Inquiry into Australia's future oil supply and alternative transport fuels

Submission by : **Mr Andrew Beveridge, Project Manager Commercialisation ***
Office of Industry and Innovation
University of Western Australia Tel : (08) 6488 2028
email abeveridge@admin.uwa.edu.au

* This submission is made by Mr Beveridge in his capacity as an employee of UWA. It contains personal opinions and also evidence gained whilst working in his capacity as an employee of UWA. Consequently, it does not necessarily represent the entire view of UWA. No explicit or implied endorsement of UWA's official position or policy on Biofuels can therefore be inferred from this submission.

Transportation Biofuels : Why Australia must accelerate the trend

Recent world events have focussed the nation's attention on the world's dwindling oil supply and the purported link between rising greenhouse gas levels and climate change. This submission sets out to examine the facts ; challenge current thinking on the transport fuel sector, and together with a limited number of projections, explore a number of options for the future. In common with many other submissions to the Committee, the aim is to develop a roadmap to lessen the impact of the inevitable economic downturn that will occur as oil reserves continue to decline and prices climb. Far from a doom and gloom scenario, I believe that Australia as a nation, and in particular Western Australia, is well placed to become a leading advocate and a major producer of transportation biofuels.

Fact #1

- In 2005, Australia's annual consumption of liquid fuels is approximately 30 Billion litres ! (Source : Frank Russell, BP Australia). This equates to 82.2 million litres per day. In the ten minutes taken to read and digest this paper, Australia will have used 570,000 litres of liquid fuel. In anyone's money, that's an awful lot !

Fact #2

- Fossil fuels are a finite resource. Irrespective of the known or 'yet-to-be discovered' reserves, the earth contains a fixed amount of oil. There is less fossil-derived oil in the world today than there was yesterday.

Given the general acceptance of Fact #2 above, we now come to our first assumption :

Assumption #1

- The economics of supply and demand imply that global oil prices will continue to rise.

    - OK, a massive new discovery will ease the price rise temporarily. A resolution of tension in the middle east may lead to a more stable and reliable supply of oil, but Fact #2 still remains valid.

So what can be done...?

For many years, there has been a growing realisation that hydrogen is the ultimate source in terms of a transportation fuel. Used in a fuel cell to generate electricity and power a vehicle, hydrogen certainly has its attractions. However the main challenge is the on-board generation or storage storing of hydrogen in a form which is both practical, economic, and safe. Storing hydrogen as a powder (metal hydrides) is showing promise, and using carbon nanotubes to store hydrogen is also showing great potential. In time, the technical challenges will be overcome, and hydrogen will emerge as the leading contender. In the short term however (2006-2015), liquid fuels are likely to remain the only serious mass-market option for transportation. The world's entire economy and transport infrastructure is based on oil,

and until there is a major shift in terms of infrastructure and resource availability, liquid fuels are here to stay.

So where do Biofuels fit in...?

Biodiesel and Bioethanol are two biofuels that offer the following advantages:

- Sustainable resource – won't run out, unlike oil.
- Made from crops ideally suited to Australia's many and diverse growing climates.
- Carbon neutral : The carbon dioxide used up by the crop during the growing cycle is released back into the atmosphere when the biofuel is combusted in a petrol or diesel engine.
- Secure : By accelerating the fledgling "home grown" biofuels industry, Australia can underpin the security of the nation's fuel supply, and reduce our increasing reliance on imported crude.
- Economically attractive : By applying existing world-class agribusiness knowledge to the biofuels sector, Australian farmers, oil companies and investors are ideally placed to develop a vibrant "Transportation Biofuels" industry. Once scaled up, this industry will generate substantial profits for farmers, oil companies, rural communities and investors alike. This in turn will result in significant tax and excise dollars for the Federal Treasury.

Australia's Fledgling Biofuels industry – current position

The current annual production of Biodiesel and Ethanol (note 1) in Australia (BP Australia figures) is 141 million litres. This represents 0.47% of Australia's liquid fuel consumption , previously stated as 30 Billion litres.

Note 1 : "Ethanol" refers to Ethanol as derived from fossil fuels;
"Bioethanol" means Ethanol produced from sustainable biomass such as sugarcane.

By 2009/10, the annual production levels based on existing and planned expansion by several companies is as follows (BP Australia figures):

2009/10	Biodiesel production	:	0.525 Billion litres.
2009/10	Ethanol production	:	1.005 Billion litres.
	Total 2009/10 Biofuel production :		1.525 Billion Litres

If the 2009/10 usage remains the same as 2005 at 30 Billion litres, Biodiesel and Ethanol production will account for a mere 1.5 Billion litres, or only 5% of the total liquid fuel used in Australia. Whilst this will represent a ten-fold increase from the 2005 Biofuels contribution of 0.47%, it will be nowhere near enough to make a serious dent in the adverse economic and financial impact that is forecast to occur.

