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by

Stewart Smith

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EXECUTIVE SUMMARY

There are two main biofuels with commercial prospects in Australia: ethanol and biodiesel. These biofuels currently comprise less than 0.1% of the Australian automotive gasoline market. The Federal Government has announced the objective that biofuels, produced in Australia from renewable resources, should contribute at least 350 million litres to the total fuel supply by 2010 – or approximately 1% of the Australian automotive gasoline market at that time. Other western countries, including the United States and the United Kingdom, have mandated various levels of biofuel use.

Ethanol is an alcohol made by fermenting and distilling simple sugars. Ethanol can be used for a variety of purposes, including as a beverage, in industrial applications and as a fuel. While ethanol can be produced from a variety of feedstock, it is predominantly produced from agricultural sources, such as waste starch, C molasses, corn, sorghum and feed wheat. The next generation of technology involves ethanol production from cullulosic feedstocks such as crop waste, grasses and trees. This technology, whilst not yet commercially proven, promises to allow ethanol to be produced more economically, with significant reductions in life-cycle carbon dioxide emissions than current processes, from a more widely available feedstock.

Biodiesel is normally produced from a reaction of vegetable oil or animal fat with an alcohol, such as ethanol or methanol, in the presence of a catalyst to yield mono-alkyl esters and glycerine, which is removed. Potential feedstocks for biodiesel include vegetable oils, animal fats and used cooking oils and fats. Biodiesel is used in conventional diesel engines. Subject to the manufacturer's advice, it can be used as a direct replacement or blended with petroleum based diesel fuel.

Biofuels are not cost-competitive compared with conventional fuel alternatives and are expected to continue to require substantial and ongoing support to maintain their production and use. Therefore, achieving a level of biofuels production and use high enough to make a meaningful contribution to energy security (whether through excise subsidies or higher costs to consumers imposed through a mandate arrangement) would impose significant economic costs.

On 14 August 2006 the Prime Minister announced new energy and alternative fuel initiatives. These included grants to service stations to encourage the development of infrastructure to deliver and sell E10 blended fuel. The Queensland Premier has announced that he would introduce legislation to mandate petrol refiners to put five percent ethanol in fuel in Queensland by 2010. In the longer term, this would be increased to ten percent. On 23 August 2006 NSW Premier Morris Iemma announced that he would establish an E10 Taskforce. Subject to the Taskforce's findings, the Government will mandate the use of E10 petrol in NSW, with a target date of 2011. The NSW Opposition Coalition welcomed the Premier's 'belated conversion to ethanol', and restated its position that it would mandate ethanol use if necessary.

1.0 INTRODUCTION

There are two main biofuels with commercial prospects in Australia: ethanol and biodiesel. These biofuels currently comprise less than 0.1% of the Australian automotive gasoline market.

In the context of the Federal 2001 election campaign, the Federal Government announced the objective that biofuels, produced in Australia from renewable resources, should contribute at least 350 million litres to the total fuel supply by 2010. In July 2003, the CSIRO, jointly with the Bureau of Transport and Regional Economics and the Australian Bureau of Agricultural and Resource Economics, were asked to investigate the appropriateness of maintaining that objective. On 30 May 2005, the Prime Minister announced the appointment of a Taskforce to examine the latest scientific evidence on the impacts of ethanol and other biofuel use on human health, environmental outcomes and automotive operations. The Taskforce report was subsequently released by the Prime Minister on 22 September 2005. These reports contain valuable information on the state of the biofuel industry in Australia.

2.0 INTERNATIONAL PERSPECTIVES

Ethanol is probably the most widely used alternative automotive fuel in the world, mainly due to Brazil's decision to produce fuel alcohol from sugarcane. As a result of this, for many years Brazil was the world's main user of ethanol as a fuel. However, recently the United States has surpassed Brazil in the production and use of ethanol. In 2003, US ethanol production capacity was 12.2 billion litres, of which 7.9 billion litres was consumed as fuel ethanol. In comparison, total ethanol production in Brazil was 6.95 billion litres.[1]

Ethanol in the United States has been an important additive in fuel, firstly due to the passage of federal *Clean Air Act* Amendments of 1990. This Act mandated that cities with the worst smog pollution use reformulated gasoline, beginning in 1995. Today, about 30% of the nation's gasoline is reformulated. Reformulated gasoline contains two percent by weight oxygen. Ethanol and MTBE (methyl tertiary butyl ether) have been the two most commonly used substances that add oxygen to gasoline. However, State actions to ban MTBE due to groundwater pollution concerns have led ethanol to become the oxygenate of choice in the reformulated gasoline program. The Energy Policy Act of 2005 (H.R. 6) removes the oxygenate requirement 270 days after enactment, in lieu of a nationwide renewable fuels standard (RFS).[2]

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1 Commonwealth of Australia, *Appropriateness of a 350 million litre Biofuels Target*. Report to the Australian Government Department of Industry, Tourism and Resources, December 2003, at 59.

2 Renewable Fuels Association (US), *Federal Regulations, RFG Required Areas*. See: http://www.ethanolrfa.org/policy/regulations/federal/rfg/, accessed September 2006.

More recently, the United States has promoted biofuels from an energy security perspective. On August 8, 2005, President Bush signed the *Energy Policy Act* of 2005 (H.R. 6) into law. The comprehensive energy legislation includes a nationwide renewable fuels standard that will double the use of ethanol and biodiesel by 2012. In addition, an excise tax exemption of $0.51 per gallon of ethanol used as motor fuel is in place.

The increased use of renewable fuels will expand U.S. fuel supplies while easing an overburdened refining industry. While no new oil refineries have been built in the U.S. since 1976, nearly 100 ethanol production facilities have been built during this time, adding critical volume to the gasoline market. As ethanol and biodiesel are blended with gasoline and diesel after the refining process, they directly increase domestic fuel capacity.

The US renewable fuel standard provisions:

- Establish a standard that mandates the use of 4 billion gallons in 2006 and increases to 7.5 billion gallons by 2012;

- Provide that beginning in 2013, a minimum of 250 million gallons a year of cellulosic derived ethanol be included in the standard.

- Provide refiners with flexibility by creating a credit trading program that allows refiners to use renewable fuel where and when it is most efficient and cost-effective for them to do so. The credit trading program will result in lower costs to refiners and thus, consumers. Renewable Fuel Standard credits have a lifespan of 12 months. Every gallon of cellulose-derived ethanol is equal to 2.5 gallons of renewable fuel. [3]

The implementation of the Renewable Fuels Standard aims to the have the following impacts by 2012:

- Reduce crude oil imports by 2 billion barrels and reduce the outflow of dollars to largely foreign oil producers by $64 billion;
- Create 234,840 new jobs in all sectors of the economy;
- Increase US household income by $43 billion;
- Add $200 billion to GDP between 2005-2012;
- Create $6 billion in new investment in renewable fuel production facilities;
- Result in the spending of $70 billion on goods and services required to produce 8 billion gallons of ethanol and biodiesel by 2012. Purchases of corn, grain sorghum, soybeans, corn stover and wheat straw alone will total $43 billion.[4]

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[3] Renewable Fuels Association (US), *Federal Regulations: Renewable Fuels Standard*, See:http://www.ethanolrfa.org/policy/regulations/federal/standard/, accessed September 2006.

[4] United States Renewable Fuels Association, From Niche to Nation. Ethanol Industry Outlook 2006, at 5. See: http://www.ethanolrfa.org/objects/pdf/outlook/outlook_2006.pdf, accessed September 2006.

Currently, virtually all United States produced ethanol comes from corn. However, a 2005 study suggests that, with aggressive technology developments, biofuels could supply some 60 billion gallons per year – 30% of current US gasoline consumption – in an environmentally responsible manner without affecting future food production.[5] This would be from cellulostic biomass, such as from agricultural and forestry residues, trees and grasses. Advanced technology can break down these cellulosic materials into their component sugars and then ferment them to make fuel ethanol. Under the umbrella of the Advanced Energy Initiative, the goal is to make cellulosic ethanol cost-competitive with corn based ethanol by 2012. The Initiative increased research funding to $150 million to help achieve this milestone.[6]

In response to rising demand, U.S. ethanol production broke production records in 2005. During 2005, 95 ethanol refineries located in 19 states produced a record 4 billion gallons, an increase of 17% from 2004 and 126% since 2001. Fourteen new refineries were completed and brought online in 2005. These new refineries, combined with expansions at existing facilities, resulted in record annual capacity growth of 779 million gallons. At the end of 2005, 29 ethanol refineries and nine expansions were under construction with a combined annual capacity of more than 1.5 billion gallons.[7]

The European Union has not been as active as the United States in the uptake of biofuels. In 2003, the European Commission established a goal of deriving at least 2% of EU transportation fuel from biofuels by the end of 2005, then growing the biofuels share by 0.75% annually until December 31, 2010, when it would reach 5.75%. However, the biofuels goal is not mandatory and individual Member States are free to establish higher standards. As a result, the degree of participation varies substantially across EU Member States. Despite various State and EU-wide policies designed to support biofuels production, the EU biofuels goal of 2% by 2005 was not achieved. Instead, it appears that biofuels attained an EU-wide share of about 1.4% of transport fuels. The European Commission has also stated that on current trends, the 5.75% objective by 2010 will also not be achieved, and that its attainment needs more political willpower.[8]

In the United Kingdom, the Government provided for the enactment of a Renewable Transport Fuels Obligation (RTFO) in the *Energy Act 2004*. On 10 November 2005, the Government announced the introduction of such an obligation for the UK. The RTFO will

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5 US Department of Energy / US Department of Agriculture, *Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply*. See: http://feedstockreview.ornl.gov/pdf/billion_ton_vision.pdf, Accessed September 2006.

