Australian Institute of Petroleum

Biofuels factsheet

AIP member companies are committed to maintaining a reliable supply of high quality fuel to Australian consumers. As part of the Australian and state and territory governments' Cleaner Fuels Program, the Australian petroleum refining industry has invested well over $2 billion to produce petrol and diesel fuels that will help to dramatically reduce motor vehicle emissions, particularly emissions contributing to urban smog. This industry focus on both high quality fuels and the environmental performance of fuels is applied to all fuels supplied to consumers, including biofuels.

AIP has consistently stated that there is a sustainable role for biofuels in the Australian fuels market provided biofuels are competitively priced, have a reliable supply and are acceptable to consumers.

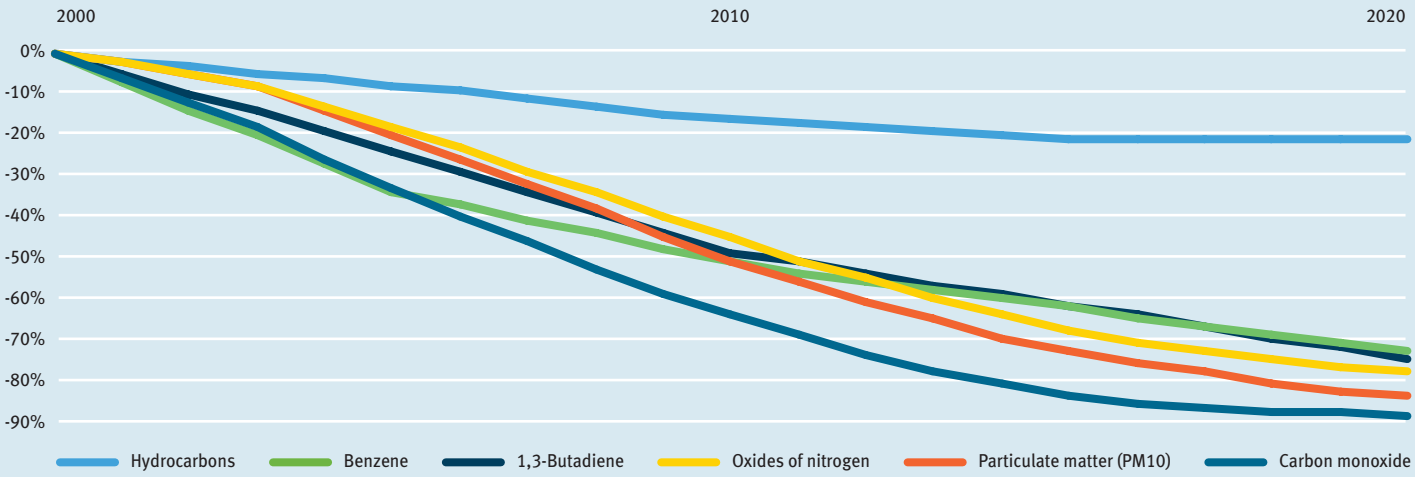
Biofuels are derived from sources such as wheat, sugar, tallow, oil crops and waste vegetable oils. There is also the possibility, in the future, that biofuels may be produced on a commercial basis from woody (cellulose) parts of plants and wood wastes.

The major types of biofuels are

- **Ethanol** — an alcohol produced from fermented feedstocks
- **Biodiesel** — Fatty Acid Methyl Esters (FAME) — esterified oil produced from a variety of sources such as waste cooking oil, tallow, palm oil and canola
- **Renewable diesel** — a product derived from tallow that is co-produced with petroleum-derived diesel and is chemically indistinguishable from petroleum-derived diesel.

Ethanol, biodiesel and renewable diesel are usually blended with conventional fuels (petrol or diesel) for use as motor vehicle fuels.

Reduction in vehicle emissions from cleaner fuels (petrol and diesel)



Ethanol

What is 'ethanol'?

Ethanol is an alcohol which can be mixed with petrol to produce an ethanol blend motor fuel. The most commonly available ethanol blend in Australia is E10, a 10 per cent blend of ethanol with unleaded petrol (ULP). Ethanol blend fuels are also available using premium unleaded petrol (PULP).

