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Australia

Biofuels Annual

2015

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Report Highlights:
Australian biofuels total production for 2015 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 variable. The main measure supporting the industry is an excise on imports of biofuels as local producers receive a rebate of the excise. The 2014 federal budget announced the excise rebate would be eliminated for imported biodiesel in mid-2015 and phased down by mid-2016. Biofuels production is also supported by a six percent NSW government mandate on ethanol. In June 2015, the Queensland government announced it would introduce a two percent biofuels mandate in that State to develop biofuels and bio manufacturing sectors. Second generation biofuels such as renewable biodiesel, energy crops, and algae-based fuels have been successfully demonstrated in Australia but not successfully commercialized.

Post:
Canberra

I EXECUTIVE SUMMARY:

Australian first generation biofuels are mainly produced primarily from molasses in Queensland and from wheat starch in NSW. There is no commercial production of second generation biofuels in Australia.
In 2015, biofuel production capacity in Australia was 740 ML consisting of 440 ML of ethanol production capacity and 300 ML for biodiesel per annum. Australian biofuels total production for 2015 was 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 largest companies in each sector are Manildra, which has capacity for 300 ML of ethanol production, while Australian Renewable Fuels (ARF) is the major biodiesel producer with a capacity of 100 ML.

The main measure supporting the industry is an excise on biofuels that is levied on both local production and imports of ethanol although local producers receive a rebate of the excise. Changes to assistance to the biofuels industry were announced in the 2014 federal budget and in subsequent statements. Under these changes, the excise rebate for local production of ethanol is being phased down by mid-2016 while imports of biodiesel are no longer eligible for the excise rebate from mid-2015. Further support for biofuels is provided from the NSW government mandate which specifies that the oil distribution industry must include ethanol in the mix of available fuels. In June 2015, the Queensland government announced it would introduce a two percent biofuels mandate in that State to further develop both the biofuels and bio-manufacturing sectors.

II 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.

Renewable Energy Target

The Australian Government has set a national target for 20 percent of Australia's electricity to be sourced from renewable energy sources by 2020. The primary mechanism for achieving this target is the Renewable Energy Target (RET) which will required an additional 45,000 GWh (162 PJ) per year of renewable energy by 2020, with the RET applying until 2030. The RET operates through the creation and surrender of Renewable Energy Certificates, each certificate being for one MWh of compliant renewable energy. Under the scheme, energy retailers and large energy users must purchase a proportion of their energy requirements from renewable energy sources.

In June 2015, the Australian government announced a reduction in the Renewable Energy Target from 41,000 GWh to 33,000 GWh for large-scale renewable energy generation in Australia by 2020. The RET was also amended to reinstate biomass from native forest wood waste as an eligible source of renewable energy, including the same safeguards that were in place prior to removal of this source from eligibility in late 2011. The RET is administered by the Federal Government's Office of the Clean Energy Regulator.

Fuel Quality Standards

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 were implemented 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 was the result of vehicle testing that showed 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 per cent 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. The Fuel Quality Standard for Biodiesel defines biodiesel as 'a diesel fuel obtained by esterification of oil derived from plants or animals'.

From January 2008, the maximum allowable sulphur content in premium unleaded petrol fell to 50 parts per million (ppm) from the previous level of 150 ppm. For all other grades of petrol, the amount of sulphur is limited to 150 ppm, effective from January 2005. The benzene content of petroleum was reduced to a maximum of 1.0% by volume from January 2006. Specifications also limit the amount of sulphur in diesel fuel to 10 ppm, which was reduced from 50 ppm in January 2009.

Fuel Taxes

Imports of petroleum products 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. No non-tariff barriers apply to petroleum product imports. The Fuel Retailing industry does not receive any government subsidies or grants. Industry products attract an excise duty at varying rates, and GST on pump prices. Excise on regular unleaded petroleum is currently set at a constant 38.14 cents per litre. In addition to collecting GST on behalf of the Federal Government, service station owners also pay tax on services and products purchased.

In June 2015, the Australian government announced the reintroduction of fuel excise indexation to take account of inflation. Under this change, the fuel excise will increase twice a year, in February and August, in line with movements of the Consumer Price Index. The first increase occurred in November 2014. All excise increases will be dedicated to road infrastructure.

