ASPO-Australia

Australian Association for the Study of Peak Oil & Gas
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Biofuels Working Group
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The ASPO-Australia working group on Biofuels feels it imperative that action is taken now to reduce the oil vulnerability of Australia's transport system by looking at alternative fuel sources. However there are many mistaken beliefs about the role that biofuels can play in supplying Australia's transport fuels.

Both in Australia and the United States of America subsidies and regulatory support for biofuel production has been used to prop up regional economies[1], not necessarily to produce viable alternative fuels.

Biofuel production from "wastes" (waste starch, C molasses, used oil and tallow) appears to be relatively benign and profitable[2]. But to expand production further biofuel producers will have to compete for feedstock with livestock and human food production[3]. Increased competition is already raising the price of these feedstocks[4]. Indeed it appears in some cases that increases in oil price and feedstocks will go hand-in-hand and constantly maintain biofuel production outside the margin of profitability. Also there are now several examples overseas where biofuel production is impacting on nature conservation and other values[5]. This seems to be particularly true for palm oil, the production of which in tropical countries is causing the loss of considerable areas of rainforest[6].

The potential for biofuels to contribute to national transport fuel energy is estimated to be very low. For example diverting the entire Australian wheat and sugar crops to fuel production has been calculated to satisfy less than twenty percent of Australia's current fuel use[7].

Biofuels have very low energy efficiency ratios[8] and make very little sense when large quantities of fossil fuels are required for production and do very little to reduce Greenhouse gas emissions.

Government excises and regulations are encouraging biofuel industries, but will be removing many of these advantages in 2011 and later. Already Australian Government fuel excises and excise rebates are causing some inappropriate responses (e.g. farmers receiving the fuel

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[1] see http://www.dpmc.gov.au/biofuels/final_report.cfm p 6 and http://quote.bloomberg.com/apps/news?pid=10000039&refer=columnist_hassett&sid=aSVm3V6ipm8I
[2] see http://abareonlineshop.com/product.asp?prodid=12755
[3] see http://www.cipav.org.co/lrrd/lrrd16/11/pres16087.htm
[4] See *http://www.planetark.com/dailynewsstory.cfm/newsid/34983/story.htm*
[5] see http://www.monbiot.com/archives/2005/12/06/worse-than-fossil-fuel/
[6] At a recent conference "Biofuels and Bioenergy in WA: Initiatives and Challenges" Mr Frank Russell of BP Australia stated that BP refused to handle biofuels from palm oil for ethical reasons.
[7] See http://www.aspo-australia.org.au/References/Fleay/Fleay06BiofuelsVsPetrol.pdf
[8] see Heinberg, R (2003) "The Party's Over: oil, War and the Fate of Industrial Societies" New Society Publishers, Gabriola Island, 274 pp and Odum, H T (1996) Environmental Accounting, Emergy and Decision Making, John Wiley, New York.

excise rebate who manufacture biodiesel is better off selling the biodiesel to a user who does not get the rebate).

Biofuels will be produced locally and are likely to supply a small proportion of Australia's energy needs. Therefore, to ensure efficiency the Government should encourage the local use of biofuels around places of production and processing.

There is no doubt that further research on biofuels is urgently required, especially into the conversion of plant residues to biofuels from lignins and hemicellulose (by fermentation, pyrolysis, enzymatic hydrolysis, gasification and high and low temperature catalytic reactions). But this does not mean that industries should be established before the research concludes that they would be viable.

Recommendations:

1. Apart from encouraging the use of "true" wastes, the Australian government should not subsidise or in any way encourage the development of biofuel industries to use resources, including land that could otherwise be used for growing food or conserving biodiversity.
2. The Government should assess current and future excise and regulation for all fuels, including the diesel fuel excise rebate to ensure that these excises do not encourage inappropriate fuels to be produced or used.
3. The Government should encourage local use of biofuels, as the quantity produced will do little more than satisfy local demand.
4. In a manner similar to the certification of tropical rainforest timber the Commonwealth Government should ensure that any imported biofuels have been produced without detriment to the originating environment.
5. More research into biofuel production is urgently required before further commitment of government (or industry) funds.

These and other issues are covered in more detail below.

