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# **Report Name:** Biofuels Annual

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**Report Highlights:**

Ethanol consumption in Australia is forecast to decline in 2021 at only 1.1-percent of the gasoline pool, and biodiesel use similarly is forecast to decline from already very low levels at only 0.1-percent of the total diesel pool. Australia has very large feedstock (grains and molasses) supplies for bioethanol as well as robust supplies of feedstock (canola, tallow and used cooked oil) for biodiesel production. However, only a very small amount of these are used for domestic biofuels production. There is no federal government subsidy, tax credit or mandate supporting the production or use of biofuels. Only two states have biofuel programs with ethanol and biodiesel mandates, but these mandates are far from being reached. The federal government's introduction of new fuel standards for gasoline from January 1, 2022 may significantly raise the ethanol blend rate in Australia.

## I. Executive Summary

Australia is almost entirely reliant on imported fuels, but despite this and ample feedstock supply, bioethanol and biodiesel consumption and production remain very low. In fact, Australia is a significant supplier of feedstock to the rest of the world for biofuel production. Australia's national average blend rate for ethanol is among the very lowest and, after some initial progress, biodiesel use is near zero. There have been no new bioethanol facilities built in the last 10 years and no change in production capacity. Ethanol consumption and production have even fallen moderately during this period. For biodiesel, the closure of multiple facilities in the early to mid-2010s and curtailment of imports forced a modest national average blend rate to collapse with consumption and production falling sharply.

Australia has very large feedstock (grains and molasses) supplies for bioethanol as well as robust supplies of feedstock (canola, tallow and used cooked oil [UCO]) for biodiesel production. However, only a very small amount of these are used for domestic biofuels production. Canola is not even used domestically for biodiesel, but there are large exports to the EU for biodiesel production there. Australia also ships tallow and UCO overseas which is used to make biodiesel and renewable diesel. Rather than produce and use more biodiesel at home, Australian feedstocks are shipped overseas to support foreign biofuel programs. This is partially as a result of no national-level Australian biofuels program with nationwide goals, and little program support in the states which have any.

Biofuels policy is driven by individual state governments, and there is no federal government subsidy, tax credit or mandate supporting the production or use of biofuels. Only two states have biofuel programs with ethanol and biodiesel mandates, but their goals are relatively modest and far from being reached. New fuel standards set to be implemented in Australia from January 1, 2022, reducing the gasoline pool maximum aromatics content from 42 percent to 35 percent. If enforced, this could prompt a significant increase in fuel ethanol use. Industry expects that, similarly to other parts of the world, ethanol will be the primary substitute for aromatics and Australia will need to approximately triple the current bioethanol use in gasoline blends. This could come from imports or increased domestic production.

COVID-19 and its impact on mobility (especially personal vehicle use) and the economy has led to a sharp decline in gasoline and fuel ethanol consumption in 2020. There is forecast to be a partial recovery in the gasoline and diesel pools in 2021, despite lengthy COVID-19 related lockdowns in the second half of 2021 particularly in the two most populated states. However, with essentially no increase in bioethanol or biodiesel use forecast in 2021, a slight diminution of biofuel blend rates is anticipated.

## II. Policy and Programs

Roadmaps and International Engagement

Australia is a member of the Asia-Pacific Economic Cooperation (APEC) Energy Working Group which includes a biofuels task force. This is an international grouping of countries seeking to make biofuels a more viable and sustainable transport fuel. Other members of the taskforce include 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.

On April 29, 2020, the federal government minister for Energy and Emissions Reductions announced that consultations have begun on establishing Australia's first national bioenergy roadmap. The primary purpose is to identify the contribution that the bioenergy sector can play in Australia's energy transition and helping Australia meet its economy-wide GHG emissions reduction commitments. This report was published in November, 2021 and can be found at https://arena.gov.au/knowledge-bank/australias-bioenergy-roadmap-report/.

The Queensland state government had taken an early lead by aiming to develop a competitive industrial biotechnology and bio products sector as part of its 10-year Biofutures Roadmap launched in 2017. Biofuels is at the core of this Biofutures Roadmap. Support at federal level via a national bioenergy roadmap is expected to enable the Queensland state government to move forward on its roadmap more rapidly.

The Queensland Biofutures Roadmap identified bioenergy as a priority industry to develop new markets for technology developers and agricultural producers. The state government has established an AU$5 million (US$3.75 million) Biofutures Industry Development Fund, an AU$5 million (US$3.75 million) Commercialization Fund, and an AU$4 million (US$3 million) Biofutures Acceleration Program. Potential feedstocks have been broadly defined, but the main sources are likely to be sugarcane and sorghum. Since launching a 10-year roadmap there have been a range of proposals supported by the funds.

The federal government provides some support to the biofuels industry via their own agencies, Australian Renewable Energy Agency (ARENA) and the Clean Energy Finance Corporation (CEFC). Bioenergy Australia is an industry body who facilitates stakeholders with R&D, production and supply channels.

Renewable Energy and Greenhouse Gas (GHG) Emissions

Australia has committed to reduce economy wide GHG emissions by 26-28 per cent below 2005 levels by 2030 as part of the Paris Agreement under the United Nations Framework Convention on Climate Change. The federal government reports that based on the current suite of policies, Australia is on track to meet its targets by 2030. The policy measures currently in place do not include GHG emissions reduction targets specific to the transport sectors.