New South Wales Ethanol Supply Mandate

The New South Wales (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. Currently, only 4 percent 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 percent, E10 at 40 percent and Unleaded Petrol (ULP) at 20 percent.

The NSW Office of Biofuels is responsible for ensuring that ethanol-blended petrol is widely available in NSW. Under legislation such as the Biofuels Act 2007 as well as the Biofuels Regulation 2007, six percent of the total volume of petrol sold in the State must be ethanol. In 2012, the NSW government removed the requirement for all regular grade unleaded petrol to be E10. The Biofuels Amendment Act 2012 implemented this policy change and came into effect in May 2012. In practice, the small price difference between regular unleaded petrol and E10 has reduced the volume of E10 sold in the State to around three to four per cent of fuels sold at service stations. In July 2015, the NSW government reportedly asked the Independent Regulatory and Pricing Tribunal to review the ethanol mandate.

Queensland Government Support for Biofuels

The Queensland Government Ethanol Industry Action Plan 2005-2007 included a commitment of A$7 million to fund the conversion of service stations for ethanol blends, distribution and blending infrastructure, as well as a commitment to mandating ethanol sales at Queensland fuel retailers. As a result, the number of service stations retailing ethanol blended fuels in Queensland rose from 47 in 2005 to over 550 in June 2010. Further, the number of Queensland motorists trialing ethanol blended fuels rose from one-in-six to two-in-five over the 2005 to 2007 period. Consequently, consumption of E10 by the Queensland Government fleet increased from around 180,000 liters per month in the three months to December 2005, to a current level of more than 660,000 liters per month in March 2010.

The potential for Queensland's biofuels and bio-manufacturing industries were explored in a discussion-paper released in June 2015 and the State government aims to commence a two percent biofuels target on 1 July 2016. The government will allow for unblended petrol in the market by applying the mandate on the total volume of regular unleaded sales (rather than requiring every liter of petrol to contain ethanol) and excluding premium unleaded petrol. This would ensure there is a choice of unblended fuels – regular unleaded and premium unleaded – for servicing those vehicles that are incompatible with ethanol blends. In addition, and to support implementation and educate consumers about the biofuels mandate, the Government proposes to develop a targeted education campaign that would be launched prior to the biofuel mandate commencing. See Queensland Government Statement on Biofuels link.

The Ethanol Grants Program

The Ethanol Production Grants (EPG) program ceased in June 2015. The aim of the policy was to support production and deployment of ethanol as a sustainable alternative transport fuel in Australia. The EPG ended in June 2015. Previously, it provided full excise reimbursement, at the current excise rate, to ethanol producers for ethanol produced and supplied for transport use in Australia from locally derived feedstock. Prior to the 2014 Budget, ethanol fuel was subject to an excise of 38.143 cents per liter on users.

The Ethanol Production Grants (EPG) Program provided a grant of 38.143 cents per liter to domestic ethanol producers on fuel supplied for transport where production inputs are sourced domestically. The effect of the EPG was to reduce the rate of excise to zero for local production. Imported ethanol was subject to a customs duty of 38.143 cents per liter and a value duty of five percent. Together, the duties and the EPG protected the domestic industry against competition from imports.

Legislative changes to the excise on ethanol and biodiesel in Australia

The Australian Government has reduced the excise on domestic production of ethanol and biodiesel to zero from 1 July 2015 and terminated the Ethanol Producer Grants and Clean Fuels Grants schemes. Instead, these alternative fuels will become partly liable to excise under a sliding scale. The rates of excise duty for domestically manufactured fuel ethanol commenced at zero on July 1 2015 and will then increase annually by 6.554 percentage points until the final schedule rate of 32.77 percent of the excise rate for petrol is attained. Imported ethanol will maintain an excise rate equivalent to that of petrol.

Table 1: Schedule of changes to the excise on ethanol, 2016 to 2030

Financial Year (from July 1st)	Excise rate for domestic ethanol (%)	Excise rate for imported ethanol (%)
July 1 2015 to July 30 2016	0	100
July 1 2016 to July 30 2017	6.554	100
July 1 2017 to July 30 2018	13.108	100
July 1 2018 to July 30 2019	19.662	100
July 1 2019 to July 30 2020	26.216	100
July 1 2020 to July 30 2021	32.77	100

Source: See link.

