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Biofuels Annual

2016

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Report Highlights:
In recent years, the Australian biofuel industry has faced lower world crude oil prices and fluctuating demand, as well as a number of policy changes. Total production for 2016 is estimated at 300 million liters (ML), comprised of 250 million ML of ethanol and 50 million ML of biodiesel. Production of ethanol is relatively stable and is supported by a mandate in New South Wales and a now legislated mandate in Queensland from 2017. Biodiesel output has significantly declined following a surge of imports. A new excise arrangement has now made biodiesel imports fully subject to prevailing excise on diesel and the industry is restructuring. Second generation biofuels such as energy crops and algae-based fuels have been successfully demonstrated but are not yet commercially viable. The Queensland government has provided support for an advanced biofuels plant. Australia exports non-GM oilseeds to the EU for the production of biodiesel.

Post:
Canberra

EXECUTIVE SUMMARY

The Australian biofuels sector is comparatively small and in recent years has faced a number of significant challenges, including a low international oil price. Total biofuels production for Australia in 2016 is estimated by Post at 300 million liters (ML), comprised of 250 ML of ethanol and 50 ML of biodiesel. Note that there are no exact statistics on the production, imports and sales of biofuel and these estimates have been made using available sources such as excise rebate statistics, industry statistics on plant capacity and greenhouse gas emissions estimates by the Department of the Environment. Most biofuel plants have excess capacity and have experienced lower demand in recent years.

Production of ethanol appears to be relatively stable and is supported by a six percent mandate in New South Wales, while a three percent mandate in Queensland will take force in 2017. The largest ethanol producer in Australia is Manildra, which manufactures ethanol from waste wheat and supplies the NSW market. Two smaller producers in Queensland manufacture ethanol from sorghum and sugar. Competition with food producers for crops has not been a significant issue for Australia's ethanol producers as current production is predominantly based on waste starch and C molasses, a waste low-value end product also used as cattle feed.

Production of biodiesel appears to have declined in recent years due to the more competitive environment and a surge of imports before the excise rebate scheme closed in mid-2015. Under this scheme, both production and imports of biodiesel received a rebate of the excise, which may have encouraged a flow of increased imports. The largest biodiesel producer, Australian Renewable Fuels (ARF), went into receivership in April 2016 but may resume production in the second half of the year. Biodiesel is mostly manufactured from waste cooking oil, tallow and non- food sources.

In recent years, Europe has been the main destination for exports of Australian oilseeds for use in the production of biofuels. These oilseeds need to be certified as sustainable. Under a 2010 EU directive, bioenergy needs to involve a 35 percent saving in greenhouse gas emissions compared to a conventional energy source. These oilseeds must also not be genetically modified (GM) in nature and the industry is currently preparing appropriate documentation certifying that oilseeds from Australia have been grown, stored and shipped in a manner that complies with the specifics of the EU directive.

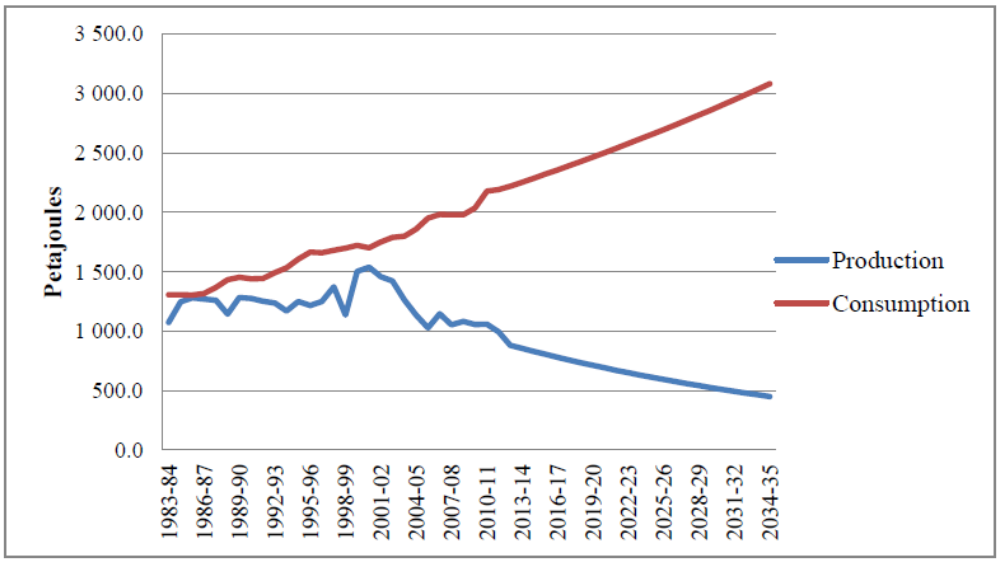
Second-generation biofuels such as energy crops and algae-based fuels have been successfully demonstrated but as yet are not commercially viable in Australia. A significant research effort has been initiated by a number of research agencies in the development of first generation and second generation biofuels. The Queensland government has recently announced a number of programs aimed at making the State a center of bio-manufacturing and biofuels production. It also hopes to develop the commercial production of biofuels for military, maritime and aviation uses.

