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Australia

Biofuels Annual

2014

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Report Highlights:
Australian biofuels total production for 2014 is estimated at 330 million liters (ML), comprised of 265 ML of ethanol and 65 ML of biodiesel. Production of ethanol is stable but biodiesel output has been more variable. The 2014 federal budget will phase down the excise rebate for local production of both ethanol and biodiesel beginning in mid-2016 and an excise rebate for biodiesel imports will be removed starting in mid-2015. This change is expected to have little effect on overall production, as most biodiesel is sold into the mining, agricultural and road transport sectors, which are exempt from the excise. Second generation biofuels such as renewable biodiesel, energy crops, and algae-based fuels have been successfully demonstrated but have not yet been successfully commercialized.

Post:
Canberra

EXEECUTIVE SUMMARY:

Biofuels are derived from renewable materials such as vegetable and animal products. This is in contrast to petrol and diesel which are made from non-renewable resources like crude oil. The Australian biofuels industry produces two main types of biofuels used as transport fuels: ethanol and biodiesel, which together account for less than one per cent of total fuel consumption in Australia. These biofuels are blended into gasoline and diesel respectively by traditional oil suppliers and refiners in Australia. Ethanol is most commonly blended with regular unleaded petrol to produce E10 while biodiesel is typically used in B5 and B20 blends. Ethanol in Australia is produced from sugar by-products and waste starch from grain, while biodiesel is produced from used cooking oils and tallow from abattoirs.

Australia has introduced a range of measures to support the development of a commercial biofuels industry. These include excise rebates for locally produced biofuels, government mandates and fuel quality standards to encourage the use of biofuels, grants to local research on biofuel production and the excise tax on imported ethanol, which raises its relative cost compared to locally produced biofuel. In 2013, three ethanol producers in Australia produced 290 million liters of ethanol, a slight decline on output compared to the previous two years. The ethanol industry receives an excise rebate under the Ethanol Production Grants (EPG) Program through a grant of A$0.38143 per liter. Ethanol imports are relatively uncompetitive due to the excise equivalent customs duty and the 5 per cent tariff rate.

This regime will change under measures announced in the 2014 federal Budget. The Ethanol Production Grant will cease from 1 July 2015 and excise taxes will be progressively applied (in five equal annual steps) starting 1 July 2016 up to an energy content rate of excise tax of A$0.125 per liter for ethanol and A$0.191 per liter for biodiesel from 1 July 2020. Customs duty for imported ethanol and biodiesel will be retained at A$0.38143 per liter over this transition period.

Biodiesel production has been more variable and difficulties with quality and distribution has led to plant closures, while others have re-opened or plan to reopen. Local biodiesel producers receive a rebate of excise tax but biodiesel importers have also received a rebate of the excise equivalent customs duty under the Energy Grants (Cleaner Fuels) Scheme. This regime will change under measures announced in the 2014 federal Budget and the rebate on imported biodiesel will cease, meaning that the full excise of A$0.38143

per liter will apply from mid-2015. Some local production of biodiesel will be subject to the phasing of an effective excise tax rate which will reach A$0.19 cents per liter in 2020. However, most biodiesel is sold to agricultural, mining and transport sectors which are exempt from the excise tax.

While the existing ethanol and biodiesel sector is based on first generation biofuels technology, research and development of second generation technology biofuels is continuing. Currently, research is being undertaken on a range of feedstocks such as the use of renewable energy crops, algae and renewable biodiesel and sustainable aviation fuel, but these are not yet commercially viable.

I POLICY AND PROGRAMS

International

Australia is a member of the APEC biofuels task force which is an international grouping of countries seeking to make biofuels a more viable and sustainable transport fuel. Other members of the taskforce are Brazil, Canada, Japan, New Zealand, Malaysia, Mexico, Singapore, Taiwan, Thailand, the United States and Vietnam. Bioenergy Australia is active in the International Energy Agency's Bioenergy group and Australia is participating in the development of ISO sustainability criteria for bioenergy.

Australian Government Energy White Paper

Federal Government support for the development of advanced biofuels in Australia will be considered in the context of the 2014 Energy White Paper which will examine issues such as security of energy supply, regulatory reform and the need for improved energy productivity. It will review barriers to the use of biofuels and other energy sources such as liquefied petroleum gas (LPG), compressed natural gas (CNG) and LNG. The Energy Policy Green paper is currently in development and is scheduled for release in June 2014 with the final White paper due at the end of 2014.

Review of the Renewable Energy Target

The Renewable Energy Target (RET) aims to encourage the uptake and development of renewable energy in Australia with a target of 20 per cent of Australia's electricity from renewable sources by 2020. Currently, renewable energy such as wind and solar photovoltaic account for over nine per cent of Australia's electricity supply and other renewable technologies, including solar thermal, marine and geothermal are being developed and may enter the Australian market over time. The Government has announced it is reviewing the legislated RET and introducing a "Direct Action" approach to reducing greenhouse gas emissions.

State Government Ethanol Supply Mandates

The New South Wales (NSW) government has a legislated ethanol supply mandate of 6 per cent for wholesale companies and a requirement for retailers with 20 or more outlets to offer ethanol product for sale. Currently, only 4 per cent has been reached. The *NSW Biofuels Act 2007* facilitated a roll-out of retail and distribution infrastructure which has allowed wider distribution of ethanol fuels. Most of the fuel ethanol produced by the three Australian producers is sold on the NSW market as E10 blend petrol.

In 2013, the market shares of fuels offered in the NSW market was Premium Unleaded Petrol (PUP) at 40 per cent, E10 at 40 per cent and Unleaded Petrol (ULP) at 20 per cent. Queensland has also considered an ethanol blending mandate but has not introduced this policy. In 2001, a voluntary national target was set for 350 ML by 2010, but this has not been replaced or extended.

The Cleaner Fuels Grants Scheme

The cleaner fuels grants scheme encourages the manufacture or importation of fuels that have a reduced impact on the environment. Eligible cleaner fuels include renewable fuels such as biodiesel and renewable diesel. The scheme is administered by the Australian Taxation Office and provides a grant to importers of biodiesel equivalent to the current excise on this fuel. The scheme is expected to end in mid-2015 when imported biodiesel will be fully subject to fuel excise taxes. The abolition of the Cleaner Fuels Grants Scheme could see demand drop significantly as the market will be price driven and not influenced by carbon reduction policies.