Mandates

Australia does not have any national mandate for bioethanol or biodiesel use and some analysts doubt that the federal government has the constitutional powers to impose such a mandate. There are,

however, two state governments that have introduced mandates for the use of both biofuels, each state having different policies. However, given permitted exemptions, these mandates are more akin to aspirational targets which are falling well short of full implementation. These mandates are domestic supplier-based (rather than consumption-based), with exceptions provided for certain suppliers and fuel grades and as such do not guarantee a specific blend rate at the pump for the entire gasoline or diesel pools.

*New South Wales Biofuels Policy*

The New South Wales government introduced the Biofuels Act in 2007 to encourage broader use of ethanol and other biofuels in the state. The New South Wales government has applied multiple amendments to the Act with the latest being in 2016, which sought to reduce the number of exemptions to encourage greater use of fuel ethanol. The New South Wales government has a legislated ethanol supply mandate of E6 across the gasoline pool for wholesale companies and a requirement for retailers with 20 or more outlets to offer ethanol blended products for sale. Under the amendment to the Biofuels Act, all fuel retailers that sell three or more types of gasoline and diesel and have sales above a certain threshold need to comply with the mandate.

The main objective of the policy is to support the development of a sustainable biofuels industry in New South Wales. The Act has a number of secondary objectives, including (a) improving air quality; (b) addressing climate change by reducing greenhouse gas emissions; (c) providing consumers with cheaper fuel options; (d) reducing the reliance of New South Wales on imported gasoline products; and (e) supporting regional development. The Biofuels Act is administered by the New South Wales Office of Fair Trading.

The New South Wales E6 mandate (with exemptions) requires that ethanol must represent six percent of the total volume of gasoline sold in the state. A B5 mandate also exists, which requires five percent of the total volume of diesel sold via major retail outlets to be biodiesel. With exemptions in play, however, actual percentage of bioethanol and biodiesel supplied in fuels in New South Wales in 2020 was 2 percent bioethanol and an estimated 0.1 percent biodiesel in 2020.

*Queensland Biofuels Policy*

The Queensland state government has also introduced biofuel mandates to boost the biofuel and bio-manufacturing industry sector. In 2015, Queensland passed legislation that requires the fuel industry to meet targets for the sale of bio-based fuels. The mandate also sets minimum requirements for the sale of ethanol-blended regular unleaded gasoline and biodiesel blend by retailers and wholesalers. The bio-based gasoline mandate applies independently to the bio-based diesel mandate. Both schemes began in January 2017. The blend mandate for bioethanol across the gasoline pool was raised to four percent effective July 1, 2018. Similarly, the biodiesel mandate was set at half of one percent across the biodiesel pool. An ethanol blend rate of 1.5 percent in Queensland was achieved in 2020, well short of the four percent mandate. Biodiesel use in 2020 is estimated at 0.1 percent, also well below target.

Fuel Quality Standards (Petrol) Determination 2019

Australia has legislated new fuel standards for petrol due to be implemented from January 1, 2022, known as the Fuel Quality Standards (Petrol) Determination 2019. The main thrust of the change is to bring the average aromatics content across all petrol grades in Australia down from 42 percent to 35 percent on a volume basis. The main aromatics in petrol are benzine, Toluene, Ethyl Benzine and Xylenes. These are all widely known to cause a range of human health issues and reducing their content in petrol seen as a positive step towards reducing human exposure to these chemicals.

This legislative change will bring petrol in Australia to European standards set in 2005 and in the United States the current standard is more advanced and set at a maximum 25 percent aromatics content.

Reducing aromatic content of petrol would reduce the octane level of the fuel so a substitute product is required to maintain the required octane levels. According to industry sources ethanol is a superior octane enhancer to aromatics and it has been widely used as a substitute for aromatics in the EU and the United States and other countries with fuel standards designed to lower their aromatic content.

Industry experts have calculated that for Australian petrol to meet the new standards in addition to the current 180 ML consumed around an additional 370 ML of ethanol could be required. If met from domestic sources this would approximately triple the current estimated fuel ethanol production in Australia. This would also equate to an average of over three percent ethanol content across all gasoline consumed in Australia but still well below current mandate levels of four and six percent in Queensland and New South Wales, respectively.

Financial Supports for Producers and Consumers

There is no direct subsidy support for producers or consumers to encourage greater use of biofuels in Australia. There has been indirect support via establishing standards for fuel blends and programs to educate consumers in terms of bioethanol blend fuel products being safe for the majority of vehicles. This includes establishing E10 compatibility-checking web sites for consumers. The Queensland government has also established a retail fuel purchase policy for its vehicle fleet giving priority to using E10 where it is practical.

There are also a range of funding sources at federal and state government levels to support research and development through to the commercialization of new feedstock products and processes to produce biofuels. At the federal level, ARENA provides financial support across the entire innovation chain and CEFC invests in clean energy technology projects. State governments also have their own biofuels related funding programs as mentioned for Queensland

A further important initiative to improve the fuel efficiency of Australia's vehicle and equipment fleet is the Energy Efficient Finance Program for Asset Finance administered by the CEFC in conjunction with financial institutions. The program entitles consumers to a discount on the interest rate on Asset Finance

facilities for new vehicles and equipment with eligibility criteria requiring substantial efficiency gains relative to vehicles and equipment that are being replaced. The combination of the two policies encourages more rapid renewal of business vehicles and equipment, which assists in fast tracking the reduction in average fleet age and the improvement of fuel efficiency of business vehicle and equipment fleets.