II. GASOLINE AND DIESEL MARKETS

Overview

Australia's supply of transport fuels is met by a mix of domestically and imported refined crude oil and other feedstock and finished product. In 2014, over 80 percent of the crude and other feedstock required for domestic refining was imported, with the balance being supplied from production in Australia. Around 40 to 45 percent of refined petroleum products are imported from overseas refineries. Since 2010, the number of Australian oil refineries declined from seven to five, with 35 million liters per day reduction in refinery capacity (Energy White Paper 2015).

Chart 2: Australian oil production and consumption, 1983-2035



Source: Bureau of Resources and Energy Economics (BREE) and Department of Industry (2015).

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. Petrol, diesel and aviation fuel are the dominant transport fuels, accounting for over 90 percent of transport energy use in 2015. The share of petrol in the transport fuel mix has decreased slowly over recent decades, outstripped by growth in diesel and aviation fuel. This reflects increased demand for diesel from mining activities and increased air transport activity.

Imports of Transport Fuel

Australia is a major importer of crude oil and refined products for transport fuels; although overall it is a leading international exporter of energy. There has been a continued decline in domestic refining capacity for transport fuels and a significant rise in import dependence. Australia has a comparatively low level of stocks of transport fuels. One of the key reasons for developing the biofuels industry has been to increase Australia's energy independence in case of possible disruptions to import supplies of transport fuel in the future.

Fuel Efficiency and Emissions

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 percent reduction from 2012 and is the third largest annual reduction since records started in 2002. In 2013, 2.2 percent of new cars sold in Australia were 'green' cars (compared with 1.2 percent in 2012). A 'green' car is a vehicle that does not exceed 120 g/km (NTC, 2014). However fuel efficiency standards in Australia lag behind those applying in Europe and the United States.

Australia's national average carbon emissions from new passenger vehicles are comparatively high. Some factors contributing to this are a consumer preference for heavier vehicles and a lower proportion of diesel powered engines. Research on biofuels suggests that average carbon emissions from cars can be lowered through the use of ethanol and biodiesel as transport fuels.

Table 1: Australian Fuel Use Projections, 2015 to 2024 (billion liters)

Calendar Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Gasoline Total	17.6	17.8	18.0	18.2	18.4	18.6	18.9	19.1	19.3	19.5	19.7
Diesel Total	20.0	20.6	21.2	21.9	22.5	24.0	23.7	24.3	25.0	25.5	26.0
On-road	7.2	7.4	7.7	7.9	8.1	8.3	8.6	8.8	9.0	9.2	9.4
Agriculture	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0	4.1	4.2	4.3
Construction/ mining	7.4	7.7	7.9	8.1	8.3	8.6	8.8	9.0	9.3	9.5	9.7
Shipping/rail	0.8	0.9	0.9	0.9	0.9	0.9	1.0	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	1.6
Heating	0	0	0	0	0	0	0	0	0	0	0.0
Jet Fuel Total	0.4	0.4	0.4	0.4	0.5	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	46.2

Sources: BREE, Department of Industry and Post estimates.

Australia has a significant resources sector which already uses higher levels of biodiesel and renewable diesel than on-road transport and has the potential to use increased volumes of these fuels. Biodiesel and renewable diesel have a number of advantages when used in the mining industry, such as lower reported emissions and a lower tendency to ignite than conventional diesel, which provides additional safety in underground mining application.

Table 2: Australian renewable energy consumption by fuel type, 2014

Source	Energy consumption (PJ)	Share (%)	Change since 2013 (%)	Average annual growth, 2005-2014 (%)
Biomass	183	53.0	-1.1	-1.4
Woodwaste	93	26.9	3.1	-0.9
Bagasse	90	26.1	-5.1	-2.0
Biogas	16	4.7	17.0	9.1
Biofuels	12	3.6	2.6	24.3
Ethanol	7	2.1	-12.1	-
Biodiesel	5	1.5	33.5	-
Hydro	66	19.2	0.8	1.9
Wind	37	10.7	28.8	31.3
Solar PV	18	5.1		58.3
Solar hot water	13	3.8		19.7
Total	346	100.0	4.0	2.4

Source: Department of Industry and Science (2015), Australian Energy Statistics, Canberra.

