

E – BRIEF



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Ethanol and biodiesel

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1 Introduction

Biofuels are fuels made from renewable biological feedstocks, either crops or waste. There are two main biofuels with commercial prospects in Australia: ethanol and biodiesel. These biofuels currently comprise less than 0.4% of the Australian automotive gasoline market.

Biofuels are generally blended with petroleum – B5 is diesel containing 5% biodiesel; E10 is petrol containing 10% ethanol.

1.1 NSW Government Policy

In August 2006 the then NSW Premier announced the Government's support for mandating the use of ethanol blended petrol. An ['E10 Taskforce'](#) was established, with the aim of advising the Government on the suitability of mandating E10 by 2011.

In 2007 the NSW Government [mandated](#) that two percent of all petrol sold will be ethanol. This obligation was imposed on wholesale suppliers. On 6 December 2008 the Minister for Lands announced that the ethanol mandate would increase to 6% by the end of 2010. In addition, a new mandate that by 1 July 2011 regular grade unleaded petrol will have to contain 10% ethanol (E10) was also announced.

A 2% biodiesel mandate was also announced, rising to 5% as supply becomes available.

2 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;
- Petroleum and natural gas.

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, currently it is predominantly produced from agricultural sources, such as waste starch, C molasses, corn, sorghum and feed wheat. The process used to produce ethanol with these feedstocks is commercially viable, and is known as 'first generation' technology.

In contrast, 'second generation' technology involves ethanol production from cullulosic feedstocks such as crop waste, grasses and trees (ie, woody or fibrous plant material). 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 compared to current processes, and from a more widely available feedstock.¹ A pilot 'second generation' [plant](#) is being built at Harwood in NSW, and if successful it is intended that a commercial scale plant will be in operation by December 2012.

Ethanol can be produced in two forms, hydrated and anhydrous. Hydrated ethanol has a purity of 95 per cent, suitable for blending up to 30 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. 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.

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 Commonwealth 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.

2.1 Supply Issues

The biofuels industry in Australia is in its infancy, with a national production target of 350 ML by 2010 (about 1% of current transport fuel usage).

Current production levels in Australia are approximately 170 ML ethanol. The current petrol fuel market in Australia is 19,500 million litres per year.²

There were four operating ethanol plants as of November 2007 with a total capacity of 245.8 ML per year. The largest of these plants is operated by the Manildra Group (capacity 126 million litres), at Bomaderry on the NSW south coast.³ The E10 Taskforce reported that at least nine new ethanol plants are in various stages of consideration in NSW, although some of these are unlikely to come to fruition.

For instance, [Agri Energy](#), which proposed a 200 million litre ethanol plant at Condobolin, and another plant of the same size at Colleambally in NSW, has been placed into voluntary administration. Its parent company, Australian Biofuels Pty Ltd, stated in October 2007 that there remains too much uncertainty in feedstock costs, biofuel markets, government legislation and consumer acceptance in the Australian market.

In contrast, in August 2008 [CSR Limited](#) announced plans to convert its ethanol distillery at Sarina in Queensland from producing 38 million litres of fuel grade ethanol and 22 million litres of industrial/beverage grade ethanol to producing 60 million litres of fuel grade ethanol. This conversion is aimed at meeting growing domestic demand for ethanol blended fuel that, according to CSR Limited, has increased by 500 per cent over the past three years. Similarly, Manildra has an application before the Government to increase capacity to 300 ML per year.

[ABARE](#) reports that Australian imports of undenatured ethanol in 2007-08 were 25 million litres (in alcohol equivalent terms), up from an average 5 million litres a year in the previous three years.

To meet the NSW E10 mandate will require approximately 500 ML of ethanol. The E10 Taskforce noted that NSW has the physical capacity to grow feedstock to meet market demands for 5% and 10% ethanol. The Taskforce considered that approximately 27% of the NSW average production of wheat would be required to meet an E10 mandate if all ethanol was created from wheat.

However, a more recent analysis suggests that this is more likely to be about 5% of the NSW wheat harvest, or 1 million tonnes of wheat. The ethanol production process produces stock feed, which can be used instead of wheat grain. So the net additional requirement for wheat grain is likely to be about 0.6 million tonnes annually. Australian wheat production averages 21.6 million tonnes per year, of which 5.5 million tonnes is consumed domestically and the balance available for export.

