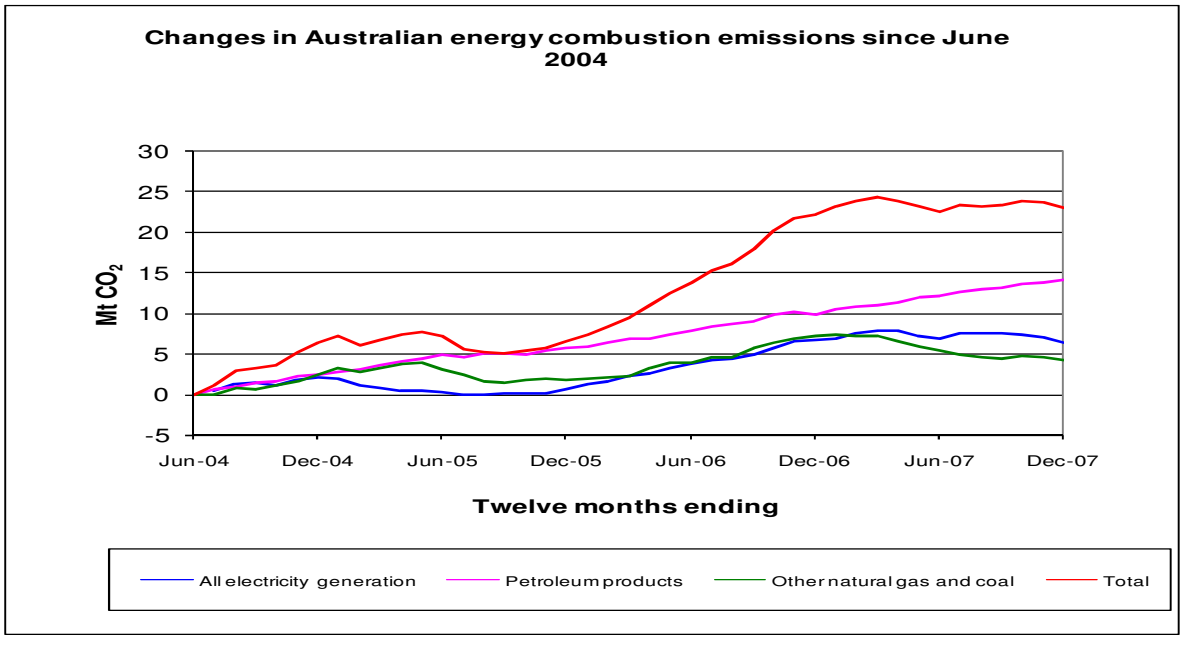
Figure 1 shows the emissions trends calculated from combustion of all petroleum products sold in Australia on a rolling 12 month basis. This demonstrates the strong consumption growth of diesel even while comsumption of ULP and other petroleum products was moderating over the period.

Figure 1: Changes in Australia combustion emissions from liquid fuels



Noting that the strong growth in emissions from combustion of all petroleum products is almost uniquely a result of growth in diesel consumption, Figure 2 shows what this increase in emissions from the combustion of diesel means for Australia's overall greenhouse gas emissions trends.

Figure 2: Changes in Australian energy combustion emissions



7. The impact of Bio-Fuels on Food Prices

It is Natural Fuel Ltd's assertion that sufficient bio-diesel can be produced in Australia, or in the bio-diesel refining assets of Australian companies located in the region, to provide significant energy supply security for Australian agriculture and transport while dampening inflationary forces in food production.

However before that assertion can be examined, the issue of the impact of ***bio-fuels*** (both ethanol and bio-diesel) on food prices must first be examined.

In the course of the last year numerous reports in the global media have stated categorically that 'bio-fuels cause food price rises'. This has been characterized as the 'food vs fuel' debate, a debate in which some assumptions appear to have become articles of faith, possibly without a great deal of substance or research to support them.

The issues are complex and there is no denying that biofuels production, coupled with Government policies in the US and the EU particularly, have caused distortions in some agricultural markets, underwritten the production of crops specifically for biofuel uses, and resulted in allocation of some agricultural land and resources to those crops.

However amongst all of the many factors driving food prices, it is difficult to ascertain how much the demand for biofuel feedstocks have contributed to food prices rises. There have been a number of reports citing biofuels as one of the main cause of food price rises (for instance, 'A Note on Rising Food Prices', by Dr Donald Mitchell cited above.) Perceived shortcomings and biases in that report were highlighted and responded to by several researchers including John M. Urbanchuk[7] who in July this year published a response and examined a number of factors that Dr Mitchell appears to have underestimated or largely ignored.

Natural Fuel Ltd does not seek to involve itself in this ongoing debate in any attempt to resolve. Nor does Natural Fuel Ltd ignore this debate. Demand for bio-fuels has, in some circumstances, in some countries, had some impact on food prices via a number of mechanisms. The extent of that impact is uncertain. It is Natural Fuel Ltd's view that any avoidable inflationary influences on food prices should be understood and avoided.

We submit however that the broad generalizations and populist approach, witnessed too often in the media, that bio-fuels demand causes food shortages, is an easy and sensational headline and an over-simplification of the issues involved.

Bio-fuels, both ethanol and bio-diesel, are produced in many countries from a wide variety of feedstocks and in economic environments that are largely engineered by Government's. Bio-fuel production and

[7] '*Critique of World Bank Working Paper, A Note on Rising Food Prices*', John M. Urbanchuk, Director LECG LLC July 11, 2008

use cannot be examined or characterized on a global scale. It can only be analysed and understood on a country by country, and on a fuel specific, feedstock by feedstock basis. This conclusion was in effect one of the primary findings of a recent report from the Royal Society in London. In their report, '*Sustainable Biofuels: Prospects and Challenges*[8]*',* they conclude in part;

> "*In this report, we highlight the complexity of the biofuels issue and the sheer diversity of options already available. Whatever the mix of policy objectives, any particular biofuel option will only provide a useful element of the solution if it is economically, socially and environmentally sustainable. It is therefore a matter of priority to establish the frameworks and methodologies to create a robust evidence base to inform sustainability analyses and policy development.*"

This is a position that Natural Fuel Ltd fully supports and recommends to this Committee.

Further, it is our view, that upon examination of the detail of the opportunities for, and obstacles to, sustainable bio-fuels production in the Australian context, it will be discovered that a very clear path is available to achieve the three goals articulated by the Royal Society of economic, social and environmental sustainability.

As previously stated, we assert that achieving this understanding, and engineering the Australian policy settings in support of sustainable bio-fuels, particularly for sustainable bio-diesel, has real potential to improve both energy security and economics in Australian agriculture and other vital industries.

Some final points about the impact of bio-fuels demand on food prices should be made which, in our view, demonstrate that there is no direct or simple link. Firstly it must be noted that palm oil prices, one of the major bio-fuel feedstocks in international markets, have dropped from highs of US$1400 per tonne earlier this year to around US$760 per tonne at time of writing, despite continuing high crude oil prices and thus continuing demand for bio-diesel. Similarly wheat prices have come off March 2008 highs near US$1250 per tonne hitting US$800 per tonne in the face of rising oil prices. We are not suggesting that these single events are sufficient evidence to suggest that there is no link at all between feedstock demands for bio-fuel and food prices everywhere, but certainly it does suggest that the link is not a simple and direct one.

Finally, the following three charts provided by David Bryant, Fund Manager of the Rural Opportunities Fund at Great Southern Ltd, would suggest that there are macro-economic forces and cycles at play in food and commodity prices that need to be understood before any final declaration on all of the factors contributing to food price rises could be made.

[8] '*Sustainable Biofuels: Prospects and Challenges*' Policy Paper 01/08, January 2008, The Royal Society, www.royalsociety.org

Figure 3: Long term commodity price movements

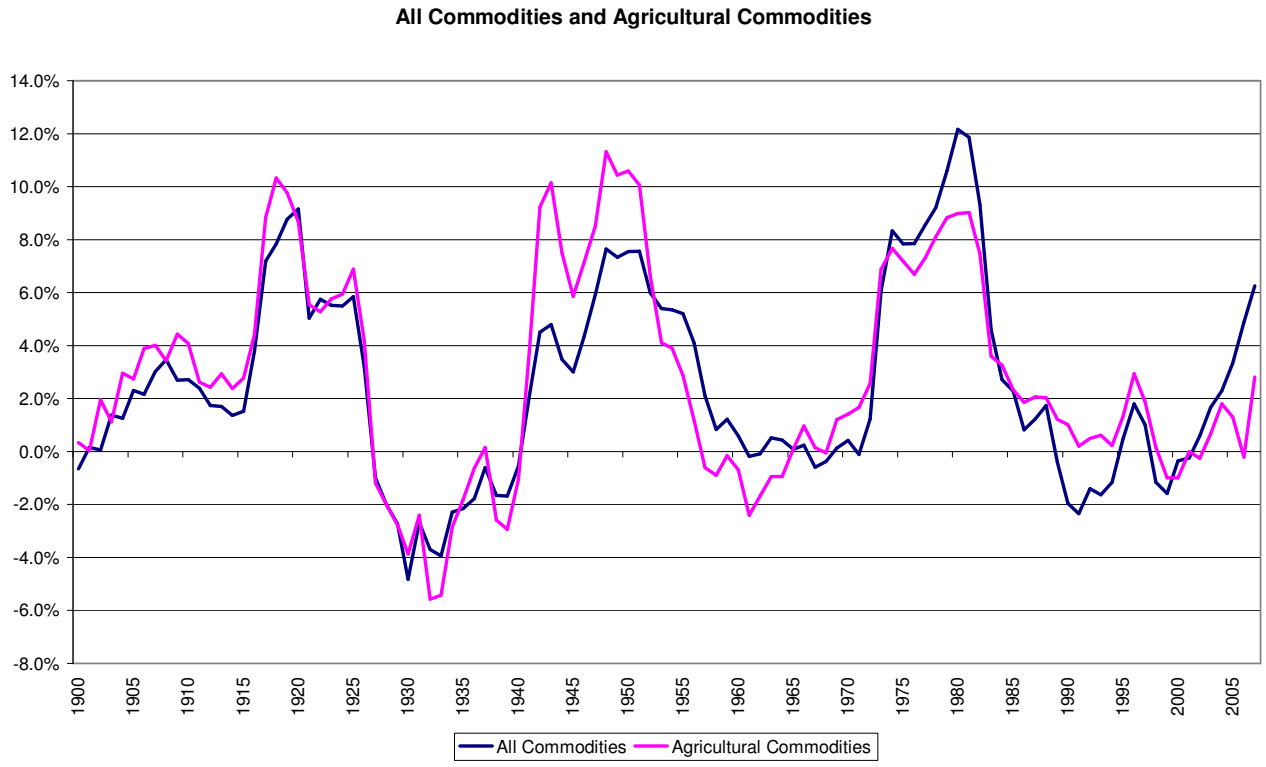


Figure 3 highlights the substantial correlation that exists between agricultural commodity price movements and long term movements in the broader commodities. The long term data provided in this chart, shows the three commodity price waves that occurred during the twentieth century and indicates the beginning of a fourth wave.

Historically, agricultural prices have risen in line with those of commodities in general in waves lasting approximately twenty years. On this basis, increases in agricultural commodity prices may be expected to continue for the next ten to twelve years.

