Sugarcane Bioenergy Inquiry 2025

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Queensland Government

Primary Industries and Resources Committee

Inquiry into sugarcane bioenergy opportunities in Queensland

Queensland Government submission

12 August 2025

Prepared by

The Department of Primary Industries (DPI)

The Department of State Development, Infrastructure and Planning (DSDIP)

Queensland Treasury

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1 EXECUTIVE SUMMARY

- The Queensland Government has committed to increasing the value of agricultural production to $30 billion by 2030. Sugarcane has the potential to be used to produce multiple products, including sugar, biofuels, and for electricity cogeneration.
- The diverse and competing uses for sugarcane underscore the importance of adopting a strategic approach to identify the most viable long-term investments for the sugarcane industry. Careful evaluation of the commercial trade-offs and comparative advantages between cogeneration and other bio-based applications at each mill site will be essential to ensuring that future investments support a sustainable sugar industry.
- Increasing cogeneration from sugarcane is largely an economic and technical issue within an established domestic market and regulatory framework. It is technically possible to expand cogeneration in Queensland's sugar mills; however, it must be approached with a clear understanding of the technical and market considerations. Opportunities should only be pursued where it makes commercial sense; cogeneration competes with other renewables and may not be the cheapest or most efficient renewable energy source.
- Not all mills are equally suited to cogeneration expansion. Mills located closer to major load centres, in areas with stronger grid infrastructure are likely to have a competitive advantage in exporting electricity. Similarly, larger mills with higher bagasse production volumes may find it easier to justify the capital investment required for cogeneration upgrades. Mills will also require sophisticated organisational capability to manage operational complexities and adapt to evolving market conditions.
- The Queensland Government has committed to actively look at ways biofuels can expand, noting the importance of working closely with agricultural cropping production areas. The government has also committed to supporting and participating in a national biofuels feedstock strategy. These election commitments recognise the potential value of establishing a biofuels industry in Queensland. Biofuels is one of three priority industries, along with biomedical and Defence, identified as a focus for industry development by DSDIP.
- The market demand for biofuels is growing and there is an opportunity for Queensland to capitalise on its several comparative advantages to develop a biofuels industry. This includes the Australian Defence Force which considers domestic biofuel production critical to enhance national fuel security.
- Developing a biofuels industry requires improving project economics while competing with international producers; and creating favourable domestic policy settings that provide certainty for investors within complex international market and regulatory frameworks. Industry stakeholders are urging Federal policy action now to realise the opportunity before it is lost to overseas producers.
- Ethanol, which can be made from a range of agricultural residues, is a biofuel with long established technologies. Technologies to create more advanced biofuels from ethanol, such as sustainable aviation fuel or renewable diesel, are only starting to be deployed commercially globally. There are cost-premiums associated with first-of-kind projects reflecting investor risk appetite as well as operational inefficiencies which reduce as technologies mature.
- International biofuel policies recognise the importance of maintaining global food security while decarbonising the economy. Key frameworks that provide sustainability certification requirements for biofuels preference byproducts such as bagasse, and biofuel cropping feedstocks with a lower risk of inducing land use change, such as crops with increased yields or rotational crops.
- It will be critical to ensure that Australian feedstocks are recognised by international certification frameworks, and that sustainability credentials and life cycle emissions values

specific to Australia are calculated and incorporated, as these are directly related to emissions factors and the eventual price that can be obtained for biofuels.

- There is significant existing investment in research and development relevant to bioenergy from sugarcane. Potential future research could include exploring high biomass varieties, decreasing feedstock cost by increasing yields, efficiencies to liberate bagasse, exploring crop rotations and alternative crops in fallow and improving harvest, supply chain and processing efficiency.
- There is significant competition for land for multiple uses, including agriculture, mining, urban development, renewable energy production and conservation. The amount of land under sugarcane has seen a net decline since 1999, in part due to a shift to other agricultural uses.
- Queensland's sugarcane industry operates under robust industrial relations regulations and to a high standard of sustainability, which may provide an advantage in international markets. Further industry development of bioenergy potentially provides opportunities for growers to diversify their revenue streams from sugarcane and additional feedstock crops.

2 CONTENTS

3 INTRODUCTION

3.1 About this submission

On 11 June 2025, the Primary Industries and Resources Committee resolved to self-refer an inquiry into sugarcane bioenergy opportunities in Queensland. The Committee sought assistance from Queensland Government agencies with a request to provide a written briefing on the issues to be investigated under the terms of reference for the inquiry:

1. The role and benefits of sugar cogeneration in Queensland's electricity generation mix, including existing capacity and potential for expansion.
2. Market, regulatory, and infrastructure barriers to increased bioenergy production from sugar.
3. Opportunities to align sugar biofuel production with national security and Defence liquid fuel needs.
4. Policy and funding mechanisms to de-risk investment in cogeneration and biofuels by manufacturers and growers, including examples of successful policy implementation from overseas and other industries.
5. The research and development (R&D) agenda to underpin a world leading sugar-led bioenergy industry.
6. Strategic land use and regional development considerations affecting cane growing and sugar manufacturing capacity.
7. Benefits for growers in diversification opportunities.
8. Consideration of food verses fuel.

This submission has been prepared jointly by the Department of Primary Industries (DPI); Department of State Development, Infrastructure and Planning (DSDIP); and Queensland Treasury.

DPI has responsibility for agricultural industry development, including diversification and opportunities to add value to agricultural products, and driving the Government's commitment to increase the value of primary industries output to $30 billion by 2030.

DSDIP's role is primarily developing the supply side of the biofuels industry. This touches on all aspects of the supply or value chain from feedstock production through to the end purchaser and leads delivery of the Government's commitment to look at ways biofuels can expand, while working closely with the agricultural sector.

Queensland Treasury is responsible for energy policy in Queensland, including electricity, gas and biofuels policy and regulation. It has responsibility for planning and securing Queensland's energy mix, and the Energy Roadmap set to be delivered by the end of this year.

3.2 Sugarcane and bioenergy context

In 2024 the Australian sugarcane industry produced 28.8 million tonnes of cane from nearly 324,000 hectares of land[1]. The value of sugar, electricity and molasses produced from the crop was just under $3 billion. Sugarcane growing and sugar processing combined are Queensland's second largest agricultural commodity by value, after beef cattle. Australia is in the top ten producers of sugar

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[1] Australian Sugar Manufacturers *Annual Industry Statistics (2015-2024)* (2025)

worldwide with Queensland responsible for 95% of our country's production. Up to 85% of the raw sugar produced in Queensland is exported.

The Queensland sugar industry comprises 18 sugar mills owned by seven milling companies, supplied by approximately 3,300 sugarcane enterprises. The majority of farms remain family-operated and typically range from 40 to 250 hectares in area. Australian Sugar Manufacturers (ASM) estimates that the sector in total supported around 22,000 jobs directly and indirectly in 2024[2].

Sugarcane by-products include bagasse, molasses and cogeneration of electricity. These byproducts are increasingly recognised as valuable resources for a range of bioenergy applications, including renewable electricity, biofuels, bioplastics, and animal feed (Figure 1).

Cogeneration of electricity from bagasse currently provides about 1.6% of the total electricity generated in Queensland. The Sarina distillery produces about 60 million litres of bioethanol per year from sugarcane molasses. About two-thirds of this is used in Australian E10 and E85 fuels.

4 COGENERATION

Sugarcane bioenergy, particularly through cogeneration at sugar mills, represents a promising avenue for further renewable energy production and economic development in Queensland. However, while the technical potential for expanding cogeneration exists, it should be evaluated through a commercial viability lens, considering the regulatory, technical, and market factors that influence its financial feasibility and competitiveness.

Cogeneration—using bagasse to produce electricity and heat simultaneously—is technically mature and has long been a feature of Queensland's sugar milling operations. It presents a low-emission, dispatchable energy source embedded within existing industrial infrastructure, with mills able to use heat and electricity to process sugar and export excess electricity to the grid. Further cogeneration from bagasse represents a potentially underutilised renewable energy source.

Expanding cogeneration requires a thorough assessment of the commercial viability, including technical feasibility, market dynamics, and competing uses for bagasse. Careful evaluation of the commercial trade-offs and comparative advantages between cogeneration and other bio-based applications at each mill site will ensure that future investments are sustainable and support a future vibrant sugar industry.

This section seeks to provide a balanced perspective on the opportunities and challenges associated with cogeneration expansion in the sugarcane industry, while also considering the broader context of alternative bioenergy uses for bagasse.

