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Report Highlights:

Ethanol consumption in Australia is forecast to remain stable in 2020 at only 1.4-percent of the gasoline pool, and biodiesel use similarly is forecast to remain steady at only 0.2-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.

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. Of the EU and another dozen and a half countries worldwide with active biofuel programs, 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 has 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 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. With the federal government reporting that Australia is already on track to meet its greenhouse gas emissions reduction commitments by 2030, there is little sign of a major change in federal policy and states with no policy are not expected to adopt one any time soon. With no expected change in mandates or other related support policies, along with the current low crude oil prices, no significant near or medium-term growth in biofuel consumption or production is expected.

COVID-19 and its impact on mobility (especially personal vehicle use) and the economy has led to sharp declines in the gasoline and diesel pools including biofuels. Gasoline and ethanol are impacted more that diesel and biodiesel as noted in Section III. With blending mandates holding, biofuel consumption is forecast to fall in line (at the same rates) with the larger fuel pools.

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 energy emissions reduction commitments.

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$3.25 million) Biofutures Industry Development Fund, an AU$5 million (US$3.25 million) Commercialization Fund, and an AU$4 million (US$2.6 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. 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. They are domestic supplier (not consumption)

blending mandates with exceptions 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 a legislated ethanol supply mandate of E6 for wholesale companies and a requirement for retailers with 20 or more outlets to offer ethanol blended products for sale. A certain percentage of the total volume of gasoline sold via the retail network in the state is required to be ethanol and a certain percentage is required to be biodiesel.

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. A range of exemptions, however, are provided to gasoline retailers and as a result the actual percentage of bioethanol and biodiesel supplied in fuels in New South Wales in 2019 was 2.5 percent and an estimated 0.2 percent in each fuel pool, respectively. 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. Under an 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.

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, such as E10 and biodiesel blend. 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 mandate for bioethanol fuel was raised to four percent effective July 1, 2018 and the biodiesel mandate was set at half of one percent. The bioethanol fuel used in Queensland in 2019 was 1.8 percent, well short of the four percent mandate. Biodiesel use in 2019 is estimated at 0.2 percent, also well below target.

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. In conjunction with this policy, business use vehicles and equipment up to the value of A$30,000 (US$19,500) are able to be depreciated in one year, minimizing business taxation liabilities (although for a short period from March 12 to June 30, 2020 the threshold is A$150,000). 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 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 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$0.423 per liter (US$0.275 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 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 rate on July 1, 2030. Currently the excise tax rate

on bioethanol is AU$0.111 per liter (US$0.072 per liter) which is 26.2 percent of the gasoline fuel excise rate and the biodiesel excise rate is AU$0.056 per liter (US$0.036 per liter) which equates to 13.3 percent of the diesel fuel excise rate.

Table 1 - Excise rates for fuel in Australia, from Feb 3, 2020

Description	Excise Rate Feb 3, 2020
Gasoline Fuel	AU$0.423/liter
Diesel fuel	AU$0.423/liter
Fuel Ethanol [a]	AU$0.111/liter
Biodiesel [a]	AU$0.056/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 domestic biofuels.

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$0.423/liter
2207.10	Undenatured Ethanol	4%** and AU$86.90/liter
3826.00.10 & 2710.20.00	Biodiesel	AU$0.423/liter

Note: * 4% applies to Hong Kong, Korean Republic, Singapore and Taiwan
** 5% applies to Hong Kong, Korean Republic, Singapore and Taiwan

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.

