

## Submission to the Cleaner Fuels Programme: Powering Low-Carbon Liquid Fuel Production in Australia From Sugarcane to Jet Fuel: Driving Australia's Sustainable Aviation Future

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### Executive Summary

Australia can reduce aviation lifecycle emissions by up to 80%<sup>1</sup> while strengthening food security, positioning itself as a global leader in low-carbon fuels. Leveraging its world-class sugarcane industry (~30 million tonnes/year) and underutilised ethanol infrastructure (440 ML/year at ~40% utilisation; Grain Central, 2025), Australia can rapidly deploy Sustainable Aviation Fuel (SAF) via commercially proven Alcohol-to-Jet (ATJ) technologies. This approach enables conversion of sugarcane-derived ethanol into jet fuel, while co-producing yeast-based single-cell protein (SCP) from ethanol side streams, maximising resource efficiency, supporting Australia's Net Zero goals, and strengthening local industry.

MicroBioGen is an Australian biotechnology company with a global track record in enhancing the industrial capabilities of *Saccharomyces cerevisiae*, the world's most widely used microorganism. Through our long-standing partnership with Novonosis, we co-developed the Innova<sup>®</sup> yeast series, which powers over 30 billion litres of ethanol annually across global markets. Recent innovations such as Innova<sup>®</sup> Delta demonstrate higher yields and faster fermentations in non-GM settings. MicroBioGen's technology platform delivers robust fermentation and high yields, with significant potential for dual outputs: drop-in jet fuel via ATJ, and functional SCP from plant side streams, making it ideally suited to accelerate Australia's fuel plus food biorefinery model.

Beyond sugarcane juice, substantial biomass is available in ethanol production side streams, such as bagasse and vinasse<sup>2</sup>. MicroBioGen's yeast technology can convert these streams, via GM strains for additional ethanol and via non-GM strains for SCP, unlocking further value and helping Australia meet both its SAF and domestic protein needs. For example, bagasse alone represents up to 30% of harvested cane mass, and vinasse is produced at 10-15 litres per litre of ethanol, offering significant untapped feedstock for advanced biorefining.

If adopted domestically, our integrated fuel and food biorefinery would reduce costs, improve sustainability and support rapid SAF deployment. With technology at TRL 5-7 and ready to scale to TRL 9 within 3 years, MicroBioGen offers a low-risk, high-impact solution to help Australia meet Net Zero 2050 targets while driving regional economic development and strengthening domestic fuel and food security.

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<sup>1</sup>Ethanol-to-jet fuels produced from sugarcane ethanol typically achieve ~60–80% lifecycle GHG reductions versus conventional Jet A, depending on energy inputs and logistics (ICAO, 2025).

<sup>2</sup>Vinasse, also referred to as dunder, refers to the liquid residue left over from the distillation of ethanol.

## MicroBioGen's Role and Capabilities

MicroBioGen is one of the few companies globally optimising microorganisms for both ethanol and functional single-cell protein (SCP) within an integrated biorefinery model (Figure 1).