Environmental Sustainability and Certification

No environmental sustainability or certification requirements have in the past, or are currently, in place for the production of biofuels in Australia.

Excise (Sales) Taxes and Import Duties

Biofuels produced in Australia receive some tax relief with point-of-sale excise tax (retail sales tax) rates that are lower than those for fossil fuels, but the advantaged position is being reduced over time. Gasoline and diesel fuels attract an excise tax rate of AU$0.433 per liter (US$0.325 per liter) as shown in Table 1 below. This rate is reviewed biannually in line with the Consumer Price Index and administered by the Australian Taxation Office.

Prior to July 1, 2015, biofuels did not attract an excise tax. From this date, on an annual basis the excise tax rate on domestically produced ethanol is scheduled to increase to reach a maximum of 32.8 percent of the gasoline fuel excise rate on July 1, 2020. For biodiesel, the excise rate is scheduled to annually increase before reaching a maximum of 50 percent of the diesel fuel excise rate on July 1, 2030. Currently the excise tax rate on bioethanol is AU$0.142 per liter (US$0.106 per liter) which is 32.8 percent of the gasoline fuel excise rate and the biodiesel excise rate is AU$0.087 per liter (US$0.042 per liter) which equates to 20 percent of the diesel fuel excise rate.

**Table 1 - Excise rates for fuel in Australia, from Aug 2, 2021**

| Description | Excise Rate Aug 2, 2021 |
|---|---|
| Gasoline Fuel | AU$0.433/liter |
| Diesel fuel | AU$0.433/liter |
| Fuel Ethanol [a] | AU$0.142/liter |
| Biodiesel [a] | AU$0.087/liter |

Source: Australian Taxation Office

Note: a = Excise calculated based on proportional product contents and their respective applicable rates

Imported fuel ethanol attracts a 5 percent import duty plus a customs duty rate equivalent to the excise (sales) rate applied to gasoline (see Table 2). Imported biodiesel attracts an import duty equivalent to the excise rate applied to diesel. Thus, the price competitiveness of imported biofuels are disadvantaged relative to biofuels produced domestically.

**Table 2 – Australian Import Duties**

| HS Code | Product Description | Import Duties |
|---|---|---|
| 2207.20.10 | Ethanol for use as Fuel in Internal Combustion Engine | 5%* and AU$0.433/liter |
| 2207.10 | Undenatured Ethanol | 5%** and AU$88.91/liter |
| 3826.00.10 & 2710.20.00 | Biodiesel | AU$0.433/liter |

Note: * 4% applies to Hong Kong, Korean Republic, Singapore and Taiwan
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There are no limitations on imports of biofuels into Australia, and they are permitted to meet supplier obligations under the New South Wales and Queensland mandates.

## III. Ethanol

Ethanol production in Australia is primarily used as a renewable energy for passenger and commercial vehicles. It is also produced in Australia for alcoholic beverage, industrial chemical, and solvents including pharmaceutical and cosmetic purposes. Despite large feedstock availability, ethanol production remains small in Australia because there is no nationwide fuel ethanol program and the only two states with a fuel ethanol program have mandates which do not enforce higher blending. Over the last decade there has been no increase in fuel ethanol capacity or production. In fact, one of the three remaining ethanol producing facilities closed in February 2020 before reopening to support the surging demand for hand sanitizers at the time of the COVID-19 pandemic outbreak in Australia. This facility subsequently closed in September 2020 and has remained closed since that time and there are no indications that it will reopen in the short term.

Bioethanol fuel is produced by fermenting starch and sugars from a range of feedstocks such as wheat, sorghum, barley, and molasses. The most commonly available ethanol blend in Australia is E10, a 10-percent blend of ethanol with regular ultra-low sulfur petrol (ULP) (<95 RON). Ethanol blend fuels are also available to consumers Premium ULP (PULP) (95-97 and 98+ RON). Sales of gasoline and ethanol fuel blends for motor vehicle use in 2020 are shown in Table 3.

New South Wales and Queensland, the two states with mandates, have the highest consumption of ethanol blended fuel. Victoria is the only other state in Australia that sells ethanol blended fuel although it is a relatively small amount (just 0.6 percent of gasoline sales). The effective ethanol blend rate of gasoline sales in the states of New South Wales and Queensland is 2.0 percent and 1.5 percent, respectively. No other states consume ethanol and on a national level ethanol use is just 1.1 percent (1.0 percent after gasoline is standardized in accordance with the International Energy Agency).