Figure 4: Commodity Prices 1998 to 2002

Figure 4 demonstrates that energy led other commodities in the current upward cycle. While the long term decline of agricultural commodity prices ended in 2001, significant upward movement did not occur until October 2006.

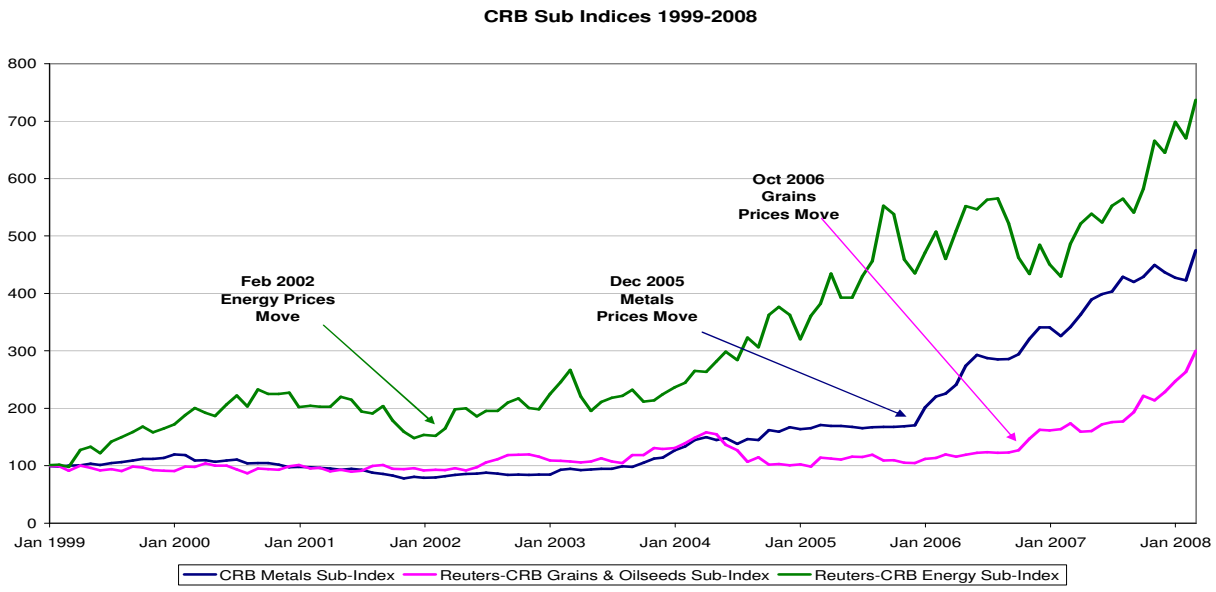


Figure 5: Australian Inflation vs Commodity Prices

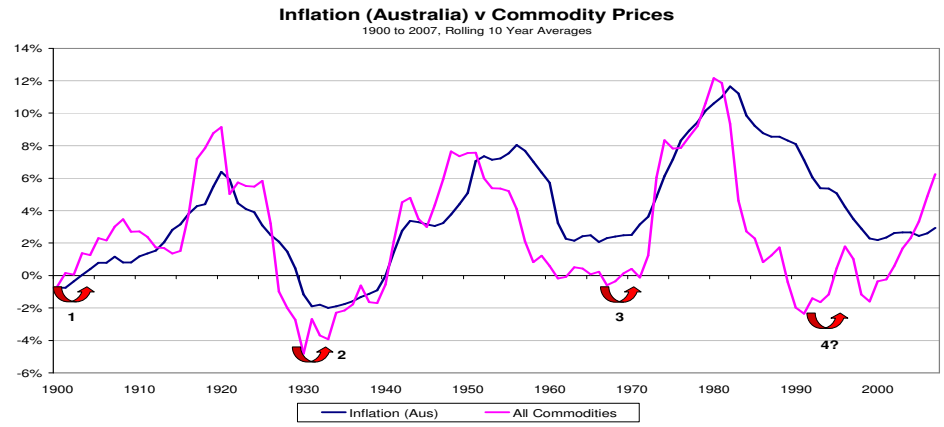


Figure 5 shows how high inflation and strong commodity price growth are cyclical and move together.[9]

[9] Figures supplied by David Bryant, Great Southern Ltd, *Sources: Barry Bannister, Stifel Nicolaus, ABS, Brown, HP (1964) 'Three Aspects of the Australian Retail Price Indexes' Economic Record, KR-CRB Commodity Indices*

8. The Impact of Commonwealth regulation on Bio-diesel

Fuel excise in Australia is A$0.3814 per litre. The same level of excise is payable on biodiesel. Eligible customers are able to claim a tax refund for fuel excise they have paid. Eligible customers who can claim excise refunds comprise all off-road users (e.g. agricultural consumers, mining companies) and on-road users who operate vehicles with a gross weight above 4.5 tonnes (except for a A$0.20/litre road-user charge that is applied equally to fossil diesel and biodiesel).[10]

However, the Fuel Tax Act (2006) altered the taxation arrangements for the biodiesel sector in Australia. **If the producers or importers of biodiesel received a subsidy or grant, for instance under the Cleaner Fuels Grant, then eligible customers are no longer entitled to a tax refund for fuel excise paid on that bio-diesel**.

Effectively this means that to compete with fossil diesel for these customers, biodiesel (if sold in B100 format) would need to be priced at least A$0.3814 per litre less than fossil diesel, which at current feedstock costs is not feasible. Since it is estimated that 97% of diesel is sold to commercial customers, this effectively eliminates the B100 market[11].

However blends of fossil diesel and biodiesel may be used and the full excise reclaimed by the user, as long as the blended diesel complies with the Australian Diesel Standard. This standard does not specify a maximum percentage of biodiesel in the blend, but does set an overall maximum density for any diesel fuel of 850kg/m^3.

Because biodiesel is denser than fossil diesel, this maximum allowable density effectively caps the proportion of bio-diesel that can be included. A blending percentage of 20% is generally taken as the maximum (i.e. 20% bio-diesel and 80% fossil diesel). Any higher proportion of biodiesel in the blend would cause the overall density to exceed this figure.

At this point it has to be asked what the downside or risk is if a diesel oil (blended or pure of either persuasion) were denser than the Australian Fuel Standard allows. The evidence would suggest that there is no significant technical issue or risk. We understand that 'oil majors' sometimes import tanker loads of diesel oil that exceed this density limit, and when needed they simply apply for an exemption to the Standard to allow that fuel onto the market. An exemption which we understand is always granted.

As far as equipment manufacturers are concerned there is no greater risk to higher proportion bio-diesel blends, or even pure biodiesel, being used in their equipment, than is presented by any fuel if it does not meet specifications for fuel quality (not density). Caterpillar, the world's largest manufacturer of heavy

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[10] Independent Market Research on the Biodiesel Market", Frost and Sullivan, Nov 2007, p29.

[11] Ibid, p29.

diesel engines, both mobile and stationary, has issued specific guidelines for use of bio-diesel blends and 100% pure biodiesel in their equipment. In some of their material they even list the benefits of bio-diesel such as increased lubricity compared to low sulphur fossil diesel, reduced unburnt hydrocarbons at the exhaust and reduced particulate emissions among other benefits.

Despite these benefits, commercial users who might choose to manage their equipment in a manner that allows them to use higher blends of bio-diesel or 100% renewable bio-diesel, and effectively avoid all liability for emission permits from that equipment, are penalized by the Australian Government's fuel excise treatment and Australian Fuel Standards treatment of bio-diesel. The obvious beneficiaries of these regulations are fossil diesel producers. Those disadvantaged include not just commercial vehicle operators, such as transport operators or mining contractors, who may wish to avoid all CO_2 emissions from a piece of equipment, but also those commercial users who might want to run electricity generators on B100, thus generating renewable electricity.

Presently there is a review of the Australian Fuel Standard underway and there have been some suggestions that changes may be made that reduce the maximum bio-diesel blend to as little as 5%. Should this occur it will effectively make bio-diesel completely irrelevant to commercial and agricultural users in Australia, making them more reliant upon and exposed to crude oil supplies and prices, at a time when such increased exposure, in any analysis, must equate to higher risk of exposure to inflationary forces and possibly even decreased security of supply.

A further disincentive written into the existing Australian Fuel Standards is the requirement for the user to demonstrate that a bio-diesel blend used complies with the Standard, which is a significant disincentive for customers to blend themselves[12].

The net result of these regulations has been to drastically reduce the attractiveness of biodiesel as a fuel in Australia.

[12] Ibid, p29.

9. Sustainable Bio-diesel for Sustainable Agriculture

Their are existing options for farmers to produce oil seeds for production of organic oils that can be converted to bio-diesel, however these are all presently oil-seeds that are used as food. The most common oil seeds used now in bio-diesel production are soy bean and canola. It must be noted that even when they are crushed for oil that is used in bio-diesel production, the seed cake remaining is then available as a high value stock feed. Farm collectives or large agricultural enterprises could now produce their own bio-diesel from their own seed crops if they have access to mills to crush their own seed for the oil, and then had the relatively low tech equipment required to produce bio-diesel.

However for the time being, with the prices being fetched for food grade oils, it is far more profitable to sell the oil or seeds, and buy diesel with the proceeds.

However ultimately the objective of the bio-diesel industry must be to develop feedstocks that do not compete for food commodities and preferably to not compete with food crops for resources such as prime land and water.

There are a number of highly prospective feedstocks for bio-diesel that are non-food crops and that are capable of being integrated into agricultural practices such that they could improve the sustainability of agricultural lands.

Two tree species[13] – *Moringa oleifera* and *Pongamia pinnata* are presently being trialled in different locations throughout WA. Seeds are harvested leaving the trees to grow, sequestering carbon. These trees can grow on marginal land and have tolerance to salinity. Investigations are currently underway with two mining companies interested in utlising these species for the production of bio-diesel.

A third highly prospective species Jatropha curcas, has been extensively planted throughout India, parts of South-east Asia, Madagascar and Africa in the last decade. Large quantities of Jatropa oil will begin to come to market for bio-diesel producers by 2010. This species is unfortunately banned as a weed in Western Australia and in the Northern Territory.

Natural Fuel Ltd has commenced its own trials of Pongamia in the Northern Territory with very promising results and has contracted to secure supplies of Jatropha oil from suppliers with advanced plantations in Madagascar and India.

These three tree species, while not yet having cultivars that lend themselves easily to mechanized agriculture, have tremendous attributes making them suitable in dryland agriculture in Australia. All of them are very drought tolerant and able to prosper on poor and sandy soils.

Yields and other characteristics of these trees would be greatly improved through dedicated breeding programs. A huge amount of work is underway into the productivity and habit of these species in many

[13] More detail about each of the tree species mentioned here is contained in Appendix 2 to this submission.

countries, although the attention they have received thus far in Australia is extremely disappointing, particularly given the potential they pose for Australian agriculture and energy security.

Critics will say that the volumes of bio-diesel that you can produce from tree crops that are not competing directly with food crops will be a drop in the bucket compared to the fossil diesel that is being used. Once again there has not been enough work done to establish what sort of productivity is possible in Australia from these sort of tree crops. And even if it is found that the volumes that can be produced are relatively small, in a crisis, or when supply shocks force crude prices extremely high, every alternative capacity that is in place will be useful to maintain critical energy supplies.

