

Sustainable Aviation Fuel Alliance of Australia and New Zealand & Cleaner Fuels Alliance Submission Productivity Commission: Opportunities in the Circular Economy

Bioenergy Australia (BA) is the national industry association committed to accelerating Australia's bio economy. Our mission is to foster the bioenergy sector to generate jobs, secure investment, maximise the value of local resources, minimise waste and environmental impact, and develop and promote national bioenergy expertise into international markets.

This submission from Bioenergy Australia is on behalf of the Sustainable Aviation Fuel Alliance of Australia and New Zealand (SAFAANZ) and the Cleaner Fuels Alliance (CFA). These alliances were founded to accelerate the development and deployment of Low Carbon Liquid Fuels including sustainable aviation fuel (SAF) and renewable diesel, as well as established biodiesel and ethanol fuels. Individual members of the alliances will be providing more detailed submissions specific to their business and expertise. This submission is a collective response and does not represent the views of any specific member.

Australia's Bioenergy Roadmap (ARENA, November 2021) outlines how, by the start of the next decade, Australia's bioenergy sector could contribute to around \$10 billion in extra GDP per annum and 26,200 new jobs (predominately regional), reduce emissions by about 9 per cent, divert an extra 6 per cent of waste from landfill, and enhance fuel security. Now is the time to capitalise on the significant circular economy opportunities that will flow from the development and expansion of Australia's low carbon liquid fuel industry.

We thank the Productivity Commission for the opportunity to provide feedback on the **Opportunities in the Circular Economy paper**. We support the Australian Government's commitment to support a circular economy that improves materials productivity and efficiency in ways that benefit the economy and the environment. A critical industry that can help achieve this objective is Australia's low carbon liquid fuels (LCLF) industry—an industry that recovers, utilises, and maximises low-value waste to create high-value renewable liquid fuel.

Information request 1: Circular economy success stories and measures of success

Australia's LCLF industry is a significant waste-to-energy solution that will support a circular economy.

LCLF include:

- Sustainable Aviation Fuel (SAF) (aviation)
- Renewable Diesel (heavy haulage, rail, construction, mining, agriculture)
- Biodiesel (heavy transport, marine, construction, agriculture)
- Ethanol (Road and pathway for aviation)

- Biomethanol (Marine and heavy transport)
- BioLPG including propane, butane and dimethyl ether (DME) (standalone high intensity heat, industrial manufacturing and food processing)

These renewable fuels can be produced from a range of waste and residue feedstocks, including tallow, used cooking oil, agricultural residues, forestry residues, algal residues, landfill materials, municipal solid waste (MSW), and commercial, industrial, and construction and demolition wastes.

The feedstocks for each process can be seen in the table below from the Transitioning Australia’s Liquid Fuel Sector: The Role of Renewable Fuels Report.¹

Fuel	Process	Feedstocks
SAF, Biodiesel, Renewable Diesel	HEFA/HVO	Fats and Oils (e.g. vegetable oils, oil crops, animal fats, used cooking oil)
Biodiesel	Transesterification	Fats and Oils (e.g. vegetable oils, oil crops, animal fats, used cooking oil)
SAF, Biodiesel, Renewable Diesel	FT	Waste, forestry residues, lignocellulosic biomass (e.g. crop residues (straw), wood processing residues, horticulture residue)
Ethanol	Fermentation	Sugar, starch
SAF	AtJ	Hydrolysed sugar, hydrolysed starch, hydrolysed polysaccharides from lignocellulosic biomass

Thus, LCLF production utilises waste that would otherwise end up in landfills, decay in fields, be burned off, or remain as waste, transforming these materials into high-value, sustainable energy that can be utilised to decarbonise Australia’s hard-to-electrify sectors.

LCLF further support the circular economy as they can be used as drop-in or blended fossil fuel replacements within existing infrastructure, equipment, engines, or vehicles. This compatibility allows for emissions reduction without requiring the creation or installation of new infrastructure, nor the retirement of existing assets. This enables current liquid fuel-reliant assets to fulfill their operational lifespans, thereby reducing the need for premature replacements.