6 United States White House, National Economic Council, *Advanced Energy Initiative*, February 2006, at 5.

7 United States Renewable Fuels Association, From Niche to Nation. Ethanol Industry Outlook 2006, at 2. See: http://www.ethanolrfa.org/objects/pdf/outlook/outlook_2006.pdf, accessed September 2006.

8 European Commission, *New and Renewable Energies*, See: http://ec.europa.eu/energy/res/sectors/bioenergy_en.htm, Accessed September 2006.

obligate all fuel suppliers to include at least 5% biofuels by volume in their market mix by 2010 along with fossil-derived fuels. In April 2006 the UK Government announced the obligation will be introduced in 2008 with an obligation of 2.5% biofuels in 2008-2009, 3.75% in 2009-2010, reaching 5% for 2010-2011. The fuel may be supplied as either 5% blends that can be used in any vehicle, or as higher blend fuels as vehicle technology and warranties allow.[9]

3.0 THE AUSTRALIAN FUEL MARKET

In 2003-04, Australian demand for transport fuels was about 42,500 ML. Total demand is growing at one to two percent a year. The key product components in 2003-04 were:

Product Components of Australian Transport Fuel Demand

Automotive gasoline	47% or 19,962 ML
Automotive diesel	34% or 14,462 ML
Jet fuel	10% or 4,329 ML
LPG	6% or 2,547 ML
Others, incl lubricants	3%, or 1,200 ML.

Source: Australian Government Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 30.

The Biofuels Taskforce reported that there are three commercial Australian producers of fuel ethanol: the Manildra Group; CSR Distilleries; and the Rocky Point Sugar Mill and Distillery. Fuel ethanol production capacity was an estimated 75 ML pa, with Manildra accounting for 90% of this. However, fuel ethanol production in Australia has fallen from an estimated 75 ML in 2002-03 to 23 ML for 2004-05, less than 0.1% of the automotive gasoline market in Australia. As explained later in this paper, the Commonwealth Government's Biofuels Capital Grants program has provided funding for three ethanol production facilities with production capacity of 77.6 ML.

4.0 THE BIOFUELS

4.1 Ethanol

Ethanol is an alcohol made by fermenting and distilling simple sugars. It can be manufactured from:

- Biomass via the fermentation of sugar derived from grain starches of many crops including wheat wastes and sugar cane;
- Biomass via the use of the cellulose component of crops; and
- Petroleum and natural gas.

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[9] British Sugar, *UK Renewable Transport Fuel Obligation*, See: http://www.britishbioethanol.co.uk/RVEd44f7868845343bdbd91f9f9416b3e6f,,.aspx, accessed September 2006.

Ethanol can be used for a variety of purposes, including as a beverage, in industrial applications and as a fuel. While ethanol can be produced from a variety of feedstock, it is predominantly produced from agricultural sources, such as waste starch, C molasses, corn, sorghum and feed wheat. The next generation of technology involves ethanol production from cullulosic feedstocks such as crop waste, grasses and trees. This technology, whilst not yet commercially proven, promises to allow ethanol to be produced more economically, with significant reductions in life-cycle carbon dioxide emissions than current processes, from a more widely available feedstock.[10]

Ethanol can be produced in two forms – hydrated and anhydrous. Hydrated ethanol has a purity of 95 per cent, suitable for blending as a 15 per cent emulsion in diesel that is known as diesohol. A second stage refining process is required to produce anhydrous ethanol (100 per cent purity) for use in ethanol blends in petrol. Anhydrous ethanol can be used as an additive in petrol, or as a fuel in its own right. For instance, as an automotive fuel in Brazil it is usually composed of 85 per cent ethanol with 15 per cent petrol (E85). The addition of the petrol improves the ignitability of the alcohol. Most common around the world is the use of 10 per cent ethanol, known as petrohol or E10.[11]

Anhydrous ethanol is typically blended at up to 10% volume in petrol for use in most unmodified engines. When ethanol is blended into fuels at levels above 10% volume, some engine modifications may be necessary, although the exact ethanol percentage at which modifications are required varies according to materials used in different fuel systems. The government has established a 10% limit for ethanol in petrol. This limit came into force on 1 July 2003 with an amendment to the fuel quality standard.

The Characteristics of Alcohol Fuels

Ethanol is an alcohol which contains 34 per cent by weight of oxygen. In contrast, petrol and diesel are both mixtures of a range of hydrocarbons, none of which contain oxygen. The addition of ethanol to conventional petrol or diesel (in blended fuels), affects the fuel characteristics, including combustion properties, energy content and vaporisation potential.

The energy content of ethanol fuel blends is lower than for the base fuels. This is because the energy content of ethanol is lower than for petrol or diesel. The octane rating of a fuel refers to the tendency of the fuel to self-ignite (knock) during engine combustion. Engine knock occurs when the fuel ignites in the compression stroke prior to application of the spark and can lead to engine damage. The higher the octane rating, the greater the knock resistance of the fuel and the higher the compression ratio that can be used resulting in increased engine efficiency. Ethanol is one of a number of compounds that may be used in petrol as an oxygenate and octane enhancer. The addition of ethanol also increases the volatility of petrol, which has the negative effect of increasing evaporative hydrocarbon emissions.

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10 Australian Government Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 30.

11 Commonwealth of Australia, *Appropriateness of a 350 million litre Biofuels Target*. Report to the Australian Government Department of Industry, Tourism and Resources, December 2003, at 60.

In terms of fuel consumption, Table 1 compares fuel consumption for conventional petrol and E10 petrol.

Table 1 Fuel Consumption of Petrol and E10 Fuelled Vehicles

	Mean Fuel Consumption (L/100km)		
	City Fuel	Hwy Fuel	NAFC
Pre-1986 Car, Petrol	12.6	9.1	11.0
Pre-1986 Car, E10	12.7	9.3	11.2
Post – 1986 Car, Petrol	12.1	8.8	10.6
Post -1986 Car, E10	12.5	9.0	10.9

NB: NAFC – National Average Fuel Consumption calculated using 55/45 city/hwy ratio. In 1986, new cars were required to have a catalytic converter installed.

Source: Commonwealth of Australia, *Appropriateness of a 350 million litre Biofuels Target*. Report to the Australian Government Department of Industry, Tourism and Resources, December 2003, at 67.

Table 1 shows that cars powered using E10 fuel have a slightly greater fuel consumption than conventional petrol. This is because ethanol has a lower energy content than straight petrol, which results in an increased fuel consumption of about 2 per cent.

E10 Tailpipe Emissions

Cars emit a range of exhaust emissions, including: regulated pollutants; greenhouse gases; air toxics; and particulate matter. The only significant Australian study into the emissions effect of E10 fuel was conducted in 1998 by APACE Research, in conjunction with the NSW Environment Protection Authority. The Biofuels Taskforce noted that there are five atmospheric issues on which it is difficult to make firm statements in relation to the environmental performance of ethanol (used as E10) because past studies have produced conflicting results. These are:

- Vehicle emissions of particulates;
- Ozone forming potential of ethanol blended fuels;
- Vehicle emissions of air toxics;
- Vehicle emissions of methane and nitrous oxide;
- Full fuel-cycle greenhouse gas emissions.

Greenhouse Gases

Of the greenhouse gases emitted in the vehicular exhaust, carbon dioxide is by far the largest mass emission. The tailpipe emissions of carbon dioxide show increases of between 1.8 and 4.8 g/km of carbon dioxide for vehicles using petrohol, relative to the base petrol. Other greenhouse gases, including nitrogen dioxide and methane, are also important. However, the term 'carbon dioxide equivalent' is used as the measure of the total greenhouse gas emissions. According to the Kyoto Protocol, the carbon dioxide equivalent of the renewable energy component of transport fuels can be removed from the total carbon dioxide equivalent due to the carbon dioxide sequestered during crop growth. Hence net carbon dioxide equivalent emissions from vehicles powered by E10 are less than conventional fuel, as shown in Table 2 below.

Table 2: Net Carbon dioxide equivalent emissions g/km from vehicles with petrol and petrohol/E10.

	Net carbon dioxide equivalent (using city cycle fuel consumption)
Pre 1986 Petrol	261.4
Pre 1986 E10	239.5
Post 1986 Petrol	289.6
Post 1986 E10	272.8

Source: Commonwealth of Australia, *Appropriateness of a 350 million litre Biofuels Target*. Report to the Australian Government Department of Industry, Tourism and Resources, December 2003, at 73.