[2] Australian Sugar Manufacturers *Annual Industry Statistics (2015-2024)* (2025)

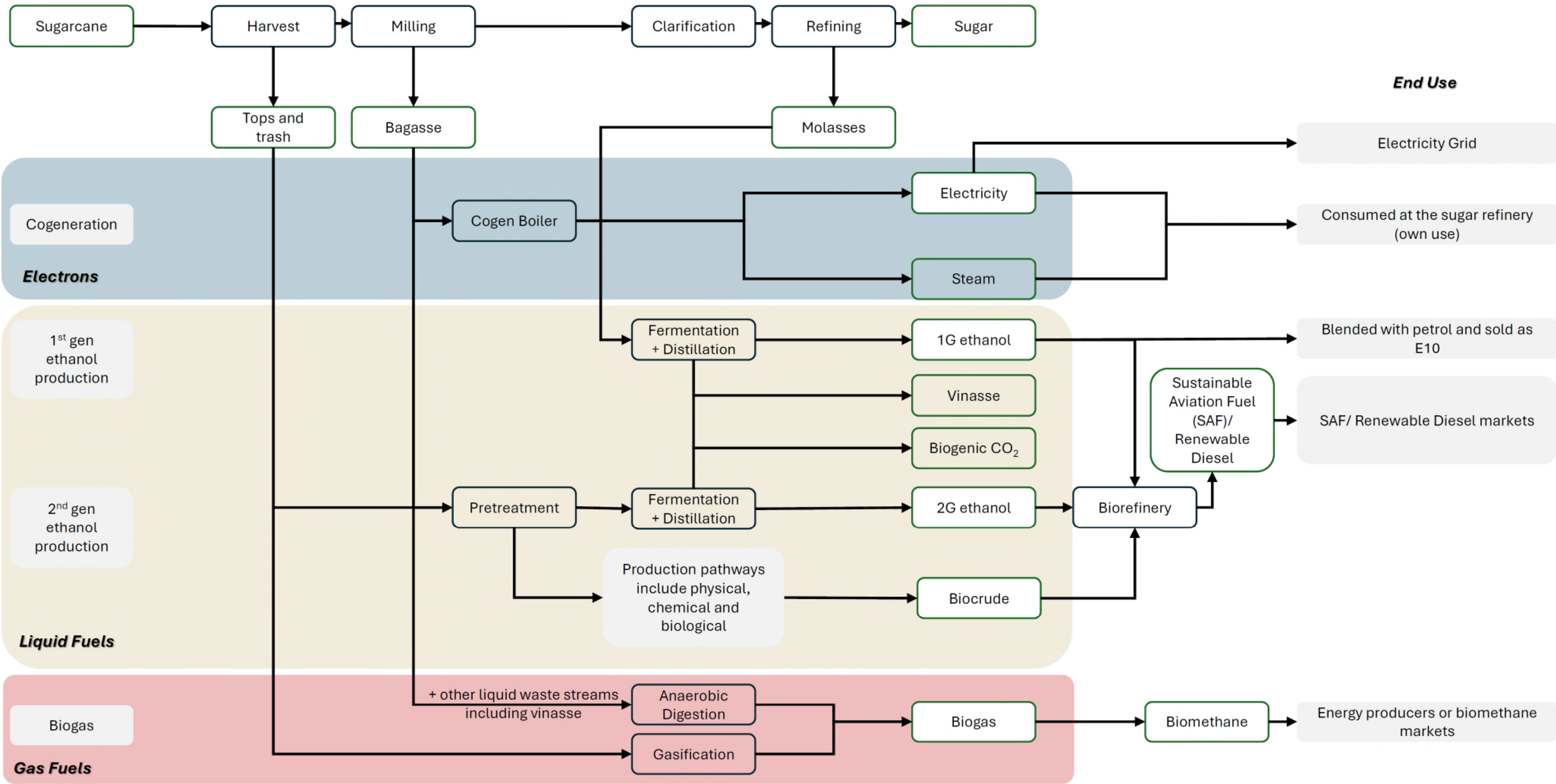

Figure 1 Sugar industry energy by-products

4.1 Context for cogeneration in Queensland

As of 2025, Queensland has bagasse cogeneration facilities at 18 mills with a total installed capacity of about 448 megawatts (MW), ranging in size from 5 MW to 69 MW. The power is used on site to run the mill, and some mills also have capacity to export to the grid. Bagasse generation accounts for only around 1.6% of total electricity generation in Queensland. Bagasse generation is highly seasonal, with most generation occurring between July and December, aligning with the sugar milling season. This seasonal profile limits the ability of bagasse cogeneration to contribute meaningfully during Queensland's summer peak demand period (January to March), when both average and maximum electricity demand are highest.

4.2 Technical considerations

4.2.1 Mill cogeneration modernisation

Upgrading cogeneration infrastructure at Queensland sugar mills presents a potential opportunity to increase renewable energy from bagasse and contribute to a reliable, low-emissions system. Advanced high-pressure boilers and condensing turbines can significantly boost energy yields, but are capital-intensive, making long-term revenue certainty essential for investment. Larger mills are better placed to modernise as they can leverage more consistent bagasse supply and economies of scale to offset these costs. In contrast, smaller mill cogeneration may struggle to be commercially viable, particularly where internal steam demand limits electricity export potential.

Cogeneration must integrate with existing milling schedules and processes. The operation of boilers, turbines, and ancillary systems must be synchronised with the mill's steam and energy needs to avoid process disruptions, reduced energy efficiency or production losses. Detailed feasibility assessments and process integration studies are essential prior to investment decisions.

To gain the most value from the significant investment in modern cogeneration systems, maximising capital utilisation is critical, such as a shift towards year-round generation, shorter maintenance windows, and increased capability in energy market trading and compliance. These operational and commercial shifts, combined with the scale of required investment, highlight the importance of combining commercially robust business models and technically capable organisations to realise the full value of cogeneration.

4.2.2 Logistical considerations

The reliability of a cogeneration facility hinges on an efficient bagasse supply chain, including harvesting, transport, and storage. Bagasse's low density and high moisture content make long-distance transport costly, leading most mills to use it on-site under a "crush-and-burn" model. Only mills with ample on-site bagasse and minimal competition for its use are suited for expanded cogeneration, as transport costs can render energy generation uncommercial for others.

Extending cogeneration operations beyond the sugar milling season requires adequate storage facilities to ensure a consistent fuel supply. Increasing the density of bagasse could improve storage efficiency and reduce degradation, but the high costs associated with this process may make it impractical.

The future availability of bagasse may be further constrained by other potential uses, such as biofuel. Growing demand for bagasse for use in biofuels could increase costs or reduce supply for cogeneration. As the bio-based product market grows, sugar mills may face economic trade-offs between electricity generation and other applications, potentially complicating the investment decisions around expansion of cogeneration capacity.

4.2.3 Grid integration

Sufficient grid access is essential to enabling sugar mills to export electricity to the National Electricity Market (NEM). Proximity to strong substations improves connection feasibility. Some regional mills may face weaker feeders and consequently more costly upgrades, such as substations and voltage control systems, which can impact expansion viability.

Grid connection complexity increases with generation system size. Smaller cogeneration facilities (typically under 5 MW) are often exempt from the full Generator Performance Standards (GPS) mandated by the Australian Energy Market Operator (AEMO), and follow less stringent technical requirements set by local network service providers, reducing compliance and capital costs. They are less likely to require significant augmentation, supporting commercial feasibility.

Larger plants face more stringent GPS compliance due to their potential effect on grid stability. These increased requirements necessitate advanced systems, skilled operations, and extensive grid upgrades, raising project costs and complexity.

Commercial viability is further influenced by Marginal Transmission and Distribution Loss Factors, which reflect energy lost in transmission. In remote or constrained areas, mills are likely to attract higher loss factors, reducing market revenue.

The challenges sugar mills face in achieving grid integration—such as connection costs, compliance requirements, and loss factors—are common to all generators seeking to connect to the NEM. Accurately assessing and accounting for these factors in expansion proposals is critical to determining their commercial viability.

4.3 Energy market considerations

4.3.1 Competition from other renewable sources

Solar and wind projects benefit from scale and low marginal costs. While bagasse cogeneration has the advantage of dispatchability and embedded infrastructure, it suffers from higher capital and operating costs. Without long-term contracting options, cogeneration is likely to struggle to compete purely on a cost basis with renewable generation and other dispatchable technologies like batteries and gas in the electricity market.

4.3.2 Revenue from generation

Bagasse cogeneration provides multiple revenue streams, including electricity sales, firming services, and Large-scale Generation Certificates (LGCs). Unlike wind or solar, it relies on a combustion process with variable fuel availability and operational constraints tied to mill operations, requiring careful coordination of fuel supply, generation timing, and plant utilisation.

Bagasse cogeneration can generate revenue by participating in the NEM spot market, where electricity prices fluctuate based on real-time supply and demand. Spot prices can be highly lucrative during periods of peak demand, but reliance on spot price revenue introduces exposure to price volatility, with prices potentially falling during periods of high generation or low demand. Larger and more flexible cogeneration plants are better positioned to take advantage of price spikes by adjusting generation to align with market conditions. Effective participation in the spot market will depend on the organisation's ability to actively trade and effectively manage trading risks to optimise revenue opportunities.

Power Purchase Agreements (PPAs) offer a predictable revenue stream for bagasse cogeneration facilities by locking in long-term contracts with electricity buyers, such as retailers or industrial users. PPAs typically involve selling electricity at a fixed price or under a structured pricing arrangement, reducing exposure to the volatility of the spot market. The value of a PPA is influenced by the scale, location, and flexibility of the cogeneration facility, with larger and more reliable plants often securing more favourable terms.

The value of LGCs, like electricity itself, is driven by the balance of supply and demand, with higher prices during surges in renewable energy obligations or reduced renewable energy generation. For sugar mills, LGCs can provide a revenue stream that complements electricity sales. Larger cogeneration plants are better positioned to generate more LGCs, but mills must carefully consider market dynamics, as fluctuations in LGC prices can significantly affect financial returns.

These commercial dynamics are key to the financial viability of expansion proposals for bagasse cogeneration. While larger and more flexible facilities are generally better positioned to navigate these complexities, success also hinges on the organisational capability to effectively manage market risks, negotiate favourable agreements, and optimise operations. All mills must carefully assess not only market conditions but also their organisational expertise and resources to ensure they can maximise returns and adapt to evolving energy market demands.

4.3.3 Scheduled generation classification

As export potential grows, mills may also consider transitioning to scheduled generator classification, which allows greater market participation but comes with additional compliance and operational requirements.

Currently, all sugar mills operate as non-scheduled, non-market generators, exempt from the requirements of scheduled generators. However, mills may be reclassified if generation (export) capacities expand beyond 30 MW or system stability becomes a concern. Scheduled status requires real-time telemetry, participation in central dispatch through the AEMO, and market bidding functions that require specialist staff, IT systems, and continuous operations, with 5-minute settlement obligations. These obligations increase costs and require mills to establish or contract energy trading and compliance capabilities.