The Manildra plant may ultimately be able to supply more than sufficient ethanol to meet the requirements of an E10 mandate. However, the E10 Taskforce noted that increased supplies to meet higher ethanol percentages were potentially problematic.

Competition with food producers for crops has thus far not been an issue for Australia's few ethanol producers, as current production is based on waste starch and C-molasses.

A national E10 target would require about 2000 ML of ethanol. Since there is only limited capacity to supply ethanol from C-molasses and waste starch feedstocks, this would mostly need to be from cereals, ie it would require some 5640 kilotonnes (kt) of grain. In average years, this could be met. In drought years, however, producing 2000 ML of ethanol could force the import of wheat. As an example, if an E10 target were to be met based on domestic wheat during the drought of 2001–02, imports could have ranged from 2550 kt to 5 640 kt. There are legal obstacles to the import of grain due to biosecurity risks.⁴

The NSW E10 Taskforce concluded that the impact of the 2% mandate should be subject to comprehensive review before any extension to higher mandated levels. It stated that increasing mandate levels too early may provide counter productive reliance on the development of first generation grain based plants which may prove to be unsustainable.

2.2 Other issues

There are a variety of factors driving the use of biofuels, including:

- Fuel security;
- Greenhouse gas emissions;
- Regional development.

In order for biofuels to play a significant role in Australia's energy security, [one study](#) suggested that an industry which could contribute perhaps 10–20 % or more of the total fuels mix would be necessary.

When used in an E10 blend, greenhouse gas emissions (as compared to unleaded petrol) are lower by 1.7% (from wheat) to 5.1% (C-molasses using co-generation).

Biofuels may present new opportunities for regional Australia. The size, extent and chances of success of many perceived opportunities cannot be quantified for Australia based on existing studies. The current economic view of regional impacts of biofuels is largely in terms of construction and ongoing operation of production plants rather than products themselves.⁵

3 Biodiesel

Biodiesel is used in conventional diesel engines. 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 depend 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.

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. Internationally, most biodiesel is sold as blends.⁶

In general, engine and equipment manufacturers in the Australian market have taken a position limiting biodiesel to B5. Manufacturers claim that higher blends raise significant issues

involving engine performance, efficiency, emissions and warranties.

The 2007 biodiesel capacity in Australia was 323 ML with a planned capacity of 1,122 ML. However, the industry is in a state of flux, with some plants in NSW mothballed, and others have had their development applications approved but construction has not commenced.

Worldwide there is considerable research and development underway on new sources of biodiesel feedstocks (eg, from algae). For Australia, the best estimate based on the conversion of domestic waste oil, tallow exports and oilseed exports to biodiesel is that they could have theoretically provided an upper limit of 4–8% of Australia's current diesel usage.

The benefits of biodiesel are:

- all major air pollutants except oxides of nitrogen are significantly lower when replacing low sulphur diesel with biodiesel;
- particulate matter emissions are lower for biodiesel blends, and significantly lower for pure biodiesel (B100) for tallow, canola and waste oil than compared to diesel.
- Greenhouse gas emissions for biodiesel based on waste vegetable oil range from 89.5 % lower for B100 to 4.2 % lower for B5 than diesel.
- Greenhouse gas emissions for biodiesel based on tallow range from 29 % less for B100 to 1.5 % less for B5 as compared to diesel.
- Greenhouse gas emissions for biodiesel based on canola range from 15 % less for B100

to 1.5 % less for B5 as compared to diesel.

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- ¹ Australian Government Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 30.
 - ² Rural Industries Research and and Development Corporation, [Biofuels in Australia, Issues and Prospects](#). May 2007.
 - ³ Asia Pacific Economic Cooperation, [Australia Biofuels Activities](#)
 - ⁴ Rural Industries Research and and Development Corporation, [Biofuels in Australia, Issues and Prospects](#). May 2007.
 - ⁵ Rural Industries Research and and Development Corporation, [Biofuels in Australia, Issues and Prospects](#). May 2007.
 - ⁶ Australian Government, Biofuels Taskforce, *Report of the Biofuels Taskforce to the Prime Minister*, August 2005, at 39.