- Ethanol contains 68 per cent of the energy content of petrol. In an E10 blend this means around 3 per cent less energy is available, which translates to a similar loss of fuel economy on average across the vehicle fleet. Individual vehicle performance may vary significantly from the average.
- Ethanol has a high Research Octane Number (RON)—RON measures the performance of the fuel under normal driving conditions
  - use of ethanol does not increase the Motor Octane Number (MON) of the fuel to the same extent as its RON—MON measures the performance of the fuel under harsher driving conditions and/or high temperature engine operation
  - with very few exceptions, vehicles on Australian roads are not able to gain performance benefits from using petrol with higher octane (which could be provided by an ethanol blend) than recommended by the manufacturer of the vehicle.

Can I use ethanol in my vehicle?

Ethanol up to a 10 per cent blend (E10) with petrol can be used satisfactorily in most new and many older vehicles. The Federal Chamber of Automotive Industries (FCAI) maintains a list of vehicles[1] which are suitable to run on ethanol blend fuels.

The Australian Government recently released the report of an independent technical study conducted by Orbital Australia Pty Ltd which confirms the accuracy of the FCAI car list. The key finding is that 60 per cent of petrol engine vehicles in the current Australian fleet can suitably operate on ethanol blend fuels. The proportion of vehicles which can suitably operate on ethanol blends in the Australian fleet will increase gradually as newer vehicles are added to the fleet and older vehicles are replaced.

If you have any doubt about whether your vehicle can use E10, please contact your vehicle manufacturer for advice.

- Ethanol has different solvent properties to petrol and the use of ethanol blends may dissolve built-up residues in fuel systems in older vehicles, leading to fuel filter blocking.
- Blends containing greater than 10 per cent ethanol were shown to damage components commonly used in Australian vehicles.
- For this and other technical reasons the Australian Government limits the ethanol content in petrol to a maximum of 10 per cent.
- Vehicles with appropriate modifications or specialised manufacture are operated elsewhere in the world on blends with over 10 per cent ethanol content. Limited numbers of demonstration models are currently available in Australia.

What will E10 cost?

The price of ethanol blends will vary according to market prices for ethanol and petrol, the effective excise exemption on the ethanol component of the fuel, and normal competitive wholesale and retail market forces.

- The bulk supply price of ethanol is heavily influenced by the cost of feedstocks such as wheat and sugar, the availability of ethanol, and the price of petrol
  - in 2006 in the United States, the price of ethanol was well above the price of petrol due to strong demand and at one point was double the price of petrol.
- Given the different characteristics of ethanol there are also additional supply chain costs for ethanol blending and storage.
- Ethanol is currently effectively excise free compared with petrol which incurs an excise of 38.143 cents per litre
  - in an E10 blend this represents an excise advantage of almost 4 cents per litre but the market price also depends on the additional supply chain costs and the relative prices of petrol and ethanol.
- The ACCC formally monitors the price of E10 blends and reports on the price differential between E10 petrol and unleaded petrol on a quarterly basis
  - the December 2006 report found the average price for E10 petrol was 2.9 cents lower than the average price for ULP.
- The Australian Government announced major changes in 2006 to move the fuel taxation system towards greater taxation neutrality between vehicle fuels. However, ethanol and other alternative fuels will continue to enjoy a significant excise advantage (50 per cent of the excise rate on an energy equivalent basis) compared to conventional petroleum fuels)
  - from 1 July 2011 to 1 July 2015, excise on ethanol will be increased in five equal annual instalments to 12.5 cents per litre, resulting in an ultimate excise benefit of 25.643 cents per litre
  - in an E10 blend this represents an excise advantage of just over 2.5 cents per litre
  - under current regulations, any imported ethanol would attract the full rate of petrol excise (38.143 cents per litre) until July 2011, at which time it will be subject to the same taxation treatment as Australian-produced ethanol.

Are there environmental benefits from using E10?

Tailpipe emission performance of petrol fuelled vehicles has improved dramatically since 2002 because of the rapid and significant impact of the Cleaner Fuels Program for conventional fuels (see chart on page 1). The cleaner fuels standards and the changes to motor vehicle technologies will see very dramatic drops in urban air pollution levels from motor vehicles, with most pollutants reducing to less than 30 per cent of 2000 levels, and carbon monoxide emissions reducing to about 10 per cent of 2000 levels.

- The Prime Minister's Biofuels Taskforce has initiated a series of studies to be completed in 2008 to assess the environmental performance of ethanol blend fuels in the Australian fleet.

