

6th December 2021

For Clients of APAC Biofuel Consultants.

Comment on Australia's Bioenergy Roadmap, 2021

APAC's key comments regarding the Roadmap

In November 2021, ARENA released its long awaited '**Australia's Bioenergy Roadmap**' (Roadmap)¹. The aim of the Roadmap is to lay a vision for a sustainable bioenergy industry to '*enhance the growth of Australia's bioenergy sector and identify bioenergy's role in Australia's future energy mix*' (p4).

Biofuels are a key component of the broader definition of bioenergy. The focus of APAC Biofuel Consultant's (APAC)² review of the Roadmap therefore is on *biobased liquid fuels* only, generically referred to as *biofuels for transport*. These fuels are *ethanol* (fuel grade), *biodiesel*, *renewable diesel* (or *hydrogenated vegetable oil* (HVO)), *bio jet* (more commonly known around the world as *Sustainable Aviation Fuel* (SAF)) and *bio marine diesel*³. Currently, most biofuels are used as blend stock with its corresponding primary fossil fuel.

APAC has closely followed and reported on the Australian biofuel industry since 2006. World demand for biofuels is increasing annually. Most importantly, it is a well-known fact, as demonstrated around the world, that government policy support is mandatory for the successful development of biofuels in developed economies.

Turning to the Roadmap, APAC believes that the Roadmap has failed to offer the industry a much needed new material pathway or policy basis to encourage new investment in biofuels in Australia.

The closest identification of any new pathway the Roadmap offers biofuels (and bioenergy generally) is in its description of its Targeted Development scenario. This scenario, it says, '*consists of concerted effort by industry on end use markets that are hard to abate*'. Missing from this description was any accompanying summary of what '*concerted effort*' means or what the Government offers biofuels as part of a Roadmap!

Of the biofuel opportunities, the Roadmap correctly identified the 'drop-in' biojet fuel - SAF - as a market opportunity for the 'hard-to-abate' sector. Missing from the discussion however, was the other 'hard to abate' biofuel – marine biodiesel.

Interestingly, the Roadmap emphasizes in several places, a new future for biofuel demand as a complementary fuel for other emission alternatives - namely hydrogen - for road transport!

The Roadmap identified that there is insufficient clarity on resources – feedstocks in the case of biofuels – that link to the bioenergy source. This is a valid observation and calls for further research on feedstock sources for biofuels.

¹ <https://arena.gov.au/knowledge-bank/australias-bioenergy-roadmap-report/>

² APAC is an Ecco Consulting P/L and EnergyQuest P/L joint venture

While on one hand the Roadmap specifically acknowledges the limited effectiveness of State mandates, no mention is made of the overall ineffectiveness of the largest single biofuel policy influencer in Australia - the existing Federal Government's support policy of excise concessions and import protection of domestically produced ethanol and biodiesel. The Federal Government's excise concessions have not encouraged any new investment in the sector since 2012. The Roadmap did not propose any alternative abatement scheme or overarching policy direction to replace the outdated and ineffective excise concession scheme. This indicates to APAC that the Federal Government is intent on maintaining the 33% to 50% (energy adjusted) excise concessions on domestic production for the five or six remaining biofuel producers of scale in Australia!

The Roadmap correctly identifies the current high costs of producing SAF (and HVO) compared with the cost of refining conventional jet fuel. As discussed further on pages 5 and 6, the higher SAF (and for that matter, HVO) costs are basically attributable to any significant crude oil/higher biofuel feedstock price differential, plus the higher processing costs for producing a 'drop-in' fuel. Yet the Roadmap does not propose how this 'hard to abate' sector can be protected from such a risk through policy advancement.

In its modelling results (p18), APAC seriously questions the Roadmap's forecast growth of ethanol demand between 2020 and 2030 for 'Road Transportation' (Petrol)' for both the Business as Usual and Targeted Deployment scenarios. The Roadmap forecasts that ethanol demand will grow from around 5 PJ (about 200 megalitres (ML) pa) in 2020 to 76 PJ (about 3,200 ML pa) by 2030 – an increase of 1,400 per cent. Without knowing the model's assumptions and without any indication of new policy initiatives, APAC believes this forecast is unsustainable. Furthermore, this forecast brings into question the Roadmap's statement (p11) that by 2030 locally produced biofuels for local consumption will make up 7 percent (currently 0.4%) of the total road transport fuel market by to 2030s!