4.3.4 Current limitations of market signals for firming services

The energy-only nature of the NEM does not adequately reward generators that provide reliability or firming services. While this is being addressed through capacity investment mechanisms, existing market signals still undervalue firm, low-emission, distributed energy sources like bagasse cogeneration. NEM policy reforms would be needed to monetise the value these generators provide, especially during critical peak demand periods.

5 BIOFUELS (LOW CARBON LIQUID FUELS)

5.1 Current situation and context

Global demand for biofuels is growing exponentially, driven by demand from hard-to-electrify sectors such as aviation, shipping and heavy haulage which are turning to biofuels as a viable alternative to meet corporate and legislated carbon emissions reduction. To meet this demand, global supply has approximately quadrupled since 2014, supported by mechanisms such as the USA's tax credits, renewable fuel scheme and production credits that reduce the cost difference between fossil fuels and biofuels. While development of the global biofuels industry has recently experienced challenges associated with fluctuating commodity markets and cost escalation in the construction sector, the impact of these challenges is expected to be largely temporary as biofuel demand continues to grow, and feedstock prices normalise.

A biofuels industry in Queensland could increase economic diversity and complexity, particularly in regional areas, support high quality jobs and assist the State's critical industries such as agriculture, resources and tourism to remain globally competitive.

The Clean Energy Finance Company's (CEFC's) 2025 report *Refined Ambitions: Exploring Australia's Low Carbon Liquid Fuel Potential*[3] estimates a mature domestic industry could deliver $36 billion of fuels sold in 2050, and that most of the $15 billion domestic feedstock opportunity could be supplied by Australia's agricultural sector.

Australia uses 7 billion litres (BL) aviation fuel and 30BL diesel each year, with Queensland using 8BL of diesel per year. The current export value of Australia's biofuels feedstocks (predominately sugar, canola and tallow) is 3.9 billion AUD.

5.2 Biofuel production and technology

Advanced generation Renewable Diesel (RD) and Sustainable Aviation Fuel (SAF) are chemically similar to their mineral fuel equivalents, which means they are "drop-in" alternatives and can be used or blended with mineral fuels without significant modifications to existing engines or fuel systems, and can leverage existing logistics for fuel distribution and storage. The "drop-in" characteristics can also address some of the reluctance of customers to use these fuels and enable warranty support from Original Equipment Manufacturers (OEMs) for blends that meet new 2025 federal fuel quality standards.

There are no existing Australian producers of RD or SAF. There are currently two ethanol producing facilities in Australia, one of which is in Queensland. There is some existing production of first-generation biodiesel[4] in Queensland but at small volumes. There have been some imports of SAF and RD into Australia from overseas producers, such as Qantas, Sydney Airport and Ampol's recent two million litre import of unblended SAF in May 2025.

The commercial production technology for the fuels imported to date is HEFA (Hydrotreated Esters and Fatty Acids), which creates hydrocarbon fuels from vegetable oils or animal fats (not sugar). HEFA is currently the only commercial production technology for these advanced fuels. LanzaJet reports that its

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[3] CEFC *Refined Ambitions: Exploring Australia's Low Carbon Liquid Fuel Potential* (2025)

[4] Biodiesel is a first-generation renewable fuel produced from vegetable oils, animal fats or recycled cooking oils. Renewable diesel is a more advanced diesel made from sustainable sources and is refined to be chemically similar to petroleum diesel, and unlike biodiesel, works seamlessly as a drop-in fuel in existing diesel engines and infrastructure.

[Freedom Pine Fuels](#) Alcohol-to-Jet plant in Georgia, United States, is set to be the first commercial scale plant to come online sometime in 2025 to produce RD and SAF from low carbon ethanol.

Production of SAF or RD from sugarcane feedstocks, including ethanol and bagasse, requires emerging technologies that aren't yet at commercial scale. These include:

- Alcohol-to-Jet (AtJ) which converts ethanol into hydrocarbon fuels
- Fischer-Tropsch (FT) which processes sugarcane or byproducts like bagasse, into syngas which is then converted into hydrocarbon fuels
- Hydrothermal liquefaction (HTL) which uses high pressure water to convert biomass such as bagasse to a liquid bio-oil that can be further refined to renewable fuel.

Some of the key pathways using potential feedstocks from Australia are detailed in Figure 2.

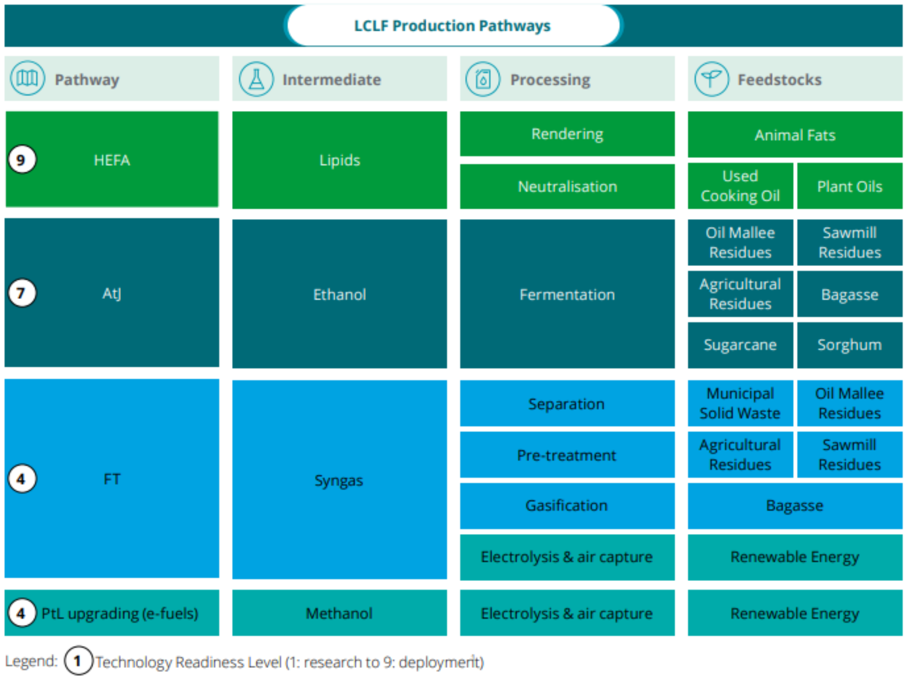

Figure 2 Production pathways for low carbon liquid fuels (Source: CEFC 2025 page 49)

The CEFC report identified that biofuel production using the HEFA pathways from tallow, used cooking oil, canola and oilseeds as the most prospective in the near-term in Australia (page 12). Production using sugarcane through the AtJ pathway and bagasse through FT were evaluated as a strategic medium-term option for Australia. However, SAF and RD derived from these feedstocks were not identified as the most cost-effective options for emissions abatement (measured in $/t CO2e). This is primarily due to the lower technological readiness of these pathways compared to the oil-based HEFA process, which is widely used in plants globally. The HEFA pathway benefits from lower capex requirements, while the emerging technologies have greater learning curves, contributing to higher costs particularly for the first-of-kind plants.

Under a current trajectory scenario, the cost of SAF produced today via the HEFA process using used cooking oil is estimated at $3.53/L, sugarcane using the AtJ process is estimated at $4.62/L and SAF from bagasse using the FT process is estimated at $6.32/L.

5.3 Biomethane / biogas

The production of biomethane and biogas from bagasse may offer opportunities to support the state's transition to a clean economy, whether by use in natural gas networks or for use in power generation. However, there are several challenges:

- Improving the anaerobic digestion (AD) process used to convert organic byproducts such as bagasse into usable energy. AD requires precise conditions, including controlled temperature and active microbes to break down the waste. Sugarcane bagasse is harder to break down, resulting in lower energy output compared to other source materials. Managing these conditions currently requires advanced and costly systems.
- Converting raw biogas into biomethane involves removing impurities such as carbon dioxide and moisture, which can be expensive, depending on the size of the system.

Distance and infrastructure from point of production to point of use. Potential users of biogas and biomethane, such as remote facilities such as mines or agricultural centres, often lack direct access to natural gas pipelines and infrastructure. The Australian Standards for natural gas pipeline injection w previously posed a regulatory barrier, but were updated in June 2025 to include provisions that are more accommodating for bio-produced gases.

There is only one currently active biomethane project in Australia – Jemena's Malabar biomethane injection project, which utilises wastewater as a feedstock.

6 POLICY SETTINGS TO DE-RISK BIOFUEL INVESTMENT

6.1 Policy context

Industry stakeholders broadly agree expediting development of a domestic biofuels industry is contingent on:

- having the right policy settings to stimulate demand and supply, and create the right environment for investors, taking the learnings from overseas jurisdictions that have implemented policy and mechanisms and applying in the Australian context
- action being taken now to realise the opportunity, or it will be lost as investment and Australian feedstock is locked up by overseas biofuels producers.

Barriers to increased biofuel production from sugar and other feedstocks include:

- costs (feedstocks, production facilities, products) – sugarcane and other feedstocks are subject to variability in price and volume, driven by factors such as growing conditions and global markets trends.
- finance – setting up or expanding bioenergy facilities, such as cogeneration plants or bioethanol refineries, requires high upfront capital which can be difficult to secure due to demand and revenue uncertainty.
- sustainability credentials (emissions reduction factors) – some aspects of international certifications are not fit-for-purpose for Australia; for example, the sustainable aviation fuel certifications by the International Civil Aviation Organization (ICAO) currently do not account for all Australian feedstocks, and the default emissions factors do not reflect Australia's carbon intensity values.
- supply-demand risk – feedstock suppliers may be unable or unwilling to enter into offtake agreements to supply feedstock which is already utilised and the proposed alternative use for

biofuels is not in operation; conversely, biofuel project proponents require certainty over feedstock availability to secure project investment.
- customer uptake – the value of biofuels to end users is linked to the carbon abatement cost option (e.g. carbon credit unit prices) and OEM approval for use of biofuels.