The rates of excise duty for domestically manufactured biodiesel will commence at zero from July 1 2015 and then increase on 1 July of each year by 3.333% until the final schedule rate of 50% of the excise duty rate for diesel is attained. Imported Biodiesel will maintain an excise rate equivalent to that of diesel.

Table 2: Schedule of changes to the excise on biodiesel, 2015 to 2030

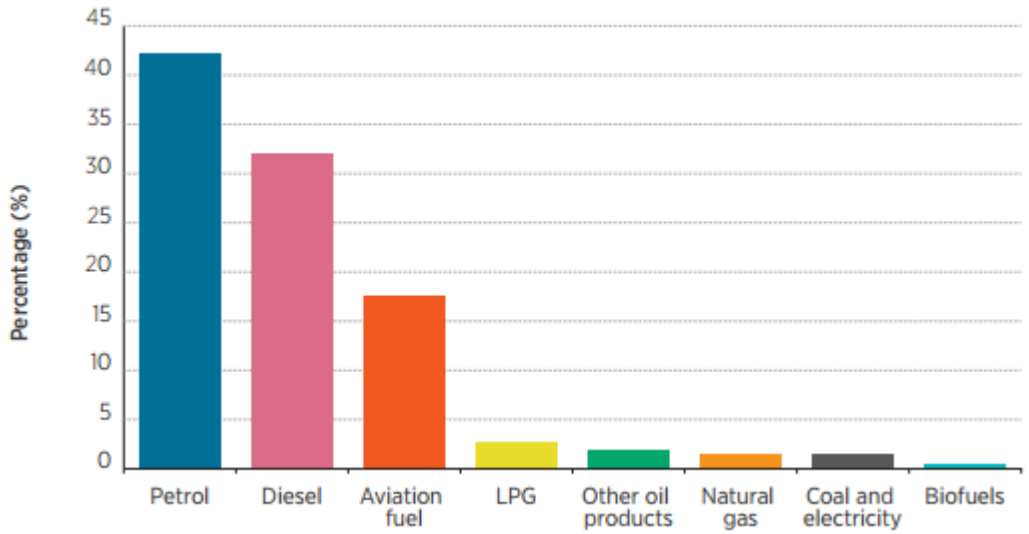
Financial Year (from July 1st)	Excise rate for domestic biodiesel (%)	Excise rate for imported ethanol (%)
July 1 2015 to July 30 2016	0	100
July 1 2016 to July 30 2017	3.333	100
July 1 2017 to July 30 2018	6.667	100
July 1 2018 to July 30 2019	10	100
July 1 2019 to July 30 2020	13.333	100
July 1 2020 to July 30 2021	16.667	100
July 1 2021 to July 30 2022	20	100
July 1 2022 to July 30 2023	23.333	100
July 1 2023 to July 30 2024	26.667	100
July 1 2024 to July 30 2025	30	100
July 1 2025 to July 30 2026	33.333	100
July 1 2026 to July 30 2027	36.667	100
July 1 2027 to July 30 2028	40	100
July 1 2028 to July 30 2029	43.333	100
July 1 2029 to July 30 2030	46.667	100
July 1 2030 to July 30 2031	50	100

Source: See link.

AUSTRALIAN FUEL USE

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 1:Energy consumption in the Australian transport sector, share of fuel, 2013 (%)



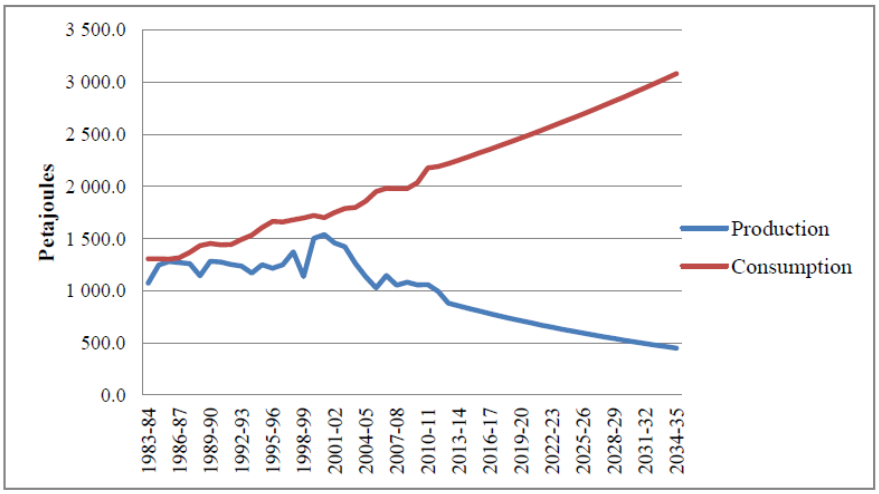
Source: BREE (2014).