Projected Financial Impact –current position

It has been stated by a number of sources (Senator Christine Milne, Australian Greens, TAS; Prof David Harries, Director of the Research Institute for Sustainable Energy, Murdoch University), that the Federal budget is projected to have a hole of $12 Billion per annum by 2015. This projected blow-out is purely due to our over-reliance on oil as a transportation fuel. Clearly, this would cause the economy to slow, interest rates to rise, inbound and domestic travel and tourism to fall, and before long, we would be heading into a recession. Thankfully, we can take steps now to reduce the financial impact as stated, though we only have a short window of time in which to make key decisions.

Fact #3

- If we take no action, we are faced with a $12 Billion deficit in 2015.

Assumption #2

- If we take decisive action in 2006, we can significantly reduce this deficit. The aim should be to eliminate this blow-out completely. Transportation Biofuels are only part of the solution, but they have a crucial role to play.

Fact #4

- The level of oil & gas exploration expenditure (onshore and offshore) in Australia in 2003-4 was ***$944 Million*** (Source : mineral $ petroleum Exploration Australia 8412.0)

Fact #5

- The exploration costs for biofuels ***are precisely zero***. Biomass crops are being grown in increasing quantities our back yard – we don't need to spend vast sums of money going looking for them ! We do however need to prime the Biofuels pump as it is only providing a slow trickle rather than the steady and increasing stream that Australia needs.

So why aren't all the oil companies accelerating the trend towards Biofuels ?

And this is the crux of the matter. Political considerations aside, my view is that the answer to this question can be summarised as follows :

- Oil companies work on a business model that spends vast sums on exploration, looking for the next "big find." Once an economically viable field is discovered, the oil and gas industry's huge infrastructure machine grinds into action. The business model is to extract and process large quantities of oil and gas products. Very few processing plants are required as the economies of scale do not support smaller refineries. Production is very efficient; the business model is finely tuned, and profits are generated with manageable levels of (moderate) risk. Of course, the exploration successes have to pay for the many exploration failures. Now that most of the 'easy' reserves have been discovered, companies are moving into much more difficult territory, into much deeper water (eg Woodside), where the challenges are much greater. Given the huge investment in existing infrastructure, oil companies are reluctant to move away from this model, and we should accept this as a fact of life. It's not a criticism of oil companies at all, more so a realisation of why the oil and gas industry operates in this way.

- The Biofuels industry as I will explain, operates on a much different business model. The 'raw materials' (ie Biomass such as Bagass; Mallee roots; chaff; canola) are cost effective to grow, but are of relatively low value and have a high "volume per dollar". Hence, it is inconceivable that cellulose waste from the WA wheatbelt would be trucked across to QLD or anywhere else for that matter. The logistics just don't support the "Single refinery" model as noted above. The ***"economic radius"*** within which biomass can be transported is generally very small, and can range from " as little as 6miles for Bagass" (Clear Fuels Inc, Hawaii) to "perhaps 250km maximum" for Mallee (Dr Hongwei Wu, Curtin University). Research into the economics, energy balance and transport logistics of Biofuels production carried out by many leading proponents of the Biofuels industry has led me to conclude that following business models for the Biofuels Industry will evolve over the next 10 years :

Biofuels Industry : Potential Business Models

Biodiesel

It is my view that the Biodiesel industry will continue to expand successfully, and ultimately end up as a mature industry with three types of producers :

(i) **"Microproducers"**. These are typically enthusiasts who produce sufficient Biodiesel for their own use. No third party Quality Assurance ("QA") is done on each batch of fuel, but there is an appropriate level of 'self testing' carried out before use. As with the homebrew 'beer and wine' industry, there is little prospect of extracting excise duty, and so we need to be pragmatic about this and legislate accordingly

(ii) **"Community Producers"** who band together to produce small volumes for their local community. They may retail some of their production to commercial and private vehicle operators, via the major filling station chains. Community producers will be typically based in rural and regional Australia, and will have good access to Biodiesel starting materials. Community producers will be required by law to QA their fuels (by sending an express sample to laboratory) and to pay full excise duty.

(iii) **"Major Producers"** such as oil companies and entrepreneurial investors, Major producers recognise the need to construct medium sized Biodiesel plants located within perhaps 100km of major population centres, and no more that 250km from the Biomass producers. On-site QA of each batch of fuel will be a prerequisite. Full excise duty will be paid.