LCLF have demonstrable success in Australia, for example:

- Biodiesel is already being produced in Australia by its three biodiesel facilities, which have a combined capacity to produce at least 100 million litres annually.² Biodiesel is already used as a drop-in fuel in the maritime, shipping, mining, and construction sectors as it is fully compatible with these applications.
- In 2023 Queensland company EcoTech Biodiesel provided biodiesel as part of the ANL, Woolworths Group, the Port of Brisbane, bp Marine and EcoTech collaboration to undertake a 42-day trial voyage between South East Asia and Australia powered by locally produced biodiesel. For this trial, the container ship was powered by 500 metric tonnes of biofuel made up of bp Marine’s Very Low Sulphur Fuel Oil blended with a biodiesel produced by Brisbane-based company EcoTech Biodiesel from recycled cooking oils, fats and grease. Preliminary

¹ [Transitioning Australia’s Liquid Fuel Sector: The Role of Renewable Fuels](#)

² <https://ethanolproducer.com/articles/report-biofuel-consumption-in-australia-remains-minimal-in-2022-19909>

data showed the voyage could reduce emissions by approximately 17% as well as reducing nitrous oxides and sulphur oxides (air and marine pollutants).³

- Australia's ethanol refineries produced approximately 175 million litres of ethanol in 2022 but has the capacity to produce 440 million litres annually.⁴
- Murrays Coaches in Queensland have run their vehicles on B100, which delivered very similar power and fuel efficiency as fossil diesel and resulted in an 80% or more reduction of CO2 emissions.⁵
- Cleanaway launched a HVO100 demonstration, with two of their heavy collection vehicles from their Perry Road depot in Victoria, operating on HVO100 – a renewable diesel made exclusively from used cooking oil and that reduces greenhouse gas (GHG) emissions by 91 per cent.
- Ampol undertook a renewable diesel trial where they supplied Hanson with a fuel blend consisting of 20 per cent renewable diesel and 80 per cent ultra-low sulphur diesel in addition to its Ampol Amplify additives.
- bp and BHP collaborated on a trial to power haul trucks and other mining equipment at their Yandi iron ore operations in Western Australia using renewable diesel.
- In May 2022, Rio Tinto partnered with BP in which they trialled a biodiesel blend to power its marine fleet for 12 months. Using a combination of biodiesel and very low sulphur fuel oil, it was estimated that this blend could reduce emissions by 26% in comparison with standard marine fuel oil.⁶
- In Australia, approx. 162,000L of renewable diesel (HVO) has been used by Australian construction companies, including Lendlease construction of NSW Government Powerhouse Parramatta and the Queensland New Performing Arts Venue.⁷
- Wilmar Sugar and Renewables, Australia and New Zealand's largest manufacturer and marketer of raw and refined sugar products, has swapped conventional diesel for renewable diesel in a landmark trial aimed at reducing greenhouse gas emissions in its locomotive fleet.⁸
- In 2024 Bioenergy Australia launched The Renewable Diesel Ford Ranger campaign. Powered by 100% renewable diesel supplied by Refuelling Solutions, a Ford Ranger is touring Australia, visiting schools, events, trade shows, and businesses to highlight the opportunity Renewable Diesel presents in the nation's decarbonisation challenge.
- At the 2023 Williamstown Air Show in Australia, the Roulettes, the Royal Australian Air Force's aerobatic display team, performed a first public display using [Neste MY Sustainable Aviation Fuel™](#). This is an important first step for the Australian Defence Force (ADF) as it looks at how

³ [Queensland Government, 'Queensland welcomes home successful biofuel shipping trial'](#)

⁴ <https://ethanolproducer.com/articles/report-biofuel-consumption-in-australia-remains-minimal-in-2022>

⁵ <https://www.scania.com/au/en/home/about-scania/newsroom/news/>.

⁶ [Rio Tinto and bp sign one-year trial of marine biofuels](#)

⁷ [ACA & Lendlease, 'Renewable fuel use in construction: latest changes & developments', presentation apart of Decarbonising diesel-reliant industries at Australian Renewable Fuels Week \(19 March 2024\)](#)

⁸ Wilmar Sugar and Renewables, [Media release: Trialling Renewable Diesel](#) (2023)

it can reduce its environmental impact by using more sustainable fuel to cut its carbon emissions.⁹

- Neste, Airbus, Safran Engines and Microflite, a leading Australian helicopter operator, jointly operated Australia's first helicopter flights using sustainable aviation fuel (SAF) at the 2023 Avalon Airshow.¹⁰

Although these examples highlight successful LCLF use in Australia, the country lags behind its global peers in developing a local LCLF industry. For comparison:

- In 2022, the U.S. produced 18.7 billion gallons of biofuels, with 17.6 billion gallons consumed.¹¹
- There were 16 operational renewable diesel plants in the U.S. as of December 2022, with another 16 expected by the end of 2025.¹²
- Biodiesel represented about 9% of U.S. biofuels production and consumption in 2022.¹³
- Ethanol accounted for 82% of U.S. biofuel production and 75% of consumption in 2022.¹⁴ Over 95% of U.S. gasoline is blended with ethanol as E10 (10% ethanol, 90% petrol).
- Renewable diesel made up about 8% of U.S. biofuel production and 9% of consumption in 2022.¹⁵
- The EU has nearly 200 biodiesel plants, producing around 13 million tonnes annually.¹⁶
- The EU currently operates 16 renewable diesel facilities, with capacity expected to rise from 5.287 billion liters in 2021 to 5.488 billion litres in 2022.¹⁷
- According to the International Energy Agency, biofuel demand is set to expand 38 billion litres over 2023-2028, a near 30% increase from the last five-year period. They estimate that total biofuel demand is set to rise 23% to 200 billion litres by 2028, with renewable diesel and ethanol accounting for two thirds of this growth, and biodiesel and biojet fuel making up the remainder.¹⁸
- Sustainable Aviation Fuel (SAF) has powered over 700,000 commercial flights, including successful 100% SAF test flights.¹⁹

⁹ <https://www.neste.com/news/the-royal-australian-air-force-s-aerobatic-display-team-rouettes-flies-on-saf-for-the-first-time-supported-by-neste-viva-energy-and-vitol>

¹⁰ <https://www.bioenergyaustralia.org.au/news/australias-first-helicopter-flight-sustainable-aviation-fuel>

¹¹ [US Department of Energy, '2023 Billion-Ton Report: An Assessment of U.S. Renewable Carbon Resources \(2024\)](https://www.energy.gov/eere/bioenergy/us-department-of-energy-2023-billion-ton-report-an-assessment-of-u-s-renewable-carbon-resources-2024)

¹² <https://farmdocdaily.illinois.edu/2023/03/overview-of-the-production-capacity-of-u-s-renewable-diesel-plants-for-2023-and-beyond/>.

¹³ <https://www.eia.gov/energyexplained/biofuels/>

¹⁴ <https://www.eia.gov/energyexplained/biofuels/>

¹⁵ <https://www.eia.gov/energyexplained/biofuels/>

¹⁶ <https://ebb-eu.org/about-biodiesel-2/#>.

¹⁷ <https://biodieselmagazine.com/articles/eu-demand-for-biodiesel-renewable-diesel-to-remain-flat-in-2022-2518236>

¹⁸ <https://iea.blob.core.windows.net/assets/>

¹⁹ [Sustainable aviation fuel: Aviation: Benefits Beyond Borders \(aviationbenefits.org\)](https://aviationbenefits.org)

Information request 2: Priority opportunities to progress the circular economy

Prioritising the development and adoption of LCLF presents a significant opportunity to advance a circular economy in Australia. These opportunities include:

- **Environmental opportunities:**

- LCLFs are a waste management solution that converts waste and residues into valuable renewable liquid fuels capable of decarbonising Australia's hard-to-abate sectors. By utilising local waste, Australia can establish domestic fuel production and simultaneously reduce the environmental impact associated with importing fuels, given that 90% of its liquid fuels are currently imported.²⁰
- Renewable diesel offers an excellent, tested and readily available alternative to mineral diesel for heavy trucks, with as much as a 75-95% reduction in life cycle emissions compared with mineral diesel.²¹ Replacing just 2 per cent of diesel with biodiesel or renewable diesel, based on current targets, would be the equivalent of taking 29,000 rigid trucks off the road.
- Biodiesel (which differs from renewable diesel²²) is also a pathway which produces less carbon dioxide emissions than oil-based fuels over the full lifecycle of production and use with reduced tailpipe emissions.²³
- SAF can reduce emissions across the lifecycle by 80%, compared to fossil jet fuel, depending on the feedstock.²⁴ Replacing just 10 per cent of jet fuel with Sustainable Aviation Fuel, based on airline targets, could be the equivalent of around 220 million less kms flown annually by a Boeing 747.
- Ethanol burns cleanly, lowers emissions, and improves the efficiency of engine combustion by providing additional oxygen (it is known as both an octane enhancer and oxygenate). Replacing just 6 per cent of petrol with bioethanol, based on targets, would be the equivalent of taking 730,000 vehicles off the road.
- Biomethanol is chemically identical to fossil fuel based-methanol but results in significantly lower GHG emissions during the entire life cycle.²⁵