There has been significant work undertaken by industry and governments to understand measures that could support the establishment of a biofuels industry. This includes CSIRO-Boeing's *Sustainable Aviation Fuel Roadmap* (2023), the Queensland Government's 2023 *Preparing for take-off: the case for public private collaboration to catalyse an Australian SAF value chain*, CSIRO-Boeing's *Sustainable Aviation Fuel State of Play* (2024) and the CEFC's *Refined Ambitions: Exploring Australia's Low Carbon Liquid Fuel Potential* (2025), which identifies key investment risks in development of the supply chain (Figure 3).

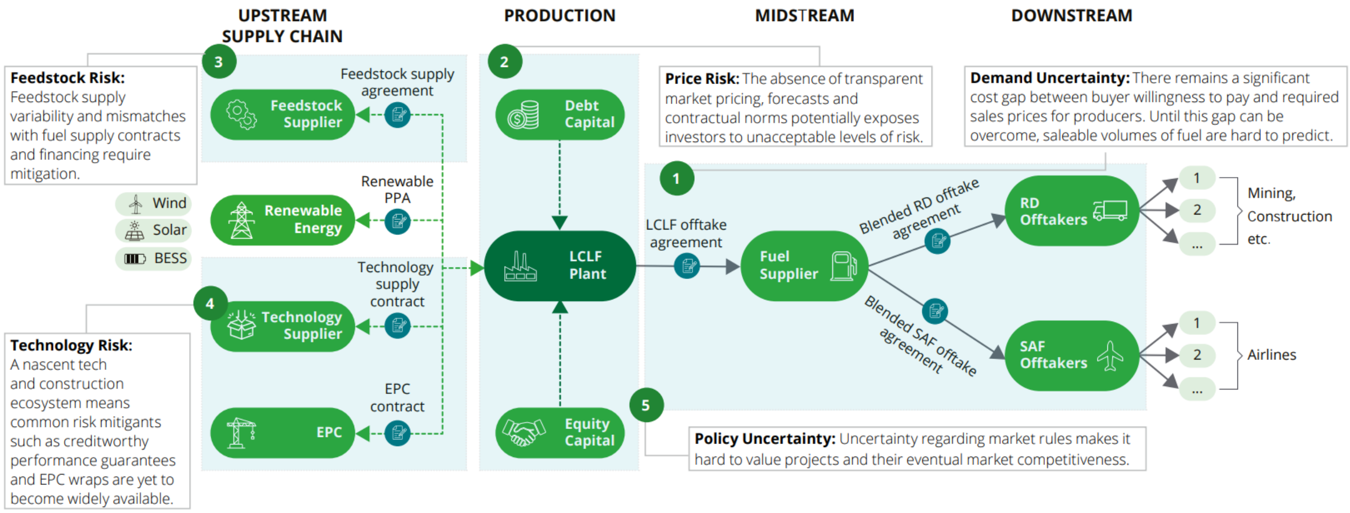

Figure 3 Key supply chain investment risks (Source: CEFC 2025 page 72)

There is no single policy which can support a biofuels value chain – a range of complementary policies that address both supply and demand are needed to deliver outcomes. These mechanisms can be broadly categorised as policy, funding and financing measures that support both the demand and supply for biofuels by addressing demand uncertainty, price risk, feedstock risk, technology risk and policy uncertainty. The CEFC identified key issues to be addressed to make a domestic industry a reality, including:

- feedstock risk – competition for land, potential for Australian feedstock to be diverted overseas through long-term feedstock offtake agreements, providing certainty to local feedstock producers to participate in a domestic biofuels market and developing the value chain
- technology risk – newer technologies still being tested commercially and delivering projects at pace and scale to meet demand
- price risk – closing the gap in the cost premium of biofuels in comparison to fossil-based fuels plus carbon abatement, supplying feedstock at a cost that provides a return to growers and allows production at a reasonable cost
- demand uncertainty – market and regulatory mechanisms that signal demand, such as a low carbon fuel standard applied to all fuels, and customer and OEM acceptance of fuels
- policy uncertainty – building trust in decarbonisation outcomes of locally produced fuels through fuel certification to demonstrate its guarantee of origin and emissions intensity, more advanced policy interventions in other jurisdictions globally attracting projects.

6.2 National policy mechanisms

In 2024, the Australian Government undertook a "Consultation on Future Made in Australia: Unlocking Australia's low carbon liquid fuel opportunity"[5]. This paper focused on the opportunities and barriers for advanced generation Renewable Diesel (RD) and Sustainable Aviation Fuel (SAF). Multiple policy and regulatory settings to advance low carbon liquid fuels were considered as part of the discussion paper, including:

- supply side policy options such as a production incentive potentially delivered through:
    - competitive grants (such as a contract for difference or fixed grant amount), or
    - production tax incentive
- demand-side options, including mandates or a low carbon fuel standard.

There is general agreement among industry stakeholders that national level policy settings to provide demand certainty and stimulate supply are critical.

The Australian Government has already taken some steps to develop policy settings to enable emerging biofuel industry development, creating new fuel quality standards[6] in 2025 to enable the lawful sale and use of RD in Australia. These include:

- a new paraffinic diesel fuel standard that describes the requirements for paraffinic diesel, including RD
- an amended and renamed conventional diesel standard, which includes allowing for blends of mineral diesel and RD.

Currently, the Australian Government's support for the industry includes:

- Future Made in Australia (2024-25 Federal Budget) - $ 1.7 billion over the next decade in the Future Made in Australia Innovation Fund to support the Australian Renewable Energy Agency in commercialising net zero innovation, including $250 million earmarked for biofuels.
- Developing a certification scheme for biofuels, including SAF and RD
- Undertaking regulatory impact analysis of the costs and benefits of introducing mandates or other demand-side measures for biofuels
- Consideration of production incentives to support the establishment of a made-in-Australia biofuels industry.

6.2.1 Guarantee of Origin (GO) scheme

The Australian Government is developing a Guarantee of Origin Scheme (GO Scheme) for low carbon liquid fuels. The intent of the GO Scheme is to show where a product has come from, how it was made, and the greenhouse gas emissions throughout its lifecycle. Australian based sustainability credentials may help ensure that lifecycle emissions and sustainability of Australian feedstocks like sugarcane are properly measured. Where Australian conditions and growing conditions result in lower lifecycle emissions due to existing more sustainable practices, the final product will have a lower emissions intensity and attract a higher price.

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[5] Department of Infrastructure, Transport, Regional Development, Communication, Sports and the Arts *Low Carbon Liquid Fuels – A Future Made in Australia: Unlocking Australia's low carbon liquid fuel opportunity – Consultation Paper* 2024

[6] Department of Climate Change, Energy, the Environment and Water (DCCEEW) *Regulating Australian fuel quality* Accessed July 2025.

6.2.2 *Safeguard Mechanism*

The Australian Government's Safeguard Mechanism requires Australia's largest greenhouse gas emitting facilities to reduce their emissions in line with Australia's emission reduction targets of 43% below 2005 levels by 2030 and net zero by 2050. The Safeguard Mechanism applies to facilities across all sectors of the economy which emit more than 100,000 tonnes carbon dioxide equivalent per year. In 2023-24, there were 70 Safeguard Mechanism facilities in Queensland; mostly in the resources sector.

In 2023–24, covered emissions from all 219 safeguard facilities made up 31% of Australia's total emissions. In 2022–23, liquid fuel use varied across industries: the mining sector relied on liquid fuels for approximately 59% of its energy needs, 98% for manufacturing, and 73% for construction.

Modelling from the 2025 CEFC Report shows potential electrification pathways for sectors noting for some sectors there continues to be a significant reliance for liquid fuels across sectors in 2050 (Figure 4). These figures highlight the potential of low carbon liquid fuel alternatives to help reduce emissions.[7]

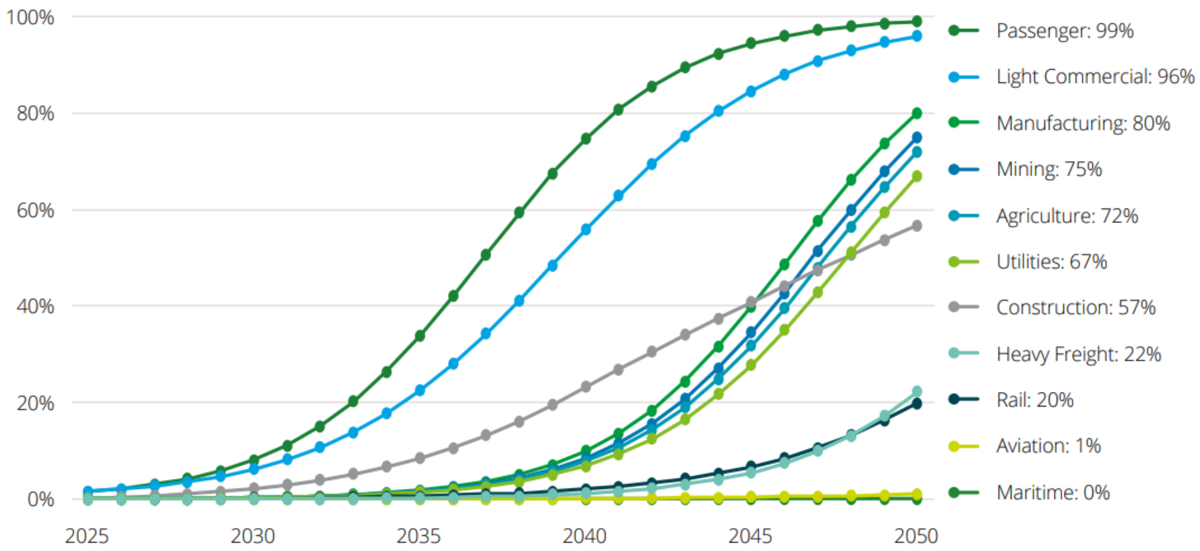

Figure 4 Fuel sector electrification fitted to simple adoption curves (CEFC 2025 page 20)

The Safeguard Mechanism is also supported by the National Greenhouse and Energy Reporting (NGER) Scheme, which is a national framework for reporting company information about greenhouse gas emissions, energy production and energy consumption.