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

SUBMISSION ON BIOFUELS – Supplementary Document
As at 19 February 2006
David Bennett,
Convenor, ASPO-Australia Biofuels Working Group

Terms of Reference: Australia's future oil supply and alternative transport fuels, with particular reference to:

a. projections of oil production and demand in Australia and globally and the implications for availability and pricing of transport fuels in Australia;
b. potential of new sources of oil and alternative transport fuels to meet a significant share of Australia's fuel demands, taking into account technological developments and environmental and economic costs;
c. flow-on economic and social impacts in Australia from continuing rises in the price of transport fuel and potential reductions in oil supply; and
d. options for reducing Australia's transport fuel demands.

Submissions relating to Terms of Reference:

b. Potential New Sources - Biofuels[9]

What constitutes a biofuel?
We take as a source the Australian Institute of Energy's Fact Sheet No 8 "Biomass" (http://www.aie.org.au/facts_index.htm)

How can biofuels be produced

Descriptions of how ethanol can be produced can be found at (http://www.greenhouse.gov.au/transport/comparison/pubs/2ch6.pdf) and for biodiesel at (http://www.greenhouse.gov.au/transport/comparison/pubs/1ch4.pdf).

General issues

Regulatory Requirements

"Biodiesel is subject to the excise regulatory system when produced. The excise rate (38.143c/L) is the same as low sulphur mineral diesel. The manufactured biodiesel must comply with Australian standards and records must be kept for inspection. The cost to test biodiesel to the current standard, is approximately $3000 (Hobbs 2005).This implies a high per unit cost of testing for small on-farm batches of biodiesel. In addition, those who make or store biodiesel must be registered with the ATO as a fuel manufacturer to preserve the integrity of the excise system. The production premises and storage facilities must be registered, and it is necessary to maintain and keep well documented records for 5 years." (Kingwell and Plunkett, 2006) This makes on-farm, or even small-scale production of biofuels very expensive.

[9] Note this part of the submission relates only to biofuels. We are leaving it to others to discuss coal-to-liquids and gas-to-liquids, etc.

How much biofuel can be produced?

Apart from the use of biological wastes, biofuel production has to displace another land use, either cropping (e.g. wheat or sugar), or forestry, or the natural environment. For example there is increasing concern about the expansion of palm oil production on the tropical rainforests of the World (See (http://www.monbiot.com/archives/2005/12/06/worse-than-fossil-fuel/). Preston and Leng (2004) point out that biofuel production will disturb food supplies. "At the present time it is estimated that 12% of the maize production in the United States will be diverted from animal and human feed to alcohol production. This will surely dry up world surplus grain and throw into doubt the world's chances of avoiding mass starvation if natural or man made food shortages occur in the developing nations, particularly Africa. Many countries are now actively encouraging the development of fuel ethanol industries (see Berg 2001).

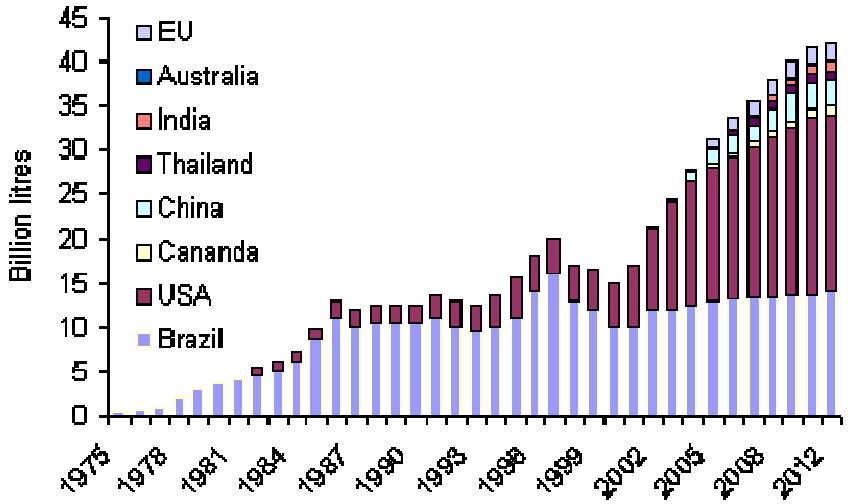

Figure 3: Global tendencies in production of alcohol (Berg 2001)