III 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.

Fuel Taxes

Imports of petroleum products such as petrol and diesel attract a customs duty equivalent to the excise on domestically refined products. Petroleum refiners and independent fuel wholesalers account for the bulk of imports, which they on-sell to service station operators. The fuel retailing industry does not receive any government subsidies or grants.

In June 2014, the Australian government announced the reintroduction of fuel excise indexation to take account of inflation. Under this change, the fuel excise is indexed to movements of the Consumer Price Index in February and August of each year. In February 2016, the excise on petroleum and diesel fuels was set at A$0.395 cents per liter. Lower excise rates are set on biofuels. See link to the excise schedule administered by the Australian Taxation Office.

The Ethanol Production Grants (EPG) program ceased to operate in June 2015. The scheme had provided a full reimbursement to ethanol producers of the fuel excise. The rate of excise duty on locally produced fuel ethanol is now gradually increasing to one third of the excise rate for petrol by 2030. Imported ethanol continued to be subject to the full excise rate applying to petrol.

The rate of excise on locally produced biodiesel will increase to one half of the excise rate for diesel by 2030. Imported biodiesel has been subject to the full rate of excise which applies to diesel since mid-2015. Prior to this, biodiesel imports received a full excise rebate to encourage the use of

more environmentally friendly fuel. In 2016, the excise rates on ethanol and biodiesel were A$0.026 per liter and A$0.013 per liter respectively.

Fuel Standards for Ethanol

Federal government regulations apply to the quality of petrol and diesel fuel in Australia. The Fuel Quality Standards Act 2000 provides a legislative framework for setting national fuel quality and fuel quality information standards. Fuel quality standards apply to petrol, diesel, biodiesel, autogas and ethanol E85. The standards aim to reduce the amount of toxic pollutants in vehicle emissions. A fuel quality information labelling standard covers Ethanol (in petrol) and Ethanol E85.

Under the fuel standard for E10, suppliers who supply petrol containing ethanol must comply with the Fuel Quality Information Standard (Ethanol) Determination 2003 (labelling standard). The labeling standard is in place to inform consumers that the fuel they are purchasing contains ethanol. The Australian Government capped the level of ethanol that can be added to petrol at 10 percent in July 2003. This followed vehicle testing that suggested that petrol containing ethanol blends of 20 percent or more could cause engine problems in some older vehicles. A requirement to label ethanol blend petrol was introduced in 1 March 2004 and amended in January 2006 to simplify the labelling standard.

Under the Fuel Quality for Ethanol-e85 (a fuel blend of 70–85 percent ethanol with the remainder petrol), the fuel may only be used in cars that have been specifically built or modified to use E85. These include flexible-fuel vehicles and V8 racing supercars.

Fuel Standards for Biodiesel

The Fuel Quality Standard for Biodiesel defines biodiesel as 'a diesel fuel obtained by esterification of oil derived from plants or animals'. B5 is the common blend use in Australia, consisting of 5 percent biodiesel and 95 percent petrol by volume. The B5 fuel is considered as identical with normal diesel fuel and is sold unlabeled in Australia. The B20 biodiesel blend (20 percent biodiesel and 80 percent petrol) is generally sold for commercial operations and is labeled.

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, pure biodiesel (B100). Biodiesel blends, usually B5 or B20 have been made available at an increasing number of service stations across Australia.

NSW Government Biofuels Policy

The ethanol mandate in NSW is designed to encourage broader use of ethanol and other biofuels in the State. Most cars in NSW that use ULP can use 10 percent ethanol-blended fuel. The NSW government has a legislated ethanol supply mandate of 6 percent for wholesale companies and a requirement for retailers with 20 or more outlets to offer ethanol product for sale. Under the NSW *Biofuels Act 2007*, a certain percentage of the total volume of petrol sold in NSW by volume fuel sellers is required to be ethanol and a certain percentage is required to be biodiesel.

The *Biofuels Act* is administered by the NSW Office of Fair Trading. The NSW mandate for ethanol requires that ethanol must represent six percent of the total volume of petrol sold in NSW. It also requires that two percent of the total volume of diesel sold should be biodiesel. A range of exemptions applied to petrol retailers which has lowered the effective mandate for ethanol below six percent. The NSW government is currently seeking to reduce the number of exemptions to the Biofuels Act, so as to encourage greater use of the E10 fuel.