NGER Scheme includes annual determinations on when using low carbon fuels (such as biofuels) contribute to zero emissions by facilities. The NGER Scheme currently does not recognise "book and claim", where a facility such as a remote mine that cannot directly access a biofuel, can purchase certificates that incentivise another fuel user that has access to switch to those low carbon fuels. Scope 3 emissions are not included in Australia's emissions reporting schemes. As a result, there is no policy impetus for airports to mandate the use of SAF to offset aviation fuel emissions.

It is anticipated that further announcements on these policies, especially in response to the low carbon liquid fuels consultation paper, will be made later in 2025 by the Australian Government.

[7] DCCEEW *Australian Energy Update 2024* 2025

6.2.3 *Finance*

The Australian Government's CEFC has a stated purpose to increase flows of finance into the clean energy sector and to facilitate the achievement of Australia's greenhouse gas emissions reduction targets. The 2025 CEFC report details some of the challenges for biofuels in Australia with the current market conditions, one of which is cost.

RD and SAF remain significantly more expensive than conventional fuels, currently costing 2 to7 times more. All modelled SAF production pathways continue to carry a substantial cost premium compared to conventional jet fuel. However, when considering RD and SAF as an alternative to conventional fuels, fuel users are likely to make purchases based on comparative carbon abatement costs; i.e. cost per tonne of CO2 avoided, rather than a standard $/L pricing model.

6.3 State policy mechanisms

The Queensland Government recognises the potential value of establishing a biofuels industry in Queensland and has committed to:

- support and participate in a National Feedstock Strategy
- actively look at ways the renewable fuels sector, such as biofuels, can expand, noting the importance of working closely with agricultural cropping production areas within Queensland
- reach a $30 billion primary industries output by 2030, supported by a focus on increasing productivity, expanding market access, and fostering innovation across the agricultural sector.

Biofuels is one of three Queensland Government priority industries, with biomedical and defence, identified as a focus for industry development. These industries will draw on Queensland's strengths, build sovereign capability and grow our regions.

The Queensland Government's levers to support supply within a biofuels industry include:

- Legislation and regulation, such as the powers of the Coordinator-General and Economic Development Queensland. Both are unique to Queensland and have land acquisition, development and planning instruments that can be used to support industry development in particular locations such as State Development Areas.
- Delivery of common use infrastructure and integrated planning, for example a shared road, utilities or other services that activate a precinct for multiple complementary projects.
- Project facilitation that assures inter-agency collaboration and navigation of approvals to progress developments and mitigate issues. On occasion this may include targeted financial assistance such as through the $188.6M Sovereign Industry Development fund to accelerate development of the priority industries of Defence, Biomedical and Biofuels.
- Increased opportunities for local business, by implementing the Queensland Charter of Local Content.
- Contributing to 'social license' and building awareness and trust in a sector by promoting and contributing to demonstrations and trials. For example, the 2019 SAF trial with Brisbane Airport and Virgin; and the 2022 renewable diesel ANL shipping trial.
- Influencing national policy and programs. For example, commissioning Deloitte's 2023 "*Preparing for Take-off*" report which reviewed international policies that have created favourable conditions for SAF industry development, informed how government and industry can work collaboratively to overcome barriers, the levers available to government to encourage investment in the industry, and outlined the role each stakeholder. This report was a key contributor to discussions with the Australian government.

- Strategic intelligence to inform industry, government and communities such as the biofuels feedstock expansion study which is expected to be finalised by the end of 2025. The study will set out the critical pathways for each region in Queensland of the most viable opportunities for biofuels feedstocks to meet commercial production requirements.
- Working with industry to increase OEM acceptance of biofuels or blends. OEM acceptance in vehicle documentation is essential for customers to confidently use biofuels in their vehicles. Emerging biofuels such as RD may not yet be acknowledged at all by OEM documentation.

6.3.1 Existing biofuel mandate

In Queensland, biofuels mandates are already in place which require some petrol retailers to sell at least 4% biobased petrol (e.g. ethanol), and fuel wholesalers to sell at least 0.5% biobased diesel.

The most common ethanol blended fuel, E10, is limited to 10% ethanol. This means in practice the 4% ethanol mandate on retailers requires 4 in 10 (or 40%) motorists to choose E10 instead of regular unleaded petrol. Ultimately, it is the choice of motorists at the bowser that determines how much E10 is sold, as regular unleaded petrol without ethanol is still lawfully made available. Over the last 5 years, retailers liable under the mandate have averaged about 2.9% ethanol, meaning about 3 in 10 motorists have been choosing E10 over regular unleaded petrol. This is up from about 1.5% ethanol before the mandates commenced in January 2017.

Given the consumption of petrol has been in long-term decline over at least the last 15 years[8], and this decline is likely to accelerate with the uptake of more fuel-efficient engines, hybrids and electric vehicles, it is not expected that the retail petrol market will present a growing opportunity for sugarcane-derived petrol blends.

Queensland's biobased diesel mandate allows wholesalers to sell first generation biodiesel (currently made in Australia), advanced generation RD (currently imported) or diesel made from waste such as lube oil (currently made in Gladstone). Biobased diesel sales have averaged about 0.2% over the last five years, up from negligible amounts before the mandates commenced in 2017.

Similar to the ethanol mandate, end users are not required to buy a biobased diesel blend from their fuel supplier. Commercial users mostly choose mineral diesel to avoid the higher costs and perceived fuel quality concerns with biobased diesel blends.

In contrast to the declining petrol market, the consumption of diesel has been increasing over the long term, driven by growth in industry. This suggests that there may be an emerging opportunity for RD as a drop-in transition fuel in hard-to-electrify sectors, such as long-haul heavy transport, mining, construction and rail. Similarly, jet fuel consumption has also been growing over the long term (excluding COVID impacts), suggesting an emerging opportunity for SAF to contribute to lower carbon targets for the aviation industry (Figure 5).

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[8] DCCEEW *Australian Petroleum Statistics* July 2025

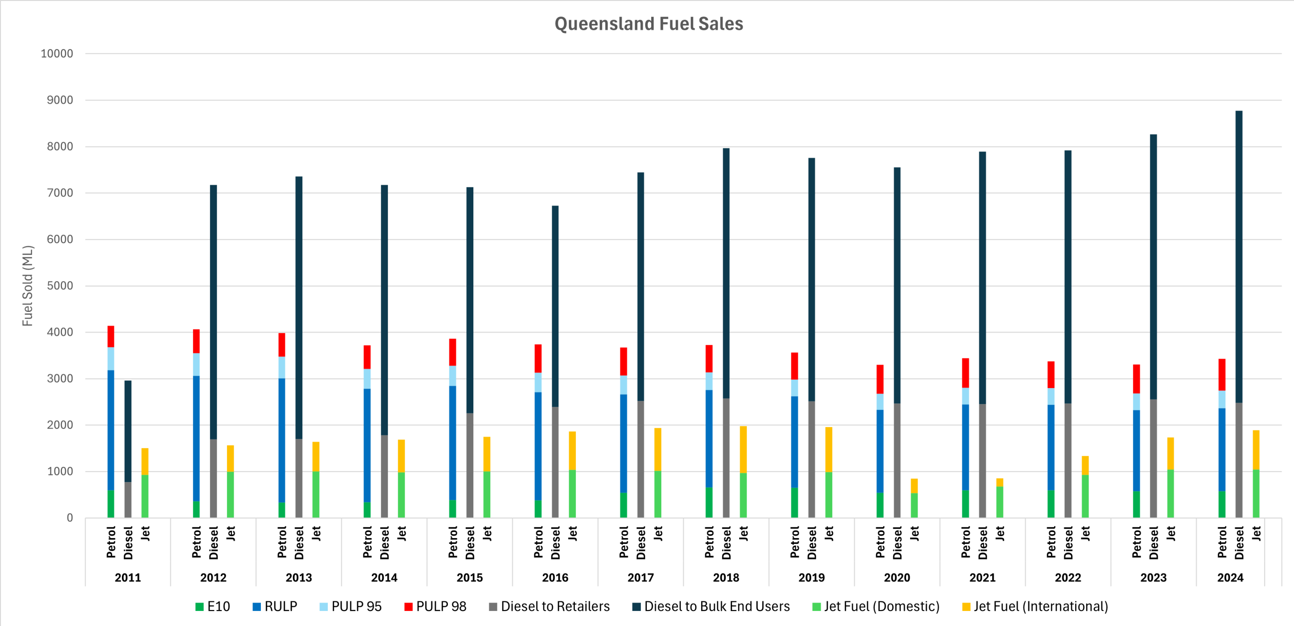

Figure 5 Trends in Queensland liquid fuels (Source: Australian Petroleum Statistics)

6.4 International comparisons

6.4.1 Sugarcane industry comparison with Brazil

Brazil is the world's largest producers of both biofuels and bioenergy from cogeneration. In Brazil, the most common contractual arrangements between sugarcane farmers and manufacturers are Outgrower Schemes, which include the provision of goods and services such as farming inputs and technical assistance from manufacturers to growers and lend themselves to small and mid-size sugarcane farming operations.