In general, on a fuel life cycle basis, there can be greenhouse gas savings of up to 5 per cent from the use of E10. The Biofuels Taskforce concluded that on a life-cycle analysis, savings in greenhouse gas emissions from E10 over neat petrol are generally from 1 – 4 percent, depending on feedstock. However, it also noted that a recent life-cycle analysis for a proposed ethanol plant has suggested that savings of between 7 and 11.5 percent can be achieved with optimum use of non-ethanol co-products.

The Biofuels Taskforce found that the consumption of 350 ML of biofuels (148 ML ethanol, 202 ML biodiesel), would result in a reduction of total greenhouse emissions in 2010 of approximately 442,000 tonnes. The Taskforce concluded that for all practical purposes, the present value of the economic and environmental benefits that flow to Australia from the mitigation of around 442,000 tonnes of greenhouse gas emissions in 2010 to be immeasurably small.[12]

In terms of emissions of regulated pollutants, carbon monoxide, nitrous oxides and total hydrocarbons, the impacts of ethanol were: significant decrease in carbon monoxide emissions; reduced hydrocarbon emissions; and no discernible effect on nitrogen oxides for pre-1986 vehicles with a minor increase in nitrogen oxides for post 1986 vehicles. In regard to aldehydes and air toxics, the NSW EPA study found with the use of E10 fuel: 13 per cent decrease in benzene; 6 per cent decrease in 1,3-butadienne; 19 per cent increase in formaldehyde; and 159 per cent increase in acetaldehyde. When these results are combined into an air toxics index, the use of E10 reduces the value of the index (on a per kilometre basis) by 17 per cent.

Evaporative Emissions

Evaporative emissions from petrol fuelled vehicles can form a significant proportion of total hydrocarbon emissions, which can affect ozone formation and the levels of air toxics. Evaporative emissions are fuel and oil vapours that are released by the vehicle prior to combustion. The factors that affect evaporative fuel emissions are: fuel volatility; ambient temperature; driving conditions; and vehicle specific factors. Reactive hydrocarbons in the atmosphere react with oxides of nitrogen and sunlight to form ozone, a major constituent of smog.

The addition of ethanol to petrol increases the fuel blend volatility, which leads to

12 Australian Government Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 99.

increased evaporative emissions. Limited studies exist, particularly in Australia, which have quantified evaporative vehicle emissions. However, US studies have shown that higher evaporative emissions occur from ethanol blended fuels, relative to petrol, and that these have resulted from the higher vapour pressure and differences in distillation characteristics of the fuel. What this means, in terms of the impacts of E10 on ozone formation, is less clear.[13] In 2004 the NSW Department of Environment and Conservation commissioned CSIRO to examine the impact on air quality of the introduction of E10 into Sydney. The CSIRO study showed both increases and decreases in modeled ozone concentrations, depending on the meteorological conditions, demonstrating the complexity of ozone formation. The Biofuels Taskforce noted, assuming robust CSIRO modelling, that it is reasonable to conclude that ozone formation arising from waived Reid Vapour Pressure limits associated with E10 blends is not currently a concern in Sydney.[14]

Particulates

The 2003 350 ML Target Report concluded that the use of ethanol as E10 in fuels is not expected to significantly alter tailpipe emissions of particulate matter. However, studies from the United Kingdom and the United States have indicated that the addition of ethanol to fuel can reduce particulate mass emissions by up to 46 percent. The Biofuels Taskforce concluded that experimental work should be carried out to evaluate the impacts of E10 and E5 on particulate matter emissions from petrol vehicles under Australian conditions.

The Effect of Ethanol on Vehicle Operability

Consumer confidence in the use of fuel ethanol was damaged significantly in 2002–2003 after reports of the distribution of high-concentration (20–30%) ethanol blends around Sydney, and widely publicised allegations of vehicle damage. At the time, the Australian Automobile Association (AAA) and other consumer advocates became concerned about the potential operability and additional motoring costs associated with ethanol-blended fuels.

The addition of ethanol increases petrol's ability to hold water – and most metal components in car fuel systems will corrode or rust in the presence of water. The greater the concentration of ethanol, the greater the ability to 'hold' water. Several studies from around the world indicate that ethanol content up to 10 per cent does not increase corrosion in vehicle tanks and fuel system components in everyday operation. Pre-1986 vehicles may have fuel components that are sensitive to ethanol blends, but specific documentation on the effect of ethanol on older fuel systems is often lacking. Ethanol blends may also have a deteriorating effect on the rubber components of an engine. In older models, deposits in fuel tanks and fuel lines are occasionally loosened by E10, and the fuel filter may become plugged. This is fixed by a fuel filter change. In Brazil, cars are specifically modified to cater for the higher ethanol fuel content. Modifications include nickel plating of steel fuel lines and fuel tanks to provide corrosion protection, as well as changes in the engine calibration to ensure proper engine operation. Hence an engine calibrated for the Brazilian

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13 Commonwealth of Australia, *Appropriateness of a 350 million litre Biofuels Target*. Report to the Australian Government Department of Industry, Tourism and Resources, December 2003, at 79.

14 Australian Government Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 82.

market may not perform satisfactorily on neat petrol.[15]

The Australian Biofuels Taskforce concluded:

- Almost all post-1986 vehicles can operate satisfactorily on E10. As was known when setting the fuel standard in 2003, E10 is not optimal for vehicles that have carburettors or mechanical fuel injectors, mainly pre-1986 vehicles;

- As part of a broader campaign to assist in restoring confidence, and to assist vehicle manufacturers in determining the suitability of their vehicles for E10, further E10 vehicle operability testing is warranted;

- For post-1986 cars using E10 ULP, fuel consumption increases in the order of 2.6–2.8%. Discounted pricing strategies that reflected this would assist in encouraging uptake of ethanol-blended fuel.

In the United States, Brazil, Sweden and the United Kingdom, several automobile manufacturers are marketing vehicles that are capable of operating on various blends of fuel ranging from 100% petrol to 15% petrol with 85% denatured ethanol (E85). These vehicles are called flexible fuel vehicles (FFVs). The main differences between ethanol FFVs and petrol vehicles are the materials used in the engine and fuel management system and modifications to the engine calibration system. There are no FFVs currently available in the Australian market, given that E10 is the maximum ethanol blend allowed.[16]

4.2 Biodiesel

Biodiesel is normally produced from a reaction of vegetable oil or animal fat with an alcohol, such as ethanol or methanol, in the presence of a catalyst to yield mono-alkyl esters and glycerine, which is removed. Potential feedstocks for biodiesel include vegetable oils, animal fats and used cooking oils and fats.

The fuel properties of biodiesel depends on the type of feedstock used. Biodiesel produced from tallow, a highly saturated fat, will tend to have a higher freezing point that can inhibit cold flow properties. Data indicates that any addition of biodiesel to diesel would improve the lubricity of the biodiesel blend, whilst also increasing its biodegradability. Biodiesel also has a much higher flashpoint than petroleum diesel, which makes it safer to handle and attractive for use in mining applications.

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15 Commonwealth of Australia, Department of Environment and Heritage, *Setting the Ethanol Limit in Petrol*, 2002, at 5.

16 Australian Government Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 31.

The energy content of biodiesel varies depending on the feedstock and production process. Compared with diesel, the energy content of biodiesel varies between 88% and 99% of diesel.

Biodiesel is used in conventional diesel engines. Subject to the manufacturer's advice, it can be used as a direct replacement or blended with petroleum based diesel fuel.

Biodiesel has only recently been made commercially available in Australia. There are 10 licensed producers of biodiesel, who collectively produced about 1 ML in 2003-04 and 4 ML in 2004-05. Current biodiesel capacity is estimated to be around 15.5 Ml per annum. Other biodiesel projects that have been proposed could, in theory, add 508 ML of biodiesel over the short to medium term. Four projects are being supported by the Commonwealth Government Biofuels Capital Grants Program, with the potential to produce 157 ML of biodiesel.

The bulk of biodiesel production in Australia is sold in blends of 20% or less with petroleum diesel. B5 is a blend of 5% biodiesel with 95% petroleum diesel, and B20 is a blend of 20% biodiesel and 80% petroleum diesel. A number of local governments have trialled biodiesel at B100 and B20 in garbage trucks and other diesel vehicles. A key market for biodiesel may be through the sale of biodiesel blends in bulk to centrally fuelled fleets and straight biodiesel in sensitive marine environments. Internationally, most biodiesel is sold as blends.[17]

Biodiesel Tailpipe Emissions

The present standard for diesel is referred to as ultra low-sulphur diesel (sulphur <50 ppm), and this will change to extra low-sulphur diesel (sulphur <10 ppm) from 1 January 2009. The Biofuels Taskforce reported that for rigid trucks, greenhouse gas emissions results were:

- B100 from waste cooking oil produces 90% less greenhouse emissions than extra low-sulphur diesel;
- Biodiesel from tallow or canola reduces emissions by 23% and 29% respectively;
- There are negligible benefits for canola or tallow derived B5 compared to extra low-sulphur diesel, though waste cooking oil achieves a 35 reduction.

The Taskforce concluded that there is insufficient data to assess the air toxic emissions from biodiesel, and that the only significant negative impact of biodiesel blends on air quality is the increased tailpipe emissions of nitrous oxides, which could contribute to an increase in ozone production.[18]

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17 Commonwealth of Australia, Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 39.