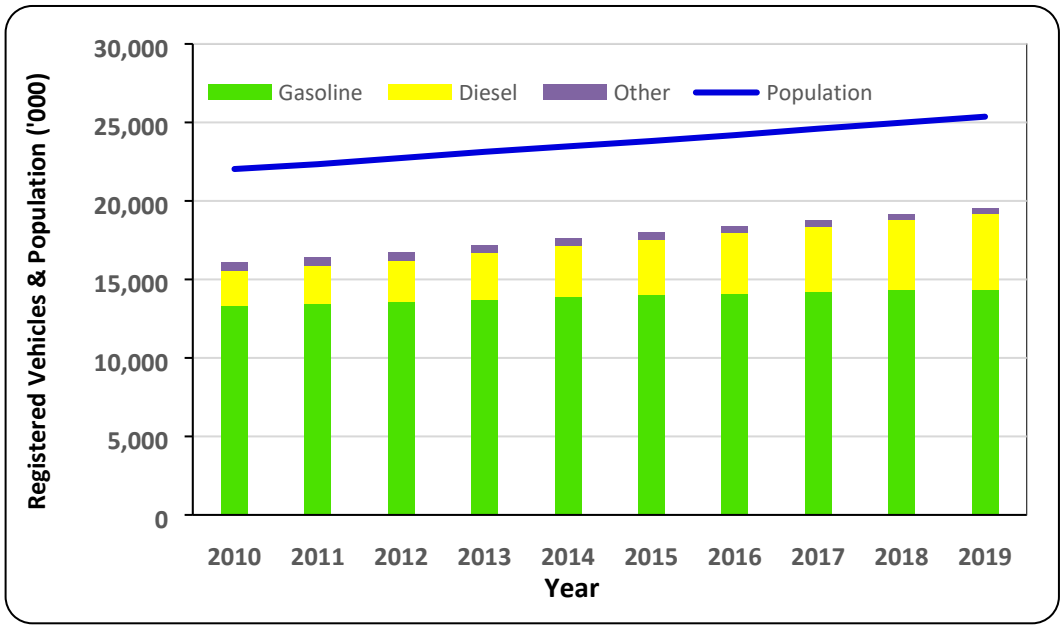
III. Gasoline and Diesel Pools

As a result of: 1) a larger and faster growing transport diesel pool compared to gasoline due to improving fuel efficiency of gasoline vehicles; 2) growth in diesel vehicle purchases running ahead of gasoline vehicles; and 3) heavy equipment/vehicle use of diesel mostly tied to a growing economy - the total fuel pool for biofuel blending is larger and has created more growth opportunity for biodiesel than ethanol in Australia.

Vehicle registrations have increased in line with population growth (see Figure 1), rising marginally from 73 to 77 vehicles per 100 head of population from 2010 to 2019. The Australian registered vehicle fleet over the last 10 years has remained predominantly gasoline based at 74 percent of all registered vehicles in 2019, but has gradually declined from 83 percent in 2010. As evident in Figure 1, there has been a pronounced shift towards diesel vehicles in Australia.

Due to the very small volume of vehicles that are powered by compressed natural gas, duel systems, and electric battery, the Australian Bureau of Statistics reports them as one group ('Other'). In 2010 this group represented 2.2 percent, while in 2019 this had declined to 1.8 percent. According to industry sources this is predominantly due to a decline in compressed natural gas vehicles, while duel system and electric vehicle numbers have increased. Nevertheless, the number of duel fuel and electric vehicles in Australia is very low.

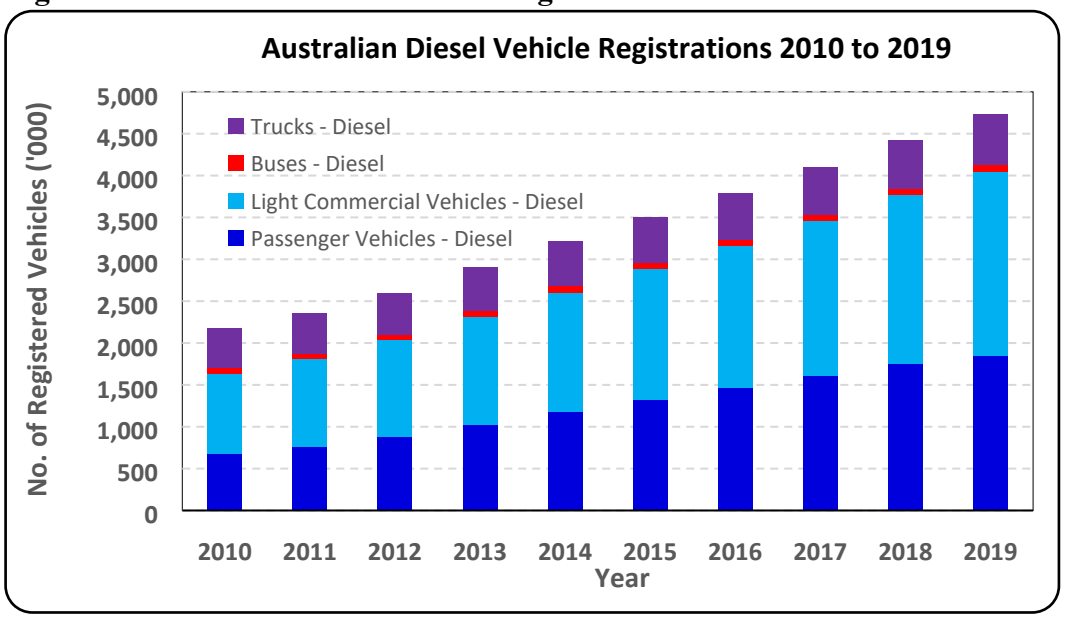
Figure 1 – Australian Trend in Vehicle Registrations by Fuel Type Relative to Population Growth