In contrast to Australia's sugarcane industry, Brazil's supply chain includes large, vertically integrated business that own both sugarcane farms/plantations and mills (as well as other components of the sugar supply chain and value-add supply chain), as well as grower-owned mills or cooperatives far larger in scale than Australia's grower-owned mills. For example, Queensland's largest sugar manufacturer, Wilmar Australia, has a collective capacity of about 15,000,000 tonnes across its facilities. In contrast, two Brazilian (integrated plantation sugarcane farming, manufacturing, bioenergy cogeneration and biofuel) producers, Raizen and Copersucar (a cooperative), have capacities of 105,000,000 tonnes and 120,000,000 tonnes, respectively. Increased scale and integration generally improve access to project capital and provide supply chain resilience to market volatility.

6.4.2 Global policy mechanisms

Global policy levers that have been implemented to support the biofuels industry include:

- Market mechanisms that signal demand, such as a low carbon fuel standard applied to all fuels, which rewards production and use of renewable fuels. This type of demand signal could only be effectively implemented as a national scheme.
- Measures to address biofuel cost premiums, such as time limited production credits through the income tax system or capital grants, which support supply by addressing operating expenditure and revenue challenges for early mover projects. Such measures could be implemented by either or both the federal and state governments. This is also a place for customers to meet part of the cost premium and, for example, some businesses are already partnering with airlines to do this.

- Cooperation between industry and government to develop the value chain, help government to develop practical policies and build trust in SAF safety claims.

Specific global biofuel demand-side interventions from governments include:

- the US Renewable Fuel Standard, which commenced in 2005, which required a certain volume of renewable fuels to be used to replace or reduce the quantity of fossil fuel in transportation fuel, home heating oil or jet fuel. It has supported the approximately 520 per cent growth of biofuels in the USA since 2011.
- The US *Inflation Reduction Act 2022* included provisions to support biofuels including a performance-based tax credit for the production of low emission transportation fuels. Recent legislative changes in the US have continued the tax credit to 2027 but reduced the maximum claim per gallon.
- implementation of mandates and fuels standards with SAF mandates in both the European Union and the United Kingdom commencing in 2025.
- Jurisdictions including Japan, Singapore and Malaysia moving to regulate scaled uptake of SAF in the coming decade.
- Brazil's Proalcool program, which began in 1975 to reduce Brazil's dependence on imported oil with an ethanol mandate to create demand and supply measures in the form of subsidies.

7 NATIONAL SECURITY AND DEFENCE

National security and defence are the responsibilities of the Australian Government, which also has lead responsibility for liquid fuel security. The Australian Government has announced a number of measures and proposals it is taking towards liquid fuel security and the liquid fuel needs of defence, including the "Future Made in Australia" Discussion Paper.

The *Defence Strategic Review*[9] in 2023 identified the need for a whole-of-government Fuel Council with representatives from relevant departments and industry to deliver resilient national fuel supply, distribution and storage. The Department of Defence and the Department of Climate Change, Energy, the Environment and Water (DCCEEW) subsequently established and co-chair the National Fuel Council to address these matters. A key focus of the National Fuel Council is to ensure broader government and industry awareness of Defence fuel requirements and integration of those efforts to enhance fuel security, including the role of low carbon liquid fuels.

Defence also released in 2024 two key strategies – the *Defence Future Energy Strategy*[10] and the *Defence Net Zero Strategy*[11]. The Defence Future Energy Strategy identified RD, SAF and electrification as likely alternative energies over the short to medium term.

The proposed adoption of RD and SAF by Defence (see roadmap of future energy mix on page 7) suggests there may be opportunities to align sugar production, as a fuel feedstock, with liquid fuel security and defence fuel requirements.

[9] Defence *National Defence: Defence Strategic Review* 2023
[10] Defence *Future Energy Strategy* 2024
[11] Defence *Net Zero Strategy* 2024

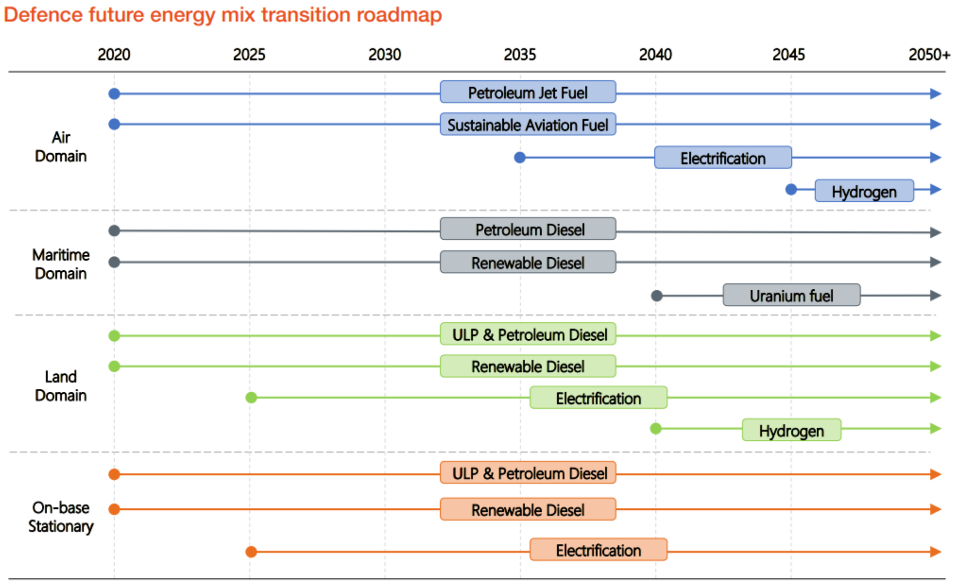

Figure 6 Defence future energy mix roadmap (Source: Defence Future Energy Strategy)

8 RESEARCH AND DEVELOPMENT

The sugarcane industry in Australia has access to some of the world's best capability in sugarcane breeding, production, manufacturing and diversification research through organisations including Sugar Research Australia, Department of Primary Industries, CSIRO, Queensland University of Technology, University of Queensland and other universities across Australia.

The sugarcane industry has identified research objectives related to enhancing bioenergy production through the SugarPlus industry roadmap[12] and the SRA strategic plans, 10-year R&D plan and annual operating plans. However, given other sector research priorities including varietal development, agronomy and farming systems, and crop protection, only limited funding has been available through industry mechanisms to direct toward bioenergy and broader revenue diversification activities.

There is an opportunity for co-investment in other national and international funding schemes to unlock additional funding. For example, Sugar Research Australia (SRA) currently invests in the Australian Research Council Research Hub for Engineering Plants to Replace Fossil Carbon.

DPI invests $2.85 million annually for sugarcane research, development and extension projects through SRA. DPI's current research priorities include research that:

- underpins new opportunities in sugarcane diversification based on market and consumer demand
- develops alternative products or uses of sugarcane that will provide options to growers
- fast tracks the uptake of new transformational breeding technologies to remain globally competitive in producing high yielding and disease resistant varieties
- develops systems that growers can use to predict, tailor and manage biomass and sugar production to meet demand.

Currently DPI is investing $1.3 million over 4 years in the genetic analysis of lignocellulosic composition and biomass in sugarcane to maximise biofuel production project, through The University of

[12] Sugar Research Australia *Sugar Plus: Fuelling the Future of Food, Energy and Fabrication* 2022

Queensland's Australian Research Council Research Hub for Engineering Plants to Replace Fossil Carbon.

A project currently in contracting phase is the proof of concept for sugarcane Gene Editing. Once developed, Australia will have the ability to edit sugarcane crops for targeted traits including biomass production.

DPI previous research investments have included:

- Biomass accumulation in sugarcane varieties (2009)
- Measurement of in-field sucrose loss by automated refractometry (2008)
- Best-practice harvesting - Increased harvest recovery: reducing sugar loss and stool damage (2011, 2014)
- Developing sugarcane for production systems utilising total biomass (2009)
- Maximising genetic gain from family selection (2011)
- Advancing yield, disease resistance and ratooning by exploiting new sources of genetic variability from wild relatives of sugarcane (2014)
- A Profitable Future for Australian Agriculture: Biorefineries for Higher-Value Animal Feeds, Chemicals, and Fuels (Rural R&D for Profit) (2015)
- Productivity improvements through energy innovation in the Australian sugar industry (2017)
- Establishing a strategic roadmap for product diversification and value addition (2018)
- Environmental Risk Assessment & Life Cycle Assessment of the Raw Sugar Manufacturing (2020)
- Feasibility studies to assess the economic viability of producing hydrogen from bagasse and compostable bioplastic from sugarcane juice (2020)
- Opportunity assessment – Investigation of a potential new oil cane product and associated market opportunities (2020)
- Green Market Opportunities (2021)
- Use of machine learning to determine the extraneous matter and billet length in cane consignments (2022)

The QUT Mackay Renewable Biocommodities Pilot Plant and Cauldron's precision fermentation contract manufacturing facility are examples of government investment in supporting and scaling technologies that use sugarcane as a feedstock. The Mackay Renewable Biocommodities Pilot Plant has been foundational in creating research infrastructure of long-term benefit to the sugar industry. This facility with the support of the Queensland and Australian Governments has recently undergone a $19.1 million redevelopment.