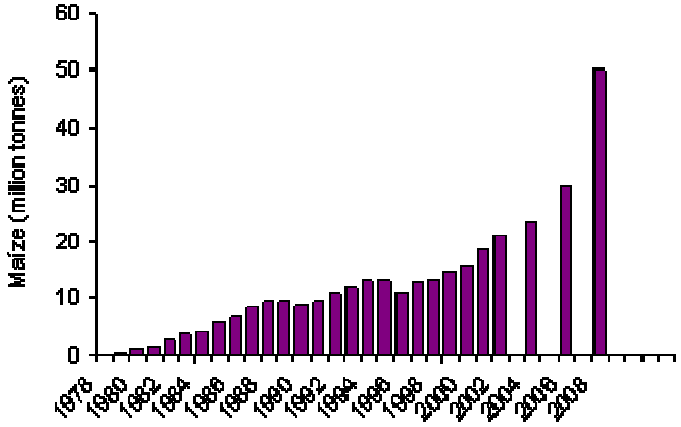

Figure 4: Past and future trends for conversion of maize to alcohol in USA (Pearce Lyons and Bannerman 2001)

“It therefore appears inevitable that inexpensive grain will become scarce in a world where large numbers of resource-poor people already suffer under-nutrition and mal-nutrition. However, the alcohol industry is going to develop world wide, competing for feedstock with food and feed and removing surplus grain from the market and ensuring that the world price will be high and availability for feeding animals will be low. The insanity of any scheme to produce alcohol as the major transportation fuel is well illustrated by the calculations of Pimmentel and his colleagues, which showed that with highly optimistic assumptions about the costs of alcohol production from grain, to fuel one car for 12 months would need 4.4 ha of good crop land planted to maize whereas, in comparison, only 0.6 ha of crop land is currently used to feed an American citizen. Thus more then 7 times more crop land is required to fuel one automobile than is required to feed one person. If all cars in the USA were fuelled by ethanol this would require a greater amount of cropland then the size of the USA.” (See Preston & Leng, 2004)

The Biofuels Taskforce Report (2005) (“The Report”) came to a similar conclusion: “**Conclusion 29:** *The Taskforce considers that, on current policy settings, there is real potential for subsidised grain ethanol plants to have a local impact on feedgrain prices in the short to medium term. In the longer term, fuel ethanol rates of return are likely to drop as the policy settings reduce the subsidies—and as ethanol import competition is allowed in 2011. The fuel ethanol industry would then be placed on a more even footing in its ability to bid for grain against the livestock industry*.” (The Report p 18).

Already demand for ethanol as a fuel is stretching Brazil’s ethanol industry as the following quote reveals:

‘World Ethanol Demand to Test Brazil Cane Industry

‘By 9 February, 2006 *http://www.planetark.com/dailynewsstory.cfm/newsid/34983/story.htm*

‘Brazilian sugar cane mills, the world's top producers, have visions of motorists from New York to Tokyo filling their tanks with ethanol, making the biofuel a full-fledged world commodity and making local producers as rich as Saudi sheiks.

‘But many observers doubt Brazil's ability to become a reliable international ethanol supplier. A disappointing cane harvest and thin ethanol stocks have helped lift sugar prices to 25-year highs, and the government has demanded price caps on the fuel.

‘Mills are struggling to build adequate fuel stocks to keep local prices from spiking. Any surprise such as a drought in the main cane-growing region would only exacerbate the problems.

‘The International Energy Agency said ethanol could make up as much as 10 percent of the world's gasoline mix by 2025. US President George W. Bush is looking to wean the United States off its dependence on oil imports by boosting production of energy alternatives including ethanol.

‘"There is huge demand for direct shipments of anhydrous ethanol from Brazil to the United States even with the 54 cent (per gallon) tariff," said Ernesto Coutinho, an ethanol specialist for international analysts Societe J Kingsman.

‘"So far, no contracts have been closed to the US but prices set for shipments to other destinations are rising well into harvest," he said.

‘Brazil's main cane region entered the interharvest period in December. With the government worried about tight ethanol supplies and rising prices, mills pledged to begin the harvest earlier than normal in March.

‘FIRM PRICES

‘Sugar and ethanol prices traditionally fall as the center-south cane harvest advances. But traders are reporting export contract prices into June show no such decline this year, despite the forecast of a much larger crop.