Note: 'Other' includes compressed natural gas, duel fuel and electric powered vehicles
Source: Australian Bureau of Statistics

Of the 3.44 million increase in vehicle registrations from 2010 to 2019, 1.02 million were gasoline vehicles compared to 2.57 million diesel vehicles, along with a 0.15 million decline in 'Other' fuel powered vehicles. There has been a clear trend toward Australian consumers choosing diesel vehicles over the last decade. Although passenger vehicles have been a strong contributor to this trend, light commercial vehicles have been the major driver as evident in Figure 2 below. Although there have been increases in the number of registered trucks and buses on Australian roads, the change has been moderate by comparison.

Figure 2 - Australian Diesel Vehicle Registration Trend



Source: Australian Bureau of Statistics

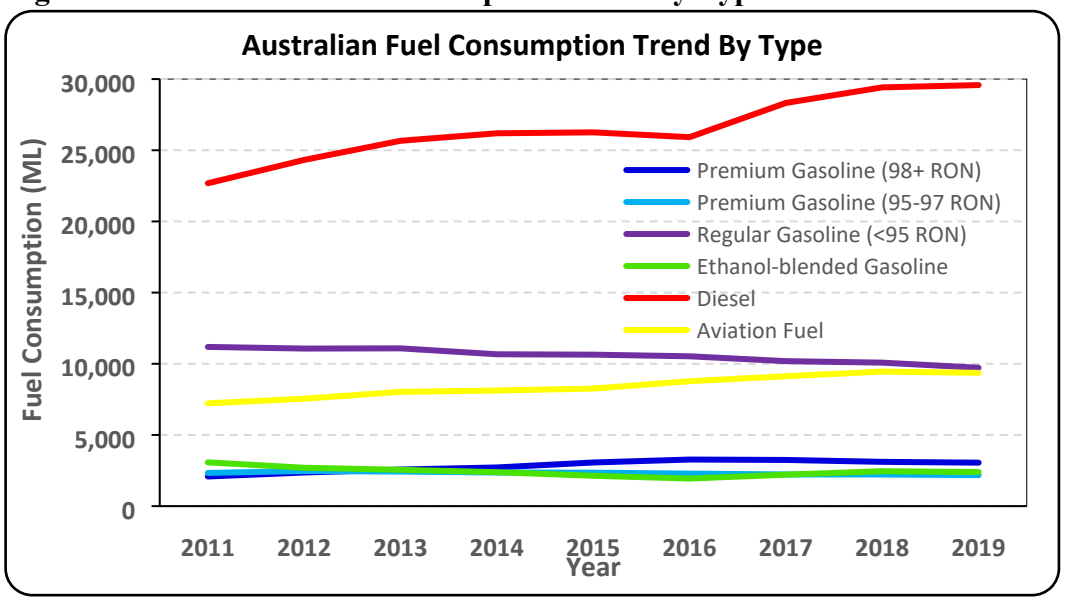
There has been a substantial seven percent decline in the gasoline pool since 2011, from 18.7 billion liters to 17.3 billion liters in 2019. This is despite a 7.7 percent increase in the number of registered gasoline vehicles over the last 10 years. This highlights a significant improvement in the fuel efficiency of the gasoline vehicle fleet in Australia.