The R&D agenda to underpin a world leading sugar bioenergy could include collaborative R&D across industry and research providers to:

- develop new sugarcane varieties targeting high biomass energy canes
- enhance cost-effective solutions for improving energy efficiency of sugar mills to liberate byproducts like bagasse to bioenergy technologies
- support translation of bioenergy technologies through pilot and demonstration scale projects
- undertake technology assessments for new and emerging technologies and their application within the sugarcane industry considering collaborative efforts along the supply chain and considering new business model for delivery
- reduce sugarcane feedstock costs including increasing crop yields, improving the efficiency of collection and sourcing networks, and economies of scale for pre-treatment

- exploring crop rotations and alternative crops in fallow
- improve processing yields - this can include improving sugar extraction for AtJ, through process change
- support emerging technologies that could use sugar or its byproducts as a feedstock such as precision fermentation within the Alcohol to Jet pathway
- continue scaling Power to Liquid technologies that could use sugar and its byproducts as feedstock.

9 BENEFITS FOR GROWERS

9.1 Sugar pricing and trends

International demand for sugar is increasing by over 1% year on year with the increase mainly from countries with developing economies. Balancing this, the world sugar price is highly volatile, distorted by international subsidies, and has been decreasing, in real terms, since the 1970s. The volatility means that there can be significant price fluctuations within the general downward trend. For example, in 2022 and 2024 the in-season price for raw sugar resulted in returns to growers of approximately $50 and $58 per tonne of sugarcane respectively. These prices bookended a 2023 price of over $72 per tonne of sugarcane which was one of the highest prices on record.

At any given time, the world sugar price is a function of supply and demand, or the case of the futures market, forecast or speculation on supply and demand. The size and international nature of the market means that this price is independent of the cost of production in Australia. While Australia is considered to be reasonably efficient in growing sugarcane and manufacturing it into sugar there have been recent occasions where the world price has dropped below the cost of production in Australia.

9.2 Grower revenue

The price received by growers for their crop is based on the cane price formula, which is largely based on the international price for raw sugar. The formula allocates approximately two-thirds of returns from sugar to growers and one-third to millers. However, the formula does not include any consideration of potential revenue from other sugarcane products.

Decoupling from a sole reliance on this uncertain revenue stream would require negotiation between growers and mills to share risks and rewards, but offers potential benefits for growers. There are examples of this worldwide; for example, in Brazil, sugarcane not only underpins a sugar industry but is also widely used to produce ethanol for both domestic and export markets. The price of ethanol is pegged against the world oil price and the proportion of Brazil's sugarcane allocated to the production of sugar or ethanol is often determined by pricing. A greater proportion of Brazil's cane being processed into ethanol reduces supply of sugar into the world market and can result in an increase in the spot price for raw sugar.

Queensland's sugarcane industry operates under robust industrial relations regulations and to a high standard of sustainability. The Reef protection regulations address land-based sources of pollution flowing to the Great Barrier Reef. Sugarcane growers in the Reef regions need to comply with standard conditions, which focus on retaining nitrogen, phosphorus and sediment on-farm to minimise run-off and improve water quality.

Smartcane Best Management Practice (BMP) program is an industry-led, voluntary program available to all Queensland sugarcane growers. Developed with funding from the Queensland Government, it is run by CANEGROWERS Australia and was launched in 2013 to assist growers to document, benchmark and continuously improve their on-farm practices for productivity, profitability and stewardship. 44% of Queensland's cane land is accredited under Smartcane BMP. Smartcane BMP has been benchmarked against the international Bonsucro Production Standard, demonstrating full alignment with the Standard’s indicators.

These standards leave the Queensland sugarcane industry well placed to meet the demand for more ethically and sustainably produced products and this may provide an advantage in international markets.

9.3 Economics of sugarcane as a feedstock

An issue with the use of any high-volume, low-density product as a feedstock is the logistics and cost of aggregation. For that reason, many biofuel or energy production projects are located at an aggregation site such as a refuse transfer station. The well-developed transport networks between sugarcane farms and their local mill make the sugar mill an ideal location for future bioeconomy initiatives.

A characteristic of the sugarcane industry in Queensland is the employment of a ‘fallow period’, or break in production for a year, on up to 20 per cent of a cane farm at any given time. The summer season after harvest and before planting also provides a short fallow period each year. These periods allow for the planting of a rotational or fallow break crop which is often a legume that re-charges the soil with nitrogen. In many cases the plant is ploughed into the field at the end of the fallow period but there is potential for some crops to be harvested and provide an alternative revenue source to growers. For example, soybean is a legume and produces seed that can be used for oil production. In that case a farm could provide feedstock for fuel production without undermining the production of food.

10 LAND USE AND REGIONAL DEVELOPMENT

10.1 Current land use and infrastructure

In 2023, sugarcane was harvested from approximately 340,000 hectares across Australia. This compares with over 400,000 hectares harvested between 1998-99 and 2006-07. Most of this sugarcane is grown in Queensland with the balance harvested in northern NSW.

The total area mapped as sugarcane (including fallow and non-productive farm areas) in Queensland is nearly 532,000 hectares (based on land use data largely from 2021). Since sugarcane land was previously mapped in 1999, there has been a gain of almost 65,000 ha but a loss of just over 144,000 ha, resulting in a net decrease in sugarcane land of almost 80,000 hectares (Appendix 1).

A number of factors influence changes in the area of land under cane. In some cases, farmers have made the business decision to move to alternative crops such as macadamia and avocado tree crops or seasonal horticulture such as sweet potato. Cane land is concentrated around the mills, and as towns have built up around the mills some of this land has been lost to urban expansion as these population centres have grown. More recently there has been some solar photovoltaic renewable energy developments built on sugarcane land.

Sugarcane begins losing sugar content once harvested and, ideally, should be processed within 16 hours of harvest. Transport time and cost creates a geographic region from which sugarcane can be economically supplied to a sugar mill. ASM advises that the preferred distance is 30 km with 60 to 70 per cent of cane sourced from within 10 km of the mill. Transport costs, and industry rationalisation, has resulted in a single mill within a viable distance of most farms creating a co-dependence between growers and their local mill. Excluding the cost of the sugarcane itself, most of the costs of a mill are fixed. This means that mills rely on volume of throughput to remain profitable, and there is a critical threshold of sugarcane throughput below which a mill will not be economically viable. A reduction in sugarcane grown close to the mill can threaten mill viability over the medium term.

10.2 Regional planning

Competition for land is intensifying in regional Queensland due to increasing demand for land for the competing priorities of energy, infrastructure, housing, industrial and manufacturing opportunities, critical minerals, agricultural production, and environmental conservation.

The Queensland Government has committed to delivering new regional plans across Queensland and is working on developing a more effective approach to land use planning through regional plans. The current focus is on facilitating housing supply and economic growth via agriculture, development and construction, mining and extractive resources and tourism.

This work includes updating the mapping of prime agricultural land and land uses through the reviews of statutory regional plans. While this work has been focused on spatial and economic analysis, work is also underway to ensure mapping captures primary industry sector's requirements for productive land and access to water resources.

Government is also working on mapping areas that could potentially be used for expanded primary production, taking into consideration land use conflicts that may constrain future agricultural opportunities. This will contribute to achieving the Government's goals of ensuring the long-term future for traditional primary industries and to improving on farm productivity and profitability for growers.

10.3 State Development Areas

The Mackay State Development Area (SDA), declared in February 2024, provides land for development and investment opportunities for new and emerging industries, including renewable energy and biofutures industries.

The Mackay SDA sets aside 907 hectares of land, including 137 hectares of land adjacent to the Racecourse Mill and 770 hectares of land at Rosella, to support diversification of the regional economy and provides opportunities for new industries that value add to the sugarcane production. The SDA leverages Mackay's regional strengths in rural production to support the establishment of industries critical to the global shift to net zero, such as biomanufacturing, renewable energy and sustainable aviation fuel.

The Rosella SDA offers medium to longer-term development opportunities for large footprint and hard to locate industries that are well separated from residential communities and areas of environmental significance.

The Racecourse Mill SDA offers short to medium-term development opportunities for pilot and demonstration commercial-scale projects, with the opportunity to co-locate with the existing sugar mill and build on the existing infrastructure supporting the sugar refinery and co-generation facilities. The Mackay SDA is currently home to the mill; the sugar refinery producing about 400,000 tonnes of refined white sugar annually; and the cogeneration plant, which provides over a third of Mackay's electricity. Also on the site, the Queensland University of Technology (QUT) Renewable Biocommodities Pilot Plant is a common-user research and development facility that converts biomass into biofuels, green chemicals and other bioproducts.

11 CONSIDERATION OF FOOD VERSUS FUEL

In its 2024 paper *Carbon Accounting for Sustainable Biofuels*, the International Energy Agency (IEA) highlighted the important role of decarbonising the global transport sector, but warned that large-scale deployment of biofuels would raise sustainability concerns in relation to land use, net carbon emissions and impacts on biodiversity and food prices[13].

The IEA also noted that although direct land use change (DLUC) (conversion from non-cropland to bioenergy cropland) can be quantified, indirect land use change (ILUC) (induced expansion of cropland as a result of bioenergy crops elsewhere) needs to be modelled. There is a high degree of uncertainty and risk of arbitrariness in attributing ILUC values in carbon emission accounting for biofuels. The impacts of ILUC are beyond the direct control of biofuels producers; effective land use policies, including the protection of food security, natural forests and areas with high biodiversity are necessary to address these challenges.

Potential impacts on food production are not usually considered to the same extent by other industry sectors, including renewable energy production (through cogeneration or large-scale renewables), mining (for fossil fuels), expansion of conservation areas, or urban expansion. Land use change can also occur purely as a result of market factors and the choices of individual farmers in relation to the best use of the land for their situation.