Similarly, without knowing the model's assumptions, the Roadmap forecasts that Australia's demand for 'Aviation fuel' (assuming SAF) in its Targeted Deployment scenario, will grow from zero in 2020 to 70 PJ (32,000 barrels per day) by 2030. This seems ambitious.

APAC was hoping that, in the Roadmap's almost two year gestation, it would offer much more in terms of policy or initiatives to develop and encourage further investment in the Australian biofuel sector. ARENA has not seen fit to take the lead from other developed economies such as USA, Great Britain, New Zealand and EU to outline new policy objectives on biofuels in relation to carbon abatement or its carbon intensity advantage.

Australia is a significant supplier of feed stocks to the European and Singapore/USA biodiesel/renewable diesel markets. It therefore begs the question as to why the Roadmap has not articulated a policy to facilitate further investment in Australia's own renewable diesel and SAF sectors.

Finally, going as far back as 2011, there have been several significant research studies (covering technology and commercialization) on SAF opportunities in Australia. Also, since 2012 there has been, and there continues to be, a Sustainable Aviation Fuel Alliance addressing SAF issues and opportunities in Australia and New Zealand. There was no mention in the Roadmap of the Alliance or of the test flights by Qantas and Virgin using SAF. APAC believes that while 'promoting' SAF on one hand it did not pick up on these advancements or (again) propose a much needed policy direction as a base to launch future investment in SAF in Australia.

Background Notes.

The wider aim of the Roadmap was to lay a vision for a sustainable bioenergy industry to *‘enhance the growth of Australia’s bioenergy sector and identify bioenergy’s role in Australia’s future energy mix’* (p4). It goes on to say that the Roadmap *‘is designed to help inform future policy and investment decisions’* and according to Minister Taylor’s statement on 13th September 2019 when first announcing the review *‘by quantifying opportunities where Australia has a competitive advantage in the bioenergy sector’*.

ARENA engaged the French consulting group, ENEA Consulting, as the primary consultant for this project and Deloitte Australia as the Australian consultant.

The Roadmap identified bioenergy as a form of renewable energy generated from the conversion of biomass into heat, electricity, biogas and liquid fuels (p4). Biomass, the 25 page Roadmap says, includes organic matter derived from forestry, agriculture or waste streams available on a renewable basis. Bioenergy accounts for 47% of Australia’s current renewable energy production and 3% of total energy consumption.

The Roadmap modelling shows that bioenergy has the potential to provide up to 20% of Australia’s total energy consumption by the 2050s, if commercial scale is able to be achieved and if production costs can be reduced (p5).

The Roadmap goes further saying that by the start of the next decade (2030s), the sector could contribute around \$10 billion in extra GDP per annum and 26,200 new jobs, reduce emissions by 9%, divert an extra 6% of waste from landfill and enhance fuel security (p5)!

In the time it has been researching the industry since 2006, APAC has seen the biofuels (ethanol, HVO and biodiesel) sector go through a rapid growth period between 2006 and 2013 with a mish mash of policy inconsistencies and policy changes (from federal and state governments), significant financial grants, fuel excise exemptions, select protection from imports and the commissioning and de-commissioning of many new biofuel plants with the survival of a few. Since 2012, other than some expansion of some well-established integrated plant operations, Australia has not seen any significant new investment in biofuels. The market is not growing.

Australian biofuel status briefly

Ethanol. Fuel grade ethanol is usually blended (at 10% vol) with petrol and sold as E10. A blend of up to 85% ethanol is available in the market but requires special ‘flex fuel engine’ technology. With the support of the (standard fuel excise equivalent) Ethanol Production Grant first introduced in 2002 (ceased in 2015) by the Howard Government, ethanol plant capacity expanded from around 90 ML pa in 2006 to 450 ML pa by 2012. Today, the two integrated plants operating in 2006 remain the only two plants of scale operating in 2021 and with an expanded aggregate capacity of about 360 ML pa. Several (new investment) fuel ethanol projects have come and gone within that period. Even the 76 ML capacity Dalby Bio-Refinery in Queensland (owned by United Petroleum) which was commissioned in 2007 and is the only greenfield ethanol plant in Australia to ‘survive’ the ‘rush’, ceased operation for the second time in 2020. In 2020-21 demand for fuel ethanol amounted to 190 ML (about 5 PJ), down from about 310 ML in 2011. The decline in ethanol demand has continued especially as demand for gasoline in Australia continues to slowly decline. Imports of ethanol ‘for internal combustion engines’ have been subject to standard excise equivalent (non-energy adjusted)

Customs Duty since 2002 - a key protection mechanism for the fuel ethanol industry. Domestic ethanol production is subject to concessional excise rate of 32.77% (energy adjusted) of the standard petrol excise rate. Based on 190 ML consumption of ethanol, foregone excise revenue (energy adjusted) under the current scheme in 2019 – 20 amounted to about AUD\$27m³.