**Table 3 - Sales of gasoline and ethanol fuel for motor vehicle use in Australia, 2020**

| Fuel Use (Million Liters) | | | | | | |
|---|---|---|---|---|---|---|
| **Gasoline Type** | **Premium (95-97 RON)** | **Premium (98+ RON)** | **Regular (<95 RON)** | **Ethanol Blended Fuel** | **TOTAL** | **Ethanol Content** |
| New South Wales | 853.6 | 1,333.2 | 1,657.1 | 1,079.1 | 4,923.0 | 2.0% |
| Queensland | 345.5 | 623.1 | 1,792.3 | 540.1 | 3,301.0 | 1.5% |
| Victoria | 342.8 | 633.6 | 2,472.8 | 249.3 | 3,698.5 | 0.6% |
| South Australia | 83.7 | 146.2 | 854.9 | 0.0 | 1,084.8 | 0.0% |
| Western Australia | 205.2 | 254.2 | 1,206.2 | 0.0 | 1,665.6 | 0.0% |
| Tasmania | 45.2 | 0.0 | 287.1 | 0.0 | 332.3 | 0.0% |
| Northern Territory | 23.3 | 0.0 | 104.6 | 0.0 | 127.9 | 0.0% |
| **TOTALS** | **1,899.3** | **2,990.3** | **8,375.0** | **1,868.5** | **15,133.1** | **1.1%** |

*Source: Australian Petroleum Statistics, Commonwealth of Australia 2021Note: The Australian Petroleum Statistic is actual consumption based on a range of gasoline types (RON contents) and differs from the International Energy Agency annual consumption which is adjusted to a standardized gasoline.*

Ethanol is blended with gasoline by the major petroleum companies using methods including "splash" or sequential blending, in tank blending and gantry side stream blending. Storing and blending ethanol with gasoline to produce E10 has involved additional investment in infrastructure at terminals and storage facilities of around US$30 million by the refinery sector which handles retail distribution. This investment was facilitated by the Biofuels Capital Grants Program to support new or expanded biofuel production capacity, which ended ten years ago in 2010. Marketing campaigns to provide confidence to consumers that E10 vehicles are safe to use in modern vehicles, is the only other national government initiative to encourage greater consumption of bioethanol fuel.

Consumption

Ethanol consumption is forecast to decline in 2021 to 175 ML, from 180 ML in 2020 (see Table 4). The forecast ethanol consumption is driven by reduced production after one of the three ethanol production facilities closed on September 2020. This in conjunction with a five percent increase in anticipated gasoline consumption to 16,900 ML in 2021 will result in a further decline in nation-wide ethanol blend rate from 1.1 percent in 2020 to 1.0 percent in 2021. The overall gasoline consumption in the first half of 2021 is ten percent higher than the same period in 2020. However, extended COVID-19 related lockdowns in New South Wales, Victoria and the Australian Capital Territory in the second half of 2021 is expected to slow the rate of growth of gasoline consumption across the full year in line with the forecast.

Australian demand for ethanol blend gasoline reached a peaked in 2010 and 2011, equivalent to 1.6 percent of national gasoline consumption, due to a mandate introduced in New South Wales a few years earlier. Ethanol blend gasoline has declined since that time down to 1.1 percent in 2020.

Industry sources indicate that consumers real or perceived view is that the E10 blended fuel efficiency is lower than that of regular ULP and the price differential between the two fuels is not sufficient to provide any advantage to the use of E10. In addition, some consumers fear the possibility that ethanol blended fuel cause damage to their vehicle's engine. New South Wales and Queensland state governments have implemented marketing campaigns and web sites clearly outline that E10 fuel was safe and would not cause damage to most vehicles and enabling consumers to check if their own vehicles are suited to E10 fuel.

Other contributors to the modest but general decline in ethanol use in Australia is, first, the overall decline in gasoline consumption of seventeen percent from 2012 to 2020. This decline has been exacerbated by a large fall in use in 2020 due to lockdowns associated with the COVID-19 pandemic. By comparison the decline from 2012 to 2019 was only five percent. The drop in gasoline consumption from 2019 to 2020 is due to COVID-19 related lockdowns significantly reducing vehicle movement in 2020. Second, there has been a trend, particularly in New South Wales, for motorists to prefer PULP instead of regular ULP and E10 blended fuel at a rate well above the national average. Premium fuels in New South Wales represent almost 44 percent of total gasoline demand. New South Wales ethanol use reached a peak in 2010/11 as some ULP pumps were forced to be removed to increase ethanol blended fuel use. Since then, ULP and E10 consumption has declined as consumers particularly in New South Wales have continued to prefer PULP.

The trending decline in gasoline consumption, increasing preference for PULP, and some increase in EV sales will continue to limit expansion potential for ethanol. However, the New South Wales state government has signaled its intent to more strongly enforce their mandate. In addition, the new national fuel standard due to commence on January 1, 2022, if strongly enforced, offers scope for short to medium term expansion of ethanol use in gasoline in Australia. Also, as mentioned the federal government has on April 29, 2020 initiated the establishment of Australia's first bioenergy roadmap to contribute to Australia meeting its energy emissions reduction commitments. This report may subsequently drive further policy change that may lead to increased opportunity for transport biofuels.

Production

In 2020, Australian bioethanol production is forecast at 180 ML, down 10 ML from the previous year. This decline is related to one producer only being open for a part of the year in 2020 and producing a small amount of bioethanol for fuel and the balance for hand sanitizers during peak demand at the start of the COVID-19 pandemic. This facility closed in September 2020 and is not anticipated to reopen in 2021.