Within the gasoline fuel categories there has been a shift from regular unleaded gasoline (ULP) to premium unleaded gasoline (PULP) of 1.0 billion liters since 2011. During the same period there has also been a decline in ethanol blended fuel consumption of 0.7 billion liters.

The major shift in fuel consumption since 2011 has been with diesel consumption increasing 30 percent from 22.7 to 29.6 billion liters as shown in Figure 3. This is even greater than the increase in registered diesel vehicles (up 19 percent) in the same period and despite fuel efficiency gains during this time. The major reason for this is growth in diesel consumption relates to unregistered heavy equipment related to construction and mining, agriculture and shipping & rail sectors.

Biodiesel use is essentially nonexistent relative to total diesel consumption. The Australian Petroleum Statistics do not include data on biodiesel blended fuel consumption. However, based on total known biodiesel production and trade it is calculated that biodiesel consumption has fallen below 0.2 percent of the total diesel pool since 2016.

Figure 3 - Australian Fuel Consumption Trend by Type



Source: Australian Petroleum Statistics, Commonwealth of Australia 2020

Overall, there is a clear trend of declining gasoline consumption despite an increasing number of gasoline vehicles. There is also an increasing trend in the consumption of diesel and jet fuel.

Diesel consumption in Australia is almost double that of gasoline consumption and heavily weighted to on-road use (see Table 3). Despite diesel and gasoline vehicles representing 24.6 and 73.6 percent, respectively, of total vehicle registrations in Australia, on-road consumption is nearly the same for diesel and gasoline. This is due to the fact that diesel is predominantly used in trucking transport. Australia has a very large extractive mining sector relative to most countries and along with the construction sector they consume around 23 percent of total diesel use, while the agriculture and industry sectors each consume around nine percent.

Jet fuel consumption in Australia is relatively high and reflects the sheer size of the country and distances travelled, distance to major world destinations, and the high average wealth of Australians.

COVID-19 is having a severe impact on transport fuel pool and the scale of demand destruction is shocking to all industry observers. With biofuel blending expected to hold near 2019 levels, the percentage change drop in biofuel use is expected to be similar to the larger pools into which they are blended. The biggest forecast decline is for jet fuel, down 25 percent to 7,000 ML (see Table 2) due to the near shutdown of airlines in April and May 2020, an expected slow recovery in domestic flights, and even slower recovery of international travel.

The gasoline pool is forecast to fall 11 percent to 15,500 ML. The increased rate of teleworking and the virtual shut down of the food service sector in April and May 2020 has had a large impact on gasoline

fuel consumption. In most parts of Australia, the food service sector started reopening in late May 2020 with further progressive lifting of restrictions in June and July 2020. Other than the two largest states of Victoria and New South Wales, other state borders remain closed as of the beginning of June but it is anticipated that they will commence reopening in the coming months.

Diesel consumption is forecast to be the least impacted by the COVID-19 disruption with a four percent fall to 28,500 ML. Part of this fuel pool, agriculture, construction and mining and shipping and rail are less impacted by COVID-19, especially compared to personal, light duty vehicle use. The main impact of reduced diesel consumption is in the on-road sector primarily associated with reduced use of passenger vehicles, light commercial vehicles in the food service sector, and road freight of retail goods.

Table 3 – Fuel Consumption in Australia

Fuel Use (Million Liters)										
Calendar Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020f**
Gasoline Pool 1/ 2/	18,675	18,592	18,636	18,131	18,192	18,022	17,868	17,868	17,348	15,500
Diesel Pool 1/	22,680	24,321	25,666	26,191	26,257	25,919	28,324	29,417	29,578	28,500
On-road [e]	12,281	12,770	13,275	13,634	13,883	13,801	15,076	15,657	15,743	14,950
Agriculture [e]	2,201	2,227	2,236	2,251	2,323	2,379	2,586	2,686	2,701	2,750
Construction & Mining [e]	4,866	5,797	6,337	6,137	5,834	5,755	6,437	6,685	6,722	6,750
Shipping & Rail [e]	1,338	1,373	1,438	1,507	1,563	1,542	1,664	1,728	1,738	1,700
Industry [e]	1,963	2,125	2,351	2,633	2,638	2,443	2,561	2,660	2,674	2,350
Heating [e]	30	29	29	30	15	0	0	0	0	0
Jet Fuel Pool 1/ 3/	7,221	7,547	8,028	8,122	8,257	8,776	9,125	9,452	9,364	7,000
Fuel Pools Total 1/	48,576	50,460	52,330	52,444	52,706	52,717	55,317	56,737	56,290	51,000