The Ethanol Production Grant (EPG) Program

The Ethanol Production Grant (EPG) program provides a refund to producers of excise levied on ethanol produced and supplied for transport use in Australia from locally derived feedstocks. Under the scheme, which commenced in 2002, excise of 38.143 cents per liter paid to the Australian Taxation Office by ethanol producers is refunded. Over A$100 million was refunded annually to the local ethanol industry over the four years to 2013. The subsidy reduces the cost of production and supports ethanol production. Imported ethanol is subject to customs duty and a value duty of 5 per cent.

Table 1: The Ethanol Production Grant Program (EPG), 2008-2013

Date of effect	Unit	2009	2010	2011	2012	2013
Excise rate on ethanol	cents/liter	38.143	38.143	38.143	38.143	38.143
Ethanol production	ML	204	275	319	306	290
Payments under EPG	A$M	78	105	122	117	108

Source: Bureau of Resources, Energy Economics (BREE, 2014), *Excise Tariff Act 1921*, Australian Taxation Office (ATO) and Department of Industry.

Review of the EPG Scheme, February 2014

The EPG program was introduced to encourage the development of a commercially viable biofuels industry in Australia, but a report by the Bureau of Resource and Energy Economics (BREE, 2014) in February 2014 found that the industry remained dependent upon the excise rebate for its viability. The report suggested that there was no net benefit for energy security from a domestic ethanol industry based on first generation technology. On the other hand, the Biofuels Association reported that the industry contributed over A$400 million to the economy, employed over 4000 people and used the waste product wheat starch in ethanol production to reduce dependence on energy imports.

Changed Assistance for Biofuels in the 2014 Federal Budget

The 2014 federal Budget announced assistance for ethanol and biodiesel produced in Australia would be reduced. Currently, locally produced ethanol and diesel receive a full rebate of the excise tax of A$0.38143 per liter. Imports of these biofuels have a customs duty imposed equivalent to the fuel excise tax. Biodiesel local production and imports receive a rebate of excise and customs duty respectively under the Energy Grants (Cleaner Fuels) Scheme which is intended to encourage the use of renewable fuels. From July 2016, an excise of 2.5 cents per liter will be levied on local production, scaling up gradually to a maximum of 12.5 cents a liter in 2020 (see table). The Biofuels Association of Australia (BAA) expressed disappointment at the government's decision not to retain the effective excise free status of renewable biofuels until 2021.

Table 2: Proposed changes to excise and customs duty rates on fuel ethanol (cents per liter)

Date of effect	1 July 2015	1 July 2016	1 July 2017	1 July 2018	1 July 2019	1 July 2020
Excise rate	0.000	2.500	5.000	7.500	10.000	12.500
Customs duty	38.143	38.143	38.143	38.143	38.143	38.143
Difference	38.143	35.643	33.143	30.643	28.143	25.643

Source: Australian Government, *Budget Measures: Budget Paper No. 2: 2014–15*, 2014, p. 165.

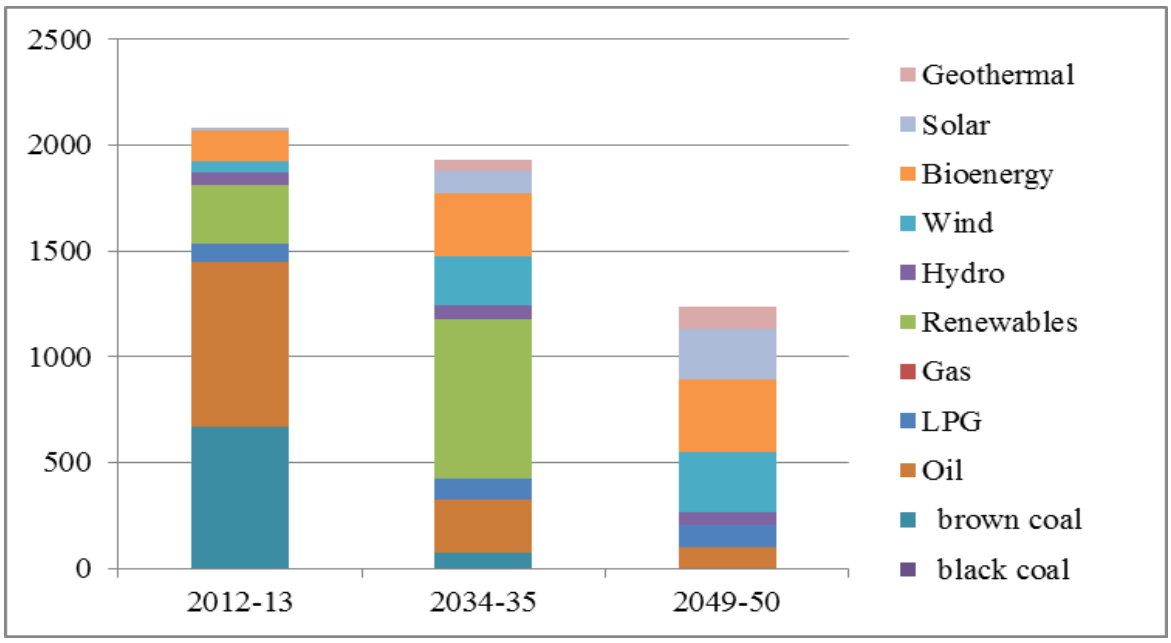
Under the provisions of the 2014 federal Budget, the refund of customs duty to biodiesel importers will cease from 1 July 2015 and a non-rebateable excise will be phased in for locally produced ethanol and biodiesel, although at a lower level than the equivalent customs duty. Grant schemes for both will be reduced to zero. The excise rate will fall to zero on July 1 2016 and then rise over five years to 2016 with an end rate of around A$0.19 cents per liter. This is 50 per cent of the energy content-equivalent tax rate. The customs rate of five per cent on imports of ethanol and biodiesel of 38.143 per liter will remain.