Manildra is the largest ethanol producer with a capacity of over 300 ML and is located in New South Wales. Manildra processes wheat starch through an integrated process which separates the gluten and processes the remaining starch into a range of food and industrial-grade starches, glucose syrups, and ethanol products. Waste from this process is then used to make stock feed products. Along with fuel

ethanol the plant produces higher value-added ethanol products including beverage, pharmaceuticals, cosmetics and industrial products.

Queensland has one active ethanol plant in Sarina owned and operated by Wilmar Australia, part of the Singapore-based company, Wilmar International. The facility generates fuel ethanol from molasses, a by-product of sugar production. It has the capacity to manufacture around 60 ML of ethanol annually. Wilmar has a further processing facility in Melbourne for the production of a range of higher value ethanol products including alcohol, industrial grade products including sanitizers and cleaning products, pharmaceuticals and cosmetics.

A second plant in Queensland owned by United Petroleum at Dalby, which had been producing ethanol from starch-based feedstock, closed its operations in September 2020. The Dalby bio-refinery is located in a sorghum growing region in the Darling Downs and had processed up to 200,000 metric tons (MT) of sorghum grain a year from local growers, which could produce as much as 80 ML of fuel-grade ethanol. At full capacity, the biorefinery also produces 830,000 MT of wet distillers-grain and in its last year installed equipment to produce dried distillers-grain, which is used for animal feed supplements, mainly in the dairy and cattle feedlot industries.

Australia has ample starch-based feedstock for ethanol production. Wheat demand for fuel ethanol production in 2020 is forecast to be around 390,000 MT which is only 1.2 percent of the 2020 record production season of 33.3 (million metric tons) MMT. Similarly, sorghum demand from the Dalby facility while operational has equated to around 12 percent of the past 10-year production average. The Wilmar sugar cane mill in Sarina is one of 24 mills and the only mill in Australia that produces bioethanol. The entire sugar cane intake at this mill equates to only 3.9 percent of total sugar cane production nationally, and only part of the molasses produced at Sarina is used for ethanol. Feedstock availability is not a limiting factor to ethanol production in Australia.

**Table 4 – Australian Bio Ethanol Statistics 2012 to 2020 and forecast 2021**

| Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Calendar Year | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021f** |
| **Beginning Stocks** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fuel Begin Stocks | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production** | | | | | | | | | | |
| Fuel Production | 287 | 285 | 234 | 230 | 282 | 322 | 279 | 247 | 190 | 180 |
| **Imports** | | | | | | | | | | |
| Fuel Imports | 37 | 5 | 10 | 17 | 26 | 5 | 42 | 32 | 5 | 10 |
| **Exports** | | | | | | | | | | |
| Fuel Exports | 28 | 34 | 3 | 13 | 40 | 5 | 6 | 8 | 15 | 15 |
| **Consumption** | | | | | | | | | | |
| Fuel Consumption | 296 | 256 | 241 | 234 | 268 | 322 | 315 | 271 | 180 | 175 |
| **Ending Stocks** | | | | | | | | | | |
| Fuel Ending Stocks | | | | | | | | | | |
| Total BalanceCheck | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fuel BalanceCheck | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Refineries Producing Fuel Ethanol (Million Liters)** | | | | | | | | | | |
| Number of Refineries | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| Nameplate Capacity | 440 | 440 | 440 | 440 | 440 | 440 | 440 | 440 | 440 | 440 |
| Capacity Use (%) | 65.2% | 64.8% | 53.2% | 52.3% | 64.1% | 73.2% | 63.4% | 56.1% | 43.2% | 40.9% |
| **Co-product Production (1,000 MT)** | | | | | | | | | | |
| DDG | 196 | 195 | 154 | 151 | 192 | 224 | 192 | 163 | 131 | 122 |
| **Feedstock Use for Fuel Ethanol (1,000 MT)** | | | | | | | | | | |
| Wheat | 476 | 471 | 341 | 331 | 463 | 565 | 463 | 382 | 389 | 389 |
| Sorghum | 151 | 151 | 151 | 151 | 151 | 151 | 151 | 140 | 17 | 0 |
| Molasses | 142 | 142 | 142 | 142 | 142 | 142 | 130 | 150 | 110 | 110 |
| Barley | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 |
| **Market Penetration (Million Liters)** | | | | | | | | | | |
| Fuel Ethanol Use | 296 | 256 | 241 | 234 | 268 | 322 | 315 | 271 | 180 | 175 |
| Gasoline Pool 1/ | 19,359 | 18,889 | 18,594 | 18,509 | 18,750 | 19,112 | 18,799 | 18,406 | 16,118 | 16,900 |
| Blend Rate (%) | 1.5% | 1.4% | 1.3% | 1.3% | 1.4% | 1.7% | 1.7% | 1.5% | 1.1% | 1.0% |

Note: 1/ Includes all biocomponents (biofuels) like ethanol and ETBE as well as MTBE if used. f = forecast

Source: Australian Bureau of Statistics (for trade data), Gasoline Pools are from the International Energy Agency, Forecasts are from FAS/Canberra.

Trade

Imports of denatured ethanol are forecast to remain minimal increasing from a very low level of 5 ML in 2020 to 10 ML in 2021. The import volume in the January to June 2021 period is 5.3 ML and the forecast volume is in line with an annualized result.