However until the research and analysis has been done, the scale of the opportunity, or the real barriers and obstacles, simply cannot be properly assessed.

While tree crops like these mentioned above have real potential for integration into existing dryland agricultural activity in Australia, the very exiting potential of micro-algae as a feedstock producer of organic oils is raising a lot of interest and attracting significant research.

Natural Fuel Ltd is also engaged in developing a serious research program into the use of micro-algae for for bio-diesel feedstocks and as a potential mechanism for bio-sequestration of CO_2 emissions directly from power station emissions. Natural Fuel is confident that this work will eventually prove up a viable process for growing, harvesting and processing micro-algae. However there is a long way to go to deliver micro-algae strains and systems that can reliably deliver cost effective volumes of organic oils.

It is our view that tree crops and micro-algae feedstocks should not be regarded as mutually exclusive alternatives with one eventually being the winner in this sector.

We submit that both these lines of enquiry are valuable and important and that ultimately, given the likely demands for alternatives to crude oil by 2020, when global emission reduction targets will be intersecting with falling crude oil supplies, rising populations and increased demands for food and energy, all of these intensively managed biological paths to renewable and sustainable energy supplies will be needed.

We submit that Australia's increasing and central reliance on diesel oil supplies requires that the Australian Federal Government makes a commitment to development of a strong Australian sustainable bio-diesel industry with the singular objective of capturing all of the national benefits of energy security, and economic and environmental sustainability that such an Australian controlled industry could deliver.

We submit that this is a matter of national importance and that the global forces and trends that we have briefly touched upon herein make the need for a high level of commitment and resolve to carry through with such support a matter of some urgency.

We repeat for your consideration, "There is no such thing as a post-agricultural society."

APPENDIX 1

Biodiesel versus Ethanol[14]

In some quarters there is very little understanding of the distinctions between ethanol and biodiesel. There is some misconceptions that these alternative fuels are interchangeable. Overseas some governments have tended to favour one over the other. Europe has chosen biodiesel as its primary biofuel, while the USA has chosen ethanol. This divergence reflects the fact that the US is a gasoline-driven economy while Europe is a diesel-driven economy.[15]

Both types of biofuels differ in important aspects from their petroleum-based substitutes. The largest and most overlooked difference is the energy content. Biofuels contain less energy than petroleum-based fuels, which means that a user will consume more biofuel than petroleum fuel to travel the same distance. In ethanol, this difference is significant. A barrel of ethanol contains 33% less energy while the energy content of biodiesel is 14% less than mineral diesel.

However, biofuels possess other positive, offsetting characteristics such as increased octane and cetane for ethanol and biodiesel, respectively, which enhance fuel performance and offer environmental benefits. Further, biodiesel has significant lubricating properties that can reduce engine wear and tear.

Figure 4: Petroleum Fuel Attributes versus Biofuel Attributes

Attribute	Conventional Motor Gasoline	Fuel Ethanol	Mineral Oil Diesel	Vegetable Oil Biodiesel
Energy Content (Btu/gal)	125,071	84,262	138,690	120,024
Octane Number (R+M/2)	87	115	n/a	n/a
Cetane Number	n/a	n/a	42	57
Average RVP (psi/gal)	11.0	18.0	n/a	n/a
Max Blend	100%	10%	100%	100%

Source: Goldman Sachs Commodities Research[16]

Biodiesel has a much greater energy density than ethanol. One litre of biodiesel has around 50% more BTUs than one litre of ethanol. Combined with the fact that diesel engines burn 35%-40% more

[14] This section is an excerpt from an earlier report prepared by Energy Strategies and Natural Fuel Ltd, '*Biodiesel in Australia – Future Import or Sustainable Growth Industry*,' March 2008. This report has been provided separately to the Committee secretariat should reference to it be required.

[15] "Food, Feed and Fuel - An agriculture, livestock and biofuel primer", Goldman Sachs, March 2007, p18.

[16] Goldman Sachs, ibid, p19.

efficiently than spark-ignition engines (ie. petrol or ethanol), the effective energy value of biodiesel is approximately 2.2 times that of ethanol.[17]

Biodiesel is technically a more efficient fuel than ethanol because it generally has a much higher ratio of energy use (ie. ratio of energy output from the final product relative to energy input during the production process). It is estimated that biodiesel has an energy use ratio ranging from 2.0 for palm oil to 2.5 for canola oil to 2.8 for soybean oil, while ethanol produced from wheat or corn has an energy use ratio of 1.1 and 1.4 respectively[18].

Ethanol produced from sugar cane in Brazil, which has a much higher energy use ratio, is the most efficient in the world due to various localized production techniques including the burning of bagasse (sugar cane stalks and waste) to produce energy during the production process.

Figure 5: Relative Efficiency of Biofuel Feedstocks

Commodity Input	Land Use (gal/acre)	Energy Use (output/input)	Breakeven prices, Feb 2007 ($/bbl) w/o Subsidy	Breakeven prices, Feb 2007 ($/bbl) w/ Subsidy	Countries Using the Input	Production By Product
Sugar-based Ethanol						
Sugar Cane	734	8.3	$45	n/a	Brazil, Lat. America	Raw Sugar, Power
Sugar Beets	715	1.5	$100	$22	France	Raw Sugar
Grain-based Ethanol						
Corn	394	1.4	$83	$62	US, Canada, China	DDGS Feed
Sorghum	374		$79	n/a	India	Animal Feed
Wheat	243	1.1	$125	$46	Europe	DGGS Feed
Biodiesel						
Palm Oil	508	2.0	$41	n/a	Phillipines	Glycerine, Fertilizer
Jatropha	364	2.0	$43	n/a	Africa, India	Glycerine, Fertilizer
Rapeseed	145	2.5	$125	$75	Europe	Glycerine, Meal
Soybean	60	2.8	$122	$80	US	Glycerine, Meal

Source: Goldman Sachs Commodities Research[19]

The implication is that, on the basis of EROEI (Energy Returned Over Energy Invested) in certain situations it is hardly worth making ethanol from wheat or corn. In the USA, the government encourages this activity to support farm incomes.

Estimates by Professor Michael McElroy of Harvard University put the EROEI from corn ethanol between 0.68 and 1.052, that is, likely a net energy loss activity[20].

[17] "Biodiesel: King of Alternative Fuels", Robert Rapier, March 2006.

[18] "Food, Feed and Fuel - An outlook on the agriculture, livestock and biofuel market", Goldman Sachs, March 2007, p13.

[19] "Food, Feed and Fuel - An outlook on the agriculture, livestock and biofuel market", Goldman Sachs, March 2007, p13.

[20] "Ethanol From Biomass: Can It Substitute for Gasoline?", Michael McElroy, Harvard University, http://www-as.harvard.edu:16080/people/faculty/mbm/Ethanol_chapter1.pdf

When all factors are taken into account Goldman Sachs has identified Jatropha curcas, a non-edible plant, and sugar cane are the most efficient energy feedstocks for biodiesel and ethanol, respectively.[21]

[21] Goldman Sachs, ibid, p13.

APPENDIX 2

Alternative non-food sources of Bio-diesel Feedstocks

Pongamia pinnata

From Wikipedia

Pongamia pinnata (Indian Beech Tree, Honge Tree, Pongam Tree, Panigrahi) is a tree thought to have originated in India and is found throughout Asia.

It is a deciduous tree that grows to about 15-25 meters in height with a large canopy that spreads equally wide. The leaves are a soft, shiny burgundy in early summer and mature to a glossy, deep green as the season progresses. Small clusters of white, purple, and pink flowers blossom on their branches throughout the year, maturing into brown seed pods. The tree is **well suited to intense heat and sunlight and its dense network of lateral roots and its thick, long taproot make it drought tolerant**. The dense shade it provides slows the evaporation of surface water and its root structures promote nitrogen fixation, which moves nutrients from the air into the soil. Withstanding temperatures slightly below 0°C to 50°C and annual rainfall of 5–25 dm, the tree grows wild on sandy and rocky soils, including oolitic limestone, but will grow in most soil types, even with its roots in salt water.

Known by many names (Indian Beech, Pongam, Honge, Ponge, and Karanj among other) it is a leguminous tree that's **well-adapted to arid zones** and has many traditional uses. It is often used for landscaping purposes as a windbreak or for shade due to the large canopy and showy fragrant flowers. The bark can be used to make twine or rope and it also yields a black gum that is used to treat wounds caused by poisonous fish. The flowers are used by gardeners as compost for plants requiring rich nutrients. Although all parts of the plant are toxic and will induce nausea and vomiting if eaten, the fruits and sprouts, along with the seeds, are used in many traditional remedies. Juices from the plant, as well as the oil, are antiseptic and resistant to pests. In addition the Pongam tree has the rare property of producing seeds of 25-35% lipid content. **The seed oil is an important asset of this tree having been used as lamp oil, in soap making, and as a lubricant for thousands of years**. **This oil is rapidly gaining popularity as an important source of fuel for diesel engines.**

Recently the seed oil has been found to be useful in diesel generators and along with Jatropha it is being explored in hundreds of projects throughout India and the third world as feedstock for biodiesel. It is especially attractive because it grows naturally through much of arid India, having very deep roots to reach water, and is one of the few crops well-suited to commercialization by India's large population of rural poor. Several unelectrified villages have

recently used Honge oil, simple processing techniques, and diesel generators to create their own grid systems to run water pumps and electric lighting.

In 2003 the Himalayan Institute of Yoga Science and Philosophy as part of its Biofuel Rural Development Initiative started a campaign of education and public awareness to rural farmers about the Pongamia in two Indian states. One of the Himalayan Institute's partners developed a consistently high yield scion that reduced the time it takes to mature from 10 years to as little as three. To help the farmers in the transition from traditional crops to the Pongamia tree the Indian government has contributed over $30 million in low-interest loans and donated 4.5 million kilograms of rice to sustain impoverished drought-stricken farmers until the trees begin to produce income. Since the project began in 2003 over 20 million trees have been planted and 45,000 farmers are now involved.

In 2006 the Himalayan Institute began looking at locations in Africa to transplant the Pongamia tree into. Initially they began in Uganda but due to the lack of infrastructure and growing desertification the project has been growing very slowly. They have also begun a project in the Kumbo region of Cameroon where conditions are better. There has been some suggestions that the Pongamia tree could be grown all the way across the continent as a way to prevent the encroachment of the Sahara.

Moringa oleifera

Moringa oleifera, commonly referred to simply as **Moringa**, is the most widely cultivated variety of the genus *Moringa*. It is of the family Moringaceae. It is an exceptionally nutritious vegetable tree with a variety of potential uses. The tree itself is rather slender with drooping branches that grows to approximately 10 m in height; however, it normally is cut back annually to one meter or less, and allowed to regrow, so that pods and leaves remain within arm's reach.

The Moringa tree **grows mainly in semi-arid tropical and subtropical areas**, corresponding in the United States to USDA hardiness zones 9 and 10. **While it grows best in dry sandy soil, it tolerates poor soil, including coastal areas. It is a fast-growing, drought-resistant tree** that is native to the southern foothills of the Himalayas, and possibly Africa and the Middle East. Today it is widely cultivated in Africa, Central and South America, Sri Lanka, India, Mexico, Malaysia and the Philippines. Considered one of the world's most useful trees, as almost every part of the Moringa tree can be used for food, or has some other beneficial property. In the tropics it is used as forage for livestock. And in many countries, Moringa is used as a micronutrient powder to aid indigenous diseases.