Australian Fuel Use

Australia's domestic energy mix is changing, albeit incrementally and from a stable long-term base. In 2012, coal remained a key fuel at 34 per cent of total energy consumption and around 69 per cent of electricity generation. Petroleum-based fuels, predominantly for transport, are the other major class of fuels accounting for 39 per cent of consumption. Gas accounts for 23 per cent of Australia's total energy consumption with considerable potential for further growth. Coal seam gas and shale gas could also become significant future sources of energy for Australia, while the share of black and brown coal in the energy mix has declined in recent years with the substitution of gas and renewable energy for electricity generation (BREE, 2013).

Biofuels such as biodiesel and ethanol have a different molecular composition and physical properties compared to non-renewable fossil fuels. The biofuels cannot be distributed traditional infrastructure networks and usually require further investment in distribution. Ethanol, for example, may require new pipelines as its corrosiveness and hydrophilic properties render it largely incompatible with existing infrastructure. Even where these fuels are blended with non-renewable fuels, additional infrastructure such as tank and blending infrastructure may be needed at either the refinery or terminal stage.

Chart 1: Australian energy production by source, 2012-2050



Source: Bureau of Energy and Resource Economics (BREE, 2012), *Australian Energy Projections to 2015*.

Australian Use of Biofuel and Biofuel Blends

Australian use of biofuels is encouraged by the current excise regime which has supported the local ethanol industry but also provided for excise free entry of biodiesel imports. Changes to the grant funding and excise treatment of alternative fuels announced in the federal Budget for 2014 will mean that biodiesel and ethanol attract an effective fuel tax from 1 July 2016. However, most biodiesel is used for the agricultural, mining and transport uses that are exempt from excise and the cost competitiveness of biodiesel and ethanol blends (for example, B20 diesel and E10 petrol fuels) will not be significantly affected from this measure.

In 2013, locally-produced ethanol supplied around 1 per cent of the total road transport fuel market in Australia. The predominant petrol-ethanol blend (E10) is largely sold in New South Wales (NSW) and Queensland and accounted for around 14 per cent of total Australian petrol sales in 2013. Ethanol is blended with petrol to make commercial products by the major petroleum companies using a range of methods including “splash” or sequential blending, in tank blending and gantry side stream blending.

Table 3: Australian Transport Fuels, 2013

Fuel	**ML**	**PJ**	**%**
Automotive diesel	22300	860	46.9
Petroleum	18400	630	34.3
Jet fuel	7780	290	15.6
Autogas	1820	50	2.6
Ethanol	280	7	0.4
Biodiesel	110	4	0.2
LNG	20	1	..
CNG	90	1	0.05

Source: BREE (2014), *Australian Energy Statistics*, Canberra.

The major petroleum refinery and distribution companies in Australia are also the main distributors of biofuels to consumers and business. Their industry association recently argued that there is no access to imported ethanol on the same terms as domestically produced ethanol even accounting for the 2014-15 Budget announcement to impose an effective excise on locally produced biofuel. It suggested that the excise on imported ethanol was "hampering the development of a competitive, efficient and diverse biofuels market in Australia" (Australian Institute of Petroleum, June 2014).

Table 4: Australian Fuel Use Projections, 2015 to 2024 (ML)

Calendar Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Gasoline Total	17.6	17.8	18.0	18.2	18.4	18.6	18.9	19.1	19.3	19.5
Diesel Total	20.0	20.6	21.2	21.9	22.5	24.0	23.7	24.3	25.0	25.5
On-road	7.2	7.4	7.7	7.9	8.1	8.3	8.6	8.8	9.0	9.2
Agriculture	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2
Construction/ mining	7.4	7.7	7.9	8.1	8.3	8.6	8.8	9.0	9.3	9.5
Shipping/rail	0.8	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0
Industry	1.2	1.3	1.3	1.4	1.4	1.4	1.5	1.5	1.5	1.6
Heating	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Jet Fuel Total	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5
Total Fuel Markets	38.0	38.8	39.6	40.5	41.4	43.1	43.1	43.9	44.8	45.5

Sources: BREE, Department of Industry and Post estimates.