18 Commonwealth of Australia, Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 90.

5.0 THE VIABILITY OF A BIOFUEL INDUSTRY IN AUSTRALIA

In July 2003, the CSIRO, jointly with the Bureau of Transport and Regional Economics and the Australian Bureau of Agricultural and Resource Economics, were asked to investigate the appropriateness of maintaining the Government objective that biofuels contribute at least 350 million litres to the total fuel supply by 2010. The main conclusions of that report were:

- The costs of implementing a policy of assisting the Australian biofuels industry to meet a 350 ML biofuels target were estimated to significantly exceed the benefits;
- Ethanol produced from waste starch and biodiesel produced from used cooking oil both appeared to be economically viable without government assistance;
- Ethanol produced from molasses and cereal grains and biodiesel produced from tallow or oilseeds would require substantial and ongoing government assistance to be viable;
- Assistance to the biofuel industry would generate some benefits in terms of health (via improvements in air quality), reductions in greenhouse gas emissions and regional employment opportunities. However, in all cases, these benefits were found to be small and varied with biofuel source, production practices and utilization circumstances.[19]

The Biofuels Taskforce requested ABARE to update the 2003 review, and report on the viability of biofuels. An important component of assessing the viability of biofuels is to determine the price at which they can be sold. This is determined by the prices of fuels set in the traditional petroleum fuel markets – ie, by the prices of the fuels that biofuels would replace. Australian producers and consumers of oil are price takers in the global oil market. Whilst the price of crude oil has more than doubled over the last four years, ABARE's current forecast is for a gradual easing in oil prices over the short and medium term. In any analysis, ABARE has to forecast both international oil prices and the Australian exchange rate. Hence any forecast is subject to some uncertainty. Nevertheless, ABARE has forecasted that the ex refinery price of unleaded petrol from 2009-10 onwards would be A39 cents/litre, whilst the benchmark price for diesel is estimated to be A41 cents/litre.

ABARE estimated that the threshold prices available to biofuel producers are 38 cents/litre for ethanol, and 52 cents/litre for biodiesel sourced from used cooking oil in 2015-16 (and 55 cents/litre for biodiesel sourced from tallow).

In the longer term, the net required revenue for fuel ethanol production is estimated to be 36 cents/litre. For C molasses, the long term net required revenue is estimated to be 33 cents/litre. When compared to the threshold price of ethanol of 38 cents/litre, fuel ethanol production is assessed as being able to compete against petroleum based fuels in the medium to long term.

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19 Short,C and Riwoe, D., *Biofuels: An Assessment of their Viability*. ABARE Report to the Biofuels Taskforce, Canberra, July 2005, at 6.

The net required revenue for biodiesel in 2015-16 is estimated to be 56 cents/litre for used cooking oil and 66 cents/litre for tallow based production. With an estimated threshold price of 55 cents/litre, tallow based biodiesel production is not viable in the long term. For used cooking oil, although operating costs would be covered, the returns available would be insufficient to warrant new investment in the long term.[20]

The ABARE report concluded that biofuel production is only commercially viable through the provision of large and ongoing industry support. This support causes an economic loss through both the reduced efficiency (of using more costly transport fuels and the need to bid resources away from productive activities elsewhere in the economy), as well as the impact of increased taxes or reduced government expenditure on services, which is required to fund the subsidy. ABARE concluded that the government target of 350 ML of biofuel production, with the government subsidies, would decrease gross domestic product by $90 million in 2010.[21]

The Biofuels Taskforce concluded that:

- consumer confidence remains a serious impediment to the uptake of ethanol and the longer this inhibits uptake and capacity expansion, the shorter the fuel tax concession window becomes;
- biofuels are an emerging market with growth likely to be incremental from a low base;
- biofuel plants would need to be constructed and operating as soon as possible to capture sufficient benefits during the fuel-tax concession period to generate acceptable rates of return on capital—most biofuel plants, however, still require capital and supply contracts to proceed;

import competition will have an effect on domestically produced ethanol from 1 July 2011. The impact of this will depend on the relative competitiveness of imported ethanol compared with domestically produced ethanol. The Taskforce noted the world ethanol price in April 2005 was about US120c/gallon or $A0.42 (based on an exchange rate of 0.75 and 3.78 litres to the gallon), which is well below the mid $A0.60-plus that Australian fuel ethanol producers are understood to be seeking for their product (even accounting for additional transportation costs).[22]

6.0 FUEL EXCISE REFORMS

On 16 December 2003, the government announced new arrangements for applying fuel tax to all fuels used in internal combustion engines. These new arrangements involved the

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20 Short,C and Riwoe, D., *Biofuels: An Assessment of their Viability*. ABARE Report to the Biofuels Taskforce, Canberra, July 2005, at 3.

21 Short,C and Riwoe, D., *Biofuels: An Assessment of their Viability*. ABARE Report to the Biofuels Taskforce, Canberra, July 2005, at 5.

22 Commonwealth of Australia, Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 114.

application of fuel tax on an energy-content basis to all fuels used in transport applications. Fuel tax rates for fuels were based on energy content, with four broad fuel tax bands:

- a high energy content band of 38.143c/L;
- a mid energy content band of 25c/L;
- a low energy content band of 17c/L; and
- a fourth fuel tax category dealing with certain other fuels at a rate of 38 cents per cubic metre.

At this time, the government also announced that alternative fuels would receive a 50% discount on energy-content fuel tax rates on the basis of a range of industry, regional and other factors. In March 2004, the government further announced that the introduction of effective fuel tax on alternative fuels would be postponed from 1 July 2008 to 1 July 2011, and apply in five equal, annual steps to reach the final rates on 1 July 2015. The transition arrangements were extended to provide more time for existing fuel producers (including the LPG industry) and users to adjust, and for new transport fuels (such as biofuels, compressed natural gas and liquefied natural gas) to establish their credentials in the market.[23]

Fuel ethanol and biodiesel are currently both, in effect, fuel-tax free. Fuel tax of 38.143c/L is applied to both, but domestically produced ethanol and imported and domestically produced biodiesel receive equivalent production grants—offsetting fuel tax until 1 July 2011, when effective fuel tax will begin to be applied incrementally to these fuels. The final fuel tax rates (net of production grants) will be 12.5c/L for fuel ethanol and 19.1c/L for biodiesel in 2015 (a 50% discount to the full energy content fuel tax rates).

From 1 July 2011, imported ethanol and domestically produced ethanol will be treated equivalently, opening domestically produced ethanol to full international competition. The Taskforce noted that ethanol can be exported from Brazil at considerably lower prices than Australian ethanol is sold. Unless the Australian product becomes significantly more cost competitive, the Taskforce concluded that much of the Australian consumption of fuel ethanol will be supplied from overseas.

The phase-ins of effective fuel tax and applicable fuel tax rates for alternative fuels are detailed in Table 3.

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[23] Commonwealth of Australia, Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 45.

Table 3 Effective fuel tax rates for alternative fuels at 1 July, 2003 to 2015 (cents/L)

	Ethanol			Biodiesel		
Year	Fuel tax	Production grant	Effective tax	Fuel tax	Production grant	Effective tax
2003	38.143	38.143	**0.0**	38.143	38.143	**0.0**
2004	38.143	38.143	**0.0**	38.143	38.143	**0.0**
2005	38.143	38.143	**0.0**	38.143	38.143	**0.0**
2006	38.143	38.143	**0.0**	38.143	38.143	**0.0**
2007	38.143	38.143	**0.0**	38.143	38.143	**0.0**
2008	38.143	38.143	**0.0**	38.143	38.143	**0.0**
2009	38.143	38.143	**0.0**	38.143	38.143	**0.0**
2010	38.143	38.143	**0.0**	38.143	38.143	**0.0**
2011	38.143	35.643	**2.5**	38.143	34.343	**3.8**
2012	38.143	33.143	**5.0**	38.143	30.543	**7.6**
2013	38.143	30.643	**7.5**	38.143	26.743	**11.4**
2014	38.143	28.143	**10.0**	38.143	22.843	**15.3**
2015	38.143	25.643	**12.5**	38.143	19.043	**19.1**

7.0 BIOFUELS CAPITAL GRANTS PROGRAM

To encourage new entrants into the biofuels industry, the Commowealth government announced on 5 July 2003 that it would provide up to $37.6 million to fund a capital subsidy for projects that provide new or expanded biofuels capacity. The subsidy will be provided at a rate of 16c/L of additional capacity to viable projects producing a minimum of 5 ML of biofuels, and will be limited to $10 million per project.

On 22 June and 23 December 2004, the Minister for Industry, Tourism and Resources, the Hon. Ian Macfarlane MP, announced the successful applicants under the two rounds of the program. With these announcements, program funding was fully allocated. Successful grantees were:

- CSR Distilleries Operations for an ethanol plant at Sarina, Queensland ($4.16 million for 26 ML);
- Biodiesel Industries Australia for a biodiesel plant at Rutherford, New South Wales ($1.28 million for 8 ML);
- Schumer Pty Ltd (Rocky Point Sugar Mill and Distillery) for an ethanol plant at Woongoolba, Queensland ($2.4 million for 15 ML);
- Biodiesel Producers Ltd for a biodiesel plant at Barnawatha, Victoria ($9.6 million for 60 ML);
- Australian Renewable Fuels Pty Ltd for a biodiesel plant in Port Adelaide, South Australia ($7.15 million for 44.7 ML);

- Riverina Biofuels Pty Ltd for a biodiesel plant at Deniliquin, New South Wales ($7.15 million for 44.7 ML);
- Lemon Tree Ethanol Pty Ltd for an ethanol plant at Millmerran, Queensland ($5.85 million for 36.6 ML).