A traditional food plant in Africa, this little-known vegetable has potential to improve nutrition, boost food security, foster rural development and support sustainable landcare.

The immature green pods, called "drumsticks" are probably the most valued and widely used part of the tree. They are commonly consumed in India, and are generally prepared in a similar fashion to green beans and have a slight asparagus taste. The seeds are sometimes removed from

more mature pods and eaten like peas or roasted like nuts. The flowers are edible when cooked, and are said to taste like mushrooms. The roots are shredded and used as a condiment in the same way as horseradish, however it contains the alkaloid spirochin, a potentially fatal nerve paralyzing agent, so such practices should be strongly discouraged.

The leaves are highly nutritious, being a significant source of beta-carotene, Vitamin C, protein, iron and potassium. The leaves are cooked and used like spinach. In addition to being used fresh as a substitute for spinach, its leaves are commonly dried and crushed into a powder, and used in soups and sauces. **The Moringa seeds yield 38–40% edible oil** (called ben oil, from the high concentration of behenic acid contained in the oil). The refined oil is clear, odorless, and resists rancidity at least as well as any other botanical oil. **The seed cake remaining after oil extraction may be used as a fertilizer or as a flocculent to purify water**.

Jatropha curcas

Jatropha curcas, Barbados nut or Physic nut is a perennial poisonous shrub (normally up to 5 m high) belonging to the Euphorbiaceae or spurge family. It is an uncultivated non-food wild-species.

The plant, originating in Central America, whereas it has been spread to other tropical and subtropical countries as well and is mainly grown in Asia and in Africa, where it is known as Pourghère. It is used as a living fence to protect gardens and fields from animals.

It is resistant to a high degree of aridity (it can be planted even in the desert) and as such does not compete with food crops.

The seeds contain 30% oil that can be processed to produce a high-quality biodiesel fuel, usable in a standard diesel engine.

Cultivation is uncomplicated. Jatropha curcas can grow in wastelands and grows almost anywhere, even on gravelly, sandy and saline soils. It can thrive on the poorest stony soil and grow in the crevices of rocks. Complete germination is achieved within 9 days. Adding manure during the germination has negative effects during that phase, but is favourable if applied after germination is achieved. However, it is usually multiplied by cuttings, because this gives faster results than multiplication by seeds. The flowers only develop terminally, so a good ramification (plants presenting many branches) produces the greatest amount of fruits. Another productivity factor is the ratio between female and male flowers within an inflorescence (usually about 1 female to 10 male flowers - more female flowers mean more fruits). **Jatropha curcas thrives on a mere 250 mm (10 in) of rain a year**, and only during its first two years does it need to be watered in the closing days of the dry season. Ploughing and planting are not needed regularly, as this shrub has a life expectancy of approximately forty years. The use of pesticides and other

polluting substances are not necessary, due to the pesticidal and fungicidal properties of the plant.

While Jatropha curcas starts yielding from 9–12 months time, the effective yield is obtained only after 2 - 3 years time.

If planted in hedges, the reported productivity of Jatropha is from 0.8 kg. to 1.0 kg. of seed per meter of live fence. The seed production is around 3.5 tons / hectare (Seed production ranges from about 0.4 tons per hectare in first year to over 5 tons per hectare after 3 years).

Oil content varies from 28% to 30% and 94% extraction, one hectare of plantation will give 1.6t (metric tonne) of oil if the soil is average. The oily seeds are processed into oil, which may be directly used to fuel combustion engines or may be subjected to transesterification to produce biodiesel.

Energy Strategies

energy

Biodiesel in Australia

technology

Future Import or Sustainable Domestic Growth Industry

Prepared By

Energy Strategies

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This report has been prepared in conjunction with **Natural Fuels Ltd**, an ASX listed company invested in biodiesel refining capacity in Australia and Singapore, and in extensive Jatropha curcus plantations as a source of long term sustainable feedstocks for biodiesel production. For further information on Natural Fuels Ltd go to http://www.naturalfuel.com.au/ or contact Dan Wallwork, Treasury and Risk Manager, Natural Fuels Ltd, ph. 61 8 9286 6788.

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Executive Summary

Significant biodiesel refining capacity in Australia is being progressively mothballed[1] to 'care and maintenance' or closed down completely due to a mix of adverse policy decisions and difficult market conditions during the past 18 months.

Australia's export oriented resources and agricultural sectors, and the essential road freight industry, are primarily fuelled by diesel. Biodiesel is the only option that enterprises in these three sectors have for fuel switching to a renewable energy source.

Biodiesel is the most effective fuel for these sectors to reduce the greenhouse emissions intensity of their operations[2].

If the fledgling Australian biodiesel industry fails, businesses in the diesel intensive sectors will very likely be importing biodiesel within a few years as part of efforts to reduce greenhouse emissions, and to avoid the costs of emissions permits.

Conversely a successful Australian biodiesel industry could deliver several very positive economic and environmental outcomes including;

- contributing to reducing reliance on fossil fuel products;
- avoiding imports of biodiesel while building the foundation for a value added export industry;
- reduction of greenhouse emissions from the export oriented, diesel fuelled agriculture and resource industries[3];
- additional and stable demand for domestic agricultural commodities; and,
- facilitation of innovation including potential investments in new energy crops (eg jatropha) and investigation of highly prospective bio-sequestration processes of CO_2 from fossil fuelled power stations that provide feedstocks for biodiesel.

Ethanol cannot be used as a biofuel additive in diesel. Confusion in some areas about this issue requires clarification. Ethanol production is growing and is used in largely consumer petrol blends in the private transport sector. Ethanol production does not provide a renewable liquid fuels option for the resources sector or for much of agriculture and heavy transport.

While some State Government's have acted to support the industry, urgent Federal action is required to secure the future of the Australian biodiesel industry. Support for biodiesel in the form of mandated targets is consistent with support for renewable energy in the

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[1] Australian Renewable Fuels Ltd refineries in Western Australia and South Australia are on care and maintenance as of November 07 and staff reduced to skeleton staffing levels. Natural Fuels Ltd Darwin 100ktpa plant is commissioned but only being used to refine medical grade glycerine. Other refining plant in Australia is mothballed or closed down, planned construction of new plant is deferred indefinitely or shelved. Approximately 800 million litres of refining capacity has been built in Australia but present utilization is thought to be less than 10% putting more than $500 million of investments at risk.

[2] The potential for biodiesel use in road freight to reduce emissions in both trade exposed industries and across the domestic economy is highlighted by Woolworth's recent decision to roll out B20 biodiesel for use by its Victorian truck fleet, '*Doing the Right Thing – Sustainability 2007 – 2015*', pg 15 Woolworths, November 2007

[3] An RIRDC report from June 2007, 'Biofuels in Australia – an overview of issues and prospects', set out the greenhouse benefits and considerations of an expanded role for biofuels in Australia - http://www.rirdc.gov.au/reports/EFM/07-071sum.html

electricity sector until such time as carbon pricing is comprehensively established throughout the economy, and providing sufficient price support for less carbon intensive energy options. Existing Federal grants for biodiesel and tax treatment of fuel use effectively cancel each other out resulting in a complex set of arrangements that provide no clear incentive to business users to select biodiesel for their operations[4].

Legitimate concerns have been raised regarding the competition that biofuels creates for agricultural land in some countries, and for foodstocks. On this latter point it is particularly acute in the USA where ethanol production from corn has increased corn prices for food. Biodiesel on the other hand does not use either corn, sugar cane or wheat.

New demand from biodiesel producers for crude palm oil has had a part to play in recent increases in the prices for palm oil. However the far larger driver of palm oil prices has been the same forces that have caused prices for tallow, wheat, soy and many other internationally traded commodities in Australia to rise sharply in the last three years - demand from China and India for foodstuffs and for industrial feedstocks. Nevertheless rapid expansion of palm oil plantations has certainly been the cause of more pressure on extremely important lowland rainforests and peat bogs in parts of South East Asia that were already under severe commercial pressures from logging activities.

The question of sustainability of biodiesel feedstocks has to be central in any future support for biodiesel in the Australian economy. No matter how such support may be structured, if it is accepted that biodiesel has a part to play in reducing the emissions intensity of diesel dependent industries, then relying on biodiesel imports from uncontrolled sources is not an option that addresses sustainability.

At the same time new feedstocks, such as Jatropha curcas and micro-algae, have great potential to form the basis of new sustainable Australian enterprises.

[4] For a good overview of the present taxation arrangements in Australia for all biofuels see Chapter 3, '*The Economics of Biofuels for Western Australia*', The Centre for International Economics, April 2007 which in part concludes, "in the case of business fuel use…….. treatment of biofuels relative to petroleum fuels will not be evident in prices paid at the bowser" and, "The regime leads to a complex set of incentives for biofuel use and production that vary according to the market segment to which fuel is sold."

Introduction

The Australian biodiesel industry has experienced unfavourable conditions over the past 18 months as a result of three main factors:

1. The Fuel Tax Act (2006) which wound back the tax benefits previously given to biofuels, effectively making biodiesel more expensive than fossil diesel and killing off domestic demand just as the industry was gearing up production and establishing distribution and blending arrangements.

2. A strong and sustained rise in the price of all 'conventional' biodiesel feedstocks since Q3 2006 which has severely affected the commercial viability of biodiesel production. Biodiesel feedstock prices have at least doubled in the past 15-18 months[5], outstripping the 30%-40% increases in crude oil prices over the same period.

3. The fall in global crude oil prices from mid-2006 to March 2007, which further weakened the competitive position of biofuels at a time when many new facilities were in, or preparing for, the early stages of production, causing business planning disruption and seriously impacted financial support at the same time as the effect of the Fuel Tax Act changes were being grappled with. Although crude prices have now recovered, this effect has been partly masked in local markets by the fall in the US dollar over the same period.

As a result of these factors, the profitability and the share prices of biodiesel producers has suffered and many proposed plants / projects have been deferred or cancelled.

The global biodiesel industry has also suffered difficult conditions since mid-2006 as a result of points 2 and 3 above, but due to continuing support from governments in Europe and the US, biodiesel productive capacity has continued to grow in these countries.

Total Australian owned biodiesel refinery capacity is growing and will reach around 1800 million litres by 2009. However around 1000 m litres (55%) of this capacity is located in Singapore and Malaysia in Australian-owned and Australian-managed plants. Forty-five percent of this capacity (800 m litres) will be located in Australia. Of the existing productive capacity of plants located on Australian soil, the capacity utilisation rate is currently less than 10%.

The biodiesel industry is investing heavily in developing alternative feedstocks that are both ecologically sustainable and will not be subject to competing demands as foodstuffs or industrial feedstocks.

Total Australian capital invested in biodiesel capacity is estimated at between A$0.5 billion and A$1 billion. With most Australian biodiesel companies currently facing a battle for survival, this capital formation in biodiesel capacity is at risk of being lost without immediate Government assistance.

[5] Palm oil at June 30 2006 was quoted by Bloomberg Financial as costing US$388/ton. At time of writing in February 2008 it is quoted at US$1,200/ton. The cost of tallow in Australia increased from around $600/ton in March 2007 to $900/ton in October 2007. Biodiesel has been selling for around AUD$900/ton.