‘A contract for February-March delivery of anhydrous ethanol closed last month for $520 a cubic meter. But a contract for 15,000 cubic meters closed for May delivery FOB Santos for $550 a cubic meter, Coutinho said. Another contract was booked this week for March delivery at $560 a cubic meter FOB Santos.

‘"I'm not sure about rising prices but it is possible we may not see prices fall," said Julio Maria Borges, head of JOB Economia consultants, adding sugar futures on the local BM&F exchange were atypically firm well into the harvest months.

‘International sugar futures have been at 25-year highs, which tend to attract mills to turn more cane into sugar during harvest. Mills expressed concerns about supplying the local ethanol market in light of world sugar prices.

‘Specialists in Brazil's sugar-ethanol industry have fretted over the government's demand for a local price cap on ethanol and are worried it could impose export quotas if international prices become too attractive.

‘"If they took such an action, it would be out of sheer incompetence," said Borges. "There is no need for it. If ethanol prices rise, motorists can switch to gasoline. That is the benefit of the flex-fuel car."

‘More Brazilian drivers are buying flex-fuel vehicles that can run on gasoline, ethanol or any blend of the two.

‘"The government would prefer to reach a voluntary agreement with the cane industry rather than imposing something on it," Angelo Bressan, director of the agriculture ministry's cane and agroenergy department, said when asked what the government might do in the event of a strong international draw on Brazilian ethanol supplies.

‘The main center-south cane mill association Unica downplayed the chance of increased ethanol exports.

‘"We don't expect exports to reach last year's levels of 2.4 billion liters, in fact we doubt they will even reach half that" this year, Unica's technical director, Antonio de Padua Rodrigues, said.’

But others feel that there are opportunities: e.g. “There is the potential to produce the entire of WA diesel needs (some billions of dollars per year) in Kununurra using crops like African Oil Palm or plantations of oil tree crops in the wheat belt. An area 66 km x 66 km of African palm oil could produce all of WA diesel needs for transport and power stations.
(http://www.sustainability.ofm.uwa.edu.au/welcome/biodiesel) ”

(a) From sugar

“Annual production of sweeteners (sugar and honey) is notionally 5 million tonnes with variations according to seasons and markets. Honey is a negligible component (ABARE 2005). One tonne of sugar yields 0.385 tonnes of anhydrous ethanol that has a high heating value (HHV) of 29.65 GJ/tonne (Patzek & Pimentel 2005). Thus potential annual anhydrous ethanol production from sugar is 1.925 million tonnes with an HHV of 57x106 GJ.” (http://www.aspo-australia.org.au/References/Fleay/Fleay06BiofuelsVsPetrol.pdf)

(b) From wheat

“From 1991/92 to 200/05 average annual wheat production was 17.2 million tonnes with a range from 8.97 million tonnes (1994/95) to 26.13 million tonnes (2003/04). Average production from 1999/01 to

2004/05 was 21.3 million tonnes (ABARE 2005). We will use a figure of 22 million tonnes. Proposals for production of anhydrous ethanol from wheat quote a yield of 0.4 litres per kilogram of wheat (Grant et al. 2005). Ethanol has a density of 0.787 kg/litre that translates this yield to 0.315kg ethanol/kg of wheat. This figure is consistent with the ethanol yield from corn in the US (Patzek 2005). Thus potential annual ethanol production from wheat is 7 million tonnes. At an HHV of 29.65 GJ/tonne this is 207 million GJ per year (Patzek 2005)." (http://www.aspo-australia.org.au/References/Fleay/Fleay06BiofuelsVsPetrol.pdf)

Potential Annual Ethanol Energy Output
Compared to Annual Petroleum Products
(From http://www.aspo-australia.org.au/References/Fleay/Fleay06BiofuelsVsPetrol.pdf **)**

Annual Petroleum Products GJ x 10^6/yr		Wheat $207x10^6$GJ/yr	Sugar $57x10^6$/GJ/yr
		Percent petroleum product	Percent petroleum product
Gasoline	687	30%	8%
Diesel	585	35%	10%
Gasoline + Diesel	1,272	16%	4.5%
Crude oil	1,630	12.5%	3.5%

So even if biofuels were to displace major crops in Australia the proportion of fuel so contributed would amount to less than twenty percent of Australia's current usage.

Would biofuels be economic to produce?