Notes 1/ Fuel pools are defined as fossil fuels plus all "bio-components" (biofuels) as well as MTBE if used in gasoline. f = forecast
2/ Excludes 'aviation ' gasoline; e = estimate
3/ Interior flights + outbound international flights.

Source: Australian Petroleum Statistics, Commonwealth of Australia 2020 / Department of the Environment and Energy, Australian Energy Statistics, Table F, September 2019, estimates and forecasts are from FAS Canberra

Over the past decade, the electric vehicle (EV) sales have rapidly accelerated in certain countries while other countries have been left behind. Australia at this point has not introduced purchasing incentives and any significant charging infrastructure support. Penalties on fossil fuel use that effect change in the transport sector and could support alternative fuel use do not exist either. An Australian Government report produced by the Department of Infrastructure, Transport, Cities and Regional Development released in August 2019 studied EV uptake in 22 countries, analyzing impediments to uptake and forecasting rates of uptake. The report identified that since 2010 the uptake of EVs in Australia has increased from zero to only one-third of one percent of vehicle sales in 2018. This uptake in Australia is very low relative to most developed countries such as the United States (2.6 percent), China (4 percent), Canada (5.4 percent), Sweden (10.3 percent) and the standout Norway at 49 percent.

Without policies to incentivize alternate vehicle use, Australia's uptake of EVs is likely to continue to remain behind countries that have taken a proactive policy approach to increase the speed of transition from fossil fuels to lower carbon emission energy use in the transport sector.

IV. 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 April 2020, fuel ethanol producers, with government support, reduced their fuel ethanol production and stepped up medical-grade ethanol production to meet the increased demand for hand sanitizers and cleaning products due to COVID-19. Industry reports that the demand for hand sanitizers and cleaning products is declining and a shift back to focusing on fuel ethanol may occur

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 2019 are shown in Table 4.

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 0.7 percent of gasoline sales). The total ethanol content of gasoline sales in the states of New South Wales and Queensland is 2.5 percent and 1.8 percent, respectively. No other states consume ethanol and on a national level ethanol use is just 1.4 percent. Both New South Wales and Queensland have consistently fallen well short of their mandate targets of six percent and four percent, respectively.

Table 4 - Sales of gasoline and ethanol fuel for motor vehicle use in Australia, 2019

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	1,045.9	1,350.8	1,773.5	1,400.6	5,570.8	2.51%
Queensland	361.0	579.3	1,972.2	649.3	3,561.8	1.82%
Victoria	400.6	738.3	3,248.6	344.1	4,731.6	0.73%
South Australia	87.9	140.5	941.1	0.0	1,169.5	0.00%
Western Australia	215.4	241.1	1,359.2	0.0	1,815.7	0.00%
Tasmania	46.7	3.1	324.3	0.0	374.1	0.00%
Northern Territory	21.6	0.6	102.3	0.0	124.5	0.00%
TOTALS	**2,178.9**	**3,054.3**	**9,721.6**	**2,393.5**	**17,348.3**	**1.38%**

Source: Australian Petroleum Statistics, Commonwealth of Australia 2020

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 2020 to 220 ML, from 239 ML in 2019 (see Table 5). The forecast decrease in ethanol consumption is driven by demand destruction of the fuel pool tied to COVID-19 and reduced mobility. The year-over-year blend rate is expected to remain unchanged, so the rate of decrease in ethanol use is in line with the rate of decline for the entire fuel pool.

Australian demand for ethanol blend gasoline reached a peaked in 2010 and 2011, equivalent to 1.6 percent of national gasoline consumption, due to mandate introduced in New South Wales a few years earlier. Ethanol blend gasoline has declined since that time down to 1.4 percent in 2019.