Market Support

The Australian Government can do four things to assist the biodiesel industry:

1. Amend the Fuel Tax Act (2006) to put biodiesel on a level playing field with fossil diesel and allow diesel users to claim the 38 cent per litre rebate on popular blends of biodiesel.

2. Abolish the impending fuel tax on biodiesel which is due to be phased in during 2011-2015.

3. Implement a legally-binding 5% biodiesel mandate so that all fossil diesel sold in Australia is required to be blended with 5% biodiesel.

4. Actively support research and development into alternative energy crops such as Jatropha curcas and in algae production and its role in biosequestration of power station emissions.

Briefing Notes

- Approximately 14½ billion litres of diesel is consumed in Australia each year, representing 42% of the nation's use of transport fuels.
- In Australia, the transport sector accounts for around 41% of final energy use (higher than the 25-33% typical for developed countries).
- Therefore, diesel accounts for approximately 17% of final energy use.
- Australia's main export industries, mining and farming, rely almost entirely on diesel fuelled equipment as does most of heavy road transport.
- Biodiesel is the singular opportunity for no-cost fuel switching and renewable energy opportunity available to much of the mining, farming and transport sectors.
- The Australian biodiesel industry has annual productive capacity of around 1800 million litres, of which 45% (800 m litres) is located in Australia, and 55% (1000 m litres) is located in Singapore and Malaysia in Australian-owned and Australian-managed plants.
- The amount of Australian capital invested in the biodiesel industry since 2002 is estimated at between A$0.5 billion and A$1 billion.
- The current capacity utilisation rate of Australian-owned biodiesel plants is less than 10%. This is largely because at current feedstock prices production of biodiesel in Australia cannot compete on cost grounds with fossil diesel.

- The Australian biodiesel industry is facing grim prospects in 2008, and is in need of emerging industry assistance from the Government.
- Most of the existing Australian capital formation in the biodiesel sector will be wasted and lost during 2008 if the industry is allowed to wither and fail at this critical time.
- Existing Australian Government policies (Fuel Tax Act 2006) effectively makes biodiesel more expensive than fossil diesel, (due to the inability to claim the 38 cent rebate on the most popular blends) thereby providing a direct and significant disincentive to use renewable liquid fuels.
- Biodiesel has the potential to make a large contribution to helping Australia reduce CO_2 emissions.
- Through the implementation of a 5% Government biodiesel mandate, Australia has an opportunity to be at the forefront of pro-active global policies to encourage renewable transport fuels.
- Mandates for biodiesel use are currently in place in many countries including Germany, Austria, Netherlands, UK, Canada, New Zealand, Taiwan, Philippines, Malaysia, Thailand, Brazil and several US states.
- Germany (which alone accounts for 40% of the global biodiesel market) is set to raise mandatory biodiesel admixture to fossil diesel from the current 4.4% to 6.0% from April 2008.
- Caltex Australia Ltd already has a voluntarily implemented a B2 blend (2% biodiesel) for all diesel from its terminal in Newcastle, NSW.
- There is more than enough productive capacity within the Australian biodiesel industry to meet a 5% mandate.
- A mandate will also foster current research activities in Australia and elsewhere focusing on new and non-food sources of biodiesel feedstocks such as jatropha and algae, thereby playing a positive role in resolving the “Food versus Fuel” quandary, and stimulating economic activity in rural and regional Australia as new energy crops are trialed and adopted.
- An Australian biodiesel mandate that encouraged further Australian research and development in non-palm oil feedstocks, would reduce pressure for further deforestation in South East Asia and PNG.
- Leading Australian biodiesel companies with the capacity to do so are already investing heavily in alternative feedstocks and research and development of new feedstocks, however these feedstocks, notably very large investments in Jatropha curcas plantations, will not begin to deliver significant yields for a further two or three years.
- A biodiesel mandate is a fiscally neutral policy initiative requiring no expenditures from Government to foster a reduction in CO_2 intensity (and emissions) by Australian industry.
- A biodiesel mandate will act to reduce Australia's dependence on petroleum imports, and improve the nation’s BOP deficit.

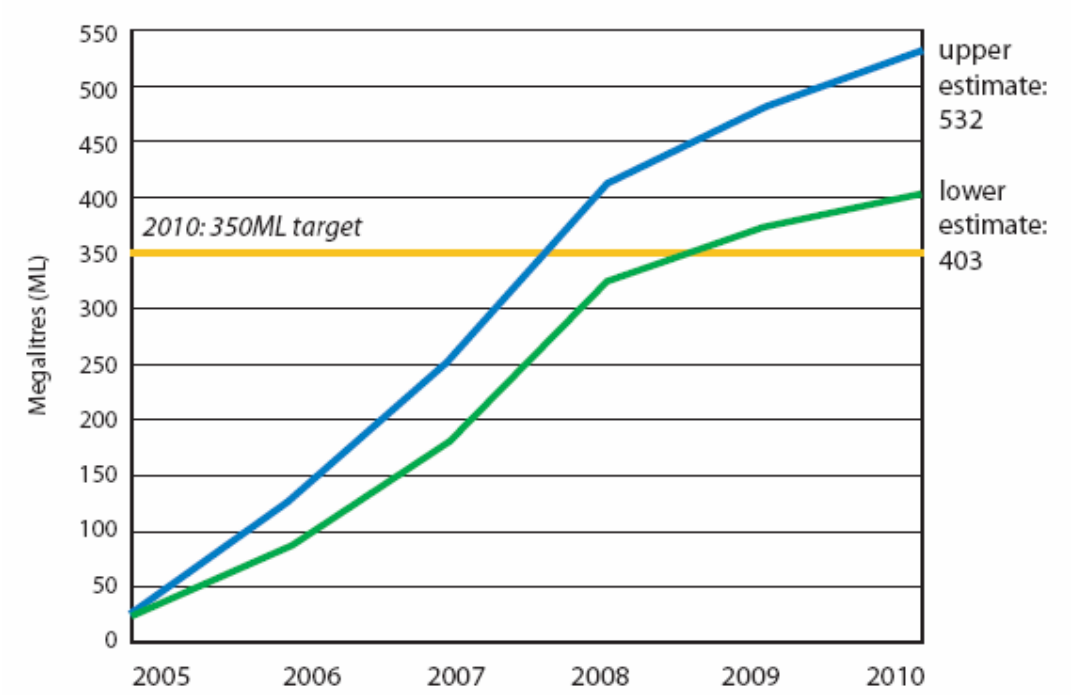
- A well formed biodiesel strategy will assist Australia in achieving and surpassing the Howard Government declared target of 350 million litres of renewable transport fuel by 2010 (which on current trends will not be achieved).
- A biodiesel mandate would assist the privately owned Australian biodiesel industry to grow hand-in-hand with the privately owned Australian mining industry without further support from Government.
- During the recent Bali climate conference delegates again pointed to the need to further stimulate production of renewable energy from agricultural products to reduce carbon dioxide emissions as part of the strategy to slow climate change.

Background

Following the announcement of the Biofuels for Cleaner Transport policy in 2001, which set a target of producing 350 million liters of biofuels by 2010, a Biofuels Taskforce was commissioned by the government to draw up a blueprint for achieving this goal. The Taskforce presented its report in August 2005 with a total of 47 conclusions and a series of recommendations. In particular, it singled out low consumer confidence and high commercial risk as key barriers to achieving the target.[6]

The Biofuels Taskforce Report was a precursor to the Action Plan for Biofuels, which was issued by the Australian government in 2005 following consultation with and receipt of individual action plans from oil majors and other industry stakeholders. It reiterated the 2001 target of producing 350 million liters of biofuels by 2010 and projected that the target could be met as early as 2008, with a possible production total of 500 million liters in 2010.[7]

Figure 1: Projected Biofuels Production in Australia



Source: Office of the Prime Minister[8]

[6] Biofuels Taskforce, Report of the Biofuels Taskforce to the Prime Minister, (Canberra: Government of Australia), August 2005.
[7] "Biofuels Target to be Met", Press Release from the Office of the Prime Minister, 22 Dec. 2005, p12.
[8] Office of the Prime Minister, The Biofuels Action Plan, Dec. 2005.

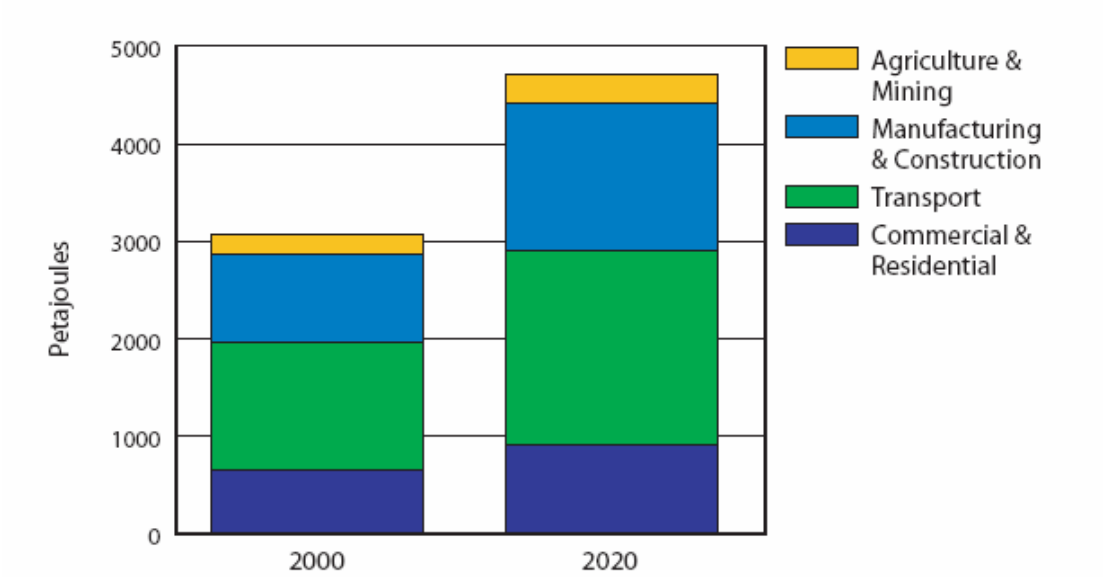
The 350 million litre target by 2010 is extremely undemanding by global standards. In 2006, Australia consumed 37,806 ML of transport fuels (of which 50 per cent was gasoline and 42 per cent diesel). Assuming this increases to over 40,000 ML by 2010, then the target would represent less than 1 per cent of fuel sales by volume (and less by energy value). This compares to the 5.75 per cent target by energy value (and more by volume) set in the EU, and the 3.4 per cent target set in New Zealand.[9]

In comparison to ethanol, policies to encourage production and consumption of biodiesel are much less developed. Following the recommendation by the Biofuels Taskforce that the government work with the Australian biodiesel industry to suggest B5, B20, and B100 as the standard forms of biodiesel,[10] a draft government position on biodiesel standards was released for public comment in 2006 and was expected to be finalized by the end of 2007.[11]

The Biodiesel Association of Australia reserved judgment on the possible impact of the Fuel Tax Bill on the industry, arguing that the structure of the bill would actually make biodiesel in most applications more expensive than fossil diesel.[12] It also asserted that eliminating the excise exemption in 2011 will not give the biodiesel industry sufficient time to build the necessary infrastructure and attain needed economies of scale.