The profitability of biofuel production will depend partly on the costs of feedstocks for the production process, partly on the degree to which the production is subsidised and partly on the value of by-products. For example, at present, due to subsidies on biodiesel in Germany and a large stock-feed market there, it is more economic for Australian producers of canola to ship the seed than to crush it locally for biodiesel production.

A general statement would be that prices paid for a product for fuel use will normally be lower than prices paid for the same product for food use. For example Roarity and Webb in their paper 'Fuel Ethanol-Background and Policy Issues' stated 'Although sugar prices have declined in real terms over the last thirty years, present prevailing prices well over A$200/tonne are still higher than sugar farmers are likely to receive if they were producing feedstock for ethanol production.' (http://www.aph.gov.au/library/pubs/CIB/2002-03/03Cib12.htm) and Short and Dickson (2004) stated that, other than ethanol produced from waste starch using existing capacity and biodiesel produced from waste cooking oil, all other options for producing biofuels were considered unlikely to be cost-competitive with traditional fuels over the medium to longer term. That assessment of economic viability, completed before the new fuel excise arrangements were finalised, assumed that after 2012 the excise rates for ethanol and biodiesel would equate to those for petrol and diesel on an energy equivalent basis.

The Report states that "Globally, and in the absence of subsidies, biofuels cost more to produce than petroleum fuels. Production costs are coming down, and there are new technologies on the horizon. However, barring unexpected scenarios such as ongoing oil prices over US$47 a barrel at a 65c exchange rate, ABARE analysis suggests that Australian biofuels will generally remain uncompetitive

with conventional fuels without continuing assistance in the longer term[10]. Depending on market conditions, exceptions could be biofuels that are produced by existing plants with sunk costs, or biofuels made from wastes." (The Report p 5)

The Report's conclusions in relation to the economic costs and benefits were:

"Conclusion 26: *Reflecting the combined effect of high world oil prices and government assistance to the industry, the rates of return potentially obtainable from fuel ethanol and biodiesel production are currently very high. However, these rates appear likely to fall significantly in the long term as world oil prices moderate, and as assistance to producers is reduced over the period 1 July 2011 to 1 July 2015 and fuel ethanol producers face full import competition at 1 July 2011.*

"Conclusion 27: *The likely long-term trajectory for world oil prices is highly uncertain. However, a reasonable consensus range for the long term world trade weighted average oil price (in 2004 dollars) appears to be US$25-45/bbl. The long-term West Texas Intermediate oil price of US$32/bbl (2004 dollars) assumed in ABARE's revised analysis is conservatively placed within the consensus range of world oil price projections[11]*.

"Conclusion 28: *At a long-term exchange rate of US65c, the long-term world price of oil (West Texas Intermediate) would need to average US$42-47/bbl in 2004 dollars (depending on the feedstock used) for new ethanol producers to be viable post-2015 without assistance. With assistance, however, the required oil price is estimated to be US$25-30/bbl. Biodiesel producers would require an oil price of US$52-62/bbl without assistance for ethanol, or US$35-45/bbl with assistance provided by current policy settings".*(The Report p 18)

These conclusions need to be re-examined in the light of very much more pessimistic views on the post-Peak world price of oil (in ranges of $100-$250 per barrel) and exchange rates and the likely effects of demand on the price of feedstocks.

Short & Dickson (2004) provide a table of the comparative costs of different feedstocks (Table 6 below).

[10] "In assessing the 350 ML scenario, ABARE assumed that all recipients of Biofuels Capital Grants would commence production by 2010, giving 148 ML of ethanol production and 202 ML of biodiesel as ABARE's assumed split of the 350 ML. For reasons given in Chapter 6, the Taskforce concludes that some biodiesel projects are unlikely to be viable in the longer run under current policy settings. The Taskforce considers that, should the 350 ML target be achieved, ethanol will be the principal biofuel produced and so has adopted the split of 290 ML ethanol and 60 ML biodiesel as used in the 2003 350 ML Target Report. The health assessment and costing undertaken for the Taskforce reflect this, as described in Chapter 5" (The Report)

[11] ASPO – Australia considers that ABARE's estimates of future prices for oil are optimistic and that prices will rise much more steeply – see other sections of this Submission.