Potential Business Models : Bioethanol

The evolution of the Bioethanol industry (ie one in which Ethanol is derived from sustainable Biomass crops rather than from fossil fuels) is a more complex issue. This is mainly due the fact that there are two major methods of production, each of which offers strengths and weaknesses :

Option 1 : Fermentation of Biomass (eg Bagass or sugarcane waste)

- This method is widely used, particularly in Brazil. It is well proven, if requiring expensive biocatalysts. The major downside is that up to half of the inherent energy in the biomass material is wasted, due to the carbon dioxide produced as a by-product of fermentation. A relatively large production facility is also required to achieve economies of scale. However, a limiting factor is still the economic radius from within which the Biomass is obtained, in order to make the process viable.

Option 2 : High temperature gasification (using wheat stubble, mallee or similar cellulose-based crops or waste)

- A number of companies from the US and Europe are developing what appears to be very compelling technology that converts Biomass into Bioethanol in two basic stages :

  (1) High temperature gasification where the cellulose is converted into Hydrogen and Carbon Monoxide, followed by
  (2) Catalysis using a 50-year old process by which the two gases are catalysed into Bioethanol.

No greenhouse gases are emitted in the process and the yield is twice that of the Fermentation process described in option 1. This technique can also use a wide range of Biomass materials and appears to offer great promise.

A note of caution : High temperature gasification is still at the emerging technology stage. One company has achieved considerable success via a pilot plant, and is now constructing 'volume' production plants in mainland USA and also Hawaii.

Having reviewed a number of factors that impact on the Biofuels industry, let's now turn our attention to a Biofuels roadmap. This roadmap attempts to address all of the terms of reference (a) to (d) as issued by the Secretary of the Senate Rural and Regional Affairs and Transport under to which this submission is made :

The Biofuels Industry : A Roadmap for Australia

Issue 1 : How to address the forecast $12 Billion (in 2015) annual deficit from Australia's over-reliance on fossil fuels for transportation.

1.1 Set a target for transportation biofuels (by 2015) that is (a) realistic, (b) challenging, and (c) eliminates the $12 Billion annual deficit.

I am advised that Australia can not grow sufficient Biomass to replace fossil fuels for transportation but that a target of 20%-30% is eminently achievable without compromising Australia's food supply or biodiversity. A 30% target would require Australia to ramp up production so that by 2015, 9 Billion litres of liquid fuel (Biodiesel and Bioethanol) is produced every year. The planned rates of expansion will only result in Australia producing 1.5 Billion litres of Biofuels per annum by 2010. This will only represent 5% of Australia's liquid fuel requirements based on the current usage rate of 30 Billion litres per year.

1.2 Accept that the major oil companies, together with investors and also consumers, need further convincing that investment in Biofuels will pay off.

Investors and oil companies will only commit substantial sums of money if the risks have been reduced to commercially acceptable levels. At present , despite the admirable efforts by some oil companies (particularly BP) , it is clear that there is some reluctance to commit wholeheartedly to Biofuels. This reluctance is understandable and does not warrant criticism. It can be solved by adopting the following approach :

(a) ***Develop a sophisticated financial and economic agribusiness model*** to enable farmers, investors and oil companies to make major Biofuels infrastructure investment decisions. These decisions need to be made on hard evidence and facts rather than supposition. By developing and testing this model over the next few years, stakeholders will have a high level of confidence to make major capital investment decisions in around 2010, to meet the 2015 target and hence head off the $12 Billion blow-out.

(b) ***Establish a Biofuels technology demonstration programme*** that trials the various Biodiesel and Bioethanol technologies with a range of Biomass materials. Small biofuel production facilities should be established in different regions of Australia that are optimised for growing particular Biomass crops. For example, a Bioethanol plant based on fermentation of Bagass in QLD may be currently seen as "best practice". How does this compare with a Gasification plan based on Bagass ? Where are the optimum regions for this type of technology, given the differing population densities, growing

conditions, soil types and transport logistics ? How would a Bioethanol plant based on wheat stubble shape up in the WA wheatbelt ? Are the conditions suitable or near-optimal ? Where would be a good location for a Bioethanol reactor based on Mallee ? Similarly, would a wheat stubble Bioethanol plant be viable in Kellerberrin ? What about a Canola-based integrated cropping and Biodiesel facility in Kununnurra ? These are typical of the questions that we need to answer, with a high degree of certainly, and quickly.

In addition, I believe we need to undertake the following activities to secure the support of the that crucial stakeholder group, the Australian population at large.

(c) Provide educational resources to communicate the benefits of Biofuels and to dispel the concerns over Bioethanol in particular. E10 should be seen as a mere "pit stop" on the way to E100 ! Why is it that since 2001, "every new car sold in Brazil must be certified by the car manufacturer to run on unleaded petrol, 100% Ethanol (ie E100) or any combination in between." (Hon Kim Chance, keynote address to the Bioenergy and Biofuels conference, Perth, 10th February 2006). So why does Australia not follow Brazil's lead ? Such technology is already proven and in mainstream use. Whether it's a BMW 7-series or a Ford Laser, cars purchased in Brazil already run quite happily on E100 ! There's no reason why E100 models cannot be manufactured and sold in Australia.