Energy demand in Australia is projected to surge 50% by 2020. The energy industry has predicted that $37 billion in energy investments will be required by 2020 to meet demand.[13]

Figure 2: Final Energy Consumption by Sector



Source: ABARE Australian Energy[14]

[9] "Independent Market Research on the Biodiesel Market", Frost and Sullivan, Nov 2007.
[10] Biofuels Taskforce, p29.
[11] Michard Ward, "Biodiesel Forum 2006,"(Sydney: Dept of the Environment and Heritage), 25 Oct. 2006, p6.
[12] "Fuel Tax Bill - Biodiesel Impacts," Biodiesel Association of Australia, 12 Nov 2006 www.biodiesel.org.au
[13] Energy Task Force, p2.
[14] Energy Task Force, p28.

Diesel in Australia

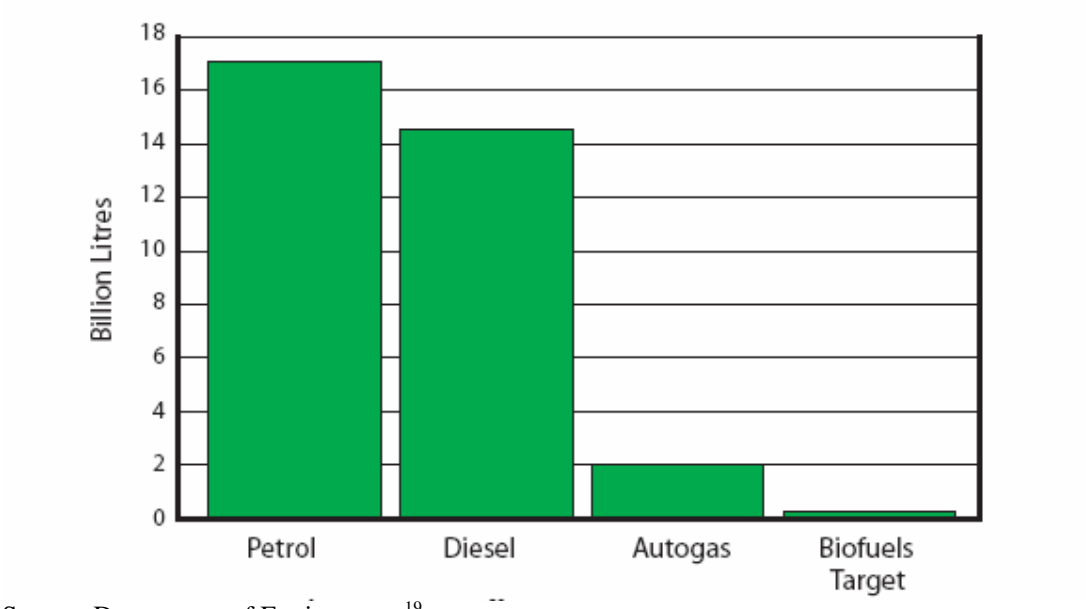
In 2001, the transport sector accounted for 41% of final energy use, virtually all of which was derived from petroleum products (Chart 3). Transport is projected to account for 90% of the total increase in final consumption of petroleum between 2000 and 2020.[15]

The Australian mining and agricultural sectors, which together account for an overwhelming majority of the nation's export earnings, rely heavily on diesel as a fuel. Diesel is used in a variety of ways in the mining industry, including as fuel for transport of inputs and products (via road and rail), as fuel for heavy mining equipment and to generate electricity to drive processing equipment (such as mills), and to provide power for other electrical needs[16]. For example, in the USA, diesel accounts for 72% of the energy used by the mining sector.[17]

Both surface and underground mining operations rely on diesel-powered equipment to extract materials and load trucks. Biodiesel is particularly useful underground or in deep pits where toxic fumes cannot easily dissipate.

Australia's oil imports have been rising steadily and helped swell the country's balance of payment deficit by $4.7 billion in 2004/05. According to GeoScience Australia, if the country were forced to rely on its own oil resources to meet its energy needs, known oil reserves would last fewer than nine and a half years.[18]

Figure 3: Current Annual Fuel Sales



Source: Department of Environment[19]

[15] Energy Task Force, p27.
[16] Fuel Taxation Enquiry, Department of the Treasury, http://fueltaxinquiry.treasury.gov.au/content/Submissions/Industry/CMEWA_155.asp
[17] Diesel Service and Supply – industrial usage, http://209.85.173.104/search?q=cache:PdLyXLc9WqMJ:www.dieselserviceandsupply.com/industrial_industry_usage.aspx+diesel+%22mining+sector%22&hl=en&ct=clnk&cd=28&gl=au
[18] "Ethanol: An Australian Policy Perspective", Renewable Fuels Australia, 9 May 2005, p16.
[19] Michard Ward, p4.

Biodiesel versus Ethanol

In some quarters there is very little understanding of the distinctions between ethanol and biodiesel. There is some misconceptions that these alternative fuels are interchangeable. Overseas some governments have tended to favour one over the other. Europe has chosen biodiesel as its primary biofuel, while the USA has chosen ethanol. This divergence reflects the fact that the US is a gasoline-driven economy while Europe is a diesel-driven economy.[20]

Both types of biofuels differ in important aspects from their petroleum-based substitutes. The largest and most overlooked difference is the energy content. Biofuels contain less energy than petroleum-based fuels, which means that a user will consume more biofuel than petroleum fuel to travel the same distance. In ethanol, this difference is significant. A barrel of ethanol contains 33% less energy while the energy content of biodiesel is 14% less than mineral diesel.

However, biofuels possess other positive, offsetting characteristics such as increased octane and cetane for ethanol and biodiesel, respectively, which enhance fuel performance and offer environmental benefits. Further, biodiesel has significant lubricating properties that can reduce engine wear and tear.

Figure 4: Petroleum Fuel Attributes versus Biofuel Attributes

Attribute	Conventional Motor Gasoline	Fuel Ethanol	Mineral Oil Diesel	Vegetable Oil Biodiesel
Energy Content (Btu/gal)	125,071	84,262	138,690	120,024
Octane Number (R+M/2)	87	115	n/a	n/a
Cetane Number	n/a	n/a	42	57
Average RVP (psi/gal)	11.0	18.0	n/a	n/a
Max Blend	100%	10%	100%	100%

Source: Goldman Sachs Commodities Research[21]

Biodiesel has a much greater energy density than ethanol. One litre of biodiesel has around 50% more BTUs than one litre of ethanol. Combined with the fact that diesel engines burn 35%-40% more efficiently than spark-ignition engines (ie. petrol or ethanol), the effective energy value of biodiesel is approximately 2.2 times that of ethanol.[22]

Biodiesel is technically a more efficient fuel than ethanol because it generally has a much higher ratio of energy use (ie. ratio of energy output from the final product relative to energy input during the production process). It is estimated that biodiesel has an energy use ratio ranging from 2.0 for palm oil to 2.5 for canola oil to 2.8 for soybean oil, while ethanol produced from wheat or corn has an energy use ratio of 1.1 and 1.4 respectively[23].

Ethanol produced from sugar cane in Brazil, which has a much higher energy use ratio, is the most efficient in the world due to various localized production techniques including the burning of bagasse (sugar cane stalks and waste) to produce energy during the production process.

[20] "Food, Feed and Fuel - An agriculture, livestock and biofuel primer", Goldman Sachs, March 2007, p18.
[21] Goldman Sachs, ibid, p19.
[22] "Biodiesel: King of Alternative Fuels", Robert Rapier, March 2006.
[23] "Food, Feed and Fuel - An outlook on the agriculture, livestock and biofuel market", Goldman Sachs, March 2007, p13.

Figure 5: Relative Efficiency of Biofuel Feedstocks

Commodity Input	Land Use (gal/acre)	Energy Use (output/input)	Breakeven prices, Feb 2007 ($/bbl) w/o Subsidy	Breakeven prices, Feb 2007 ($/bbl) w/ Subsidy	Countries Using the Input	Production By Product
Sugar-based Ethanol						
Sugar Cane	734	8.3	$45	n/a	Brazil, Lat. America	Raw Sugar, Power
Sugar Beets	715	1.5	$100	$22	France	Raw Sugar
Grain-based Ethanol						
Corn	394	1.4	$83	$62	US, Canada, China	DDGS Feed
Sorghum	374		$79	n/a	India	Animal Feed
Wheat	243	1.1	$125	$46	Europe	DGGS Feed
Biodiesel						
Palm Oil	508	2.0	$41	n/a	Phillipines	Glycerine, Fertilizer
Jatropha	364	2.0	$43	n/a	Africa, India	Glycerine, Fertilizer
Rapeseed	145	2.5	$125	$75	Europe	Glycerine, Meal
Soybean	60	2.8	$122	$80	US	Glycerine, Meal

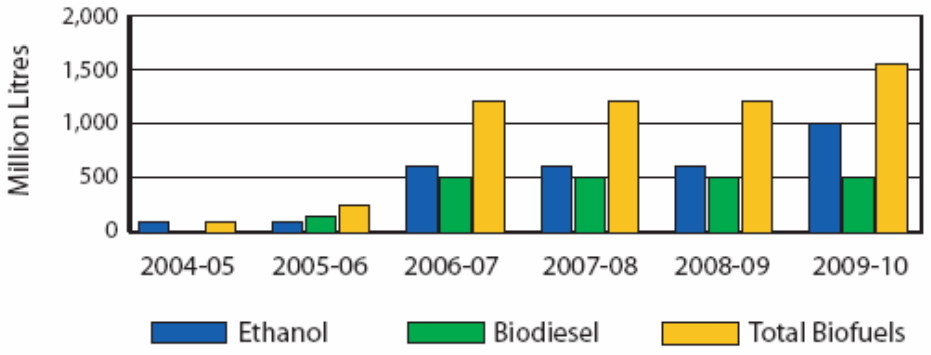
Source: Goldman Sachs Commodities Research[24]

The implication is that, on the basis of EROEI (Energy Returned Over Energy Invested) in certain situations it is hardly worth making ethanol from wheat or corn. In the USA, the government encourages this activity to support farm incomes.

Estimates by Professor Michael McElroy of Harvard University put the EROEI from corn ethanol between 0.68 and 1.052, that is, likely a net energy loss activity[25].

When all factors are taken into account Goldman Sachs has identified Jatropha curcas, a non-edible plant, and sugar cane are the most efficient energy feedstocks for biodiesel and ethanol, respectively.[26]

Figure 6: Current and Potential Biofuels Production Capacity



Source: Biofuels Taskforce[27]

In 2005, Australia's biodiesel industry had an annual capacity of 337 million liters. According to the Biofuels Taskforce Report, existing and proposed facilities could boost Australia's total biodiesel capacity to more than 500 million liters by 2009 (Figure 6). Subsequently new projects and investments have actually boosted capacity to around 800 million liters (Figure 7).

[24] "Food, Feed and Fuel - An outlook on the agriculture, livestock and biofuel market", Goldman Sachs, March 2007, p13.
[25] "Ethanol From Biomass: Can It Substitute for Gasoline?", Michael McElroy, Harvard University, http://www-as.harvard.edu:16080/people/faculty/mbm/Ethanol_chapter1.pdf
[26] Goldman Sachs, ibid, p13.
[27] Biofuels Taskforce, p42.