Queensland Government Biofuels Policy

The Queensland State government recently introduced a biofuel mandate to boost the biofuel and bio-manufacturing industry sector. The legislation passed in December 2015 requires the fuel industry to meet targets for the sale of biobased petrol, such as E10 which is an ethanol-blended petrol, and biobased diesel. The mandate sets minimum requirements for the sale of ethanol-blended regular unleaded petrol and biobased diesel. The biobased petrol mandate will apply separately to the bio-based diesel mandate. The government's intention is that both schemes will begin in January 2017. Details of the new requirements for fuel sellers are given here.

The Queensland biobased petrol mandate requires that three percent of the total volume of regular unleaded petrol sales and ethanol blended fuel sales must be biobased petrol (ethanol). The Act further provides that the ethanol mandate will increase to four percent after 18 months (from 1 July 2018). The Queensland biodiesel mandate requires 0.5 percent of all diesel fuel sold to be biobased diesel. See: Queensland Department of Energy and Water Supply website.

Queensland Biofutures Roadmap

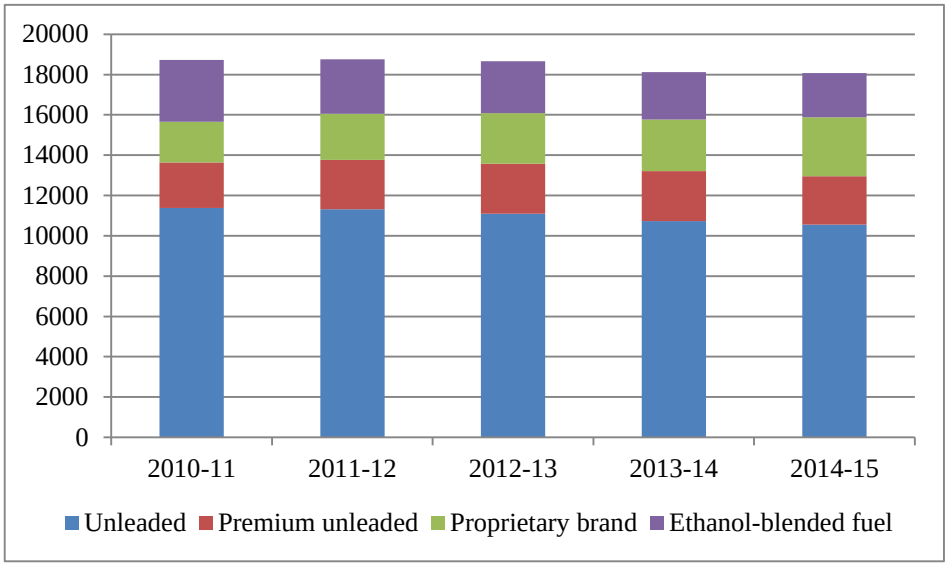
The Queensland State government is pursuing the development of a competitive industrial biotechnology and bio products sector (see: Biofutures Roadmap) which was launched at the 2016 BIO International Convention in San Francisco. The Queensland Government has identified this sector as a priority industry to develop new markets for technology developers and agricultural producers. The State government has established an A$5 million Biofutures Industry Development Fund, a A$5 million Commercialisation Fund and a A$4 million Biofutures Acceleration Program. Potential feedstocks identified include: sugarcane and green waste, sugarcane bagasse and sorghum.

IV ETHANOL

Overview

Ethanol is used as a renewable transport fuel produced by fermenting sugars from a range of feedstocks such as wheat, sorghum and molasses. Ethanol production in Australia uses first generation distillation technology in which the feedstock accounts for a high proportion of production costs. The most commonly available ethanol blend in Australia is E10, a 10 percent blend of ethanol with unleaded petrol (ULP). Ethanol blend fuels are also available using premium unleaded petrol (PULP). 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.

Chart 1: Automotive gasoline used in Australia by type, 2010-15 (ML)



Source: Department of Industry (2016), Australian Petroleum Statistics, Canberra.

Production

The ethanol industry in Australia has three established producers in NSW and Queensland, with an installed production capacity of 440 million liters (ML). The largest ethanol producer in NSW uses wheat starch and has the capacity to manufacture around 300 million liters of ethanol. The second largest producer in Queensland uses red sorghum and has a capacity to manufacture around 80 million liters of ethanol. The third largest manufacturer in Queensland uses molasses from sugar and has the capacity to manufacture around 60 million liters of ethanol annually. The use of lower cost residue feedstock from other production processes such as flour milling or sugar refining can lower costs compared to other feedstocks. In recent years actual production has been considerably below capacity.