Energy consumption in the transport sector has been growing over the past 40 years, largely reflecting economic and population growth. Road transport is the dominant means of transport for goods and passengers in Australia. It has consistently accounted for around three quarters of transport energy use. The share of air transport has increased steadily over the same period, largely reflecting increased activity and popularity.

Petrol, diesel and aviation fuel are the dominant transport fuels, accounting for over 90 percent of transport energy use in 2012–13. 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 fuel switching and increased demand for diesel, particularly associated with mining activities and increased air transport activity. Alternative transport fuels accounted for 5 percent of energy consumption in 2012–13, comprising liquefied petroleum gas (LPG) (2.7 percent), natural gas (1.6 percent) and biofuels (0.6 percent).

In terms of market share, the retail fuel market in Australia includes supermarkets (48 percent), large independent retail chains (19 percent) and branded refiners and wholesalers (33 percent) (ACCC 2014). Petrol and diesel make up around three quarters of transport fuel used in Australia. After taking into account inflation, petrol and diesel prices have fluctuated in recent years. Average prices peaked in 2007–08, declining until 2009–10. Prices grew slightly in 2013–14 (BREE 2014).

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



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

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).

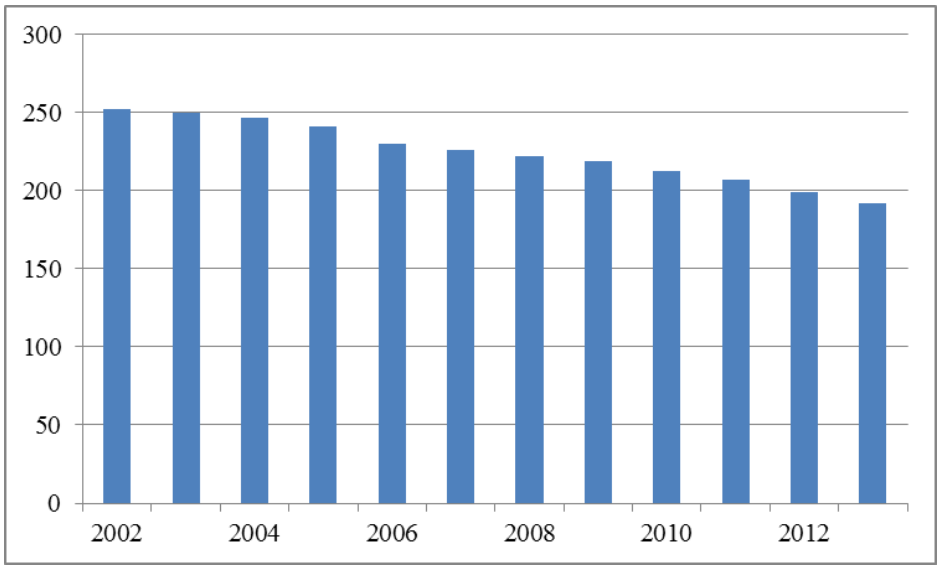
Developments and Trends in Australian Vehicle Fleet Efficiency

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.

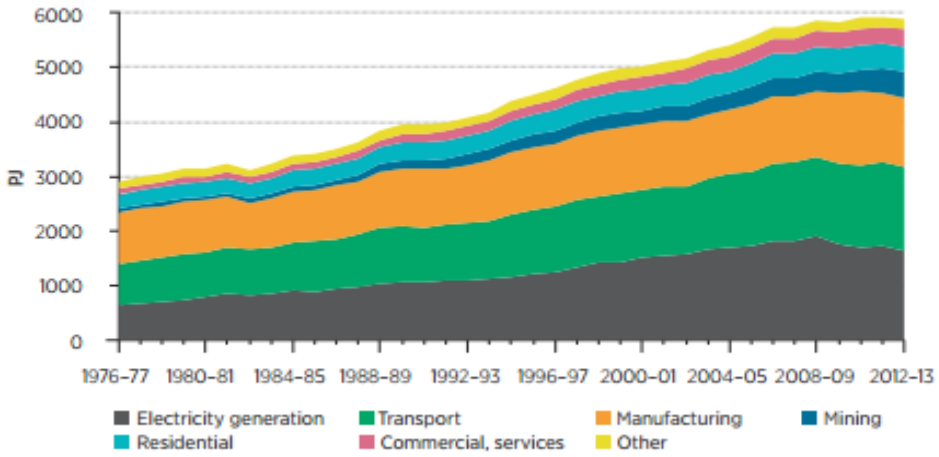
According to a 2014 study by the National Transport Commission (NTC) the average annual carbon dioxide emissions ratings of new passenger vehicles and light commercial vehicles was 192 grams per kilometer travelled, a 3.4 percent reduction from 2012 and is the third largest annual reduction since records 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).