Table 6 (from Short & Dickson, 2004) Biofuel feedstock costs and by-product revenues

	Net required revenue c/L
Ethanol – existing capacity	
Waste starch	18*#
C Molasses	26*#
Ethanol – new capacity	
C Molasses	33*#
Sorghum	37#
B Molasses	48#
A Molasses	71
Biodiesel	
Used oil	35#
Tallow	66#
Canola seed	101
Canola oil	119

Those sources marked with a * were considered by Short & Dickson (2004) to be viable at A30c/L (in 2004 dollars) and for diesel 34c/L. If one takes more recent prices (see http://www.aip.com.au/pricing/snapshot.htm) of 50c/L for 95 octane unleaded petrol and 70c/L for diesel then those marked with a # appear to be viable. With the exception of sorghum these are "waste" sources rather than production sources. It is likely that "wastes" can be profitably converted to biofuels, but the use of stockfeed and crops, such as sugar and wheat will have to be constantly re-examined. As an example the Bangkok "Nation" Newspaper reported on Januray 29th 2006 that significant feedstock price changes and the effect of government subsidies had thrown the alternative fuel supply chain into disarray (see http://nationmultimedia.com/2006/01/29/headlines/index.php?news=headlines_19778465.html)

Is it energetically efficient to grow biofuels?

The importance of Energy Yield ratios is that if they are close to one then not only is very little extra energy captured (by photosynthesis, etc.), but also one has to consider whether the feedstock may be better used in another supply chain or for another purpose. Finally it is important because, as the costs of other sources of energy rise, then the biofuel cost will inevitably rise. The issue of how much energy is yielded from different sources is subject to considerable debate.

Heinberg (2003) quotes Odum (1996) with a series of Energy Yield Ratios (or more strictly net energy or Energy Returned On Energy Invested - EROEI). In addition the Centre for Fuels and Energy at Curtin University has performed analyses on some Australian crops.

Odum's Energy Yield Ratios

Item	Energy Yield Ratio
Palm oil	1.06
Energy intensive corn	1.10
Sugarcane alcohol	1.14
Plantation wood	2.1
Lignite at mine	6.8
Natural gas, offshore	6.8
Oil Middle East purchase	8.4
Natural gas onshore	10.3
Coal, Wyoming	10.5
Oil, Alaska	11.1
Rainforest wood, 100years growth	12.0

Energy Yield Ratios from Curtin University Centre for Fuels and Energy
(Wu – personal communication)

	Energy Yield ratios
Canola – biodiesel only	1.39
Canola – all products[12]	3.62
Canola – biodiesel and cake	2.10
Mustard 1 – biodiesel only	2.00
Mustard 1– all products	5.19
Mustard 1 – biodiesel and cake	3.02
Mustard 2 – biodiesel only	1.47
Mustard 2– all products	3.81
Mustard 2 – biodiesel and cake	2.21

Wu points out that energy yield ratios for biodiesel in Europe are quoted within the range 2.5 to 4, due, it appears, to lower energy inputs of fertiliser, especially nitrogen.

A recent paper by Farrell et al (2006) re-examined the debate over the energy yield ratios by re-calculating the work of five authors on a common template (EBAMM - ERG Biofuel Analysis Meta-Model). As far as can be ascertained the most optimistic input data (from Shapouri, et al 2004) has an EROEI of 1.22, which not much above par and within the range of previous estimates.

Biofuels and regional economies

(a) Australia

The Biofuels Taskforce reported to the Prime Minister in August 2005 (Australian Government, 2005).

[12] In this case all products of the crop (oil, cake and straw) were converted into energy.

"Submissions to the Taskforce identified a number of possible benefits from biofuels:

- improved urban air quality, giving improved public health
- reduced emissions of greenhouse gases
- assisting the Australian economy generally, either through import substitution or kick-starting a new industry
- improved energy security
- regional development.

". . . the Taskforce has concluded that, of these, regional development is likely to be the principal driver of policy. In this regard, the Taskforce notes the emphasis on regional development in the government's 2001 election policy on biofuels. Although an assessment of benefits would ultimately focus on the principal driver, other benefits, such as improved urban air quality and greenhouse gas reductions, should still be taken into account." (The Report, p6)

The Prime Minister's subsequent media release is at http://www.pm.gov.au/news/media_releases/media_Release1734.html. This reported on the Biofuels Action Plan in which oil companies reported that meeting the Government's target of 350 ML per year would be achieved between 2007 and 2009. Other details of Government Action include:

- a $37.6 million Biofuels Capital Grants Program which will support new or expanded biofuels production capacity which will help to reduce supply constraints;
- Commonwealth fleet use of E10;
- simplification of the ethanol label;
- increasing the number of fuel quality compliance inspections to ensure motorists receive high quality fuel that is safe for their vehicles;
- vehicle testing of E5 and E10 blends; and
- a study to assess the health benefits of E10 under Australian conditions; and

consideration of minor specification changes to help encourage development of biofuels.