Queensland currently has two ethanol plants, one operated by United Petroleum at Dalby and a smaller facility operated by Wilmar at Sarina. Dalby and Sarina have annual capacity of 90 million ML and 60 million ML respectively. However, these plants are operating at only around 85 percent capacity, for a total of about 128 million ML a year in 2015. United Petroleum is supplying around 40 million ML of ethanol to its interstate operations with Queensland's total supply at 88 million ML a year, which is sufficient to meet the 3 percent State government mandate. The Queensland State

government expects that demand for fuel grade ethanol will increase by 75 million ML when the mandate is implemented in 2017 and then will further increase to 100 million ML by 2018.

The process of storing and blending ethanol with petroleum to make E10 (10 percent ethanol; 90 percent 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 7: The Australian Fuel Ethanol Industry (million liters)

Calendar Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Beginning Stocks	0	0	0	0	0	0	0	0	0	0	0
Fuel Begin Stocks	0	0	0	0	0	0	0	0	0	0	0
Production											
Fuel Production	42	84	149	203	275	319	347	306	260	250	250
Imports											
Fuel Imports	5	12	49	21	38	40	14	8	6	6	5
Exports											
Fuel Exports	22	9	7	8	6	3	31	37	5	22	20
Consumption											
Fuel Consumption	25	87	191	216	307	356	330	277	261	234	235
Ending Stocks											
Fuel Ending Stocks	0	0	0	0	0	0	0	0	0	0	0
Bio-refineries (number)	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	63	73	79	70	59	57	57
Feedstock Use (000 MT)											
Waste wheat	62	127	223	306	486	564	540	512	468	460	460
Sorghum	26	49	91	122	130	148	143	135	130	120	120
Waste molasses	21	42	73	96	99	117	112	106	91	90	90
Market Penetration (Million liters)											
Fuel Ethanol	25	87	191	216	307	356	330	277	261	234	235
Gasoline	25,833	25,219	22,331	19,503	18,198	17,574	18,228	18,500	18,800	17,600	17,800
Blend Rate (%)	0.3%	0.9%	1.1%	1.7%	2.0%	1.8%	1.5%	1.4%	1.3%	1.3%	1.3%

Note (a): Production statistics for biodiesel have been revised using National Greenhouse and Energy Reporting Scheme data which captures more production than the Production Grants Scheme (excise rebates); (b): Wheat consumption based on ethanol yield of 1 MT = 105 liters); (c) Post has no information on stocks.
Source: Department of Industry, BREE and Post estimates.

Consumption

In 2015, locally-produced ethanol supplied around one percent of the total road transport fuel market in Australia. The predominant petrol-ethanol blend (E10) is largely sold in NSW and Queensland. Ethanol use has been declining in recent years in Australia due partly to the lower availability of E10 pumps and a consumer preference for regular unleaded over E10. The lack of a significant price differential between E10 and regular petrol has reportedly contributed to the decline in sales in ethanol-based transport fuels.

Trade

Ethanol imports are subject to both a general tariff of 5 percent and the customs equivalent full excise on mid-energy fuels of A$0.38143 per liter. Imports of ethanol are apparently significant as they are subject to the full excise, making them uncompetitive with both locally produced ethanol and other fuels. Imports of U.S. sourced ethanol are not exempt from customs duty under the provisions of the Australia-United States Free Trade Agreement (AUSFTA).

Table 8: Australian imports of ethanol by country, 2010-2015 (000' LPA)

Country	2010	2011	2012	2013	2014	2015
Indonesia	7,717	14,206	5,954	3,375	0	0
United States	6,544	10,773	3,464	3,159	4,934	4,765
Papua New Guinea	1,645	1,136	995	621	219	0
New Zealand	298	213	206	254	235	237
Brazil	18,435	10,783	3,439	95	124	189

Note: (a) Imports include fuel plus other industrial chemicals and beverage ethanol as fuel ethanol is not separately classified.
Source: Global Trade Atlas (2207.0).

The prospects for a U.S. ethanol exports to the Australian market are unclear. Demand for ethanol as a transport fuel is likely to continue due to the six percent mandate applying in NSW and the three percent mandate to be introduced in Queensland. However, imports of ethanol are subject to the prevailing excise on petroleum which reduces their competitiveness in the Australian market.