Biodiesel. Biodiesel, an ester produced from vegetable oils and fats, is blended with diesel, generally in the range of two to 20% (vol). Biodiesel was the other biofuel to ‘take off’ from around 2005 with the rush of construction of new production facilities around Australia. Between 2006 and 2008, there were nine biodiesel plants and one HVO plant installed in Australia with an installed capacity of 417 ML – but then not all were actually operating or were operating well below capacity. Following the closures and decommissioning of six of those plants between 2010 and 2015, there now remains only three biodiesel plants of scale operating in Australia today (2019-20), with an aggregate capacity of 105 ML. Only one of those biodiesel plants has survived the distance since 2005. In 2019-20, biodiesel production amounted to about 60 ML pa, of which about 12 ML was exported. Demand for biodiesel and HVO in Australia peaked in 2014 at 450 ML, of which 350 ML was sourced from (then Customs Duty/excise free) imports. Full excise equivalent Customs Duty was imposed on biodiesel and HVO imports from mid-2015, thereby reducing imports to near zero. Domestic biodiesel (excluding HVO) production is currently subject to the concessional excise rate of 20% of the standard diesel excise rate increasing annually to 50% by 2030. Based on 50 ML consumption of biodiesel, foregone excise revenue under the current scheme in 2019 - 20 amounted to about AUD\$17 m⁴.

Mandates (NSW and Queensland). The NSW (2007 and 2016 revision) and Queensland (2015) biofuel mandates initially generated new demand for biofuels. But as the Roadmap states, they have had limited success at sustaining demand growth. The revised NSW mandate of 2016 did not generated increased ethanol demand as intended. Thus, NSW’s only ethanol producer, Manildra, has since invested in manufacturing other grades of ethanol.

International feedstock supplier. Australia is currently a significant supplier of feedstocks to international biodiesel/HVO markets in Europe and Singapore. In 2018, Australia exported sufficient feedstock (canola seed and tallow) into the international bio/renewable diesel market to produce in excess of 1,000 ML of biodiesel/renewable diesel – begging the question of the lost value-adding opportunity for Australian industry. Similar supply arrangements continue into 2021.

What the Roadmap says (pp9-14) - with comments

In the time frame of 2021 - 2024, the Roadmap identifies SAF (a ‘drop-in’ fuel) as a market opportunity requiring possible action by industry and governments. But also missing from this option is the possible market for renewable diesel (HVO) as a ‘drop-in’ fuel and bio-marine diesel application, two other biofuels fuels recognized as ‘hard-to-abate’.

Within this time range, the Roadmap identifies two possible biofuel submarkets, namely, the Royal Australian Air Force for use of SAF and (presumably ethanol) for addressing the aromatics level in fuel quality standards (the latter already progressed by the ethanol industry in 2017 for the 2019 Fuel Standard review).

³ Ethanol foregone excise = (standard excise (43 cpl) * energy adjustment 67%) less excise paid = 14.07 cpl

⁴ Biodiesel foregone excise = standard excise (43 cpl) (no energy adjustment) less excise paid = 33.6 cpl

The Roadmap recognizes the need to assess and develop Australia's feedstock resource potential for biofuels. Sustainable feedstock availability is key to any investment. Already over the past 15 years there have been a number of studies (especially from state governments) on resources availability for bioenergy.

The Roadmap identifies the possible action by government to build ecosystems. This, the Roadmap suggests, is via facilitating commercialization of mature technologies, supporting project development and raising public awareness. APAC believes biofuels have already been in this space for over a decade. Its lack of success attracting new investment has been distorted by inappropriate support schemes, the lack of clear policy direction from the federal and state governments and industry relying on governments to promote biofuels.

As a measure of future success of the industry between 2025 and 2030, the Roadmap points to cost competitiveness, feedstock availability, feedstock sustainability, and SAF co-investment and consumer awareness as measures to advance industry quickly in that period (p14).