Given this grant distribution**,** the program is potentially supporting an additional 235 ML of biofuels production capacity (157.4 ML biodiesel and 77.6 ML ethanol).

The Taskforce notes that the program decisions to fund biofuel plants were made, at least in part, before the announcement of the full package of the government's fuel taxation reforms and before the release of detailed information outlining the proposed implementation path for these reforms. Whilst reforms were announced in the energy white paper in June 2004, detailed implementation plans were not available until May 2005 in the Treasury discussion paper. As noted above, the Taskforce considers that, due to their complexity and staged announcement, several biofuel project proponents may not have factored in the full implications of fuel taxation reform and the commercial impact of these reforms on their project's viability.

ABARE's July 2005 viability assessment indicates that biodiesel produced from used cooking oil and tallow, although able to make reasonable rates of return in the period to 2015, is unlikely to be commercially viable in the longer term. The Biofuels Taskforce noted that three of the successful biodiesel projects, comprising 95% of the 157 ML of biodiesel funded under the Biofuels Capital Grants Program, are planning to use tallow as their primary feedstock. At this stage, and in the light of the announced changes to fuel taxation, it is unclear how many of these projects will be viable in the longer term and proceed.

8.0 THE REGIONAL IMPACTS OF ETHANOL PRODUCTION

The Centre for Agricultural and Regional Economics (CARE) has performed several studies on the potential regional impact of ethanol production. One study investigated ethanol production in regional NSW. A summary of their case studies is shown below:

Potential Regional Impacts of Ethanol Production in NSW

	Richmond – Tweed	**Gwydir**	**Illawarra, Nowra**
Feedstock	Forest residues	Cereal residues	Wheat starch
Plant capacity (million litres)	50	50	80
Permanent direct jobs	34	34	6
Permanent flow on jobs	288	125	357
Multiplier	8 (approx)	4 (approx)	60 (approx)
Major flow-on industries	Harvesting, hauling of materials	Transport, trade etc	Flour products processing
Construction – direct	49	58	68

jobs			
Construction – flow on jobs	63	64	87

Source: Commonwealth of Australia, *Appropriateness of a 350 million litre Biofuels Target*. Report to the Australian Government Department of Industry, Tourism and Resources, December 2003, at 156.

The underlying assumption in all three cases is that the waste feedstock sources have no economic value, and this is critical to the study's results. The variation in impact is due to differences in plant size, source and cost of feedstock, and the economic structure of the regional economy. On the basis of this report, CARE concluded that: "any region where there is ready availability of residues could establish an ethanol plant and gain economic benefits. Potentially, some 30 plants could be established in regional areas of NSW".[24]

Various proponents have put forward the following largely unquantified regional benefits regarding biofuel plants:

- Revitalisation of stressed regional and rural communities;
- Increased investment and jobs in rural and regional Australia;
- More stable regional employment;
- Economic revival in rural and regional Australia;
- Increased value added to agricultural crops;
- Product / crop diversification for farmers, making farmers less exposed to global commodity price fluctuations and other shocks;
- Alternative and stable income for growers (through fixed supply agreements that would provide a guaranteed market and price for a set volume of product);
- More diverse regional industry base;
- Regional infrastructure enhancement and maintenance.

As it is generally accepted that the costs of transporting raw feedstock to an ethanol plant are greater than the cost of transporting biofuels, biofuel plants are generally located close to feedstock supplies. Analysis has suggested that the most viable sources of feedstock for biofuel production include: C molasses; waste starch; waste cooking oil; and sorghum / feed wheat. As a result, rural sugar growing areas in northern Queensland and grain growing areas in Queensland and northern and southern NSW are the most likely locations for biofuel plants. Existing biofuel facilities are:

- Nowra, using waste starch (Manildra);
- Sarina (northern Queensland) using C molasses (CSR);
- Moama (southern NSW) using canola (Biofuel Australia); and
- Maitland, using cooking oil (Biodiesel Industries Australia) – opened in March 2003.

[24] Commonwealth of Australia, *Appropriateness of a 350 million litre Biofuels Target*. Report to the Australian Government Department of Industry, Tourism and Resources, December 2003, at 156.

The regional impact of a new biofuel facility will vary depending on many interrelated factors, including:

- Feedstock type – source and cost determines technology, labour and capital requirements;
- Size of plant – generally the larger the plant the larger the impact;
- Other plant features – eg, existence of different by-products such as high protein meals or fertilisers, which create differing employment impacts and other linkages within the regional economy;
- Technology used – capital intensiveness, whether it is local or imported or if specialist skills are required to maintain it;
- Size of town, region – larger towns/regions tend to be more diverse, able to supply more inputs locally and therefore capture more flow-on benefits;
- Extent to which plant inputs can be locally sourced rather than imported from another region;
- Existence and extent of any unemployed labour – determines whether the impact is actually new employment versus a transfer of existing employment from elsewhere.

In conclusion, the major benefits of an active biofuels industry can be summarised as:

- Strengthened regional economic opportunities – increased employment, investment, income, output etc;
- Greater regional capability to withstand structural change due to a more diverse economic base;
- Improved social outcomes, such as increased community confidence, social cohesion, social capital etc.

The estimates of direct employment impacts per ethanol plant are reasonably consistent at around 30-40 jobs, with indirect flow-on employment impacts generally similar in the range of 180 to 200 jobs. Construction employment varied widely from around 60 to 500. Multipliers used to estimate indirect impacts varied considerably from 2 to 60, but were most commonly around the 5 to 6 range. Government expenditure per direct job in 2010 is estimated to be between $210,000 and $303,000, with expenditure per total jobs (direct and indirect) estimated to be in the range of $70,000 to $101,000.[25]

Examining the likely effect on regional employment, the 2003 350 ML Target Report reviewed a number of Australian and US studies and concluded that a new ethanol plant with a production capacity of around 50–60 ML a year would provide around 30–40 ongoing direct jobs per plant. In estimating the number of indirect jobs generated, the Australian and US studies used a wide range of multipliers, 5–6 being the most common. Based on the size of the multipliers typically used in general equilibrium models, however, which take account of inter-regional effects, the 2003 350 ML Target Report suggested that a multiplier of around two would be more reasonable when estimating the number of indirect jobs generated, in a situation of relatively low unemployment.
The 2003 350 ML Target Report assumed that the additional production of biofuels

[25] Commonwealth of Australia, *Appropriateness of a 350 million litre Biofuels Target*. Report to the Australian Government Department of Industry, Tourism and Resources, December 2003, at 164.

required to meet the 350 ML target would be provided by four regional ethanol producing plants. New biodiesel plants were assumed to be located in urban rather than regional areas, on the argument that the feedstock most likely to be used would be used cooking oil sourced from urban areas. Based on the number of direct jobs per plant estimated from the Australian and US studies, a multiplier of two, and a requirement for four new regional plants, the 2003 350 ML Target Report estimated that a total of 432 new jobs, (144 direct and 288 indirect) would be created in regional areas from an assisted biofuels industry.

ABARE revised these estimates for the Biofuels Taskforce in July 2005. It estimated that if the projects that have been successful to date in the Capital Grants Program all proceed, the number of ongoing direct jobs generated by these projects could be in the vicinity of 216 (assuming an average of 36 jobs per plant). If a multiplier of two is assumed, the number of indirect jobs created could be 432, and the total number of jobs, 648.

Examining the likely costs of a subsidised biofuels industry, the 2003 350 ML Target Report concluded that subsidising a biofuels industry in a particular region could:

- distort markets and lead to inefficient outcomes, reduced employment and economic activity in other regions
- compete directly and unfairly with other industries using the same inputs and those industries producing competing products (including by-products)
- lead to the promotion of unsustainable development
- represent an expensive, inefficient and indiscriminate approach to achieving regional policy development goals.

Another issue for consideration is the effect of the grain based ethanol industry on the price of feed grains for livestock. For instance, the Livestock Feed Grain Users Group stated:

> We are opposed to the ongoing subsidization of grain based ethanol in Australia; this will disadvantage our grain dependent industries, and result in the propping up of an essentially non-viable industry at the expense of successful industries. …
>
> … Our industries are major employers, and wealth creators, in regional Australia. Subsidy induced diversion of grain to ethanol manufacture, taken with grain import restrictions and a highly variable climate, jeopardizes our access to feed grains across a range of seasons.[26]

The Biofuels Taskforce noted that under current policy settings, the high rates of return that could be obtained by the subsidised fuel ethanol industry in the short term would allow it to bid strongly against the livestock industry for grain feedstock where necessary. The 2005 ABARE report suggests that, under average seasonal conditions and at around the target level of 350 ML biofuels, fuel ethanol feedstock demands are likely to be met by redirected grain exports, with no significant effect on domestic price.