Chart 3: Carbon emissions of new Australian passenger vehicles, 2002-2013



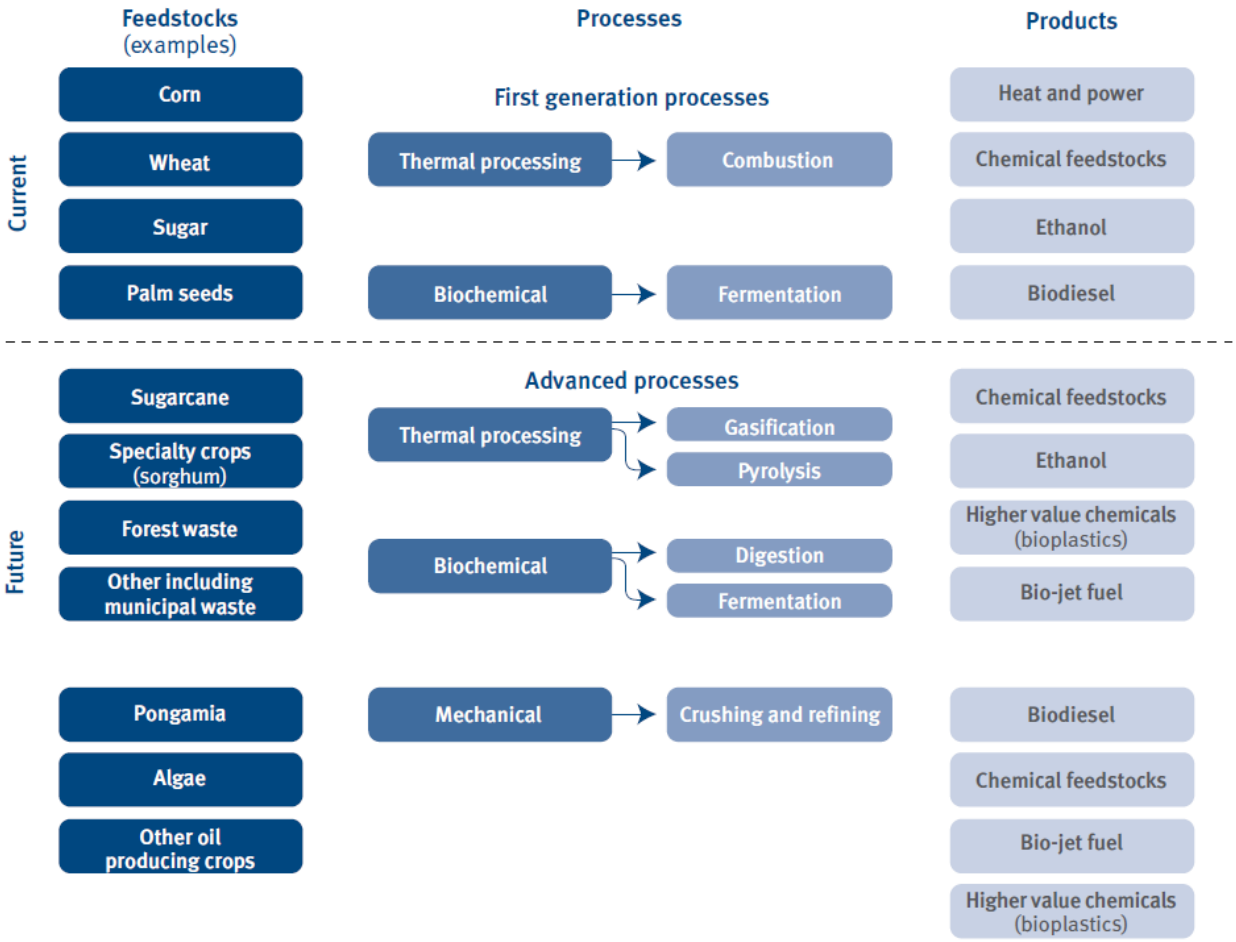
Note: Carbon dioxide emissions in terms of grams per kilometer traveled.
Source: National Transport Commission (2014).