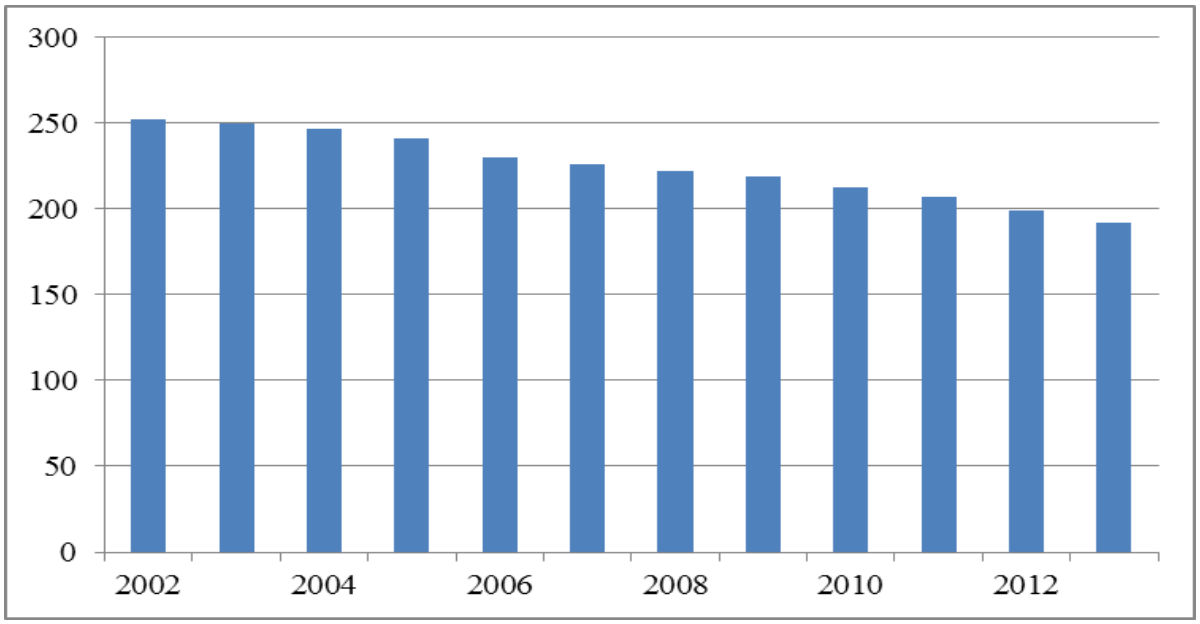
Trends in Vehicle Fuel Efficiency

The Australian road transport fleet is generally reliant on petroleum based fuels such as petrol and diesel. Petrol is the dominant fuel in the light vehicle sector, although the share of diesel has increased. Diesel is the dominant fuel in the heavy vehicle sector. Imposition of excise on liquefied petroleum gas (LPG) has lowered demand for the fuel. Biofuels are produced using a range of biological feedstock and include ethanol and biodiesel. These fuels are then blended with petrol or diesel and can produce the same fuel efficiency with lower carbon intensity. However, at current rates of production and usage, these fuels are likely to remain as a small proportion of the traditional fuel market.

Australia has a range of policy measures to increase fuel efficiency in the vehicle fleet. Since 2004, the Australian Government has mandated fuel consumption labelling of all new vehicles up to 3.5 tonnes, to provide information to consumers on the relative performance of individual models. There are a range of voluntary measures in place to reduce vehicle CO2 emissions and improve fuel efficiency. The Australian Government and the Federal Chamber of Automotive Industries (FCAI) agreed to a voluntary national average fuel consumption (NAFC) target for new passenger cars of 6.8 L/100km for petrol passenger cars. The Green Vehicle Guide (GVG) website provides model specific information to consumers on the emissions performance of all light vehicles produced since mid-2004.

According to a 2014 study by the National Transport Commission (NTC) the average annual carbon dioxide emissions ratings of new passenger vehicles and light commercial vehicles was 192 grams per kilometer travelled, a 3.4 per cent reduction from 2012 and is the third largest annual reduction since records started in 2002. In 2013, 2.2 per cent of new cars sold in Australia were ‘green’ cars (compared with 1.2 per cent in 2012). A ‘green’ car is a vehicle that does not exceed 120 g/km (NTC, 2014).

Chart 2: Carbon emissions of new Australian passenger vehicles, 2002-2013



Note: Carbon dioxide emissions in terms of grams per kilometer traveled.
Source: National Transport Commission (2014).

In 2012 Australia's national average carbon emissions from new passenger vehicles was 44 per cent higher than in the European Union (190 g/km compared with 132 g/km). Some factors are the Australian consumer preferences for heavier vehicles with larger and more powerful engines, a lower proportion of diesel powered engines and the comparatively low cost of fuel in Australia partly because of a freeze on indexation of fuel excise taxation. The 2014 Budget announced that indexation would be re-introduced.

II ETHANOL

Ethanol, or a blend of ethanol and gasoline, is used as a fuel. It is produced by fermenting sugars from any feedstock with plentiful natural sugars or starches. Ethanol production in Australia uses first generation grain-based distillation technology in which the feedstock accounts is a high proportion of production costs, although waste residues from co-production processes such as flour milling can lower costs. 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 and in an E10 blend provides 3 per cent less energy. Ethanol accounts for 1 per cent of the road transport fuel market, while ethanol blended fuels (mainly E10) accounted for 14 per cent of total petrol sales in 2013 (BREE, 2014).

Production

The ethanol industry in Australia comprises three producers in New South Wales and Queensland, with an installed production capacity of 440 million liters (ML). In 2014, there were three ethanol fuel manufacturing plants, each distilling different feedstocks. The largest ethanol producer in NSW uses wheat starch with capacity to make 300 million liters of ethanol. The second largest producer in Dalby, Queensland uses red sorghum with capacity to make 80 million liters of ethanol while the third largest at Sarina, Queensland uses molasses from sugar and has a capacity of 60 million liters of ethanol. The use of lower cost residue feedstock from other production processes such as flour milling or sugar refining can lower overall costs compared to commercially sold grain or other feedstocks. Actual production is considerably below capacity but firm-specific output is not available.

Table 5: Capacity of the Australian Ethanol Industry, 2014 (million liters)

Ethanol plant	**Location**	**Installed capacity**	**Feedstock**
Producer A	NSW	300	Waste wheat starch
Producer B	Queensland	80	Red sorghum
Producer C	Queensland	60	Molasses
Total capacity	Australia	440	

Source: BREE (2014) and Biofuels Association of Australia.

The process of storing and blending ethanol with petroleum to make E10 (10 per cent ethanol; 90 per cent petroleum) has involved additional investment in infrastructure at terminals and storage facilities of around A$40 million by the refinery sector which handles retail distribution of ethanol fuels in Australia. This investment was facilitated by the Biofuels Capital Grants Program to support new or expanded biofuel production capacity, which ended in 2010.

Table 6: The Australian Ethanol Industry (ML)

Calendar Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2015**
Beginning Stocks	0	0	0	0	0	0	0	0	0	0	0
Fuel Begin Stocks	42	0	0	0	5	5	6	7	7	7	7
Production											
Fuel Production	42	84	149	203	275	319	306	290	265	265	265
Imports											
Fuel Imports	5	12	49	21	38	40	14	8	20	20	20
Exports											
Fuel Exports	22	9	7	8	6	3	31	36	36	36	36
Consumption											
Fuel Consumption	67	87	191	216	307	361	295	269	256	256	256
Ending Stocks											
Fuel Ending Stocks	0	0	0	0	0	0	0	0	0	0	0
Number of Bio-refineries	3	4	4	4	4	3	3	3	3	3	3
Nameplate Capacity	120	120	189	456	440	440	440	440	440	440	440
Capacity Use (%)	35	70	79	45	86	82	67	61	60	60	60
Co-product Production											
Bagasse	0	0	0	NA	NA	NA	NA	NA	NA	NA	NA
Co-product B	0	0	0	0	0	0	0	0	0	0	0
Feedstock Use (000 MT)											
Feedstock A (wheat)	0	0	0	NA	NA	NA	NA	NA	NA	NA	NA
Feedstock B (sorghum)	0	0	0	NA	NA	NA	NA	NA	NA	NA	NA
Feedstock C (molasses)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Market Penetration Million liters)											
Fuel Ethanol	67	87	191	216	307	361	295	269	256	256	256
Gasoline	25,833	25,219	22,331	19,503	18,198	17,574	18,228	18,500	18,800	18,800	18,800
Blend Rate (%)	0	0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Note: Wheat consumption based on ethanol yield of 0.55L/kg (132 gal/MT)

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 market forces. The bulk supply price of ethanol is also influenced by the cost of feedstocks such as wheat and sugar and the price of petrol.