The current general understanding of the environmental performance of E10 is

- **Greenhouse benefits:** on full life cycle basis E10 can have some greenhouse gas abatement benefits depending on how the ethanol is produced
  - most ethanol currently produced in Australia will be able to demonstrate moderate levels of greenhouse gas abatement
  - if emerging ethanol production technology using cellulosic materials becomes commercially viable, greenhouse benefits could rise substantially.

Are there environmental benefits from using E10? (continued)

- **Air quality benefits:** Australian urban air quality is generally good with pollution levels in most cities well below the target levels set by Australian governments. The major continuing problem is ozone formation, which is a smog pre-cursor largely related to emissions of volatile organic compounds (VOCs) and oxides of nitrogen (NO_X)
  - the use of E10 blends reduces tailpipe emissions of carbon monoxide (CO) and VOCs but emissions of oxides of nitrogen (NO_X) are increased. Evaporative emissions of VOCs are also increased
  - the emissions of some air toxic compounds (e.g. benzene, 1.3 butadiene) are reduced by the use of E10 blends while other air toxics are increased (e.g. aldehydes)
  - overall, E10 does not appear to have a significant impact on ozone formation, one of the key air quality concerns in many metropolitan areas
  - because of its higher volatility, E10 has greater evaporative emissions of VOCs than petrol
    - E10 is subject to less stringent volatility requirements in NSW, Victoria and Queensland
    - if E10 blends were required to meet the same volatility standards as normal petrol, E10 would need to be blended from specially produced, low volatility petrol feedstocks
    - these special low volatility petrol feedstocks are more expensive to produce and are sold at a price premium to unleaded petrol in the US.
- There may be some indications of reduced small particulate matter (PM2.5) emissions from the use of E10
  - however, a US EPA draft regulation impact statement[2] for the US Renewable Fuel Standard Program in September 2006 found that evidence of reduced tailpipe emissions from cold weather climates was "too limited to support a quantitative estimate of the effect of ethanol on PM emissions"
  - particulate emissions from petrol vehicles are generally not considered to be a significant problem and are not regulated anywhere in the world
  - the Prime Minister's Biofuels Taskforce recommended that further examination was required on the health benefits of ethanol blends and the Australian Government is currently undertaking that study.

Renewable diesel

BP Australia Pty Ltd is planning to commence production of renewable diesel from tallow feedstock starting in mid 2007 at its Bulwer Island refinery in Brisbane. Full production of renewable diesel (approximately 130 ML/year), will be reached by mid 2008.

The tallow will be co-processed with petroleum-derived oil feedstock through the existing refinery diesel production infrastructure. The result is a diesel product which is physically and chemically indistinguishable from petroleum-derived diesel and fully meets the current diesel fuel standard. All of the diesel produced by the Bulwer Island refinery (about 2.4 billion litres per annum) will contain up to 5 per cent renewable diesel.

Successful pilot plant tests of the technology have already been completed in BP's laboratories in Europe and the US. An engine testing program is currently underway in Australia using renewable diesel manufactured by these pilot plants in a 5 per cent blend.

Biodiesel

What is biodiesel?

Biodiesel—Fatty Acid Methyl Esters (FAME)—is esterified oil produced from a variety of sources such as waste cooking oil, tallow, palm oil and canola oil.

- Biodiesel has a slightly lower energy content than conventional diesel although this is not significant when operating vehicles on biodiesel blends.
- There is an Australian fuel standard for unblended biodiesel (B100).
- The Australian Department of the Environment and Water Resources is developing a standard for biodiesel blend fuels.

Can I use biodiesel in my vehicle?

Most diesel engine manufacturers[3] warrant their engines for use with biodiesel blends up to 5 per cent with conventional diesel (B5) as long as the resultant blend meets the diesel standard.

- Some manufacturers have engines which are certified for fuels above B5 but there are only a limited number of such engines in use in Australia.

  If you have any doubt about whether your vehicle can use biodiesel, please contact your vehicle manufacturer for advice.