Chart 4: Australian national primary energy consumption by sector, 1976-2013



Source: BREE (2014).

Chart 5: First and second generation biofuels



Source: Queensland government discussion paper on biofuels, See: link

In 2012 Australia's national average carbon emissions from new passenger vehicles was 44 percent 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 (see policy section).

Table 3: Australian Transport Fuels, 2013

Fuel	ML	PJ	Share (%)
Automotive diesel	22,300	860	46.9
Petroleum	18,400	630	34.3
Jet fuel	7,780	290	15.6
Autogas	1,820	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.

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

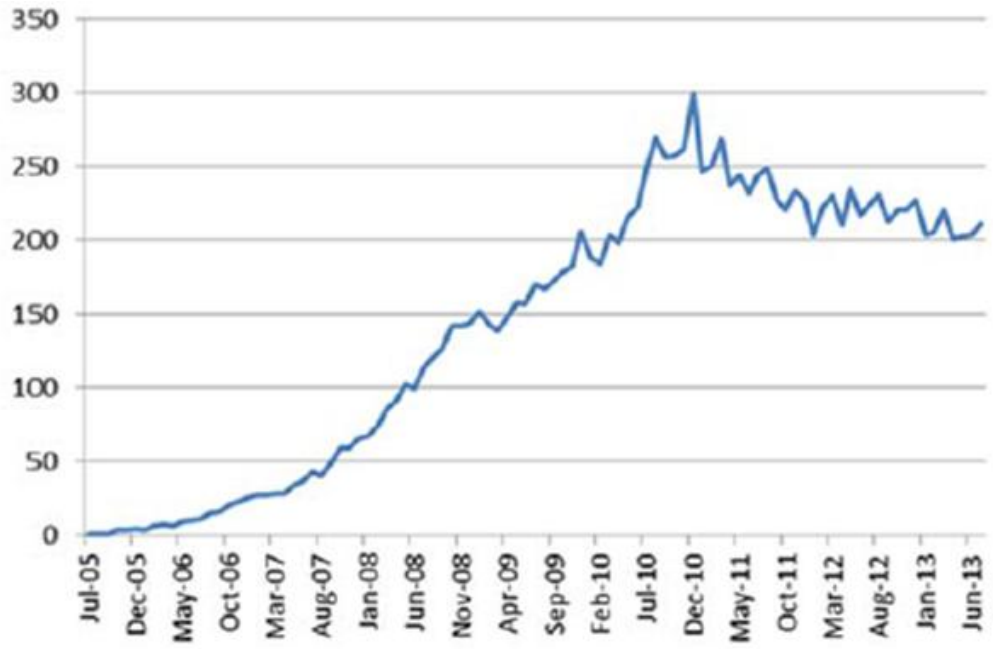
Sources: BREE, Department of Industry and Post estimates.

III 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 from co-production processes such as flour milling can lower 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 contains 68 percent of the energy content of petrol and in an E10 blend provides 3 percent less energy. Ethanol accounts for one percent of the road transport fuel market, while ethanol blended fuels (mainly E10) accounted for 14 percent of total petrol sales in 2013 (BREE, 2014). In 2014, the average price differential across Australia between regular unleaded petrol and E10 was 2.2 cents a liter, according to the Australian Competition and Consumer Commission.

Chart 6: Volume of ethanol fuel sales in Australia, 2005-13



Source: BREE (2014).

In 2013, 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 New South Wales (NSW) and Queensland and accounted for around 14 percent 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.

Ethanol capacity is 440 ML/year nationally, from two plants in Queensland and one in NSW. Ethanol use has been declining in recent years in Australia because of concern over possible engine damage from using the fuel, declining availability of E10 pumps and a consumer preference for regular unleaded over E10. The lack of a price differential between E10 and regular petrol has contributed to the decline.