In light of new fuel standards set to be implemented in Australia from January 1, 2022, that reduces the gasoline pool maximum aromatics content from 42 percent to 35 percent, if enforced this is likely to result in a significant increase in fuel ethanol imports in 2022. Industry anticipates that, similarly to other parts of the world, ethanol will be the primary substitute for aromatics and Australia will need to

approximately triple the current bioethanol use in gasoline blends. Currently there are only two operating bioethanol producers with the third mothballed and no indication that it will recommence production in the short term. On this basis, it is likely that any additional ethanol demand in 2022 as a result of the new fuel standards would be met mostly from imports.

Exports of denatured ethanol are forecast to remain stable in 2021 at 15 ML. Exports in the January to June 2021 period was 8.2 ML slightly higher than the for the same period in the prior year.

## IV. Biodiesel

Over the last decade, biodiesel production and use in Australia rose but then collapsed in 2016. In 2019 and 2020 there was a small uptick production supported by the reopening of a significant production facility. However, this facility has ceased production from mid-2021 due to their primary feedstock (tallow) more than doubling in price from their contracted supply price expiring in 2021.

Biodiesel is produced from renewable plant or animal lipids (fats and oils) through a process called transesterification. The feedstocks used in Australia are tallow and used cooking oil. Biodiesel could be produced from canola, of which there is a large supply. However, the cost of production has become too high relative to the cost of fossil diesel fuel and uneconomic in the Australian market.

B5 biodiesel fuel is the most common blend used in Australia and is considered under fuel standards to be identical with fossil diesel fuel and is sold unlabeled. The B20 biodiesel blend is generally sold for commercial operations and is labelled, and there is an Australian fuel standard for pure unblended biodiesel (B100).

Today, limited volumes of biodiesel are sold via wholesalers to the retail network or exported. For several years prior to 2016, when biodiesel production and consumption levels were higher, a large proportion of biodiesel (both domestic production and imports), was sold in bulk to mining and transport companies on long-term contracts. The majority of this was in the long-haul trucking industry. After the demise of half the biodiesel plants and three-fourths of production capacity, long-term bulk contracts ended.

U.S. and European diesel engine manufacturer warranties for engines typically allow biodiesel blends up to 20 percent with conventional diesel (B20) provided that the resultant blend meets the diesel standard. Scania trucks have five of their engines approved to run on B100 in Australia. Other diesel engine manufacturers are typically certified for fuels up to B5 in Australia.

### Consumption

Biodiesel consumption in Australia is forecast to decline to 13 ML in 2021, a fall of 28 percent from the 2020 consumption of 18 ML. The forecast consumption level is in line with 2016 to 2018. The increase in consumption in 2019 and 2020 was associated with an increase in supply from a plant that

recommenced production in mid-2019 but has ceased production in mid-2021 and is not anticipating any further production in 2021. Consumption of biodiesel in Australia is very low and is forecast at well under one tenth of one percent of overall diesel use.

Due to the fact that B5 diesel blends meet diesel standards, the volume of diesel blend sold in each state is not recorded in the Australian Petroleum Statistics and it is therefore not possible to provide an accurate assessment of the biodiesel consumption in the two mandated states. However, in 2020 the combined diesel consumption in New South Wales and Queensland was 48 percent of national consumption. If all of the biodiesel produced is consumed in these two states, which is largely considered to be the case, then this would equate to less than 0.1 percent of their diesel consumption being biodiesel in 2020 (less than 0.2 percent of on-road sector consumption). Consumption has fallen well short of the two percent mandated target in New South Wales and half of one percent in Queensland and is expected to remain the case in the forecast 2021 year.

The low consumption levels are largely driven by the absence of strong mandates which results in low domestic production and negligible imports. As shown in Table 5, both biodiesel production and imports were significantly higher from 2012 to 2015 compared to the period from 2016 to 2020.

Production

Biodiesel production is forecast to decline in 2021 to 18 ML from 27 ML in 2020, falling to levels near the three years from 2016 to 2019 when production ranged from 15 ML to 13 ML (see Table 5). The decrease from 130 ML in 2015 to 15 ML in 2016 is largely due to one producer with three production facilities being placed into receivership and shutting down production in early 2016. One of the three sites has subsequently been recommissioned and production recommenced in mid-2019, only to cease once again in mid-2021. This site is largely responsible for the small resurgence in biodiesel production approximately doubling from 2018 to 2019 and 2020.

Of the three biodiesel producing facilities in Australia, the primary feedstock for two of them is tallow and a small proportion from used cooking oil. The cooking oil is primarily used to blend with tallow during cooler months to lower the cloud point and minimize the risk of engine damage when operating temperatures are lower. The third producer primarily uses used cooking oil for biodiesel production and has been significantly impacted by the short-term impact of COVID-19 due to feedstock supply being greatly reduced during this period.

The forecast tallow consumption for biodiesel production in 2020 is 10,000 MT (see Table 5). According to a Meat and Livestock Australia report on ‘Biodiesel Additive’ published in July 2011 at that point there was over 600,000 MT of tallow produced annually in Australia. The beef cattle industry is the largest producer of tallow in Australia and the production of meat in 2020 is nearly identical to 2011. Tallow for biodiesel, at less than two percent of total tallow production, is not a limiting factor to biodiesel production in Australia.