V BIODIESEL AND RENEWABLE DIESEL (HVO)

Overview

Biodiesel is produced from renewable plant or animal lipids through a process called transesterification and can be blended at certain levels permitted by fuel quality guidelines without engine modification. The main biodiesel feedstocks used in Australia are animal fats (tallow) and recycled greases such as used cooking oil.

Renewable diesel is derived from the same lipid feedstocks, but unlike biodiesel it is chemically almost identical to petroleum-derived diesel and can be substituted one-for-one with petroleum diesel without engine modification. Hydrotreated vegetable oil (HVO) is a type of renewable diesel. Note that HVO is a full substitute for fossil diesel and can be used to upgrade diesel to particular requirements, while biodiesel is typically used as a blend with fossil diesel. Australia does not yet produce renewable diesel, but contacts suggest that Australia has imported small quantities of HVO from Singapore (around 2 million liters) as a trial shipment. Precise volumes cannot be confirmed because separate import statistics for biodiesel and renewable diesel are unavailable.

Production

Australian production of biodiesel has fallen significantly in recent years with the closure of a number of plants in response to low international oil prices, higher costs for feedstock (such as sorghum, sugar and tallow), changing policy measures and a surge in imports. Production and capacity utilization have varied 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. In early 2016, Australian Renewable Fuels (ARF), the largest biodiesel producer, went into receivership. Although it is possible that ARF will resume production later in the year, Post has markedly downgraded the production level of biodiesel in Australia for 2016 in response to this development.

Consumption

Most diesel fuel in Australia is sold in bulk to commercial/industrial customers such as mining and transport companies on long term contracts. Only a quarter of the diesel fuel used in Australia is sold through retail outlets. Of this 80 percent is bought by the long-haul trucking industry with only a small proportion sold to private customers. Diesel engine manufacturer warranties for engines typically allow biodiesel blends up to 5 percent 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 have been used in fleet operations, such as local council trucks.

Trade

Australia is a minor exporter of biodiesel but imports have significantly fluctuated in recent years. In 2011, both biodiesel production and imports were granted excise free status under the Cleaner Fuels Grant Scheme. This measure led to a significant increase in biodiesel imports, which were priced competitively with regular diesel fuel. In 2014, the Treasurer announced that imports of biodiesel would be fully subject to excise while locally produced biodiesel would be partially subject to excise (see section on policy). This policy change has led to a significant fall in the volume of imports of biodiesel.

In recent years, imports of both biodiesel and renewable diesel had increased sharply because of the excise rebate policy, which ended in mid-2015. Overall demand for biofuels in Australia reached

a record high in 2015 of almost 500 ML, due to increased imports which were competitively priced compared to local biodiesel production and regular diesel. Imports decreased significantly from 2015 as they were subject to the standard diesel excise from July 2015. It is likely that stockpiling of the fuel occurred during the excise free period to mid-2015.

Table 9: Selected biodiesel production facilities in Australia (ML), 2016

Biodiesel plant	Location	Capacity	Feedstock	Production start
Australian Renewable Fuels (ARF) Largs Bay	South Australia	45	Tallow, used cooking oil	2006 (in receivership)
Australian Renewable Fuels (ARF) Picton	Western Australia	45	Tallow, used cooking oil	2006 (in receivership)
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 (in receivership)
Ecotech Biodiesel	Queensland	30	Tallow, used cooking oil	2006
Smorgon Fuels Biomax Plant	Victoria	100	Tallow, canola oil and juncea oil	2005 (now closed)
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

Note: Details of production by plant are not available.
Source: Biofuels Association of Australia and Post estimates.

Table 10: Australian imports of biodiesel by country, 2012-2015 (`000 liters)

Country	2012	2013	2014	2015
Singapore	858	39,741	209,583	139,355
Argentina	0	28,604	32,189	4,748
Indonesia	15,488	28,339	116,956	6,084
United States	0	11,352	0	1,105
Canada	5,018	5,482	1,057	0
Other	46	4,185	10,980	8,128
Total	21,410	117,703	370,765	159,420

Note: Imports from Singapore include HVO.
Source: Global Trade Atlas (3826.0).

In October 2010, Australia imposed provisional anti-dumping and countervailing duties on imports of biodiesel from the United States. Final duties applied from April 2011. The duty was imposed due to the U.S. federal tax credit of one dollar per gallon. In April 2016, the Australian government announced the termination of its antidumping measure applying to biodiesel imported from the United States, see link.

The prospects for a resumption of U.S. biofuel exports to the Australian market are unclear, even after the termination of the anti-dumping measure applying to biodiesel imported from the United States. The prospects for imports of biodiesel into the Australian market have diminished as they are now fully subject to the prevailing excise on diesel.