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 having implemented marketing campaigns and web sites clearly outlining 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 seven percent from 2011 to 2019. 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 43 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 increased in EV sales will continue to limit expansion potential for ethanol. Without a federal nationwide mandate and stronger enforcement and expansion to more fuel classes of existing state mandates, prospects to increase fuel ethanol consumption are largely non-existent. However, 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 may subsequently drive policy change that leads to increased opportunity for transport biofuels.

Production

In 2020, Australian bioethanol production is forecast at 235 ML, down five percent from the previous year. The year-over-year production decline is less steep than consumption because some diversion to the medical grade market as well as reduced imports offset some of the fuel consumption loss related to COVID-19. The ethanol industry in Australia has three established producers in New South Wales and Queensland, with an estimated production capacity of 440 ML.

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 also has a plant producing ethanol from starch-based feedstock operated by United Petroleum at Dalby. The Dalby bio-refinery is located in a sorghum growing region in the Darling Downs and processes up to 0.2 million metric tons (MMT) of sorghum grain a year from local growers, which can produce 80 ML of fuel-grade ethanol. At full capacity, the biorefinery also produces 830,000 MT of wet distillers grain, which is used for animal feed supplements, mainly in the dairy and cattle feedlot industries.

During 2018 and 2019 there were severe drought impacts in the two ethanol-producing states affecting the supply availability and price of starch-based grains (predominantly wheat and sorghum and also barley) for the production of ethanol. This negatively impacted the economic feasibility of producing ethanol from grain feedstocks.

Since the start of 2020, the drought has all but broke and there are forecasts of significantly higher planting of wheat and sorghum. This has caused a decline in starch-based feedstock prices, however the full impact of better rainfall on prices and feedstock availability is not expected to be evident until late 2020 with the commencement of the wheat harvest. These developments are expected to reduce the cost of producing ethanol particularly in late 2020 and into 2021.

Queensland has a second 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.

Production of molasses as a feedstock was somewhat impacted by drier than normal conditions in the sugar cane growing area in 2018 and 2019, however ethanol production was maintained at capacity during this period. Supply of molasses for ethanol production in the first half of 2020 is expected to move to a more normal supply position after the sugar cane harvest commences in June 2020.

Australia has ample starch-based feedstock for ethanol production. Wheat demand for fuel ethanol production in 2020 is forecast to be 390,000 MT which is only 1.7 percent of the 10-year production average of 23.7 MMT. Similarly, sorghum demand for fuel ethanol production is forecast to be 95,000 MT compared to the 10-year production average of 1.56 MMT, which equates to 6.1 percent. 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 5 – Australian Bio Ethanol Statistics 2011 to 2019 and forecast 2020

Ethanol Used as Fuel and Other Industrial Chemicals (Million Liters)										
Calendar Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020f
Beginning Stocks										
Fuel Begin Stocks	0	0	0	0	0	0	0	0	0	0
Production										
Fuel Production	271	287	285	234	230	282	322	279	247	235
Imports										
Fuel Imports	40	14	8	6	6	6	6	8	53	45
Exports										
Fuel Exports	3	31	37	5	22	94	107	42	61	60
Consumption										
Fuel Consumption	308	270	255	235	213	194	221	245	239	220
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	3
Nameplate Capacity	440	440	440	440	440	440	440	440	440	440
Capacity Use (%)	61.6%	65.2%	64.8%	53.2%	52.3%	64.1%	73.2%	63.4%	56.1%	53.4%
Co-product Production (1,000 MT)										
DDG	184	196	195	154	151	192	224	192	163	170
Feedstock Use for Fuel Ethanol (1,000 MT)										
Wheat	435	476	471	341	331	463	565	463	382	390
Sorghum	151	151	151	151	151	151	151	151	140	95
Molasses	142	142	142	142	142	142	142	130	150	110
Barley	0	0	0	0	0	0	0	0	0	57
Market Penetration (Million Liters)										
Fuel Ethanol Use	308	270	255	235	213	194	221	245	239	220
Gasoline Pool 1/	18,675	18,592	18,636	18,131	18,192	18,022	17,868	17,868	17,348	15,500
Blend Rate (%)	1.6%	1.4%	1.4%	1.3%	1.2%	1.1%	1.2%	1.4%	1.4%	1.4%

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 Australian Petroleum Statistics, Commonwealth of Australia 2020, Forecasts are from FAS Canberra.