**Table 5 – Australian Biodiesel Statistics 2012 to 2020 and forecast 2021**

| Biodiesel (Million Liters) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Calendar Year | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** | **2021f** |
| **Beginning Stocks** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production** | 114 | 114 | 150 | 130 | 15 | 13 | 13 | 28 | 27 | 18 |
| **Imports** | 21 | 118 | 371 | 159 | 1 | 1 | 0 | 0 | 0 | 0 |
| **Exports** | 4 | 11 | 3 | 0 | 5 | 0 | 0 | 2 | 9 | 5 |
| **Consumption** | 131 | 221 | 517 | 289 | 11 | 14 | 13 | 26 | 18 | 13 |
| **Ending Stocks** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BalanceCheck | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Production Capacity (Million Liters)** | | | | | | | | | | |
| Number of Biorefineries | 6 | 7 | 6 | 5 | 3 | 2 | 2 | 3 | 3 | 3 |
| Nameplate Capacity | 297 | 312 | 212 | 197 | 50 | 50 | 50 | 107 | 107 | 107 |
| Capacity Use (%) | 38.4% | 36.5% | 70.8% | 66.0% | 30.0% | 26.0% | 26.0% | 26.2% | 25.2% | 16.8% |
| **Feedstock Use (1,000 MT)** | | | | | | | | | | |
| Tallow | 77 | 77 | 101 | 87 | 3 | 2 | 2 | 14 | 17 | 10 |
| Used cooking oil | 32 | 32 | 42 | 38 | 11 | 10 | 10 | 12 | 9 | 7 |
| **Market Penetration (Million Liters)** | | | | | | | | | | |
| Biodiesel, on-road use | 131 | 221 | 517 | 289 | 11 | 14 | 13 | 26 | 18 | 13 |
| Diesel Pool , on-road use 1/ | 12,465 | 12,858 | 13,204 | 13,901 | 13,826 | 15,376 | 16,050 | 14,950 | 15,915 | 16,358 |
| Blend Rate (%) | 1.1% | 1.7% | 3.9% | 2.1% | 0.1% | 0.1% | 0.1% | 0.2% | 0.1% | 0.1% |
| Diesel Pool, total 1/ | 23,739 | 24,850 | 25,343 | 26,269 | 25,957 | 28,720 | 29,631 | 29,692 | 29,381 | 30,200 |

Note 1/ Fuel pools are defined as fossil fuels plus all "bio-components" (biofuels) blended with fossil diesel. f = forecast

Source: Australian Bureau of Statistics (for trade data), Diesel Pool, total 1/ is from the International energy Agency, Forecasts are from FAS/Canberra. Diesel Pool, on road use 1/ is calculated by FAS/Canberra from Department of Industry, Science, Energy and Resources, Australian Energy Statistics, Table F, September 2020,

Trade

The forecast for biodiesel imports in 2021 is to remain at zero in line with 2018 to 2020. Biodiesel exports (B100 equivalent) are forecast to decrease to 5 ML in 2021 from 9 ML in 2020 after some years of no exports. The facility which recommenced production in mid-2019 had focused on the export market in Europe and other markets to diversify their risk. This explains the slight resurgence of exports in 2019 and 2020 before the forecast decline in 2021 after ceasing production in mid-2021. The other two production facilities focus their supply to the domestic market in the mandated states.

Australia has consistently exported over 400,000 MT tallow each year between 2013 to 2020. Much of this has been sourced for biodiesel production. Finnish company Neste Oil, a global leader in hydrogenation derived renewable diesel (HDRD) production, is considered to be the major buyer to support its production facilities in Singapore, Netherlands and Finland. Their current global HDRD capacity is almost 3,000 MT with expansion plans up to 4,5000 MT by 2022.

Industry also reports that the competition and price of used cooking oil in Australia is very strong due to export demand for use in biodiesel production.

Around two-thirds of Australia's canola exports are to the EU, largely for biodiesel production. In 2020, 1.1 MMT of canola was exported to the EU, enough to produce up to 1,360 ML of biodiesel. A stark difference compared to Australia's 27 ML of biodiesel production in 2020. Industry sources indicate that the cost of canola is uneconomic for the production of biodiesel in Australia. In January to June 2021 canola exports to the EU have already increased by 84 percent surpassing 2.1 MMT.

## V. Advanced Biofuels

There have been a number of research and trial projects in Australia on second generation and advanced biofuels using non-traditional feedstocks including lignocellulosic feedstocks. The Oil Mallee project for example used Mallee eucalypts to produce eucalyptus oil, activated carbon (biochar), and bioenergy in a one kW integrated wood processing demonstration plant. 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 has provided funding to projects developing advanced biofuel production technologies. None have reached commercialization stage.

*Sustainable Aviation Fuel (SAF)*

Fuel costs are a large part of airline operating expenses. Nevertheless, the global airline industry (including Australian carriers) has set its sights on supporting the commercialization of SAF which is expected to contribute more to lowering future GHG emissions (especially on long-haul routes) than any other factors including ongoing airplane technology development. Although, there have been some early initiatives with the likes of Qantas operating the first commercial SAF flight in 2012 and Virgin Australia running a two-year trial from October 2017 using SAF, progress has been slow.