(b) USA

Some political commentators believe that support for the biofuels industry is simply a method of supporting agriculture in key areas. For example:

'Feb. 13 (Bloomberg) -- In his State of the Union address, George W. Bush called for an intense effort to develop more efficient alternative fuel sources.

'``We will also fund additional research in cutting-edge methods of producing ethanol, not just from corn but from wood chips and stalks or switch grass," the president said. ``Our goal is to make this new kind of ethanol practical and competitive within six years."

'Bush should have known better. In a capital city that is full of shameless political scams, ethanol is perhaps the most egregious. There has probably never been a specific topic around which so much disinformation is spread. Ethanol lowers our reliance on fossil fuels! Ethanol helps clean the environment! Ethanol will save the family farm!

‘Such sound bites work wonders when it comes to raising money. And the amount involved is mind-boggling. The federal government subsidizes ethanol producers with a tax credit of 51 cents per gallon of fuel ethanol; those subsidies will total about $1.4 billion this year.

‘**Corn Money**

‘The Energy Department and the Agriculture Department spend tens of millions of dollars every year on biomass-based energy research and development. This is in addition to the billions of dollars -- more than $4 billion in 2004 -- the U.S. provides in subsidies for the production of corn, from which most domestically produced ethanol is derived.

‘If you look at the facts, the spending makes no sense whatsoever.

‘Consider how ethanol is produced. Corn is grown, harvested, and delivered to an ethanol plant. There the corn is finely ground and mixed with water. After fermentation, a mixture that is about 8 percent ethanol must be repeatedly distilled until it is 99.5 percent pure ethanol.

‘Growing and harvesting the corn, and heating and reheating the fermented corn to produce ethanol of a high enough quality to replace some of the gasoline in your car requires an enormous amount of energy. How much?

‘**Adding It Up**

‘A recent careful study by Cornell University's David Pimentel and the University of California at Berkeley's Tad Patzek added up all the energy consumption that goes into ethanol production. They took account of the energy it takes to build and run tractors. They added in the energy embodied in the other inputs and irrigation. They parsed out how much is used at the ethanol plant.

‘Putting it all together, they found that it takes 29 percent more energy to make ethanol from corn than is contained in the ethanol itself.

‘It's not that corn is a bad source for ethanol. The other sources mentioned by the president look even worse. Wood biomass takes 57 percent more energy to produce than it contains. Switch grass takes about 50 percent more.

‘Ethanol is just a highly uneconomical product. Some other authors have disputed these findings, but they invariably come up with more favorable calculations by excluding some of the costs.

‘**Absurd Waste**

‘Indeed, no matter how expensive fossil fuels become, ethanol will never be economical because it takes so much fossil fuel to produce. It might be possible that someday technological processes will emerge that make production of ethanol less reliant on fossil fuels, but the billions in subsidies to this point have left us with a process that is still a disgrace and an absurd waste of energy and taxpayers' money.

‘At least ethanol reduces pollution, right? Maybe the subsidies are worthwhile because they will buy us a cleaner environment.

‘Guess again. First, corn production, according to Pimentel and Patzek, ``uses more herbicides and insecticides than any other crop produced in the U.S."

‘And the Environmental Protection Agency has cited ethanol plants themselves for air pollution. In a letter to the industry's trade group, the EPA noted that pollution was a problem in ``most, if not all, ethanol facilities." These plants produce large quantities of waste water as well.

‘**Ethanol Cash**

‘Ethanol itself contributes to air pollution. Cars emit more air pollution when they run on gasoline containing ethanol than they do when running on gasoline alone. Our environment would be greener if we stopped relying on ethanol.

‘The arguments against ethanol are so persuasive you have to ask yourself: Why does Congress keep throwing money at it?