Trade

Imports of ethanol are forecast to decline from 53 ML in 2019 to 45 ML in 2020. The import volume in the January to March 2020 period is 11.6 ML and the forecast volume is in line with the first quarter result annualized. Prior to 2019 imports were stable at around six ML. The large increase in 2019 imports and continued pace in January to March 2020 is almost exclusively due to shipments from the United States.

Ethanol exports are forecast to remain stable in 2020 at 60 ML from the prior year 61 ML. Exports in the January to March 2020 period was 21.4 ML well up on the 14.7 ML in the same period in 2019. Annualized this is in line with the actual 2019 export result.

V. Biodiesel

Over the last decade, biodiesel production and use in Australia continued to rise but then collapsed in 2016. In 2019, production recovered slightly supported by domestic use and modest further production expansion is forecast for 2020 supported by exports.

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 remain at 26 ML in 2020, in line with the 2019 level. This, however, is approximately double the consumption levels from 2016 to 2018. This is due to a plant recommencing production in mid-2019. During the period from 2016 to 2018, the consumption of biodiesel was equivalent to far less than 0.1 percent of total diesel consumption (0.1 percent of on-road sector consumption) in Australia and has increased to less than 0.1 percent in 2019 (0.2 percent of on-road sector consumption) and forecast to remain the same in 2020.

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 2019 the combined diesel consumption in New South Wales and Queensland was 49 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 0.2 percent of their diesel consumption being biodiesel in 2019 (less than 0.4 percent of on-road sector consumption). Consumption has evidently fallen short of the two percent mandated target in New South Wales and half a percent in Queensland and is expected to remain the case in the forecast 2020 year.

The low consumption levels are largely driven by the absence of strong mandates which results in low domestic production and a drop off, of imports. As shown in Table 5, both biodiesel production and imports were significantly higher from 2011 to 2015 compared to the period from 2016 to 2019. Additionally, there is expected to be a trend towards more exports.

Production

Biodiesel production is forecast to increase by 50 percent in 2020 to 43 ML from 28 ML in 2019. In the three years from 2016 to 2019 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. This site is largely responsible for the increase in biodiesel production approximately doubling from 2018 to 2019 and the 50 percent forecast increase from 2019 to 2020. This facility intends to further increase production towards capacity in 2021.

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 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 26,000 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 from 2010 to 2019 has increased by 14 percent, clearly indicating tallow supply has since increased further. Tallow for biodiesel, at less than four percent of total tallow use, is not a limiting factor to biodiesel production in Australia.

Table 5 – Australian Biodiesel Statistics 2011 to 2019 and forecast 2020

Biodiesel (Million Liters)										
Calendar Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020f**
Beginning Stocks	0	0	0	0	0	0	0	0	0	0
Production	90	114	114	150	130	15	13	13	28	42
Imports	25	21	118	371	159	1	1	0	0	0
Exports	0	4	11	3	0	5	0	0	2	16
Consumption	115	131	221	517	289	11	14	13	26	26
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	6	7	6	5	3	2	2	3	3
Nameplate Capacity	297	297	312	212	197	50	50	50	107	107
Capacity Use (%)	30.3%	38.4%	36.5%	70.8%	66.0%	30.0%	26.0%	26.0%	26.2%	39.3%
Feedstock Use for Fuel (1,000 MT)										
Tallow	61	77	77	101	87	3	2	2	14	26
Used cooking oil	25	32	32	42	38	11	10	10	12	14
Market Penetration (Million Liters)										
Biodiesel, on-road use	115	131	221	517	289	11	14	13	26	26
Diesel Pool , on-road use 1/	12,281	12,770	13,275	13,634	13,883	13,801	15,076	15,657	15,743	14,950
Blend Rate (%)	0.9%	1.0%	1.7%	3.8%	2.1%	0.1%	0.1%	0.1%	0.2%	0.2%
Diesel Pool, total 1/	22,680	24,321	25,666	26,191	26,257	25,919	28,324	29,417	29,578	28,500

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), Gasoline Pools are from Australian Petroleum Statistics, Commonwealth of Australia 2020, Forecasts are from FAS Canberra.