However, a full-scale sorghum-to-ethanol plant would try to source about 200,000 tonnes p.a. of sorghum from its locality. The probability that the locality would not have such a

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26 Livestock Feed Grain Users Group, *Submission to the Senate Rural and Regional Affairs Transport Committee Inquiry into Fuel Issues*, 23 February 2006.

surplus is high. Accordingly, the local price may increase as freight costs from further afield get built in and/or growers shift from other crops to sorghum to get a premium driven by the ethanol plant's subsidies. Either way, a feedgrain user in the locality may pay more for feedgrain. In poorer than average seasonal conditions, this would be exacerbated.[27]

A study by the Centre for International Economics for the Australian Beef Industry concluded that the mandatory blending of ethanol at 10 percent for petrol and 15 percent for diesel would permanently increase the average price of grain in Australia by over 25 percent. By 2010, ethanol production would demand an additional 12.1 million tonnes of grain. This is relative to a potential pool of feedgrain of around 28 million tonnes in 2010. If grain production fell by 50 percent in 2010 as it did in 2002-03, total availability of grains would fall to around 14 million tonnes. In response grain prices would rise dramatically, and have the potential to shut down parts of the beef and dairy export industries. The report concluded that in a non-drought year, mandatory blending of locally produced ethanol would lead to a reduction in imports of petrol and diesel of around $1.3 billion (at a US$40 per barrel price of oil). However, the economy would forego exports (of grains redirected to domestic ethanol production) valued at around $2.1 billion and incur additional imports of $380 million to achieve this saving.[28]

Shell Australia has acknowledged that biofuels commercially produced from food crops will lead to pressure on food stocks and prices. This is one of the reasons that Shell internationally is developing '2nd generation' biofuels using feedstocks from wood, straw and paper by-products.[29]

The Biofuels Taskforce concluded 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.[30]

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27 Commonwealth of Australia, Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 116.

28 Centre for International Economics, *Impact of ethanol policies on feedgrain users in Australia. Prepared for MLA on behalf of the Australian Beef Industry*. August 2005.

29 Shell Australia, *Submission to the Senate Rural and Regional Affairs and Transport References Committee Inquiry into Future Oil Supply and Alternative Transport Fuels*. March 2006, at 13. See: www.aph.gov.au, Accessed August 2006.

30 Commonwealth of Australia, Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 116.

9.0 ENERGY SECURITY IMPLICATIONS OF INCREASED BIOFUELS USE

One argument put forward in support of a greater role for biofuels in Australia is that of energy security. For instance, the company Renewable Fuels Australia stated:

> Globally there is now recognition that as a finite and nonrenewable resource, oil is approaching a point where demand exceeds available supply. … With the advent of the current oil crisis in 2003-04, and the inherent uncertainties about the capacity of major oil companies and oil producer companies to meet future crude oil demand, biofuels have witnessed an unprecedented surge in development and investment growth.[31]

Potential energy security benefits of a greater biofuels industry have been identified as:

- a greater level of energy security from a physical supply perspective as a result of indigenous biofuels production extending fuel supplies and helping to reduce dependence on imported petroleum;
- indigenous biofuels production providing greater fuel diversity (and therefore lower risk) in both the source of, and type of, transport fuels used in Australia;
- a greater level of energy security in an economic sense as a result of indigenous biofuels replacing imported oil and hence lowering the cost of oil imports and assisting to offset higher costs from a balance of trade perspective;
- indigenous biofuels helping to offset the impact of greater reliance on imported oil, and higher world oil prices, on domestic petroleum prices faced by the consumer.[32]

However, the Australian Institute of Petroleum has questioned:

- whether or not biofuels have a meaningful role in increasing supplies of liquid fuels in a situation when crude oil and/or petroleum product supplies are curtailed;
- whether or not biofuels have a meaningful role in reducing price spikes in crude oil and petroleum product prices;
- whether or not biofuels have a meaningful role in replacing crude oil supplies as crude production declines in Australia and elsewhere;
- whether or not biofuels have a meaningful role in reducing the import bill for crude oil and imported petroleum products and hence the national balance of payments.[33]

The Biofuels Taskforce reviewed these arguments in the context of the Commonwealth

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31 Renewable Fuels Australia, *Submission to the Senate Rural and Regional Affairs and Transport Committee*, 25 July 2006. See: www.aph.gov.au, accessed August 2006.

32 Commonwealth of Australia, Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 120.

33 Commonwealth of Australia, Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 120.

Governments energy White Paper, *Securing Australia's Energy Future*, released in June 2004. The White Paper concluded that Australia has a high level of energy security due to its:

- natural endowment of crude oil, vast coal and gas reserves;
- potential for renewable energy, and access to imported fuels;
- extensive infrastructure to deliver power, gas and transport fuels to business and households;
- good access to world markets.

The White Paper also concluded that the level of security in transport fuels was not under threat. A July 2006 update of the White Paper did not change these conclusions.[34]

The Biofuels Tasforce noted that biofuels currently contribute less than 0.1% of the automotive gasoline and diesel fuel market in Australia. If the 350 ML biofuel target is achieved by 2010, the contribution rises to around 1%. Biofuels are not cost-competitive compared with conventional fuel alternatives and are expected to continue to require substantial and ongoing support to maintain their production and use. Therefore, achieving a level of biofuels production and use high enough to make a meaningful contribution to energy security (whether through excise subsidies or higher costs to consumers imposed through a mandate arrangement) would impose significant economic costs which would not seem to be justified, given the government's assessment of energy security. It was argued by the Taskforce that were the government to consider there is a need to purchase a higher level of fuel energy security, the cost-effectiveness of developing biofuels as a strategy to increase fuel security would need to be considered against other options, such as developing other alternative fuel sources/technologies (such as coal to liquids; shale oil or gas to liquids), oil stockpiles and measures to encourage greater fuel-efficiency.

On this basis, the Taskforce supported the findings of the energy White Paper conclusion that 'there is currently no case for the government to accelerate the uptake of these fuels on energy security grounds'.[35]

10.0 CONSUMER CONFIDENCE IN BIOFUELS

Consumer confidence in biofuels, and principally ethanol, was damaged significantly in 2002–2003 after reports of the distribution of high-concentration (20–30%) ethanol blends around Sydney, and widely publicised allegations of vehicle damage. Motoring organizations voiced their concerns about potential vehicle operability problems and other costs. In response, a 10% ethanol limit was announced by the Commonwealth Government on 11 April 2003 and came into force on 1 July 2003 as an amendment to the fuel quality

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34 Commonwealth of Australia, *Securing Australia's Energy Future: July 2006 Update*. See: http://www.pmc.gov.au/initiatives/energy.cfm#related_reforms, accessed August 2006.

35 Commonwealth of Australia, Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 124.

standard for petrol.

The Biofuels Taskforce noted that consumer confidence remains a key barrier to the uptake of ethanol-blended fuels in Australia. Stakeholders, including representatives of the ethanol industry, oil companies and consumer groups, consider that consumer confidence needs to be addressed urgently if an Australian ethanol industry is to be further developed. For instance, Caltex Australia has stated that its research and experience shows less than half of all consumers would consider buying ethanol blended fuel if it were available. Caltex concluded that whilst the economics of ethanol blending are currently positive, selling the products to motorists remains a challenge.[36]

A key aspect of consumer confidence is clear advice on which vehicles and engines can use ethanol blends. The Biofuels Taskforce reviewed the evidence on vehicle operability on biofuel blends, and in regard to ethanol concluded:

- Almost all post-1986 vehicles can operate satisfactorily on E10. As was known when setting the fuel standard in 2003, E10 is not optimal for vehicles that have carburettors or mechanical fuel injectors—mainly pre-1986 vehicles. Drivers should seek advice from manufactures about the suitability of fuel types if they are not certain about their particular model.
- As part of a broader campaign to assist in restoring confidence, further testing could usefully validate the suitability of vehicles in the current fleet to operate on E10.
- For post-1986 fuel-injected cars using E10 ULP, fuel consumption increases in the order of 2–3%. Pricing strategies reflecting this would assist in encouraging uptake of ethanol blend fuel.
- Responsibility for consumer information about the fitness of fuel for its intended purpose rests mainly with fuel retailers and suppliers. In the light of that, the current fuel ethanol information standard could be simplified primarily to require notification that the fuel contains ethanol at up to 10%.
- Given that an even higher percentage of cars can use E5 than E10, the fuel ethanol information standard could be further modified so that labelling is required only above 5% ethanol in petrol, rather than 1% as at present. As in Europe, this would give fuel companies flexibility to use up to 5% ethanol as a fuel extender or octane enhancer, without the costs of dispensing E5 as a separate blend.[37]

Biodiesel does not have the same consumer confidence problems as ethanol blends. However, the Biofuels Taskforce noted that confidence can be fragile, and that the biodiesel industry will need to ensure that consumers are properly advised on fuel blends. Advice from engine manufacturers is that the maximum biodiesel blend for the current fleet should be no greater than 5% (B5). Manufacturers have indicated that higher blends raise

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36 Caltex Australia, *Submission to Senate Economics Legislation Committee Inquiry into the Price of Petrol in Australia*. August 2006, at 33. See: www.aph.gov.au, Accessed August 2006.