(d) Encourage all federal and state government departments, together with research institutions (Universities and TAFEs), to migrate their fleet vehicles across to Biofuels. Provide incentives so that school bus operators embrace Biodiesel when it becomes available in their locality. Promote the "technology demonstrators" established in 1.2(b) as ideal cases for undertaking school projects. Promote the same technology demonstrators (and subsequent pilot plants) as tourist attractions, so that people become comfortable with the whole Biofuels concept. The aim is to really inspire and encourage people to embrace the Biofuels industry, as it is part of our future.

Western Australia (WA) is conducting a significant amount of research into these topics, as of course are other states around the nation. The aim is to develop and implement an Australia-wide strategy that minimises the impact of the oil price hike, and helps to secure Australia's position in terms of economic stability.

Many stakeholders in WA and beyond have expressed an interest in collaborating under a cohesive framework to implement 1.2(a) and 1.2 (b) above. The University of Western Australia, Murdoch University (via RISE- the Research Institute for Sustainable Energy); Curtin University and the University of Melbourne are leading the charge in this respect. WA's Department of Industry and Resources (DoIR); WA's Department of Agriculture, and the WA Sustainable Energy Development Office (SEDO) have all expressed their enthusiasm for a initiative such as proposed here. The aim is to involve key stakeholders from all states, including industry partners such as BP, CBH, Holden, Ford, Orbital Engine, Jabiru (aircraft engines) the Grain Growers Association; RIRDC, and regional groups across the state and ultimately across the nation. Such groups are all keen to see a national strategy evolve, and WA is ideally suited to take the lead. The aim is not for the initiative to become WA-centric, but for WA to catalyse the Biofuels industry by co-ordinating the many excellent activities that are already underway around the nation.

Biofuels Industry Roadmap : How might this work in practice ?

The WA-based stakeholders are planning to submit a proposal to the WA State Government to establish a **"WA Centre of Excellence in Transportation Biofuels".** This Centre, if approved, aims to implement Roadmap activities 1.2(a) and 1.2(b) above, initially within WA.

An enlarged programme in 2007 would be to submit an application to the Australian Research Council for a Co-operative Research Centre (headquartered in WA) to expand the Roadmap across all states and to involve all of the key stakeholders throughout Australia as industry partners. The overall objective (by 2010) is this :

- **To provide Australia with a proven solution so that oil companies, investors, community groups and stakeholders can make decisions in 2010 that will enable the nation to produce 30% of the nations liquid fuel needs via Biofuels, by the year 2015.**

This will head off the $12 Billion budget blow-out and ensure that Australia is well protected against the economic downturn that is sure to result. The challenge is that the next CRC round is not until 2007. Stakeholders are saying to me :

> ***"how can you help us to get started now : Do you need money ? What else can we provide ?"***

Other than some modest 'Glue funding' to enable the work to commence in 2006, I am of the view that the entire Roadmap activities can be supported under the existing state and federal funding programmes. ***No "new money" is required to implement this roadmap.*** All that is required is a recognition that we need to do something, and that we need to develop a sense of urgency.

AusIndustry has a vital role to play in this respect, and I would argue that market failure is occurring in the Biofuels industry. So much so that current grant schemes should be enhanced so that 80% of the costs of establishing, operating and monitoring 'demonstration' projects are covered by grant funding, as opposed to the 'dollar for dollar' schemes that are currently in place. The 'market failure' precedent has been used in Europe with great success, and whole industries have been revived or indeed developed from scratch as a result of visionary modification to existing funding programmes. I can provide more information on this issue if required.

In closing, I believe that the Biofuels industry in Australia is on the cusp of a very exciting strong growth phase. It has a crucial economic and environmental role to play in Australia's development over the next 20 years and can play a major part in revitalising parts of rural and regional Australia. Provided key strategic decisions are taken during the next 1-2 years, we have a very good chance of heading off the $12 Billion annual budget blowout. Taking no action now will lead to economic stagnation followed closely by recession. All it needs is a willingness to take action, and I am keen to play a part in helping the Biofuels industry fulfill its potential. I am happy to discuss issues raised in this submission with the Senate committee in more detail should this be requested. I look forward to a healthy debate on the future of Australia's oil supply, and feel that the Biofuels industry can play a fundamental part.

A. Beveridge.

Andrew Beveridge
Project Manager Commercialisation
University of Western Australia
Office of Industry and Innovation
Tel : (08) 6488 2028Fax : (08) 6488 2333 Email: **abeveridge@admin.uwa.edu.au**