Trade

The forecast for biodiesel imports in 2020 is to remain at zero in line with 2018 and 2019. Biodiesel exports (B100 equivalent) are forecast to increase significantly in 2020 to 16 ML from 2 ML in 2019. The facility which recommenced production in mid-2019 is focused on the export market in Europe and other markets to diversify their risk. The first quarter exports for 2020 is already double that of all of 2019. According to management at this facility the domestic price for biodiesel is low particularly since crude oil prices have slumped earlier in 2020. This facility intends to continue to increase production towards capacity and focus on the export market.

Australia has annually exported from 401,000 MT to 470,000 MT of tallow between 2015 to 2019. Some of this has been sourced for biodiesel production. Finnish company Neste Oil, a global leader in hydrogenation derived renewable diesel (HDRD) production, announced the opening a new office in Melbourne in November 2019 to support additional sourcing of biofuel feedstock for its production

facilities in Singapore, Netherlands and Finland. Their current global HDRD capacity is almost 3 MMT with expansion plans up to 4.5 MMT 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 2019, 1.2 MMT of canola was exported to the EU, enough to produce up to 1,360 ML of biodiesel, compared to Australia's 28 ML of production in the same year. Industry sources indicate that the cost of canola is uneconomic for the production of biodiesel in Australia.

VI. 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, and the global airline industry (including Australian carriers) has set its sights on supporting the commercialization of SAF to reduce cost risk associated with complete dependence on fossil fuel and as a defensive measure to lower its carbon footprint before it is forced to do so in regional markets. Some commercial airlines, most notably a few early adopters based in America, Europe as well as Australia and Japan, have taken the first steps to set up multi-year offtake agreements with fuel providers to supply a portion of their demand at key airports. A 2011 study by the Commonwealth Scientific and Industrial Organisation (CSIRO), supported by Boeing, Airbus, Qantas and Virgin, found that a sustainable aviation fuels industry could be developed and would decrease greenhouse gases by almost 20 percent in the aviation sector. In 2012, Qantas operated Australia's first commercial SAF flight from Sydney to Adelaide with a 50 percent blend of SAF with traditional jet fuel in one engine.

Virgin Australia had in October 2017 announced a two-year initiative trialing sustainable aviation fuel through the Brisbane Airport fuel system using alcohol-to-jet synthetic paraffinic kerosene (ATJ-SPK), one of eight biomass-based fuels currently approved for jet engines, supplied by U.S.-based Gevo Inc. Virgin Australia, with large debt and lost business due to COVID-19, has placed itself under administration from Deloitte and the status of the SAF fueling initiative is unclear at this point. Qantas

has 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.

Advanced 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.

VII. 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 284 March 2020, Commonwealth of Australia 2020. 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 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;

- HS2207 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 2019
    - The table provides sector-by-sector diesel consumption in petajoules on an annual basis from July to June starting from 2009/10 through to 2017/18
- The data was converted to an annual calendar year basis by taking 50 percent of the energy use in 2009/10 and 50 percent from 2010/11 and adding the two together to produce the 2010 energy consumption of diesel for each industry sector. This method was applied to produce annual results from 2010 to 2017 on a calendar year basis.
- The data was then converted from petajoules to ML by applying a conversion of 36.9 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 Australian Petroleum Statistics Issue 284 March 2020, Commonwealth of Australia 2020 and presented in Table 2 for 2010 to 2017.
- 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 2019 was compared to the diesel consumption data from Australian Petroleum Statistics Issue 284 March 2020, Commonwealth of Australia 2020 with the following variances;

Year	2011	2012	2013	2014	2015	2016	2017
Variance	0.82%	0.69%	1.01%	-0.64%	-3.29%	-7.79%	-3.48%

- The industry sector diesel consumption for 2018 and 2019 is based on the same calculated proportional industry sector usage as 2017. These proportions are applied to the diesel consumption data from Australian Petroleum Statistics Issue 284 March 2020, Commonwealth of Australia 2020 for 2018 and 2019.

Attachments:

No Attachments