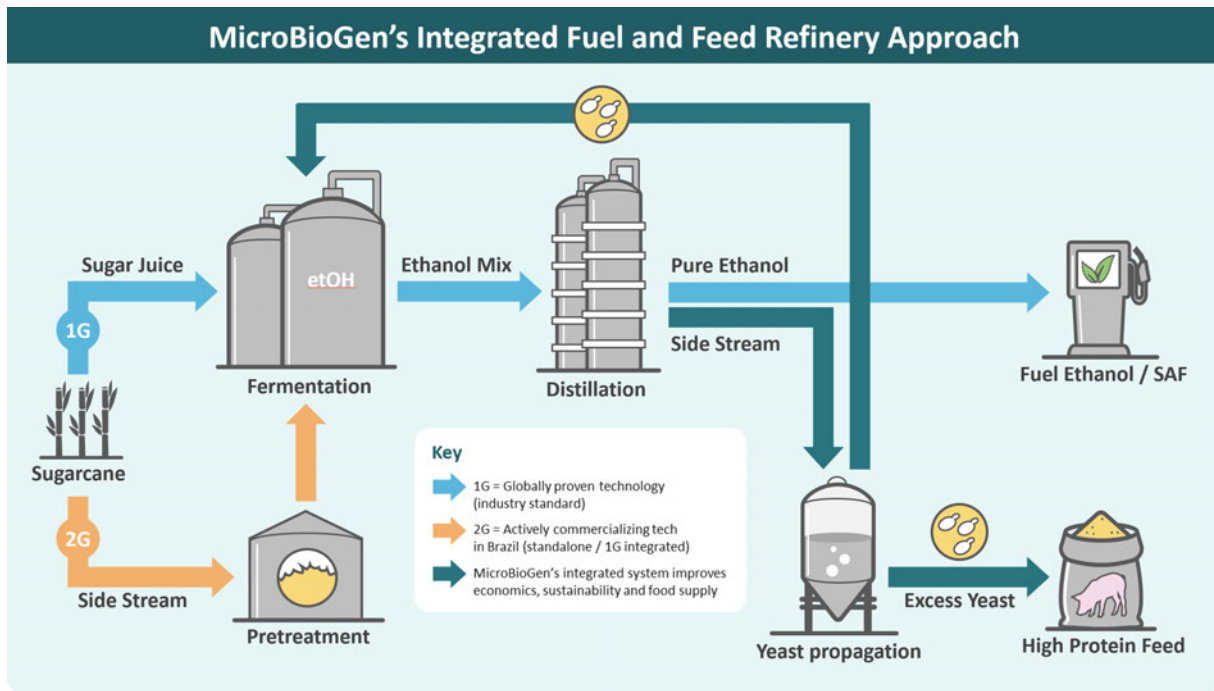


Figure 1 - MicroBioGen Technology for an Integrated 1G/2G Fuel and Feed Biorefinery: More Ethanol and SAF via ATJ, SCP for Food/Feed and Materially Less Waste.

Our yeast technology platform delivers:

- **Enhanced Efficiency:** Robust fermentation with higher ethanol yields and fewer process interruptions. Our yeast can convert low- and negative-value side streams, such as vinasse and bagasse, into ethanol using GM yeast, and into single-cell protein (SCP) and other valuable co-products using either GM or non-GM yeast. Bagasse makes up about 30% of processed sugarcane, or roughly 9 million tonnes annually in Australia (CANEGROWERS, 2024). Vinasse is produced at 10-15 litres per litre of ethanol, resulting in over 1.7 billion litres each year (Reis & Hu, 2017). Utilising these streams allows for significant increases in SAF and protein output without expanding land use.
- **Improved Sustainability:** Dual outputs of fuel and feed from both primary and secondary feedstocks, reducing waste and greenhouse gas emissions while supporting energy and food systems.
- **Cost Reduction:** Lower ethanol production costs from sugarcane juice (1G) and future lignocellulosic feedstocks (2G), enabling cost-competitive SAF via ATJ pathways.

We collaborate globally with leading technology suppliers and ethanol producers, including Novonosis, ensuring compatibility and scalability. In Australia, we have a proven track record of partnership and investment, including \$8M in federal grants (ARENA, 2021).

## Project Scope and Readiness

- **Investment to Date:** A\$25M total, including A\$8M in federal grants
- **Partnerships:** Established collaborations with Novonosis (Denmark) and Raízen (Brazil)
- **Technology Readiness:** Currently at TRL 5-7, with a clear pathway to TRL 9 within 3 years
- **Independent LCA:** Significant sustainability benefits (Bontinck & Grant, 2021), summarised in Figure 2 below.