A more recent initiative has been from Qantas who has announced an offtake agreement with supplier SG Preston for 8 million gallons of SAF over 10 years beginning in 2020. The agreement will fuel Qantas jets flying from the Los Angeles airport LAX to Australia. In June 2021 Australia's largest domestic and international carrier Qantas announced that it will invest AU$50m towards the development of SAF supply in Australia. Its goal is to have four to six domestic suppliers by 2025. Qantas stated that renewable hydrogen and electric engines wouldn't help it reduce its carbon footprint because they are not suitable technologies for long haul flights across Australia and overseas. SAF is viewed as their only option to reduce carbon emissions over the next 10 to 15 years so the development of SAF has become one of the most important issues on the company's radar.

*Advanced Pilot Biofuel Plant in Queensland*

In March 2016, Southern Oil Refining company, an oil recycling company, committed to build an AU$16 million biofuel pilot plant in Australia. The facility, called the Northern Oil Advanced Biofuels

Pilot Plant, has now been built in Gladstone, Queensland and produces biodiesel derived from sugarcane bagasse. The pilot plant is operational and in conjunction with its research laboratory is undertaking a range of projects exploring alternate feedstock options. There are plans to eventually expand the plant into an AU$150 million commercial scale refinery with a capacity of 200 ML of advanced biofuel a year. The Queensland State and federal governments have provided grants supporting this initiative. At this point there is no commercialized biofuel production from this facility.

## VI. Notes on Statistical Data

There are no comprehensive statistical series provided by industry or government for biofuel production, consumption, trade, and stocks in Australia.

Bioethanol consumption is derived from Australian Petroleum Statistics, Issue 299 June 2021, Commonwealth of Australia 2021. The report provides monthly statistics of gasoline, diesel and jet fuel consumption by state. Gasoline consumption data includes the volume of ethanol blended gasoline consumed. For the purpose of this report, it is assumed that all ethanol blended gasoline is E10 which is sold throughout the retail network. Using this data in conjunction with import and export data from Trade Data Monitor, a service of IHS Markit which sources directly from the Australian Bureau of Statistics, the annual production of bioethanol is calculated as the "residual" statistic presented in Table 4.

Biodiesel production from 2016 to 2020 in Table 5 is based on advice from biodiesel producers. Production data from 2011 to 2015 is unchanged from the 2019 FAS Canberra Biofuel Annual report. In conjunction with import and export data for denatured ethanol from Trade Data Monitor, biodiesel consumption is calculated as the "residual" statistic presented in Table 5.

The industry supply chain for gasoline and diesel involves a short time frame from production to sale, being a matter of weeks. Since both bioethanol used as fuel additive and biodiesel are sold as blended products it is assumed that beginning and ending stocks each year are zero.

Import and Export Data for biofuels in tables 4 & 5 are sourced from the Australian Bureau of Statistics based on the following HS Codes;

- HS220720 Fuel Ethanol
- HS3826 Biodiesel

Co-product production data for distillers grains, which are reported in dry form (DDGs) in Table 4 is calculated using the following conversion rates:

- Wheat 1 MT = 313kg DDG
- Sorghum 1 MT = 313kg DDG
- Barley 1 MT = 313kg DDG

Feedstock use for the production of bioethanol in Table 4 is calculated using the following conversion rates;

- Wheat 1 MT = 393 liters ethanol
- Sorghum 1 MT = 430 liters ethanol
- Molasses 1 MT = 246 liters ethanol
- Barley 1 MT = 241 liters ethanol

Feedstock use for the production of biodiesel in Tables 5 is calculated using the following conversion rates;

- Tallow 1 MT = 1,043 liters ethanol
- Used Cooking Oil 1 MT = 1,043 liters ethanol

There is no industry data providing a breakdown of annual diesel consumption by sector as presented in Table 3. This data is estimated based on the following data and calculations:

- Source data is from the Department of the Environment and Energy, Australian Energy Statistics, Table F, September 2020
    - The table provides sector-by-sector diesel consumption in petajoules on an annual basis from July to June starting from 2010/11 through to 2018/19
- The data was converted to an annual calendar year basis by taking 50 percent of the energy use in 2010/11 and 50 percent from 2011/12 and adding the two together to produce the 2011 energy consumption of diesel for each industry sector. This method was applied to produce annual results from 2012 to 2018 on a calendar year basis.
- The data was then converted from petajoules to ML by applying a conversion of 38 megajoules per liter.
- The proportion of diesel consumption for each sector in each calendar year was applied to the annual diesel consumption data from the International Energy Agency (IEA) Gasoline, Diesel & Kerosene Demand, OilMktRpt, March 2021.
- The diesel consumption calculated from energy data and converted to a calendar year basis from Department of the Environment and Energy, Australian Energy Statistics, Table F, September 2020 was compared to the diesel consumption data from the IEA report (referred to above) with the following variances;

| Year | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|
| Variance | 1.19% | 0.68% | -1.09% | -0.36% | -4.56% | 0.24% | -0.93% |

- The industry sector diesel consumption for 2019 and 2020 is based on the same calculated proportional industry sector usage as 2018. These proportions are applied to the diesel consumption data for Australia for 2019 and 2020 from the IEA report and the FAS/Canberra forecast for 2021.

**Attachments:**

No Attachments