Consumption

The most commonly available ethanol blend in Australia is E10, a 10 per cent blend of ethanol with unleaded petrol (ULP). Blends containing greater than 10 per cent ethanol have been shown to damage some components in Australian vehicles and there is consumer resistance to higher ethanol fuel blends. For this reason, the Australian Government limits ethanol content in petrol to a maximum of 10 per cent. 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 from the transport fuel.

Currently, around 60 per cent of petrol engine vehicles in the current Australian fleet can operate on ethanol blend fuels. Vehicle compatibility issues with ethanol have been reduced and the Biofuels Association estimates over 90 per cent of the vehicle fleet is now compatible with E10 and the balance of vehicles are generally older and travel shorter distances. Storage tanks for ethanol blends have been installed at many service stations and a distribution infrastructure is in place to allow an expansion in market supplies of ethanol blended fuels.

Trade

Ethanol imports are subject to both a general tariff of 5 per cent and the customs equivalent full excise on mid-energy fuels of A$0.38143 per liter. Customs duty on U.S.-sourced ethanol is not exempt from customs duty under the provisions of the Australia-United States Free Trade Agreement (AUSFTA). Imports of ethanol are not significant because they are subject to the full excise.

Consumer Resistance to Ethanol Fuels

Demand for biofuels in Australia is constrained by consumer resistance to the use of ethanol blend fuels. Ethanol has a lower energy density than conventional petroleum and due to corrosiveness can only usable in low blends (e.g. up to 10 per cent) in most conventional engines and higher blends require partial modification to engines. However, as the average age of the vehicle fleet in Australia continues to fall, ethanol fuels are expected to be more accepted as newer and often smaller engines are being designed to cope with blended fuels. The peak of ethanol use in the NSW market was four per cent (40 per cent of fuel) in mid-2012 and since then, the share of E10 has fallen.

Ethanol Labeling Standards

In 2003, the Australian Government capped the level of ethanol that can be added to petrol at 10 per cent under the Fuel Quality Information Standard (Ethanol) Determination 2003. Fuel suppliers of petrol containing ethanol must comply with the Fuel Quality Information Standard (Ethanol) Determination 2003 (labelling standard). The labelling standard aims to inform consumers that fuel they purchase contains ethanol. A requirement to label ethanol blend petrol was introduced in 1 March 2004 and amended in January 2006 to simplify the labelling standard. All petrol pumps dispensing ethanol blend petrol must show the percentage of ethanol in the petrol.

III BIODIESEL

Biodiesel is produced from renewable plant or animal feedstocks as a replacement for diesel through a process called transesterification. Feedstocks include vegetable oils such as canola oil, animal fats (tallow) or recycled greases such as used cooking oil. Ethanol, biodiesel and renewable diesel are usually blended with conventional fuels (petrol or diesel) for use as motor vehicle fuels. Biodiesel can be mixed with normal fuels and B5 is the common blend, consisting of 5 per cent biodiesel and 95 per cent petrol. The B5 fuel is considered as identical with normal diesel fuel and is sold unlabeled in Australia. The B20 biodiesel blend (20 per cent biodiesel and 80 per cent petrol) is generally sold for commercial operations and is labeled. Renewable diesel is a product derived from tallow that is co-produced with petroleum-derived diesel and is chemically indistinguishable from petroleum-derived diesel.

Biodiesel is currently effectively excise free compared with petroleum-derived diesel which has an excise of 38.143 cents per liter. Under measures announced in the 2014 federal Budget, the government will reduce grants made under the Cleaner Fuels Grant Scheme to zero and reduce the excise on biodiesel to zero from 1 July 2015. From 1 July 2016, the excise rate for biodiesel will be increased for five years until it reaches 50 per cent of the energy content equivalent tax rate. The excise equivalent customs duty for imported biodiesel will continue to be taxed at the full energy content equivalent tax rate.

Table 7: Biodiesel production facilities in Australia (ML), 2014

Biodiesel plant	Location	Capacity	Feedstock	Production start
Australian Renewable Fuels (ARF) Largs Bay	South Australia	45	Tallow, used cooking oil	2006
Australian Renewable Fuels (ARF) Picton	Western Australia	45	Tallow, used cooking oil	2006
Biodiesel Industries Australia (BIA)	New South Wales	20	Used cooking oil, vegetable oil	2003
Australian Renewable Fuels (ARF) Barnawartha	Victoria	60	Tallow, used cooking oil	2006
Ecotech Biodiesel	Queensland	30	Tallow, used cooking oil	2006
Smorgon Fuels Biomax Plant	Victoria (now closed)	100	Tallow, Canola oil and Juncea oil	2005
Macquarie Oil	Tasmania	15	Poppy oil, waste vegetable oil	2008
Territory Biofuels plant	Northern Territory	140	Palm oil, Tallow, used cooking oil	Closed in 2009 but expected to restart in 2015
Total capacity (ML)		360		