- Biodiesel blends up to B100 are currently used in fleet operations, such as local council trucks
  - blends above B5 usually require specialist engine maintenance and the fleet operator assumes legal responsibility for the impact of the use of the blend on the engine.
- Concerns about biodiesel raised by engine manufacturers in the World Wide Fuels Charter include
  - biodiesel may be less stable, so precautions should be taken to prevent problems from fuel oxidation
  - biodiesel requires special care at low temperatures to avoid viscosity problems and hence loss of fluidity
  - special handling is required to prevent build-up of high water content and consequent risks of corrosion
  - gum residue build-up may be higher than with conventional diesel, so detergents are recommended
  - biodiesel may react adversely with natural and nitrile rubber seals and could dissolve paint coatings
  - swapping between diesel and biodiesel could lead to greater residue build-up and these residues could block fuel filters.
- Biodiesel produced from different feedstocks can have significantly different fuel quality characteristics including cold flow properties, density and oxidation stability
  - the quality of some biodiesel recently produced in Australia has been outside the acceptable specifications and has not been able to be supplied by AIP member companies to the market. The industry is working with biodiesel producers to address these quality issues.

Key information sources

1 FCAI ethanol suitable car list http://www.fcai.com.au/ethanol.php/2006/12/00000005.html, updated 14 December 2006

2 *Renewable Fuel Standard Program Draft Regulatory Impact Analysis*, United States Environment Protection Authority, September 2006

3 *Worldwide Fuel Charter*, European Automobile Manufacturers Association (ACEA), Alliance of Automotive Manufacturers, Engine Manufacturers Association (EMA), Japanese Automobile Manufacturers Association (JAMA), September 2006

General references

Report of the Biofuels Taskforce to the Prime Minister, August 2005

Appropriateness of a 350 million litre Biofuels Target, CSIRO, ABARE, BTRE, December 2003

What will biodiesel cost?

The price of biodiesel blends will vary according to bulk supply prices for biodiesel and diesel, the effective excise exemption on biodiesel blend fuels and normal competitive wholesale and retail market forces. The market price of biodiesel is heavily influenced by the cost of feedstocks such as canola, palm oil and soy beans; for example, during 2006 the price of palm oil feedstock increased significantly.

- Biodiesel is currently effectively excise free compared with petroleum-derived diesel which has an excise of 38.143 cents per litre
  - in a B5 blend this represents an excise advantage of almost 2 cents per litre
  - however, biodiesel is generally more expensive than diesel offsetting much or all of the excise advantage
- The Australian Government announced major changes in 2006 to move the fuel taxation system towards greater taxation neutrality between vehicle fuels. Biodiesel and other alternative fuels will continue to enjoy a significant excise advantage (50 per cent of the excise rate on an energy equivalent basis) compared to petroleum-derived diesel
  - from 1 July 2011 to 1 July 2015, excise on biodiesel will be increased in five equal annual instalments to 19.1 cents per litre, resulting in biodiesel having an ultimate excise benefit of 19.043 cents per litre
  - in a B5 blend this represents an excise advantage of just over 1 cent per litre.

Are there environmental benefits from using biodiesel?

Tailpipe emission performance of diesel fuelled vehicles has improved dramatically since 2002 because of the rapid and significant impact of the Cleaner Fuels Program for conventional fuels. Most pollutants, including particulate matter, are expected to decrease by at least 70 per cent by 2020 as vehicles using engine technologies which can take full advantage of these higher quality fuels are introduced (see chart on page 1). The environmental performance conclusions in the Prime Minister's Biofuels Taskforce report for biodiesel are

- **Greenhouse benefits:** on a full life cycle basis the greenhouse benefits are significant for B100, with reductions in greenhouse gas emissions of 90 per cent for waste cooking oil and around 25 per cent for tallow and canola, compared to petroleum-derived diesel
  - B5 greenhouse emissions are 2 per cent lower than petroleum-derived diesel.
- **Air quality benefits:** on a full life cycle basis B100 has significantly lower emissions of carbon monoxide (26 per cent–46 per cent) and VOCs (22 per cent–46 per cent) compared to petroleum-derived diesel (the range of emission benefits depending on the feedstock)
  - B5 has a reduction in carbon monoxide emissions of almost 12 per cent and a reduction in VOCs of 5 per cent.
- Particulate emissions from vehicles using B100 are reduced by 11 per cent–14 per cent compared to petroleum-derived diesel
  - B5 has similar particulate emissions compared to petroleum derived diesel.
- NO_X emissions from B100 are 16 per cent to 30 per cent higher than from petroleum-derived diesel
  - B5 has around an 11 per cent increase in NO_X emissions.

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Further information

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