Every biofuel producer is aware that the single largest risk to the cost of producing biofuels, especially HVO and SAF sold into a fossil fuel market, is the disconnect between the price of crude oil and the price of vegetable oils – as the industry is currently experiencing (late 2021). This risk is a simple fact, and it's a risk that needed to be bridged with appropriate support policy. For example, the current price of canola oil - a key feedstock Australia currently supplies to overseas biodiesel producers (as canola seed) - is around USD\$1,700 per tonne. The corresponding price of crude oil is around USD\$560 per tonne (USD\$70.00 per barrel). This differential is a prime example of the basis risk that greenfield biodiesel and HVO (and SAF!) industries are facing when selling into a transport fuel market.

On the other hand, Australian biodiesel producers are currently exporting finished product into the EU market which has more relevant renewable energy policies, thus offering better returns on biodiesel.

The Roadmap validly notes that in addition to feedstock cost risk, the higher cost of manufacturing SAF (using technology as certified by the airline industry) relative to the cost of manufacturing/refining jet fuel, adds to the overall higher cost of producing SAF. This is currently acknowledged as a significant challenge for the aviation industry – worldwide.

Bioenergy demand (p17-18)

The Roadmap considers the possible future demand as at 2020, 2030, 2040 and 2050, for bioenergy under four scenarios including 'Business as Usual' and 'Targeted Deployment'.

The 'Targeted Deployment' scenario '*consists of concerted effort by industry and government on end-use markets that are hard to abate*'. Sadly, in the case of biofuels, the Roadmap does not identify any policy initiatives or assumptions from which to make these forecasts.

The three biofuel markets identified by the Roadmap are 'Aviation' (presumably SAF), 'Road Transportation (Petrol)' (presumably ethanol) and 'Road Transportation (Diesel)' (presumably HVO and biodiesel).

APAC has already noted above its serious concern regarding the forecasts for ethanol and SAF.

In the case of demand for biobased diesel (biodiesel and HVO), the Roadmap is forecasting for both scenarios an increase of demand from about 60ML in 2020, to about 230 ML in 2030. If there is a policy change by the

Federal Government in favour of investing in new SAF, and HVO/biodiesel production within the next five to ten years, then this forecast, while optimistic, is feasible.

ARENA's Key insights for biofuels (Roadmap p21)

APAC believes the Road transport biofuel 'insights' on p21 add little to the advancement of biofuel development beyond what is already known within the industry.

Again, it seems that the Roadmap is prioritizing hydrogen as the future low emission fuel with biofuels as a complementary fuel.

As already mentioned, the Roadmap is correct to reiterate that high feedstock prices and poor consumer uptake have been and can be a challenge for the industry. But this requires qualification. Any greenfield ethanol, biodiesel and HVO projects are feedstock price sensitive as reflected in 'refinery margins'. If ARENA were to look back at bio refining margins for greenfield projects in Australia over the last ten years, the relatively high feedstock prices have not always been the problem. There have been times when various feedstock prices (relative to crude oil price) have favoured the industry. Furthermore, APAC questions whether the two fully integrated ethanol (and dominant) producers in Australia - Manildra (using waste starch as feedstock) and Wilmar (using molasses as feedstock) - are as sensitive to feedstock price variation as greenfield projects such as Dalby Bio Refinery (using sorghum as feedstock).

It is interesting that one of the 'Key insights', refers to Australian oil refiners' margins being protected by the Federal Government out to 2027. Such protection has not been afforded to existing greenfield biodiesel projects.

Mike Cochran
6th December 2021.

ⁱ DEFINITIONS: Biofuels includes fuel grade ethanol, biodiesel and hydrogenated vegetable oil (HVO - also called 'renewable diesel'). While 'biodiesel' and 'HVO' are both 'diesel fuels' they are different in their physical and chemical composition. Biodiesel is an ester (generally palm oil, soy oil, canola oil or tallow based) produced through the transesterification process. HVO (or renewable diesel, hydrogenated esters and fatty acids (HEFA)) is also a bio-based diesel but produced through more sophisticated hydroprocessing, a common method for producing diesel (and other petroleum products) in an oil refinery. As a 'drop-in' fuel (i.e. its physical and chemical characteristics meet diesel and SAF quality standards), HVO has significantly more market acceptability (and perhaps better quality) than biodiesel with almost zero sulphur, higher cetane, longer shelf life but lighter density. Reference to 'ethanol' refers to 'fuel grade' ethanol. Sustainable aviation fuel (SAF or biojet) is an IATA certified jet fuel, also produced from sophisticated hydroprocessing and other certified methods using a biobased feedstock, to make it a 'drop-in' fuel, suitable for blending with mineral jet fuel. 'Advanced biofuels' generally refers to biofuels produced from non-food sourced feedstocks.