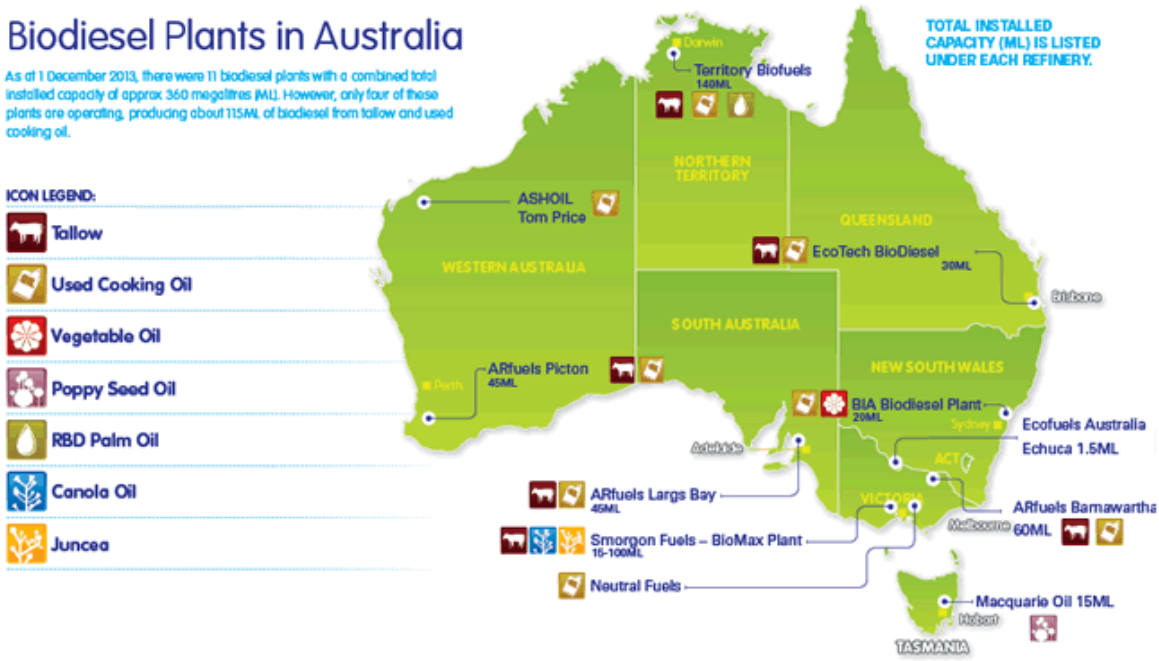
Source: Biofuels Association of Australia and Post estimates.

Biodiesel has 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 is developing a standard for biodiesel blend fuels. Biodiesel blends – usually B5 (five per cent) or B20 (20 per cent) have been made available at an increasing number of service stations in all States.

Production of Biodiesel

Australian production of biodiesel has fallen in recent years with the closure of a number of plants. Only four of the eleven biodiesel plants around Australia are currently operating and the industry association has estimated total production at 115 ML, well below total capacity of around 500 ML. Production and capacity utilization varies considerable by plant. One major producer mothballed its 100 million liter biodiesel plant in 2013 because it was unable to secure long-term deals with established petroleum refiners and distributors. On the other hand, an established producer increased production by over 40 per cent over the year and other plants may reopen or expand capacity.

Chart 3: Biodiesel Plants in Australia, 2013



Source: Biofuel Association of Australia

Australia's largest biodiesel plant is in the Northern territory and has a rated capacity of 140 million litres per year. It was designed to use palm oil and food-grade vegetable oil but has been shut since 2009. The plant was acquired in early 2014 by a U.S. biofuels and energy company. It will restart production in 2015 aiming to process a broader range of feedstocks, including lower quality tallow, used cooking oil and palm sludge oil. This U.S. company also has significant investment in other Australian biodiesel companies and aims to further increase biodiesel exports to the United States market.

Consumption

Demand for diesel and biodiesel fuel in Australia is influenced by excise rebates to major users of the fuel. The long-haul trucking industry receives 12 cents per liter rebate from the federal excise tax on the fuel, reducing their fuel excise to 26 cents per liter. The mining and agriculture industries pay no excise as they receive a full rebate of 38.141 cents per liter because their consumption is for "off road" purposes. Drivers of diesel cars pay 38 cents per liter in fuel excise, the same as drivers of unleaded vehicles. Imports of biodiesel enter Australia excise free under measures to encourage cleaner fuels.

Most diesel fuel in Australia is sold in bulk to commercial/industrial customers such as mining and transport companies on long term contracts. Only 25 per cent of the diesel fuel used in Australia is sold through retail outlets and of this 80 per cent is bought by the long-haul trucking industry with only a small

proportion of diesel sold to private customers. Diesel engine manufacturer warranties for engines typically allow biodiesel blends up to 5 per cent with conventional diesel (B5) provided that 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. Biodiesel blends up to B100 are currently used in fleet operations, such as local council trucks (AIP, 2014).

Table 8: The Australian Biodiesel Industry, 2006-2015

Biodiesel (Million Liters)										
Calendar Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Beginning Stocks	0	0	0	0	0	0	0	0	0	0
Production	21	54	50	85	85	80	51	62	65	100
Imports	2	7	4	11	9	25	21	24	25	26
Exports	0	0	0	0	0	0	10	17	20	20
Consumption	23	61	54	96	94	105	62	69	70	106
Ending Stocks	0	0	0	0	0	0	0	0	0	0
Production Capacity										
No. of Bio-refineries	7	7	9	8	6	6	7	7	8	8
Nameplate Capacity	380	380	380	380	380	380	400	300	300	400
Capacity Use (%)	5.5	14.2	13.2	22.4	22.4	21.1	18	20.7	21.7	25
Feedstock Use (1,000 MT)										
Tallow	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cooking oil	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Market Penetration (Million Liters)										
Biodiesel, on-road use	23	61	54	96	139	275	371	233	235	235
Diesel, on-road use	10,300	18,900	12,400	10,800	11,100	10,686	12,000	12,000	12,000	12,000
Blend Rate (%)	0.2	0.3	0.4	0.9	1.3	2.6	3.1	2	2	2
Diesel, total use	10,323	18,961	12,454	10896	11,239	10,961	12,371	12,233	12,235	12,235

Source: Department of Industry, BREE and Post estimates.