11.1 International schemes

The International Civil Aviation Organization's (ICAO) Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) provides the criteria for fuels to be deemed eligible as sustainable. The first phase of CORSIA (2024 to 2026) is voluntary with 126 countries including Australia committing to participate. Although commitment is voluntary, once committed, compliance is compulsory for that country's aircraft operators for flights between participating countries. Participation in CORSIA becomes mandatory for all countries in the second phase (2027 to 2035).

CORSIA provides measurement guidance on sustainability criteria for SAF. Criteria include no conversion of land with high carbon stocks; for example, primary forest or wetlands after 2008. Detailed guidance is provided on the calculation of ILUC values and the identification of low land use change risk feedstock. In general, lower land use change values are attributed to situations where there is an increase in crop yield on the same land, or biofuel crops are grown on previously 'unused' land (including marginal, underutilised or degraded agricultural land). CORSIA also makes provision for protection of food security in regions that are considered food insecure.

In most schemes, byproducts from the production of food, including bagasse, are given a land use change score of zero and are preferred.

11.2 European Union approach to SAF

The European Union (EU) has committed to the de-carbonisation of its member economies, including through increased use of biofuels, while at the same time endeavouring to protect agricultural land and future food supply and avoid impacts on global food security in other nations.

The European Union's Renewable Energy Directive (RED) sets legally binding targets for renewable energy consumption across Member States, including a target under RED III for the transport sector of

[13] IEA Carbon Accounting for Sustainable Biofuels 2024, page 7

29% renewable energy by 2030. All fuels must meet sustainability verification and certification requirements.

The EU's REPowerEU Plan released in 2022 aims to save energy, diversify energy supplies and produce clean energy. The ReFuelEU Aviation regulation aims for a 70% share of SAF at all EU airports by 2050, ramping up from a 2% SAF mandate in 2025[14]. The target applies to all airlines flying from key EU airports and therefore applies to flights between Australia and the EU.

The EU faces several feedstock supply challenges in the short-medium term. The types of SAF that are most readily produceable (e.g. biofuels from used cooking oil (UCO)) are not the most supported albeit tolerated under EU's regulations, while the most desired SAF types under the regulations (e.g. synthetic aviation fuel from sustainable energy) are not yet produceable. Europe therefore currently relies heavily on feedstock sources including UCO from Asia to fulfill its sustainable transport ambitions. In 2024-25 countries of the EU imported 3.8 million metric tonnes of Australian canola[15]. This is an increase of 1.87 million tonnes exported from the previous year and is driven by biodiesel production demand[16]. For sustainability and food safety concerns, the EU restricts the use of food and feed crops for first-generation biofuels and prohibits their use for SAF production[17].

11.3 US approach

Agriculture feedstock-sourced biofuels production is well established in the US. The three biofuels that dominate US production and consumption are sourced from corn (ethanol production), soybean (biodiesel) and fats, oils and greases (biodiesel). Ethanol imported from Brazilian sugarcane is fourth in volumetric terms.

The US Environmental Protection Agency noted in a report to Congress in January 2025 that biofuel feedstock production is responsible for some changes in agricultural land use, but the amount of land with increased intensity of cultivation and the portion of crop land expansion that is due to the market for biofuels cannot be quantified with precision. Both corn and soybean areas had increased since 2007, reversing a prior long-term decline, but were predicted to remain relatively stable from 2020 to 2025.

The US has used taxation policy to mitigate consequential land use impacts from biofuels feedstock production growth. Section 45Z of the Federal Clean Fuel Production Credit, established by the *Inflation Reduction Act of 2022,* provided incentives for the production of clean transportation fuels with reduced lifecycle greenhouse gas emissions. Lower ILUC values could improve the emissions reduction assessment outcome. However, new arrangements passed by Congress in July 2025 reduce the financial penalty on corn and soy-derived feedstock producers which had previously been disadvantaged due to higher indirect land use impacts associated with growth in those sectors.

11.4 Australian context

In 2023 the Australian Government supported the development of an Australian sustainable finance taxonomy to guide the acceleration of public and private investment toward "'net zero-aligned" activities for Australia's economy and strengthen industry's competitiveness in global low carbon value chains.

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[14] Rabobank *Europe's sustainable aviation fuel market: cleared for take-off but still taxiing* Accessed 13/6/2025
[15] Australian Bureau of Statistics (ABS) *International Trade in Goods* (cat. no. 5368.0)
[16] MSM Milling *Market Report* July 2025
[17] Rabobank *Europe's sustainable aviation fuel market: cleared for take-off but still taxiing* Accessed 13/6/2025

The *Australian Sustainable Finance Taxonomy*[18] provides sustainability guidelines for the Australian context, including technical screen criteria for biofuels and the manufacture of biogas, which include land use and land use change. The taxonomy carries a criterion drawn from the CORSIA PLUS* *Principle 1* concerning the protection of land with high biodiversity value or high carbon stock[19]. The taxonomy also requires indirect land use change to be included in life cycle assessments.

The Global Food Security Index ranked Australia as among the most food secure nations in the world[20]. In 2022, domestic food supply ranked first in the world for affordability and 22nd overall when factoring in measures of quality and safety, availability and sustainability and adaptation. Although Australia imports some foods, it is a net food exporter by a large margin, including 80% of its sugar.

The Federal Government announced in the 2025-26 budget, the development of a National Food Security Strategy. It is expected that it may consider the issue of the potential impact of biofuels feedstock production on Australian agriculture and how food security will be managed in consideration of this emerging sector.

While Australia is well placed in terms of food security, it is expected that competition for agriculture-based feedstock will increase as biofuels manufacturers seek reliable domestic supply. Growers can and will choose what to grow based on what is most economic and commercial for their situation, based on the market signals that they receive.

The sustainability credentialing of biofuels production will be particularly important as it has a direct relationship with emissions factors, which are critical to the eventual price that can be obtained for the biofuel.

In this context, activities that can increase feedstock production through yield increases, better use of rotational and fallow cropping, and increased use of byproducts such as bagasse, will likely be favoured by biofuel producers and the market. Calculation of life cycle emissions values specific to Australia will also be critical.

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[18] Australian Sustainable Finance Institute *Australian Sustainable Finance Taxonomy* Version 1 2025
[19] ISCC *ISCC EU 202-1 Agricultural Biomass: ISCC Principle 1* 2025
[20] The Economist Group *Global Food Security Index 2022* 2022

12 ABBREVIATIONS

AD	Anaerobic digestion
AEMO	Australian Energy Market Operator
ARENA	Australian Renewable Energy Agency
ASM	Australian Sugar Manufacturers
AtJ	Alcohol to jet process to convert alcohol to jet fuel
BL	Billion litres
BMP	Best management practice
CEFC	Clean Energy Finance Corporation
CO2e	Carbon Dioxide equivalent
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DLUC	Direct land use change
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DPI	Department of Primary Industries
DSDIP	Department of State Development, Infrastructure and Planning
E10 and E85	10 and 85 per cent ethanol blended with mineral petrol
EU	European Union
EV	Electric vehicle
FT	Fischer-Tropsch
GO	Guarantee of Origin
GPS	Generator Performance Standards
HEFA	Hydrotreated esters and fatty acids
HTL	Hydrothermal liquefaction
ICAO	International Civil Aviation Organisation
IEA	International Energy Agency
ILUC	Indirect Land Use Change
ISCC	International Sustainability and Carbon Certification
LGCs	Large-scale Generation Certificates
MW	Megawatts
NEM	National Electricity Market
NGER	National Greenhouse and Energy Reporting
OEM	Original equipment manufacturers
PPAs	Power Purchase Agreements
QUT	Queensland University of Technology
R&D	Research and development
RD	Renewable diesel
RED	European Union's Renewable Energy Directive
REPowerEU	European Commission's initiative to reduce reliance on Russian fuel
SAF	Sustainable aviation fuel
SBTi	Science-Based Targets Initiative
SDA	State Development Area
SRA	Sugar Research Australia
UCO	Used cooking oil

13 REFERENCES

ARENA's Future Made in Australia Innovation Fund

Australian Bureau of Statistics (ABS) *International Trade in Goods* (cat. no. 5368.0)

Australian Sugar Manufacturers *Annual Industry Statistics (2015-2024)* 2025

Australian Sustainable Finance Institute *Australian Sustainable Finance Taxonomy* Version 1 2025

Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)

CEFC's *Refined Ambitions: Exploring Australia's Low Carbon Liquid Fuel Potential* 2025

CSIRO-Boeing's *Sustainable Aviation Fuel Roadmap* 2023

CSIRO-Boeing's *Sustainable Aviation Fuel State of Play* 2024

Department of Climate Change, Energy, the Environment and Water (DCCEEW) *Regulating Australian fuel quality*. Accessed July 2025

DCCEEW *Australian Energy Update 2024*,

DCCEEW *Australian Petroleum Statistics* 2025

Defence *National Defence: Defence Strategic Review* 2023

Defence *Future Energy Strategy* 2024

Defence *Net Zero Strategy* 2024

Department of Infrastructure, Transport, Regional Development, Communication, Sports and the Arts *Low Carbon Liquid Fuels – A Future Made in Australia: Unlocking Australia's low carbon liquid fuel opportunity – Consultation Paper* 2024

IEA *Carbon Accounting for Sustainable Biofuels* 2024

ISCC CORSIA 201 System Basics Version 2.0 2023

ISCC *ISCC EU 202-1 Agricultural Biomass: ISCC Principle 1* 2025

MSM Milling *Market Report* July 2025

Rabobank *Europe's sustainable aviation fuel market: cleared for take-off but still taxiing* Accessed 13/6/2025

Sugar Research Australia *Sugar Plus: Fuelling the Future of Food, Energy and Fabrication* 2022

The Economist Group *Global Food Security Index 2022* 2022

14 APPENDIX 1 MAP OF CURRENT SUGARCANE LAND AND CHANGE SINCE 1999