Figure 7: Biodiesel Plants in Australia (Operational & Expected)

Organization	Location	Annual Cap. *(Million Liters)*	Expected Operational Date
Australian Biodiesel Group	Berkley Vale, NSW	40	Operational
Australian Biodiesel Group	Narangba, Qld	160	Operational
Australian Renewable Fuels	Largs Bay, SA	45	Operational
Biodiesel Indust. Australia	Rutherford, NSW	8	Operational
Eco Tech Bio Diesel	Narangba, Qld	30	Operational
Evergreen Fuels	Mossman, Qld	N.A.	Operational
Future Fuels	Moama NSW	N.A.	Operational
Vilo Assets Management	Laverton Victoria	50	Operational
Australian Renewable Fuels	Picton, WA	45	N.A.
Axiom Energy	Geelong, Victoria	150	June 2007
Biodiesel Producers	Barnawartha, Victoria	60	N.A.
Biosel	Sydney, NSW	4	2007
Natural Fuels Australia	Darwin, NT	147	Oct. 2006
Riverina Biofuels	Deniliquin, NSW	45	July 2007
Biosel	New South Wales	24	2007/2008

Source: NRMA (National Roads and Motorists' Association)[28]

The Australia biodiesel industry also has significant assets located offshore, primarily in Singapore and Malaysia. The largest operations include Natural Fuel's 680 million litre facility in Singapore, and those of Mission Biofuel and Sterling Biofuel International in Malaysia with capacities of 280 million litres and 110 million litres respectively. All three companies are owned and managed by Australians with headquarters in Perth[29], and production is scheduled to come on-stream during 2007/2008.

Figure 8: Australian Owned Biodiesel Plants located in South East Asia

Organization	Location	Annual Cap. *(Million Liters)*	Expected Operational Date
Natural Fuel Limited	Singapore	680	2007/2008
Mission Biofuels Limited	Malaysia	250	2007/2008
Sterling Biofuels Int'l Ltd	Malaysia	110	2007/2008

Source: Australian Securities Exchange[30]

By 2009, the Australian biodiesel industry will have an annual capacity of over 1,800 million litres per annum with production facilities located in Australia and in South East Asia. However, it is estimated[31] that in 2007, the capacity utilisation rate of biodiesel plants located in Australia was around 10%.

If the full amount of 1,800 million litres per annum of biodiesel were available to serve the domestic market it would satisfy around 4½% of Australia's anticipated use of 40,000 million litres of transport fuels by 2010.

[28] Graham Blight, "Biodiesel Forum 2006" (Sydney: NRMA), 25 Oct. 2006, p3.
[29] Australian Securities Exchange, Listed Companies Information www.asx.com.au
[30] Australian Securities Exchange, Annual Reports, www.asx.com.au
[31] "Independent Market Research on the Biodiesel Market", Frost and Sullivan, Nov 2007, p28.

Biodiesel Tax Situation in Australia

Fuel excise in Australia is A$0.3814 per litre. The same level of excise is payable on biodiesel, however imported or domestically produced biodiesel that meets the Australian biodiesel standard receives an equivalent offset grant (Cleaner Fuels Grant). This arrangement is until 1 July 2011. After that date, fuel tax will be applied to biodiesel in equal annual increments reaching a final tax value of A$0.191 per litre in 2015. This equates to a 50 percent discount compared to the tax for conventional fuels. This gave a significant benefit to biodiesel, and helped to offset the higher production costs.[32]

However, the Fuel Tax Act (2006) altered the taxation arrangements for the biodiesel sector in Australia. Eligible customers are able to claim a tax refund for fuel excise they have paid. **However if the producers or importers of biodiesel received a subsidy or grant, for instance under the Cleaner Fuels Grant, then eligible customers are no longer entitled to a tax refund for fuel excise paid**. Eligible users who can claim excise refunds comprise all off-road users (e.g. agricultural users, mining companies) and on-road users who operate vehicles with a gross weight above 4.5 tonnes (except for a A$0.20/litre road-user charge that is applied equally to fossil diesel and biodiesel).[33]

Effectively this means that to compete with fossil diesel for these customers, biodiesel (if sold in B100 format) would need to be priced at least A$0.3814 per litre less than fossil diesel, which at current feedstock costs is not feasible. Since it is estimated that 97 per cent of diesel is sold to these commercial customers, this effectively eliminates the B100 market[34].

Blends of fossil diesel and biodiesel may be used and the full excise reclaimed by the user, as long as the diesel complies with the Australian Diesel Standard. This standard does not specify a maximum percentage of biodiesel in the blend, but does set an overall maximum density of 850kg/m3 which effectively caps the proportion of biodiesel that can be included. This is because biodiesel is denser than fossil diesel and a high proportion of biodiesel in the blend would cause the overall density to exceed this figure. A blending percentage of 20% is generally taken as the maximum (i.e. B20). The onus is also on the user to demonstrate that the diesel used complies with the standard, which is a disincentive for customers to blend themselves[35].

The net result of these changes has been to drastically reduce the attractiveness of biodiesel as a fuel in Australia. Since biodiesel generally needs taxation advantages to be competitive with fossil diesel, by eliminating fuel excise for most diesel users the Government has significantly compromised the ability of biodiesel to compete on cost grounds. It is likely that biodiesel sales in Australia will show a decline in 2007 when compared to 2006[36].

Following the changes to the Fuel Tax Act, an article[37] in The Australian Financial Review asserted that "The [Australian] biodiesel industry is fighting for survival as political and environmental factors threaten its existence."

The AFR article reported: "A media statement released by Australian Democrats Leader Lyn Allison soon after the changes summed it up. '*The bill hands back $1.5 billion in excise, removing the narrow price advantage biodiesel had in the transport fuels market. Farmers … will be paying 38 cents a litre more for biodiesel than for diesel*,' it said. '*The fledgling Australian biodiesel*

[32] "Independent Market Research on the Biodiesel Market", Frost and Sullivan, Nov 2007, p29.
[33] Ibid, p29.
[34] Ibid, p29.
[35] Ibid, p29.
[36] Ibid, p29.
[37] "Fuel's Gold: How Biodiesel Tanked", The Australian Financial Review, 5 October 2007.

industry will be destroyed and international oil companies will profit.' Which is exactly what happened."

The AFR article also reported that industry insiders suggest that the former Australian government knowingly used the 2006 Budget and the subsequent changes to the Fuel Tax Act (2006) to put the Australian biodiesel industry at a disadvantage in order to satisfy the wishes of the "big oil lobby".

This widely held belief is also found in a 2007 biodiesel report to the Inter-American Development Bank: "Oil refiners … are also key [players] in the biofuels industry. In countries like Australia, the relatively modest scale of the country's biofuels program can be attributed to the powerful oil lobby, which is reluctant to see a large-scale adoption of biofuels in the transportation sector."[38]

Blending Mandates

A blending mandate requires oil companies to blend a set percentage of biofuel in all its fuel. The levels are normally set quite low, such as 2% or 5%, but there is little freedom for the oil companies. Bioethanol must be included in gasoline and biodiesel must be included in any diesel sold.

The advantage of this model is that it requirees oil majors to use biodiesel and, while percentage levels are usually low, large volumes of biofuel need to be used to meet the mandate levels. Blending mandates mean oil companies require a reliable supply of biofuel which means they are likely to team up with biofuel producers in long term agreements or even invest in their own plants[39].

Several Governments have introduced mandates, either for biofuels as a class, or for specific fuel products such as diesel. These impose mandatory targets on oil companies to include a set percentage of biofuels in their total fuel sales, or face fines. The effect of these measures is to create a guaranteed market for biofuels. Jurisdictions which have introduced mandates include UK, Germany, Austria, Netherlands, Canada, Brazil and several US states. [40]

The EU has increased its target of biofuels in the total transportation fuel mix to 10 per cent by 2020, and plans to make this binding on member states. This would create demand approaching 20 million tonnes of biodiesel annually by 2020.[41]

Asia Pacific countries have become more active in promoting biofuels consumption in their domestic markets. Mandates, for example, have been legislated in New Zealand, Taiwan, Philippines, Malaysia and Thailand. Tax benefits have been introduced in Thailand and Korea. These measures will stimulate demand for biofuels such as biodiesel in the Asia Pacific region.[42]

[38] "A Blueprint for Green Energy in the Americas", Prepared for the Inter-American Development Bank by Garten Rothkopf, 2007, p358.
[39] "European Biodiesel and Feedstock Markets", M054-39, Frost and Sullivan, June 2007, § 3.5
[40] Ibid, § 3.5
[41] Ibid, § 3.5
[42] Ibid, § 3.5

Figure 9: Examples of Government Measures to Support Biofuels

TARGETS	MANDATES	TAXATION BENEFITS	CREDITS / REBATES	OTHER MEASURES
• USA • Australia • China • India	• UK • Germany • New Zealand • The Philippines • Canada • Brazil • Argentina	• UK • France • Thailand • Korea • Brazil	• USA • Australia	• Australia • UK • France

Source: Frost and Sullivan[43]

Biodiesel Sales in Australia

To date, biodiesel has been mainly produced in Australia by stand-alone, specialist producers who lack their own fuel distribution infrastructure (Gull Petroleum / Eco-Tech is an exception).[44]

The initial business model was generally to sell in bulk quantities to customers (generally larger industrial or commercial companies or fuel distributors) who would buy in bulk and use either as B100 or produce their own blends with fossil diesel. A discount to the prevailing wholesale diesel price was generally offered to attract customers[45].

To date, major oil companies have shown limited take-up of biodiesel. Fuel marketing in Australia is dominated by four majors – Caltex, BP, Shell and Mobil - these four control or exclusively supply nearly 75% of sites (owned, leased or otherwise affiliated) and 85% of fuel sales[46].

Of the major oil companies only Caltex is offering a biodiesel blend. It sells "Next Generation Diesel" (a B2 blend) at selected service stations. Indeed Caltex already has a voluntarily implemented a B2 blend (2% biodiesel) for all diesel from its terminal in Newcastle, NSW[47].

BP has announced that they would introduce 'renewable diesel' to the market in 2007. This is a blend of hydrogenated tallow mixed with fossil diesel at up to 5 per cent. Since the tallow has not undergone esterification to produce a methyl ester, it is technically not biodiesel[48].

Retail distribution of biodiesel is dominated by independents, such as Gull Petroleum, which sells a B20 blend at over 100 service stations in Western Australia, South Australia Farmers Fuel (SAFF) which sells both B100 and a biodiesel blend at up to B20 in around 20 gas stations, and AusFuel

[43] "Independent Market Research on the Biodiesel Market", Frost and Sullivan, Nov 2007, p6.
[44] Ibid, p29.
[45] Ibid, p29.
[46] Ibid, p29.
[47] www.biodieselmagazine.com/article.jsp?article_id=1467&q=First&category_id=8
[48] Frost and Sullivan, op cit, p29.

which distributes fuel primarily to remote customers in northern Australia. The majority of biodiesel sold is however direct to end-users who will either blend themselves or in some cases may use as B100 (despite the cost disadvantage)[49].

As a result of the interaction between increased demand and limited supply, the price of the major feedstocks used in biodiesel production have more than doubled in Australia since mid 2006. In this, Australian prices have closely followed world markets.