Table 11: The Australian Biodiesel Industry, 2006-2016

Biodiesel and Renewable Diesel (HVO) (Million Liters)											
Calendar Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Begin Stocks	0	0	0	0	0	0	0	0	0	0	0
Production	21	54	50	85	85	90	114	114	150	130	50
Imports	2	7	4	11	9	25	21	118	371	159	120
Exports	0	0	0	0	0	0	10	20	20	10	0
Consumption	23	61	54	96	94	115	125	212	511	289	170
End stocks	0	0	0	0	0	0	0	0	0	0	0
Production Capacity											
No. of Biorefineries	7	7	9	8	6	6	7	7	8	8	8
Nameplate Capacity	380	380	380	380	380	380	400	400	400	400	400
Capacity Use (%)	5.5	14.2	13.2	22.4	22.4	23.7	28.5	28.5	37.5	32.5	12.5
Feedstock Use (1,000 MT)											
Tallow	28	71	56	111	111	105	67	82	87	90	35
Used cooking oil	27	69	54	110	110	103	65	79	82	88	30
Market Penetration (Million Liters)											
Biodiesel, on-road use	23	61	54	96	94	115	125	212	511	289	170
Diesel, on-road use	7,200	7,400	7,700	7,900	8,100	8,300	8,600	8,800	9,000	9,200	9,400
Blend Rate (%)	03%	0.8%	0.7%	1.2%	1.2%	1.4%	1.5%	2.4%	5.7%	3.1%	1.8%
Diesel, total use	20,000	20,600	21,200	21,900	22,500	24,000	23,700	24,300	25,000	25,500	26,000

Note: (a) Production statistics for biodiesel have been revised using National Greenhouse and Energy Reporting Scheme data which captures more production than the Production Grants Scheme; (b) Exports of biodiesel have occurred but are not separately recorded; (c) Australian import statistics do not separately classify renewable biodiesel fuel such as Hydrotreated Vegetable Oil (HVO from other types of biodiesel fuels.

Source: Department of Industry, BREE and Post estimates.

VI ADVANCED BIOFUELS

Overview

There have been a number of research projects in Australia using the second generation model based on different feedstocks including lignocellulosic feedstocks. The Oil Mallee project for example used Mallee eucalypts to produce eucalyptus oil, activated carbon and bioenergy in a one kW integrated wood processing demonstration plant to generate transport and other biofuels. Other feedstocks under development have included Indian mustard seeds (Western Australia), *Pongamia pinnata* trees (Queensland, Western Australia), *Moring oleifera* (Western Australia) and algae (Queensland, South Australia, Victoria). The Australian Renewable Energy Agency provided funding to projects developing advanced biofuel technologies.

Biofuel and Sustainable Aviation Fuel (SAF)

Aviation fuel accounts for around 30 percent of the operating costs of the major airlines in Australia and this share increased significantly over the last decade when oil prices were high, although lower oil prices in recent years has meant the relative cost of fuel has fallen. The airline industry has encouraged the development and use of biofuel as a sustainable aviation fuel (SAF) to reduce greenhouse gas emissions. A 2011 study by CSIRO, supported by Boeing, Airbus, Qantas and Virgin, found that a sustainable aviation fuels industry could be developed and would decrease greenhouse gases by almost 20 percent in the aviation sector. In 2012, Qantas operated Australia's first commercial SAF flight from Sydney to Adelaide with a 50 percent blend of SAF with traditional jet fuel in one engine.

The Roadmap Report found that by 2020 a 5 percent bio-derived jet fuel share could be possible in Australia and New Zealand, expanding to 40 percent by 2050. Ongoing research aims to develop competitive 'drop-in' advanced biofuels compatible with existing engines, infrastructure and existing supply chains. Biojet fuels create opportunity to reduce aviation CO2 emissions but, sustainable, low-cost biojet fuels have not yet become commercially viable, and the current period of lower international oil prices makes the goal even more remote.

In April 2016, Virgin Australia and Air New Zealand issued a 'request for tender' for a ten-year supply of 200 million liters of biojet fuel from 2020, equivalent to around five percent of their projected fuel consumption. The airlines aim to use biofuel to reduce their greenhouse gas emissions and also to diversify their range of fuel supplies and increase energy security. The request for tender to potential biofuel supplies was partly in response to the Australian government's emissions reduction fund safeguard mechanism, which requires the largest emitters, including airlines, to keep emissions within baseline levels from 1 July 2016. In addition, the International Air Transport Association (IATA) has set targets for an annual average increase in fuel efficiency each year from 2009 to 2020 of 1.5 percent carbon-neutral growth from 2020 and a reduction in emissions of 50 percent of the 2005 figure by 2050.