Trade

The Australian market for biodiesel is supplied from local production and imports. Under measures announced in the 2014 federal Budget, imports of biodiesel will no longer be excise free (after the Clean Energy Grant rebate to importers) and will become subject to the full excise of A$0.3841 per liter. This measure will affect the relative price of biodiesel and could reduce its market in Australia. The imposition of an excise duty on imported biodiesel of 38.143 cents a liter from July 2015 is expected to generate A$156 million in excise revenue over four years, but this could be lower if imports become uncommercial because of the policy change. Imports of biodiesel from the United States are subject to a countervailing duty which was imposed in 2011 and which will expire in 2016.

IV ADVANCED BIOFUELS

Overview

First generation biofuels are based on fermentation and distillation of ethanol from sugar and starch crops or chemical conversion of vegetable oils and animal fats to produce biodiesel. Second generation or advanced biofuels are derived from sustainable sources of organic matter not used for food production, such as wood residues, certain oilseeds, and algae. Commercialization of second generation bioenergy technologies would increase the range of sustainable resources available for both biofuels and electricity generation.

Second-generation technology, such as conversion of algae or lignocellulose (woody or fibrous plant material) to fuels such as ethanol and synthetic diesel could allow a viable biofuel industry in Australia, but this technology has not yet been sufficiently developed. There are a number of research and trialing projects in Australia using the second generation model based on different feedstocks including lignocellulosic feedstocks. The Oil Mallee project for example used Mallee eucalypts for producing eucalyptus oil, activated carbon and bioenergy in a 1 kW integrated wood processing demonstration plant.

Other feedstocks under development include Indian mustard seeds (Western Australia), *Pongamia pinnata* trees (Queensland, Western Australia), *Moring oleifera* (Western Australia) and algae (Queensland, South Australia, Victoria). ARENA is supporting South Australian research into sustainable production of biodiesel from microalgae.

The Australian Renewable Energy Agency has supports the development of advanced biofuels and has provided over A$25 million to projects developing advanced biofuel technologies. For instance, ARENA has provided A$10 million to two projects under the Advanced Biofuels Investment Readiness (ABIR) program and A$5 million to James Cook University for its High Energy Algal Fuels project investigating the production of biofuels from macroalgae. In the 2014 Budget, the Australian Government announced its intention to repeal the ARENA Act and abolish ARENA, returning its functions to the Department of Industry and returning $1.3 billion to consolidated revenue.

Sustainable Aviation Fuel (SAF)

Traditional aviation fuel represents the largest operating cost for Australian airlines, accounting for 30 per cent of their operating costs in 2013 compared to 14 per cent in 2003. The two main airlines have encouraged the development and use of sustainable aviation fuels (SAF) as a way to reduce greenhouse gas emissions and to increase energy supply security. Research aims to develop competitive 'drop-in' advanced biofuels compatible with existing engines, infrastructure and existing supply chains.

In general, transport fuels must adhere to national fuel standards, defined by the Fuel Quality Standards Act 2000, while in the aviation sector standards are set by the American Society for Testing and Materials (ASTM) Strong airline support for biofuels including research and trials has led to the revision of ASTM standards to allow airlines to accept aviation fuel that blends up to 50 per cent biofuels for two certified pathways.

A 2012 study was coordinated by Qantas and Shell on the potential for biofuels from production of hydroprocessed natural oils and animal fats in Australia (the HEFA pathway). The study assessed the commercial viability of a potential A$1 billion SAF facility with an annual production capacity of one million barrels of renewable hydrocarbons (diesel, SAF, naphtha and refinery gas). It found the plant was not commercially viable as the price of feedstock is generally higher than the price of end products, such as diesel and jet (Qantas and Shell, 2013). The Qantas/Shell study also assessed the potential for production of SAF from the certified Fischer Tropsch (FT) pathway. It found that while the conversion of gas and coal-based feedstock into hydrocarbon products using the Fischer Tropsch (FT) process is an accepted technology but it is not yet commercially viable.

Research is also being undertaken by the CSIRO and Virgin Airlines on a renewable aviation fuels supply chain based on various sources of biomass, including eucalyptus, to find the most promising sources of SAF

in the future. In 2012, Qantas operated Australia's first commercial SAF flight from Sydney to Adelaide with a 50 per cent blend of SAF with traditional jet fuel in one engine.

In 2013, Qantas also undertook a comprehensive feasibility study with Shell Australia on how the viability of an SAF industry in Australia using existing supply chain and refining infrastructure. The study examined the commercial viability of a hypothetical facility with capacity of 20,000 barrels of renewable hydrocarbons (diesel, SAF, naphtha and refinery gas) per day at a capital cost of A$1 billion. It found SAF production was technically feasible but not yet commercially viable.

There have been a number of other studies into the viability of an aviation biofuels industry in Australia. The CSIRO (2011) concluded that only next generation biomass feedstock (non-food parts of crops, plants, trees, algae and waste) could be used for SAF in the foreseeable future. The LEK report (2011) for the Australian Renewable Energy Authority (ARENA) concluded that Australia had a comparative advantage in the bio-fuels market, but significant investment and land use change is required for the industry to be viable. The Australian Initiative for Sustainable Aviation Fuels (AISAF) is a coalition of business, government and civil at the University of Sydney which aims to build commercial supply chains for sustainable aviation fuels in Australia. See: http://aisaf.org.au/

U.S.-Australia Cooperation on Biofuels

In 2012, the Secretary of the U.S. Navy established a goal that by 2020, half of the Department of Navy's energy would come from alternative energy sources and further that the Navy would deploy a "Great Green Fleet" in 2016 which would use biofuels for 50 per cent of its total fuel supplies. One goal of this policy is to demonstrate the viability of advanced alternative fuels as a substitute for petroleum and to increase energy security. Under a 2012 U.S.-Australia *Statement of Cooperation for the Research and Use of Alternative Fuels*, Australia and the United States agreed to exchange information about policies, programs, projects, research results, and publications, and to conduct joint studies in areas such as fuel sources and environmental impacts.

In May 2014, the Royal Australian Navy (RAN) confirmed plans to transform its existing fleet of naval vessels and aircraft into bio-fuel capable by 2020. This decision is in line with the US Navy's plans to convert its own fleet using at least a 50-50 fuel blend. Australia has also been offered access to the alternative fuel technology, which is currently being developed by the US military. The change would

support RAN's work with the US Navy on joint operations under which US warships and aircraft plan to visit Australian bases more frequently.