37 Commonwealth of Australia, Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 135.

significant issues involving engine performance, efficiency, emissions and warranties. The Trucking Industry Council and the Australian Trucking Association support the manufacturers' advice. The Biofuels Taskforce concluded that as B5 meets the diesel fuel standard, there is no need to label B5 blends. Labelling at higher biodiesel blends is a necessary piece of consumer information but could be relatively straightforward. In addition, the Commonwealth could work with the Australian biodiesel industry to suggest B5, B20, and B100 as the standard forms of biodiesel, in part through fuel standards for biodiesel blends.

11.0 RECENT BIOFUEL DEVELOPMENTS

In response to the release of the Biofuels Taskforce report in August 2005, the Prime Minister reaffirmed the Government's commitment to achieving a target of at least 350 ML biofuel production by 2010. Mr Howard announced that the Government will:

- demonstrate its confidence in ethanol blended fuel by encouraging users of Commonwealth vehicles to purchase E10 where possible;
- undertake vehicle testing of vehicles in the Australian market to validate their operation with E5 and E10 ethanol blends and work with the Federal Chamber of Automotive Industries to ensure that consumers receive accurate and up-to-date information;
- increase fuel quality compliance inspections to ensure ethanol blends meet fuel quality standards;
- simplify the E10 label, which inadvertently acts as a warning to consumers against using ethanol;
- subject to the results of vehicle testing, allow E5 blends to be sold without a label, as in Europe, giving fuel companies greater commercial flexibility to increase supply; and
- work with Australian fuels and transport industries to establish standard forms of biodiesel to provide certainty to the market.
- work with the States and Territories to adopt fuel volatility standards (an existing market barrier) that are transparent, nationally consistent and take full account of the latest information on the impacts of ethanol blends on air quality.[38]

On 22 December 2005 the Commonwealth released the Biofuels Action Plan, which provides annual volumetric milestones to underpin progress towards the government's target for at least 350ML of biofuel production by 2010. The Action Plan shows that the major oil companies, independents and major retailers together expect to not only meet but exceed the government's biofuels target of at least 350 megalitres by 2010. For instance,

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38 "Government support for the Biofuels Industry" *Media Release*, Hon John Howard MP, Prime Minister, 22 September 2005. See: http://www.pm.gov.au, Accessed August 2006.

on 31 March 2006 BP Australia Pty Ltd announced that it had signed contracts and a Memorandum of Understanding, and made investments that will result in the production and supply of over 200 ML of biofuels per annum by 2008.[39]

However, there has been some debate over whether the industry will achieve milestones included in the Action Plan. Renewable Fuels Australia, an organisation which represents commercial producers of ethanol and biodiesel, as well as distributors, notes that that there is uncertainty over whether the three major oil companies (BP, Caltex, Shell) will meet their declared Action Plan commitment of up to 532 megalites of biofuel use by 2010. The target set under the Action Plan for 2006 is 89 to 124 megalitres of ethanol and biodiesel use. Based on the number of biofuel contracts entered with current biofuel producers, Renewable Fuels Australia considered that there is genuine doubt whether the three large companies will meet their declared 2006 target.[40]

11.1 The Rising Cost of Petrol

Renewable Fuels Australia notes that with the current price of crude oil over US$75 per barrel, alternative fuels such as ethanol are competitive with petrol, and have the capacity to pass on competitive savings to motorists. Renewable Fuels noted that with respect to the independent fuel sector, lower fuel prices are being offered to consumers. However, they stated that many major oil company service stations are not passing on these savings to the public, out of concern that this could lower the competitive appeal of their own fuel products. The group concluded that where independent service stations are operating, biofuels are having an impact in moderating local fuel prices as oil major sites actively monitor their fuel prices and lower their own prices to moderate any impact on their fuel sales.[41] Since these comments by Renewable Fuels Australia in July 2006, Caltex has announced that it has put in place pricing arrangements for all its E10 unleaded petrol to be sold at 3 cents per litre less than regular unleaded petrol. However, the number of E10 Caltex sites is limited, with only 23 petrol stations across NSW selling the product, with none in metropolitan Sydney.[42]

Similarly, on the same day as the Caltex announcement, BP Australia announced that its 'e10' fuel would be three cents per litre cheaper than standard unleaded fuel. In this case, customers must register and receive a 'biorewards card' which will entitle them to the

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39 Commonwealth of Australia, *Biofuels Taskforce – Further Developments*. See http://www.pmc.gov.au/biofuels/further_developments.cfm, accessed September 2006.

40 Renewable Fuels Australia, *Submission to the Senate Economics Committee*, 24 July 2006. Seehttp://www.aph.gov.au/Senate/committee/economics_ctte/petrol_price/submissions/sublist.htm, Accessed August 2006.

41 Renewable Fuels Australia, *Submission to the Senate Economics Committee*, 24 July 2006. See http://www.aph.gov.au/Senate/committee/economics_ctte/petrol_price/submissions/sublist.htm, Accessed August 2006.

42 Caltex Australia, *Media Release – Caltex to discount all E10 petrol by 3 cents per litre*. 10 August 2006. See: http://www.caltex.com.au/about_news_detail.asp?id=876, Accessed August 2006.

discount. BP hopes to have 50 BP branded sites selling 'e10' by the end of August 2006. However, the discount is only available in Queensland and the Australian Capital Territory.[43] BP Australia stated:

> This initiative is due in no small way to the policies of the Federal and Queensland Governments. By incentivising ethanol instead of mandating it, they are ensuring that the benefits will be passed on to consumers.[44]

The Australian Institute of Petroleum notes that the price of alternative fuels is driven by the cost of inputs and the price of substitutes such as petroleum products. In the case of LPG, international prices have increased from US$320 per tonne in January 2004 to $580 per tonne in January 2006 – an 81% increase. Over the same period the benchmark price of crude oil has increased from US$34 to $71 – a 110% increase.

Over the past 15 months the futures price of ethanol on the Chicago Board of Trade Exchange has increased by around 290% since trading commenced in March 2005. Similarly, over the last three years, sugar prices have moved strongly upwards, in line with the price of oil. The Institute concluded:

> It is likely that any large scale substitution towards biofuels from conventional petroleum based fuels would bring fairly limited price relief for liquid fuel consumers.
>
> It would also appear that the ability of alternative fuels to ameliorate price increases in the future is limited, in particular when consideration is given to the additional supply chain costs for fuel distributors and retailers associated with biofuels.[45]

Shell Australia notes that whilst recent government initiatives can help biofuel market entry, they should not necessarily be used to promote an expectation of price discounting with ethanol blends. Shell stated:

> Future scenarios where companies are committed to ethanol blends and the ethanol price becomes more expensive than petrol represent a significant risk.[46]

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43 BP Australia, Press Release – Save 3 cents per litre with BP's ethanol blended fuel. 10 August 2006. See: http://www.bp.com/genericarticle.do?categoryId=9008681&contentId=7020700, accessed August 2006.

44 BP Australia, Press Release – Save 3 cents per litre with BP's ethanol blended fuel. 10 August 2006. See: http://www.bp.com/genericarticle.do?categoryId=9008681&contentId=7020700, accessed August 2006.

45 Australian Institute of Petroleum, *Submission to the Inquiry into the Price of Petrol in Australia, Senate Economics Committee*, August 2006. See: http://www.aph.gov.au/Senate/committee/economics_ctte/petrol_price/submissions/sublist.htm, Accessed August 2006.

46 Shell Australia, *Submission to the Senate Rural and Regional Affairs and Transport References Committee Inquiry into Future Oil Supply and Alternative Transport Fuels*. March 2006, at 14. See: www.aph.gov.au, accessed August 2006.

Caltex Australia delivered a similar message. It concluded: "E10 therefore *may* reduce petrol prices – as at present – but given the reduction of the ethanol cost advantage with lower oil prices, government policy should not rely on E10 as a mechanism to reduce petrol prices in the long term."[47]

The Australian Institute of Petroleum has the view that there should be no guaranteed role for any particular fuel in the market, whether conventional or alternative. Instead, each fuel must establish and maintain itself in the market by being:

- cost competitive;
- readily available on a reliable basis;
- of consistent high quality and complying with fuel quality and environmental standards;
- acceptable to the customer.

11.2 New Government Fuel Initiatives

On 14 August 2006 the Prime Minister made a statement to Parliament announcing new energy and alternative fuel initiatives. The Prime Minister stated:

> Today I am announcing a series of practical steps that will give Australians cheaper fuel options, further develop our energy resources and help to underpin the nation's long-term energy security. This total expenditure on these measures will be $1.576 billion over the next eight years.
>
> Ethanol blends can also make an important contribution to meeting Australia's transport fuel needs.
>
> The Government has spent $55 million to date in production grants to effectively offset the excise on ethanol production in Australia. We have already implemented a range of measures to help companies achieve a target of at least 350 mega litres of biofuel production in Australia by 2010.
>
> Substantial new investments are now underway. While there were 70 service stations selling ethanol in Australia in June last year, today the figure is about 260. BP plans to increase ethanol sales 100-fold over the next two years. Caltex plans to double the number of ethanol retail sites by the end of this year. And Woolworths is set to enter the market next year with 50 sites.
>
> The Government recognises that lack of access to distribution infrastructure remains one of the barriers to the uptake of ethanol. To address this, I announce today additional expenditure of $17.2 million over three years to reduce the infrastructure cost to retailers of installing new pumps or converting existing pumps to E10 blends and to encourage sales of E10.