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.

Table 6: Australian biofuels production capacity, 2015 (ML per year)

Biofuel plant	Location	Owner	Capacity	Feedstocks
ARFuels Barnawartha	Barnawartha, VIC	ARF	60	Tallow, used cooking oil
ARFuels Largs Bay	Largs Bay SA	ARF	45	Tallow, used cooking oil
ARF Picton	Picton WA	ARF	45	Tallow, used cooking oil
Biodiesel Industries	Rutherford NSW	Biodiesel Industries	20	Used cooking oil, vegetable oil
EcoTech Biodiesel	Narabgba QLD	Gull Group	30	Tallow, used cooking oil
Macquarie Oil	Cressy TAS	Macquarie Oil	15	Poppy oil, waste vegetable oil
Territory Biofuels	Darwin NT	Territory Biofuels	140	Palm oil, tallow, waste oil
Total capacity (ML/year)			360	

Source: Biofuels Association (2015).

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 Ethanol Industry (ML)

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	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
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	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)	62	127	223	306	486	564	540	512	468		
Feedstock B (sorghum)	26	49	91	122	130	148	143	135	130		
Feedstock C (molasses)	21	42	73	96	99	117	112	106	91		
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 ten percent blend of ethanol with unleaded petrol (ULP). Blends containing greater than 10 percent 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 percent. Ethanol blend fuels are also available using premium unleaded petrol (PULP). Ethanol contains 68 percent of the energy content of petrol. In an E10 blend this means around 3 percent less energy is available from the transport fuel.

Currently, around 60 percent 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 percent 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 percent and the customs equivalent full excise on mid-energy fuels of A$0.38143 per liter. Imports of U.S. sourced ethanol are 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, making them uncompetitive with locally produced ethanol and other fuels.

Table 8: Australian imports of ethanol by country, 2010-2014 (000' LPA)

Country	2010	2011	2012	2013	2014
Indonesia	7,717	14,206	5,954	3,375	0
United States	6,544	10,773	3,464	3,159	4,934
Papua New Guinea	1,645	1,136	995	621	219
New Zealand	298	213	206	254	235
Brazil	18,435	10,783	3,439	95	124
China	3,640	15	15	15	0

Note: No world total is available.
Source: Global Trade Atlas (2207.0).

IV BIODIESEL

Biodiesel is an alternative fuel for diesel. It is manufactured in Australia from a range of waste products including tallows, waste vegetable oils and used cooking oils. In 2011, biodiesel production and imports were granted excise free status under the Cleaner Fuels Grant Scheme. In 2014, the Treasurer announced that imports of biodiesel would be fully subject to excise while locally produced biodiesel would be subject to excise (see section on policy). Biodiesel accounts for two percent of diesel used in Australia.
The mining industry is a major consumer of biodiesel and is exempt from the excise.

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 percent biodiesel and 95 percent petrol. 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. 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 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). Biodiesel blends – usually B5 (five percent) or B20 (20 percent) have been made available at an increasing number of service stations in all States.

Table 9: 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
Total capacity (ML)		360		

Source: Biofuels Association of Australia and Post estimates.

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 percent 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 of diesel 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 are currently used in fleet operations, such as local council trucks (AIP, 2014).

Table 10: 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	18.0	20.7	21.7	25.0
Feedstock Use (1,000 MT)										
Tallow	28	71	56	111	111	105	67	82	87	132
Cooking oil	27	69	54	110	110	103	65	79	82	128
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	2.0	2.0	2.0
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.

Australian production of biodiesel has fallen in recent years with the closure of a number of plants. Only four of the eight biodiesel plants around Australia are currently operating and the industry association has estimated total production at 65 ML, well below total capacity of around 300 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.

Australia's largest biodiesel plant was built in the Northern Territory with a rated capacity of 140 million liters per year. It was designed to use palm oil and food-grade vegetable oil but was closed in 2009. The plant was then acquired in early 2014 by a U.S. biofuels and energy company which planned to produce a broader range of feedstocks, including lower quality tallow, used cooking oil and palm sludge oil.