In total, the RAN is planning to make around 50 vessels and aircraft compatible with alternative fuels. However, this goal is more likely to be achieved when the cost of biofuels approaches parity with other fuels used by the Navy. The RAN is expected to send a biofuel powered frigate and helicopter to participate in the US Navy's "Great Green Fleet" demonstration in 2016.

V BIOMASS FOR HEAT AND POWER

While overall energy generation and fuel use is dominated by fossil fuels, especially coal, petroleum and gas (Geoscience Australia, 2013), bioenergy is one of the largest contributors to Australia's renewable energy production. Australia's bioenergy industry generates energy from biomass resources including bagasse from sugarcane, landfill gas, wood waste, energy crops, agricultural products and municipal solid waste (ARENA, 2013). Bioenergy for electricity and heat generation is produced predominantly from byproducts of sugar production and waste streams. There are few detailed official statistics on the use of biomass for heat and power generation in Australia.

A range of woody biomass is currently commercially used to generate power. These are typically densely planted, high yielding varieties of poplar, willow and eucalyptus that regenerate quickly after harvesting via coppicing (shoots from the stump of cut down trees).

Residues from forests and wood processing and organic waste streams are relatively untapped resources. Wood residues include primary waste from forestry such as cleared bark and sawn branches as well as pulp logs. Secondary residues from sawmills include chips, sawdust and shavings. These residues are generally abundant in the southern and eastern coasts, and in south western WA, with supply being available year round. With the exception of pulp logs, which have an alternate use in paper production, and some harvesting issues with forest residues, wood wastes can generally be obtained at affordable costs.

VI NOTES ON STATISTICAL DATA

The main statistical sources for production of biofuels in Australia were the Department of Industry and the Australian Taxation Office as the excise rebate is based on proven production. Production and capacity details for the biodiesel industry were available on the website of the Biofuels Association of Australia and estimates were also based on other sources. Consultations were also held with the Department of Industry, ARENA and the Bureau of Resources and Energy Economics (BREE). There are a number of recent reports on possible production of advanced biofuels in Australia including the recent Qantas/Shell (2013) report and the CSIRO (2011) and LEK Advanced Biofuels Study (2011). Currently there is no commercial production of advanced biofuels in Australia.

Trade statistics have been sourced from the Australian Bureau of Statistics through the Global Trade Atlas, but modified by industry information on the biofuel share of total imports. Details of the structure and performance of the Australian ethanol industry have been sourced from the Australian Biofuels Association and BREE. Statistics on energy use in Australia were sourced from a variety of sources including BREE's (2013) report on Australian energy statistics. Reports by the Australian Competition and Consumer Commission on its monitoring of the Australian petroleum industry were also reviewed.

Details of Australian government policies on renewable energy and biofuels were sourced from the Department of Industry, the Australian Taxation Office and ARENA. Australian Budget papers and explanatory memoranda provided details of actual legislation that affects the biofuel industry and expected changes to this legislative and regulatory framework.

REFERENCES

Australian Institute of Petroleum (AIP, 2014), *Submission to Competition Policy Review*, June, link

AIP (2014), *Biofuels Fact Sheet*, see: link

Australian Bureau of Agricultural and Resource Economics (ABARES) and the Bureau of Rural Sciences (BRS) (2013), *Economic Viability of Ethanol Production in Australia*, Canberra.

Australian Competition and Consumer Commission (2013), Monitoring of the Australian Petroleum Industry, December.

Biofuels Association of Australia (2012), *The Outlook for Biofuels*, See: link

Bureau of Resources and Energy Economics (BREE) (2013) *Australian Energy Statistics* Canberra link

Bureau of Resources and Energy Economics (BREE) (2014), *An assessment of key costs and benefits associated with the Ethanol Production Grants Program*, A Report for the Department of Industry, February.

CSIRO (2011), *Sustainable Aviation Fuel Road Map: Towards establishing a sustainable fuels industry in Australia and New Zealand*, May.

L.E.K Consulting (2011), *Advanced Bio-fuels Study: Strategic Directions for Australia*, December.

National Transport Commission (2014), *Carbon Emissions from New Australian Vehicles 2013*, May link

Qantas/Shell (2013) Australian feedstock and production capacity to produce sustainable aviation fuel, June See: link

DEFINITIONS

Advanced biofuel	Liquid fuel derived from sustainable sources of organic matter not used for food production, such as wood residues, certain oilseeds, and algae.
Biodiesel	Biodiesel or methyl ester is a biofuel manufactured from a reaction between alcohol, natural oils and a catalyst which is called trans-esterification.
Bioenergy	Bioenergy is a form of renewable energy derived from biomass to generate electricity and heat or to produce liquid fuels for transport.
Biomass	Renewable organic material such as wood or forest residue, crops and animal products, dedicated energy crops and municipal wastes that can be used as an energy source.

Conversion process	The technology used to convert biomass into biofuel, such as sugar fermentation, vegetable oil transesterification, gasification followed by catalytic conversion of gases, gasification followed by fermentation, pyrolysis and lipid hydrotreating.
Drop-in fuel	Fuel refined so as to be used without modifications to fuel distribution infrastructure or equipment.
Ethanol	Ethanol is an alcohol-based fuel manufactured from sugars usingf fermentation and distillation. In Australia, ethanol is blended with petroleum under a mandated system. Ethanol is classified as a biofuel in Australia.
Feedstock	The raw material used as an input to manufacture a biofuel.
Renewable diesel	Renewable diesel is manufactured from natural oil feed stocks using hydrogen as a reactant in a process called hydroprocessing. Renewable diesel is chemically identical to ordinary diesel. It is classified as a biofuel in Australia.
Renewable fuel	Fuel derived from renewable sources
Fischer-Tropsch	Chemical reaction that converts syngas into liquid hydrocarbons.
B2	Liquid fuel with 20% biodiesel and 80% diesel
B5	Liquid fuel with 5% biodiesel and 95% diesel
E10	Liquid fuel with 10% ethanol and 90% gasoline