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47 Caltex Australia, *Submission to Senate Economics Legislation Committee Inquiry into the Price of Petrol in Australia*. August 2006, at 33. See: www.aph.gov.au, Accessed August 2006.

> The Government will allocate up to $20,000 to the cost of converting retail petrol stations to supply E10. Up to $10,000 will be provided after the conversion is complete and an additional $10,000 after an ethanol blend sales target is reached.
>
> The additional grant on reaching a sales target will provide a clear incentive for retailers to discount the price of E10 fuel. Recipients of grants from the ethanol distribution programme will be expected to sell ethanol blends at a discount and to display the price of ethanol blends alongside price information for other petroleum products.
>
> Because this Government believes in consumer choice we are not persuaded to mandate the use of ethanol. We will, however, continue to explore practical measures that effectively mandate the availability of cheaper ethanol-blended fuels for Australian motorists.[48]

The new measures were designed to assist in the uptake of alternative fuels, and involved the following:

- A new grants project to encourage the development of infrastructure at service stations to deliver and sell E10 blended fuel. The grants consist of up to $20,000 per service station for infrastructure to supply E10 blended fuel.

- A new grants programme commencing on 1 October 2006 will provide rebates of $2000 per vehicle for conversions and $1000 per vehicle for new purchases of LPG vehicles.

- Biofuels will continue to be excise free until 2011.

- From 2015 they will attract a 50 per cent concessional excise rate compared with other fuels of similar energy content. The rate for ethanol will be 12.5 cents per litre and for biodiesel will be 19.1 cents per litre as opposed to 38.143 cents per litre for other fuels such as petrol.

- The Government has set a biofuels production target of at least 350 megalitres by 2010. Major oil companies, petrol retailers, car manufacturers, consumer groups and the biofuels industry are working with the Government to achieve the target.[49]

One of the strongest critiques of the Commonwealth Government initiatives came from within, from Senator Boswell, Leader of the Nationals in the Senate. Senator Boswell discussed the role of the four major oil companies and biofuels in the Parliament. He stated:

> The independent fuel suppliers and retailers … supply only about eight per cent of the

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48 Hon John Howard MP, Prime Minister, *Statement to Parliament on Energy Initiatives* http://www.pm.gov.au/news/speeches/speech2074.html, Accessed September 2006.

49 Australian Government, *Alternative Transport Fuels and Renewable Energy: August 2006 Update*. See: http://www.pmc.gov.au/initiatives/docs/alternative_fuels.rtf, accessed September 2006.

> transport fuel market, yet distribute three-quarters of the ethanol used – some 30 million litres.
>
> The key to making an impact on Australia's fuel consumption lies in the big markets of Sydney and Melbourne, and with the major distributors, Shell, Caltex, BP and Mobil. The ethanol fuel sales to the four oil majors for the first six months of this year represent less than 0.1 per cent of one per cent of total petrol sales of 20 billion litres. The reality is that the oil companies, with the exception, perhaps, of BP, are stalling the advancement of alternative fuels, with one exception – that is, LPG. And why is that? It is because they control the production and distribution of LPG.
>
> … Ethanol blended fuel can provide immediate price relief to motorists, yet E10 is only available at around 260 outlets of the nation's approximately 6,300 service stations, which is less than two per cent.
>
> Of the $1.5 billion package announced yesterday by the Prime Minister, $17.2 million was allocated to further development of a market for ethanol. … $1.3 billion is for the LPG industry for conversions and forgone revenue. … The big winners in the package are the four major oil companies. They have not had to make one extra commitment to distribute alternative fuels to benefit from this package, but $1.37 billion will directly benefit their industry and expand the market for their products.
>
> [in regards to the $20,000 grant to service stations for E10 infrastructure supply] This initiative is tinkering around the edges of the ethanol issue. The main game is compelling the major oil companies to blend and distribute E10.[50]

Senator Boswell advocated the implementation of a volumetric biofuel obligation system to compel the major oil companies to purchase an increasing percentage of their fuel supplies from renewable sources.

On the 17 August 2006, in the middle of a re-election campaign, the Queensland Premier Peter Beattie announced that he would introduce legislation to mandate petrol refiners to put five percent ethanol in fuel in Queensland by 2010. In the longer term, this would be increased to ten percent. Mr Beattie was reported as saying that this approach would take pressure off high fuel prices, and the policy was conditional on a Federal Government trial of ethanol blended fuels in 16 vehicle types being successful.[51]

On 23 August 2006 NSW Premier Morris Iemma announced that he would establish an E10 Taskforce. Subject to the Taskforce's findings, the Government will mandate the use of E10 petrol in NSW, with a target date of 2011. The E10 Taskforce will report to the Premier on implementation issues, including:

- sources and certainty of ethanol supply;
- infrastructure requirements in the fuel supply chain – eg service stations;
- an appropriate pathway for phasing in ethanol content (eg E1, E2) to the target E10 level in 2011.[52]

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50 Commonwealth of Australia, *Parliamentary Debates, Senate*, 16 August 2006, at 51.

51 "Qld: Beattie promises cheaper fuel with ethanol" in *AAP News*, 17 August 2006.

52 Premier of New South Wales Hon Morris Iemma MP, "NSW Moving Towards Mandated

The members of the E10 Taskforce were announced on 20 September 2006. The six members were:

- Dr Col Gellatley, Director General NSW Premiers Department;
- Dr John Keniry, former Chair of the Prime Minister's Biofuel Taskforce;
- Dr Brian Fisher, Agricultral Economist;
- Dr Paul Martin, Director, Australian Centre for Agriculture and Law, University of New England;
- Mr Alan Evans, President of the NRMA;
- Mr Tony Windsor MP, Federal Member for New England.

In announcing the membership, the Minister for Rural Affairs Hon Tony Kelly MLC stated:

> It will undertake consultation with industry and the community, including refiners, importers, retailers, primary producers, as well as environmental, motoring and consumer groups.
>
> The taskforce will also be charged with consulting with Commonwealth, State and Territory Governments to examine the feasibility of implementing a mandate on a national basis.
>
> From day one the NSW Government has said that a mandate would work best on a national basis. In the absence of Commonwealth leadership, it is up to the States to move this important issue forward.[53]

The NSW Opposition Coalition welcomed the Premier's 'belated conversion to ethanol'. Opposition Leader Peter Debnam stated: "I made it clear last month, I will mandate ethanol use if necessary to achieve a dramatic increase in ethanol."[54]

The response of Caltex Australia to the Premier's announcement was not so positive. Caltex stated:

- Development of the ethanol market can be achieved without mandates through the policy of the Australian Government to encourage both supply (capital grants) and demand (excise concessions and sales incentives);
- Caltex is opposed to mandatory blending of ethanol in petrol;
- Caltex believes any mandatory ethanol scheme is impractical and inappropriate. For example, manufacturers advise that a significant number of older vehicles and other equipment (such as outboard motors) are not suitable for E10, and less than half of consumers say they would use E10;

E10 Fuel", *News Release*, 23 August 2006.

53 Hon Tony Kelly MLC, "NSW E10 Taskforce Members Announced" *Media Release*, 20 September 2006.

54 NSW Liberal/Nationals Coalition, *Media Release – Premier's Belated Conversion Welcome: He Should Now Attend Lib/Nats Roundtable*. 23 August 2006.

- Caltex is committed to the Australian Government's biofuels industry action plan and Caltex's targets under that plan through to 2010;
- Caltex is discounting E10 Unleaded (its 10% ethanol/petrol blend) by 3 cents per litre versus regular unleaded petrol at company operated sites and at the wholesale level. This is boosting E10 Unleaded sales. In addition Caltex will expand the number of branded sites selling E10 Unleaded to more than 100 by year-end, including additional sites in northern NSW;
- Caltex will discuss its position in detail with the government, including through its proposed E10 Taskforce.[55]

12.0 CONCLUSION

The Australian biofuels industry is still in its infancy. Even when the Commonwealth 350ML biofuel use target is met biofuels will contribute only one percent of Australian fuel consumption. Internationally, biofuels have been attracting increasing interest, with both the United States and the United Kingdom mandating their use. The Commonwealth Government does not support mandating the use of biofuels, preferring a range of incentives to increase voluntary use of the fuel. In contrast, both the Queensland and NSW Governments have announced their intention to mandate up to 10 percent ethanol in petrol. Due to their population size and geographical spread, time will tell whether the actions of these two governments effectively mandates 10 percent ethanol in petrol for the whole nation.

55 Caltex Australia, *Media Release – Caltex position on Premier Iemma's ethanol policy announcement*. 23 August 2006, see: http://www.caltex.com.au/about_news_detail.asp?id=883, Accessed August 2006.

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