- **Feedstock opportunities:**

- LCLF can utilise a range of feedstocks that are currently waste products or of limited commercial value to produce fuels. These fuels can assist in creating alternative pathways for hard to manage waste materials. If fuels are produced using municipal solid waste or waste from hard-to-abate industries, it has the double benefit of reducing emissions and reducing waste.
- Australia is one of the highest per capita waste generators in the world. Australia generated an estimated 74.1 million tonnes (Mt) of waste in 2018-19, with 27 per cent going to landfill

²⁰ [CSIRO Sustainable Aviation Fuel Roadmap \(2023\)](#)

²¹ [Industry Letter, 'Open Letter to The Hon Chris Bowen MP- Minister for Climate Change & Energy' \(2023\)](#).

²² [US Department of Energy, Biodiesel and Renewable Diesel](#)

²³ [lifecycles, 'Greenhouse gas and sustainability footprints of current and future biofuels for Queensland' \(2016\)](#)

²⁴ [IATA, 'Developing Sustainable Aviation Fuel \(SAF\)'](#)

²⁵ <https://www.sciencedirect.com/science/article/abs/pii/>.

(20.5 million tonnes).²⁶ This highlights the significant feedstock available for LCLF production.²⁷

- Australia's agricultural feedstock will support the rapid growth and development of LCLFs. The CSIRO Sustainable Aviation Fuel Roadmap estimates that Australia has sufficient biogenic feedstock to supply approximately 5 billion liters of SAF by 2025, satisfying about 60% of local jet fuel demand projected for 2025, and growing to 90% by 2050.²⁸
- According to the Australian Bureau of Statistics (2016-17), crop stubble and other agricultural waste are commonly removed by burning, with approximately 2.1 million hectares cleared using cool to moderate burns and around 1.4 million hectares cleared with hot burns. This agricultural waste holds significant energy potential and could be utilised for LCLF production.

²⁹

- **Economic opportunities:**

- LCLF incentivises the repurposing and utilisation of waste, transforming materials that would otherwise be discarded into valuable revenue streams.
- The LCLF industry can generate significant employment opportunities, particularly in regional Australia. According to the Qantas and Airbus ICF Report, an Australian SAF industry could create nearly 13,000 jobs across the feedstock supply chain and an additional 5,000 high-value jobs for facility construction and operation.³⁰ This growth supports new skills and training while allowing traditional energy workers to transition to cleaner energy roles, as highlighted in the 2023 Jobs and Skills Australia Report.³¹
- A domestic SAF industry has the potential to contribute A\$13 billion to Australia's GDP annually by 2040.³²
- By utilising locally produced agricultural residues and waste, LCLFs can produce valuable by-products that serve as inputs for bio-based chemicals, renewable hydrogen, and synthetic fuels, providing farmers with extra income and supporting regional communities.
- A domestic LCLF industry can help Australia maintain international connectivity by enabling the refuelling of international vessels/fleets with fuels that meet global decarbonisation standards, ensuring Australia's tourism sector remains competitive.
- Establishing a domestic LCLF industry reduces Australia's reliance on imported fuels, bolstering energy security and supply stability.
- A local LCLF industry can attract significant international investments for project development, leading to increased economic growth, job creation, enhanced local production, and innovation in the region.

²⁶ <https://cdn.revolutionise.com.au/cups/bioenergy/files/jsqguyb1zftkx6c.pdf>

²⁷ [Race for 2030, 'Anaerobic Digestion for electricity, transport, and gas B5 Opportunity Assessment' \(2023\)](#)

²⁸ [CSIRO Sustainable Aviation Fuel Roadmap \(2023\)](#)

²⁹ <https://www.abs.gov.au/statistics/industry/agriculture/land-management-and-farming-australia/latest-release>

³⁰ [ICF Report, 'Developing a SAF industry to decarbonise Australian aviation' \(November 2023\), p2.](#)

³¹ [Jobs and Skills Australia, The Clean Energy Generation: workforce needs for a net zero economy \(2023\)](#)

³² [ICF Report, 'Developing a SAF industry to decarbonise Australian aviation' \(November 2023\)](#)