Over this period prices of petroleum products, including diesel, have also increased. For example, the increase in the wholesale cost of diesel since early 2006 has been about 15 c/L[50]. Note that this increase is less than the increase in US$ denominated prices in world markets, because of the depreciation of the US dollar against the Australian dollar (and most other currencies). This is equivalent to an increase of approximately 20% in the cost, exclusive of excise. An increase that is not sufficient to make biodiesel economic given feedstock prices.

Biofuels R&D in Australia

The bulk of biofuels research and development in Australia is carried out by local governments or government-affiliated research institutes such the South Australian Research Institute, the CRC for Sugar Industry Innovation through Biotechnology (SIIB), and the Sugar Research Institute (SRI). In particular, the South Australian Research and Development Institute (SARDI) has developed a new biofuels research program, with an initial focus on biodiesel. SARDI is developing feedstocks from crops, microalgae, and other sources (studies have shown that algae can produce up to 60% of their biomass in the form of oil)[51].

SARDI is also engaged in using breeding and farming systems to develop mustard and canola varieties specifically for biodiesel production.[52]

The Rural Industries Research and Development Corporation (RIRDC) has undertaken a study to examine the possibility of producing ethanol from wood products.[53]

The University of South Australia has linked up with the South Australian Department of Transport to examine the long-term effect of using biodiesel and compressed natural gas in Adelaide metro buses.[54]

These efforts are laudable and should be supported. However if Government's are committed to rapidly and significantly reducing carbon emissions while maintaining economic activity then research into biofuels in general, and biodiesel in particular needs to be generously supported.

Critical issues facing the biodiesel industry that would benefit from a sustained R&D effort include sustainable supply chains for 'traditional' feedstocks such as palm oil, identification of alternative feedstocks, and feedstocks improvement programs. This latter issue is particularly the case for the

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[49] "Independent Market Research on the Biodiesel Market", Frost and Sullivan, Nov 2007, p29.
[50] Analysis by Energy Strategies, based on Singapore spot diesel prices from International Energy Agency, *Oil Market Report*, various issues, and exchange rates from the Reserve Bank of Australia.
[51] Ibid, p368.
[52] "SARDI Biofuels Research Program", SARDI, 12 Nov. 2006 www.sardi.sa.gov.au/pages/biofuels/biofuels_research_program.htm:sectID=877
[53] "Wood for Alcohol Fuels Status of Technology and Cost/Benefit Analysis of Farm Forestry for Bioenergy", RIRDC, 12 Nov. 2006 www.rirdc.gov.au/reports/AFT/02-141sum.html
54 "Biofuels", Invest Australia, 12 Nov. 2006 www.investaustralia.gov.au/index.cfm?id=5A2E6520-508B-A0EB-6835F7F0C49CA738&setLanguage=AU

highly valuable Jatropha curcas plant, a perennial tree crop whose inedible nuts yield approximately 35% by weight of crude bio oils. Leading biodiesel companies in Australia with a long term commitment to the industry have already invested in establishment of large scale Jatropha plantations in countries such as India, Thailand and Madagascar. The plant has potential for significant improvements in yield, ripening characteristics and harvesting practices given an appropriately resourced improvement program.

Similarly research into development of algae as a path way for bio-sequestration of power plant emissions and then use as a feedstock for biodiesel deserves serious support and priority status in research programs.

Sustainability of feedstock farming and management require investigation and resolution. Recently the establishment of palm oil plantations on virgin ground in parts of Indonesia, Malaysia, Borneo and PNG has attracted critical press coverage. It should be noted that the increase in the price of palm oil that has driven new palm plantings cannot be attributed to the demand from biodiesel producers. Along with soybeans, wheat, other vegetable oils and a number of international food commodities, prices have risen dramatically and to record highs on the back of increasing demand from a number of rapidly industrialising economies. While the price of palm oil is presently too high to make an economic feedstock for biodiesel, there are several biodiesel producers who are taking an active role in the international efforts to ensure the long term sustainability of palm oil production as there will almost certainly come a time when palm oil is an economic feedstock for biodiesel production. Active support for sustainable production of palm oil is an important program for the long term future of the industry.

Ultimately it is likely that the biodiesel industry will seek to move away from dependence on any feedstock that is also in demand as a food.

Introduction of a Mandate in Australia

The outlook for the industry in Australia would be much improved with the introduction of a legally-binding mandate system which requires the blending of a small percentage of biodiesel (usually 5%) into all fossil diesel sold.

The introduction of a mandatory national biofuels target (either at an overall level or for gasoline and diesel individually) is feasible and would be especially useful in helping Australia reduce greenhouse gas emissions from its major exporting sectors of minerals and agriculture and generally across heavy transport.

Labour administrations in the UK and New Zealand have both introduced mandates of this type from 2008 [55]. New South Wales and Queensland have announced that they will introduce ethanol blending mandates. Queensland has announced that it will introduce a mandate from 2010 that ethanol will be blended at 5 per cent in all gasoline produced in the State. New South Wales has introduced a 2 per cent blending mandate from October 1st 2007 on all gasoline sold in the state, and plans to increase this to 10 per cent from 2011[56].

Although no specific announcements have yet been made on biodiesel, the introduction of similar biodiesel blending mandates would be a logical corollary to these ethanol mandates.

Given the significant effect that biodiesel can have on greenhouse gas emissions, there is likely to be growing interest from larger companies concerned with reducing the environmental impact of their operations.[57]

BHP Billiton is trialing alternative fuels including biodiesel on their fleet of Caterpillar equipment. Linfox, Australia's largest trucking company, has appointed a Group Manager Environment and Climate Change to review ways to reduce greenhouse gas emissions and is trialing use of biodiesel blends in its trucking fleet. [58]

Given Australia's access to large amounts of coal and other fossil fuels at significantly cheaper costs than their renewable alternatives, a price on emissions of carbon is seen as critical in stimulating take-up of renewable fuels. Such a scheme will boost biodiesel use, given the significant carbon savings incurred by use of this fuel, particularly amongst the largest mining / industrial companies who would be liable under existing the reporting requirements of the National Greenhouse and Energy Reporting Act (2007) and who are likely to be significantly affected by the introduction of emissions caps and permits.[59]

However before the price of emissions permits comes into play and is bedded down in the economy support for biodiesel is required to ensure a domestic capacity is in place and on a solid footing to be able to meet future increases in domestic demand for liquid fuels.

[55] Ibid, p33.
[56] Ibid, p33.
[57] Ibid, p33.
[58] Ibid, p33.
[59] "Independent Market Research on the Biodiesel Market", Frost and Sullivan, Nov 2007, p33.

Types of Government Assistance

In the absence of compulsory mandates, most users are only prepared to buy biodiesel (either in B100 format or in a blend) if the price is no higher than fossil diesel after taking account of taxation benefits, if any. In some markets (such as Germany) the taxation advantage given to biodiesel has generally been sufficient to enable biodiesel to be sold at a significant discount to fossil diesel, despite higher production costs.[60]

In other markets the taxation advantage has been more marginal. In the UK for example biodiesel has had a £0.20 per litre excise duty rebate over fossil diesel. This has meant that when sold in a B5 blend the excise duty is £0.01 per litre lower than straight fossil diesel[61].

Depending on the feedstock used, and prevailing fossil oil and vegetable oil prices, this reduced excise may not be enough to offset higher production costs for biodiesel and hence producers may at times face the choice of matching fossil diesel prices but accepting a loss.

Figure 10: Maximum Sales Price for Biodiesel

COUNTRY	ASSUMED WHOLESALE DIESEL PRICE $ PER TONNE	TAX BENEFIT FOR BIODIESEL – LOCAL CURRENCY, 2008	TAX BENEFIT - $ PER TONNE, 2008	MAXIMUM SALES PRICE FOR BIODIESEL - $ PER TONNE
US	625	$1 per gallon	300	925
Germany	610	€0.32 per litre	510	1,120
UK	610	£0.20 per litre	452	1,062

Source: Frost and Sullivan[62]

There are indications that the German Government will soon raise mandatory mixing of biodiesel to fossil fuels to probably 6-7% from April 2008 onward as compared to the current 4.4%. The German Government has recently confirmed the intention to sharply raise production and usage of biofuels to reduce carbon dioxide emissions.[63]

There may be an additional regulation forcing the German industry to add another 3% of vegetable oils in the diesel refining process in order to raise the total biofuel content of diesel fuel to 10%.[64]

In France biodiesel quotas will be raised sharply from January 2008 onward, which will boost French biodiesel consumption to 2500 million litres in calendar year 2008 compared with 1500 million litres in 2007.[65]

[60] Ibid, p41.
[61] Ibid, p41.
[62] Ibid, p49.
[63] Oil World Monthly, 14 December 2007, No. 50, Vol. 50.

[64] Oil World Monthly, 14 December 2007, No. 50, Vol. 50, p643.
[65] Ibid, p643.

Conclusion

Although the Australian biodiesel industry has experienced difficult business conditions over the past 12 months, the main drivers underpinning the industry remain intact.

The importance of renewable fuels has intensified over the past year as concerns grow over greenhouse gas emissions, a significant proportion of which is generated from transport fuels. There are also increasing concerns over the long-term security of global mineral oil supplies and the increase in mineral oil prices globally.

To address these issues, as well as to stimulate their agricultural sectors governments in many countries have taken an increasing range of measures to stimulate biofuels consumption and production. Most important amongst these measures have been the introduction of biofuels mandates, which effectively create guaranteed markets for biofuels such as biodiesel.

These mandates will create a virtual certainty of significant biodiesel sales wherever they are applied. This will reduce the linkage between biodiesel and mineral diesel prices, and enable producers to pass on increased feedstock prices.

The International Energy Agency reckons that more efficient manufacturing, and transport could reduce energy demand worldwide by a third by 2050[66].

Since transport fuels invariably need to be liquid, and since in Australia, the transport sector accounts for around 41% of final energy use -- much higher than the 25-33% typical for developed countries[67] -- Australia needs biofuels more than other countries to cut CO_2 emissions. Yet Australia lags the rest of world in biofuels.

It is clear that productive capacity of both ethanol and biodiesel has increased in Australia and there should be little difficulty meeting the target of 350 million liters by 2010 should the economics of operating that capacity be profitable. However, Australia will only become a significant global player in biofuels if the Government introduces mandatory biofuels blends. Unless governments follow the lead of New South Wales in implementing state mandatory blends, biodiesel consumption in Australia will remain relatively low.[68]

The introduction of a biofuels mandate is a fiscally neutral yet significant measure that would assist Australia achieve its target CO_2 emissions reductions. The development of a healthy domestic biodiesel industry should be understood as an important strategic consideration in assisting trade exposed commodity industries reduce the emissions intensity of their operations. The biodiesel mandate needs to be introduced in 2008 before the estimated A$½ billion to A$1 billion invested in biodiesel capital formation is lost.

[66] "On the rebound", Economist.com, Dec 17th 2007. From Economist.com. http://www.economist.com/daily/columns/greenview/displaystory.cfm?story_id=10311863&fsrc=nwlvb
[67] Ibid.
[68] "A Blueprint for Green Energy in the Americas", Prepared for the Inter-American Development Bank by Garten Rothkopf, 2007, p368.