Table 11: Australian imports of biodiesel by country, 2010-2014 ('000 liters)

Country	2010	2011	2012	2013	2014
Singapore	0	0	858	39,741	209,583
Argentina	0	0	0	28,604	32,189
Indonesia	0	0	15,488	28,339	116,956
United States	0	0	0	11,352	0
Canada	0	0	5,018	5,482	1,057
Other					
Total	0	0	21,410	117,703	370,765

Source: Global Trade Atlas (3826.0).

Table 12: Australian imports of acyclic ethers and derivatives by country, 2010-2014 (tonnes)

Country	2010	2011	2012	2013	2014
Japan	0	199	553	271	434
Netherlands	1	0	43	58	130
United States	0	0	54	36	0
China	0	1	0	29	0
Other					
Total	46	263	691	452	705

Source: Global Trade Atlas (2909.19).

Table 13: Australian imports of petroleum with biodiesel by country, 2010-2014 ('000 liters)

Country	2010	2011	2012	2013	2014
United States	0	0	0	818	8,066
Belgium	0	0	0	1,456	1,661
Other					
Total	0	0	0	2,274	10,227

Note: Up to 30 percent biodiesel.
Source: Global Trade Atlas (2710.20).

V 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 abolish ARENA but has not obtained Parliamentary support for this policy.

Sustainable Aviation Fuel (SAF)

Traditional aviation fuel represents the largest operating cost for Australian airlines, accounting for 30 percent of their operating costs in 2013 compared to 14 percent 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 percent biofuels for two certified pathways.

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. The industry has recognized that beyond the limited option of greater fuel efficiency, biofuels represent the main opportunity to reduce aviation emissions but the price of biofuels has not yet become commercially viable, especially in a period of falling international oil prices.

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 Tröpsch (FT) pathway. It found that while the conversion of gas and coal-based feedstock into hydrocarbon products using the Fischer Tröpsch (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 percent 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: link

Note: 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 percent 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.

VI 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 (Geoscience Australia, 2013). 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. However, there are few detailed official statistics on the use of biomass for heat and power generation in Australia.

In 2014, bioenergy accounted for over ten percent of Australia's renewable electricity production. These projects include converting food and meat processing waste into biogas, producing ethanol from bagasse and creating biofuels from feedstock such as sorghum, wood waste, or straw and waste biomass. There were 389 accredited renewable energy power stations under the Renewable Energy Target with 139 accredited bioenergy power stations (Clean Energy Regulator, 2014). Australian electricity generation by State is shown in the table below for 2009.

Table 14: Australian electricity generation from bioenergy, MW, 2009

	Biogas	Bagasse	Wood waste	Other bioenergy	Total bioenergy
New South Wales	73	81	42	3	199
Victoria	80	0	0	34	114
Queensland	19	377	15	4	415
South Australia	22	0	10	0	32
Western Australia	27	6	6	63	102
Tasmania	4	0	0	0	4
Australian Capital Territory	1	0	0	0	1
Australia	226	464	73	104	867
Share of total renewable Electricity capacity (%)	2.2	4.4	0.7	1.0	8.3

Source: Geoscience Australia and ABARE, 2010.

Part of heat and energy generation total comes from the burning of some four to six 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). Other large energy contributions are from bagasse (sugar cane residues) and wood waste in heating and electricity generation, as well as capture and use of methane gas from landfill and sewage facilities.

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. Nevertheless a range of thermal energy projects have proceeded, generally using process wastes such as sawdust at sawmills. 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. Wood wastes can generally be obtained at affordable costs and there have been a number of proposals to use wood waste for biofuels, although none have so far become commercially viable.

Table 15: Australian renewable energy consumption, growth, 2011-12

Renewable energy source	Energy type	Consumption 2011-22 (PJ)	Growth, 2010 to 2012 (%)	Share (%)
Clean energy	Hydro	51	-16.2	1.0
	Wind	22	5.3	0.3
	Solar	17	19.0	0.2
Bioenergy	Biomass	165	-0.9	2.3
	Biofuels	11	-55.7	0.4
	Total	265	-7.3	4.3

Source: Australian Energy Statistics

Table 16: Australian imports of fuel wood by country, 2010-2014 (tonnes)

Country	2010	2011	2012	2013	2014
Malaysia	957	1,654	1,954	1,487	1,373
United States	783	857	864	912	1,036
France	396	359	176	294	889
Other					
Total	4,172	5,058	4,050	4,113	5,058

Source: Global Trade Atlas (4401.0).

VII 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.