- **Fuel customer opportunities:**

- LCLF is compatible with existing infrastructure, vehicles, and assets, enabling fuel customers to utilise this renewable product without the need for upgrading investments or prematurely retiring existing assets.
- LCLF complements electrification efforts, providing an alternative pathway to decarbonisation for hard-to-electrify industries that will continue to rely on liquid fuels.
- LCLF diversifies energy sources, reduces reliance on imported fossil fuels, and ensures a stable energy supply, which is crucial for uninterrupted operations and meeting customer demands.
- LCLFs support competitiveness by enabling businesses to meet emission targets, ensuring compliance with regulations and upholding consumer demands for sustainability.
- By developing a domestic LCLF industry, customers can benefit from increased fuel security, as local production reduces dependence on volatile global markets and supply chains.
- LCLF protects optionality by ensuring Australian consumers, businesses, and industries have consumer choice (by allowing consumers the flexibility to continue using assets that align with their lifestyle and preferences); support the ongoing operability of legacy technology (as it can operate within existing technology without the need for significant upgrading); and optionality (providing consumers with a broader range of energy choice while reducing emissions).

Information request 3: Hurdles and barriers to a circular economy

Key barriers restricting the development of Australia's LCLF industry, thereby limiting a significant circular economy opportunities:

- Lack of certification under the Federal Guarantee of Origin Scheme.
- Lack of supportive policy such as:
 - Insufficient supply-side support which makes it difficult for local project developers to establish projects and scale up production in the early stages.
 - Insufficient demand-side mechanism which creates market and offtake uncertainty.
- Due to the lack of supportive policy, industry is facing significant supply and demand side market uncertainties. This hinders market development, investment and acceleration of this industry. Government action can provide a market signal, switching on the green light for project development investment.
- Lengthy and complicated planning approval processes can delay project development and create uncertainty, inefficiencies and higher costs. Streamlining these processes and reducing the upfront costs associated with them can significantly reduce delays, lower project costs, and incentivise investment.
- Lack of equal support for LCLF compared to other alternative energy sources, which may be less practical, feasible or available for hard to abate sectors. This disparity of support can impact the widespread recognition and investment certainty for LCLF projects.

- While abundant, Australian feedstock is widely dispersed across regions, leading to technical and economic barriers related to collection and distribution.
- Inefficient waste logistics can result in higher costs and delays in feedstock collection and transportation. Optimising these logistics is crucial for maximising feedstock collection, utilisation and reducing operational costs.

Information request 4: Governments' role in the circular economy

The technology, production and market readiness of LCLF are long-proven, a fact demonstrated by Australia's international counterparts who have been reaping its significant circular economy benefits for many years. However, with supportive policies in place, there is no reason why Australia cannot also take advantage of these benefits.

We recommend the following policy actions as critical to supporting Australia's domestic LCLF industry and leveraging its circular economy benefits:

- Fast-track the inclusion of LCLF in the Future Made in Australia (Guarantee of Origin) Bill.
- Introduce demand side mechanism such as:
 - Low carbon fuel standard connected with a trading scheme.
 - Mandate introduced over time.
 - Government procurement targets (i.e. Defence and Government Department and Agencies)
 - Extending excise/fuel tax mechanism to support LCLF and enable growth of new renewable fuels (e.g. SAF and renewable diesel) in the market.
- Implement supply-side support, such as capital and development grants (i.e. increased funding to ARENA to expand funding available for LCLF projects), production credits, tax incentives, contracts for difference and R&D support.
- Acceleration of the role of a SAF accounting framework, noting the potential of international cooperation.
- Development of a national sustainability framework that aligns with existing international models to avoid imposing additional and inconsistent requirements on feedstock providers, fuel producers, and offtakers.
- Support the coordination of supply chains to improve feedstock collection, storage, and processing, as a means to reduce logistical costs.
- Streamline regulatory and planning approvals for LCLF projects to reduce delays and costs.
- When designing policy, strengthen support and recognition for LCLF to match the level afforded to other energy sources, such as hydrogen.
- Raise public awareness and educate consumers about the role, compatibility, and sustainability of LCLF.

More details on these recommendations can be found at [Bioenergy Australia Submission: Future Made in Australia: Unlocking Australia's low carbon liquid fuel opportunity \(July 2024\)](#).

Thank you for taking the time to consider our submission. Any questions or request for further assistance are welcome

Sincerely,

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