Advanced Biofuel Plant in Queensland

In March 2016, Southern Oil Refining company, an oil recycling company, committed to build a A$16 million biofuel pilot plant in Australia. The facility is called the Northern Oil Advanced Biofuels Pilot Plant and will be built in Gladstone, Queensland. The main feedstocks for biodiesel would be sugarcane bagasse and possibly woody biomass and used farm and mining tires. The pilot plant is expected to be operational later in 2016 and will aim to produce one million liters of fuel within three years for use in field trials by the US and Australian navies. There are plans to eventually expand the plant into an A$150 million commercial-scale refinery with a capacity of 200 million

liters of advanced biofuel a year. The Queensland State government is providing a grant to cover part of the costs of building the plant in Gladstone.

U.S.-Australia Cooperation on Biofuels

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.

The Great Green Fleet initiative of the U.S. Department of the Navy and the U.S. Department of Agriculture aims to make alternative fuel blends a regular part of the military's bulk operational fuel supply. 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 the Navy would in 2016 deploy a fleet using biofuels for a proportion 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.

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 companies for possible use by the US military. In total, the RAN plans to make fifty vessels and aircraft compatible with alternative fuels. However, the use of biofuels will depend on a competitive price with fossil fuels and the availability of sufficient supplies of biofuels. The RAN is expected to send a biofuel powered frigate to participate in the US Navy's 'Great Green Fleet' demonstration in late 2016.

VII BIOMASS FOR HEAT AND POWER

While overall energy generation and fuel use is dominated by fossil fuels, especially coal, petroleum and gas, bioenergy is one of the largest contributors to Australia's renewable energy production. Energy from biomass is derived from five separate energy sources: garbage, wood, waste, landfill gases, and alcohol fuels. Most biomass uses incineration to generate power. Biomass generally includes plant or animal matter used for the production of fibres or chemicals, and may also include biodegradable wastes that can be burnt as fuel. Biomass can be converted to energy in many different ways, including direct combustion, gasification, combined heat and power (CHP), anaerobic digestion and aerobic digestion.

In 2015, bioenergy accounted for around one percent of Australia's electricity production and seven percent of renewable electricity production. Biofuels accounted for around one percent of Australia's transport fuel consumption. The bioenergy industry uses a range of biomass resources including: bagasse, which remains after sugar has been extracted from sugarcane; landfill gas, wood waste and black liquor, energy crops, agricultural products and municipal solid waste. In 2013, there were 390 accredited renewable energy power stations with 140 accredited bioenergy power stations (Clean Energy Regulator, 2014).

Australia's sugar industry produces considerable renewable energy (electricity and steam) from bagasse, which is the leading source of renewable electricity generation. A number of agencies in Australia are currently researching whether sugarcane trash and bagasse can be converted to biogas and upgraded to biomethane for use in sugarcane farming and transportation. Solids from biogas production could then be converted via hydrothermal liquefaction to biofuels and chemicals.

Wood energy is derived both from the direct use of harvested wood as a fuel and from wood waste streams. The largest source of energy from wood is pulping liquor or 'black liquor' which is a waste product from the industrial processes of the pulp, paper and paperboard industry. Australia burns an estimated five million tonnes of firewood per year. 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).

The heat component of industrial cogeneration (such as alongside sugar mills) and dedicated industrial thermal energy are not supported by a specific mandatory target or Renewable Energy Certificates (RECs) in Australia. Residues from forests and wood processing and organic waste streams are relatively untapped resources for heat and power generation in Australia. 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. There have been a number of proposals to use wood waste for biofuels, although none are yet commercially viable.

VIII NOTES ON STATISTICAL DATA

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.

Data on the production of biofuels in Australia was taken from the Department of Industry and the Australian Taxation Office. Until 2014, the excise rebate provided an estimate of production which has bene supplemented by data from the Australian National Greenhouse and Energy Reporting Scheme and the Biofuels Association of Australia. There are a number of 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).

Trade statistics have been sourced from the Australian Bureau of Statistics through the Global Trade Atlas. Statistics on energy use in Australia were sourced from a variety of sources including BREE's 2015 report on Australian energy statistics. Reports by the Australian Competition and Consumer Commission on its monitoring of the Australian petroleum industry were also reviewed.