‘The answer appears to be that elected officials from corn-growing states such as Iowa and Illinois see it as a cash cow for their constituents.

‘The ethanol business is a pretty good source of cash for the lawmakers too. The political action committee of Archer Daniels Midland Co., the world's largest producer of corn-based ethanol fuel, gave $69,000 to federal candidates for the 2004 elections, according to the Center for Responsive Politics.

‘In 2002, before such unlimited ``soft money'' donations were outlawed, ADM gave $1.8 million to political parties. Its political action committee gave close to $200,000 to individual campaigns and committees.

‘ADM spread the money around wisely that year, to beneficiaries ranging from Republican House Speaker Dennis Hastert of Illinois to Democratic Senator Tom Harkin from Iowa. Beneficiaries in 2004 included Hastert as well as Democratic Senator Kent Conrad of North Dakota.

‘Where's the Race?

‘Let's summarize the economics this way. Exxon Mobil Corp. had $36 billion in net income last year. If an alternative fuel source could be developed that would compete for that business, the potential rewards would be enormous. There would be a race to get there first, and firms would be lining up to do ethanol research. We wouldn't need a subsidy.

‘But even with decades of federal subsidies, private companies still haven't developed an economical ethanol, and public sector progress is minimal.

‘Bush's speech holds out hope that finally, after all those wasted billions, we are just six years away from a quality product. But it seems unlikely that the magic formula will soon be discovered. Folks have been distilling things for years. How much technical progress could the process possibly undergo?

‘The fact is, ethanol is a scam that allows farm states to extract resources from everybody else and pretend to be virtuous while doing so. We would all be better off if Congress just wrote these states a check with no strings attached. At least then we wouldn't be wasting all that energy.

Kevin Hassett at khassett@aei.org see (http://quote.bloomberg.com/apps/news?pid=10000039&refer=columnist_hassett&sid=aSVm3V6ipm8I).’

References

ABARE (2005) from Fleay

Australian Government (2005) “Biofuels Taskforce Report to the Prime Minister” (see http://www.dpmc.gov.au/biofuels/final_report.cfm)

Berg C (2001) World Ethanol Production Fo Licht’s International Molasses and Alcohol Report. http://www.fo-licht.com (Quoted by Preston & Leng – see below)

Ericson, M. and Odehn, G. (1999) A life-cycle assessment on ethanol fuel from wine – a study on present ethanol fuel for buses including comparisons to diesel, natural gas and ethanol from wheat or wood, Master of Science Thesis, Chemical Engineering, Chalmers University of Technology, Gothenburg, Sweden.

Farrell, A E, Plevin, R J, Turner B T, Jones, A D, O'Hare, M & Kammen, D M (2006) Science Vol 311 p 506-9 (see http://rael.berkeley.edu/EBAMM/)

Grant et al. (2005) from Fleay

Heinberg, R (2003) "The Party's Over: oil, war and the Fate of Industrial Societies" New Society Publishers, Gabriola Island, 274 pp

Hobbs, S (2005) De-centralised energy production. Australian Nuffield Farming Scholars Association 2003 Scholarship Report, sponsored by RIRDC, 45 pp (quoted by Kingwell 2006)

Kingwell, R and Plunkett, B (2006) Economics of biofuel production. Paper to the WA Sustainable Energy Association and the Sustainable Transport Coalition "Bioenergy and Biofuels in WA: Initiatives and Challenges Conference, February 10th 2006

Odum, H T (1996) Environmental Accounting, Emergy and Decision Making, John Wiley, New York.

Patzek (2005) from Fleay

Patzek and Pimmentel (2005) from Fleay

Pearse Lyons T and Bannerman J (2001) The US Fuel Alcohol Industry from 1980 to 2001; Lessons for other markets . In A time for Answers. Proceedings of Alltech's 15th Asia-Pacific Lecture Tour 115

Preston T R and Leng R A (2004) Global decline in oil and natural resources; implications for the scope and content of papers for publication in LRRD. *Livestock Research for Rural Development. Vol. 16, Art. #87.* Retrieved February 2, 106, from http://www.cipav.org.co/lrrd/lrrd16/11/pres16087.htm

Shapouri, H and McAloon A (2004) The 2001 net energy balance of corn ethanol US Department of Agriculture, Washington, DC. (see http://www.usda.gov/oce/oepnu/index.htm#2002Ethanol)