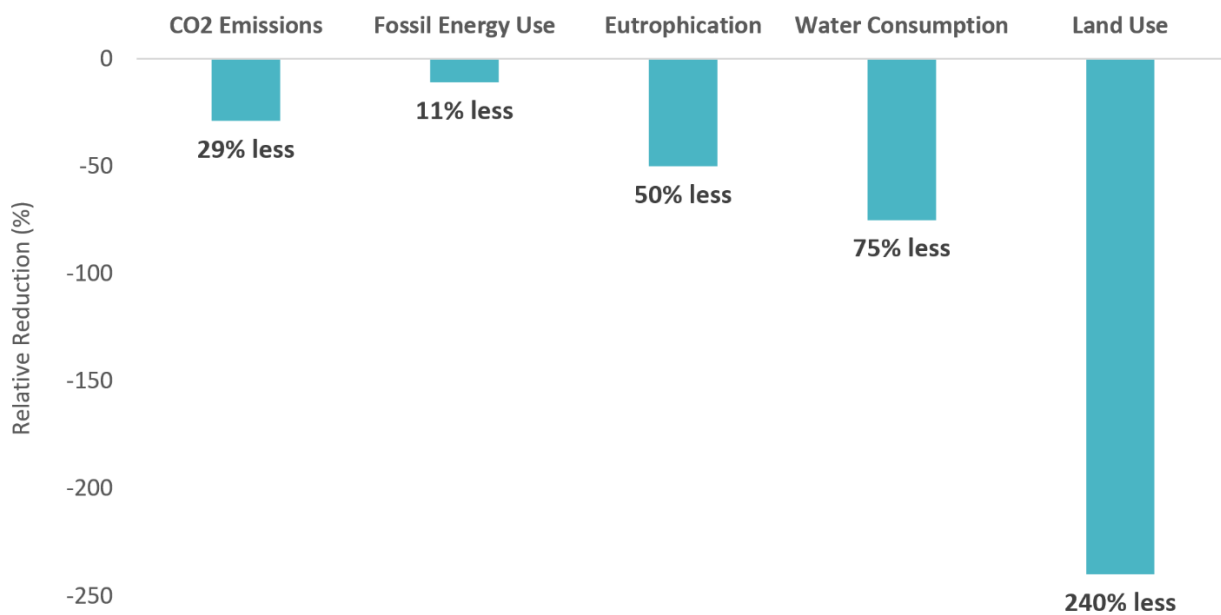


Figure 2 – Summary of key results from an independent, peer-reviewed Life Cycle Analysis (LCA). The LCA indicated significant ESG benefits could be achieved across several key measures when using MicroBioGen 2G yeast versus conventional 2G yeast for ethanol production (Bontinck & Grant, 2021). The technology is currently at TRL 5-7. R&D was conducted in collaboration with Novonosis, and 50% of the project funding was provided by ARENA.

## Priority Pathways and Feedstocks

Australia should prioritise SAF production pathways that offer the greatest potential for cost-effectiveness, scalability and alignment with sustainability goals:

- **Sugar to SAF (via ATJ):** Highly scalable, sustainable and future proof. Leverages existing sugarcane infrastructure and mature ethanol conversion technologies.
- **Lipid-based SAF (e.g. used cooking oil, tallow):** Lower cost and commercially mature, but constrained by limited domestic supply and competition from international biofuel markets

Sugarcane stands out as Australia’s most strategic feedstock for low-carbon fuel production through 2035. It offers exceptional yields, proven scalability and a well-established supply chain. Its composition, rich in readily fermentable C6 sugars, enables efficient ethanol production using commercially validated processes. Globally, ATJ technologies are now operational at commercial scale (Hydrocarbon Processing, 2025), providing Australia with a clear pathway to accelerate SAF deployment in line with international standards for aviation fuels (ASTM International, 2025).

The following table summarises key requirements for domestic SAF production and MicroBioGen’s strategies to address them:

Table 1 - Key Requirements and Strategies for Scaling Sustainable Aviation Fuel (SAF) Production in Australia.

Requirements for Domestic Production of SAF*	Strategies to Achieve SAF Production in Australia
Increased feedstock availability (i.e. ethanol)	Harness side streams from sugar-ethanol plants
Reduced feedstock costs / Improved efficiency	Superior technology for sugar-to-ethanol conversion
Enhanced sustainability (produce food plus fuel)	Deliver both bioethanol and feed products
Centralising feedstock production in regional hubs	Initial geographical focus on Queensland canegrowers

Australia’s annual sugarcane production (~30 million tonnes) and raw sugar exports (>3 million tonnes) demonstrate significant scale and export capacity (CANEGROWERS, 2024; USDA FAS, 2024). With ~341,000 ha under cultivation and a mature supply chain, Australia is well-positioned to deploy SAF via the ATJ pathway. Converting today’s raw sugar export volume domestically to ethanol and then ATJ would plausibly yield ~1.1 billion litres of SAF - around ~14% of current jet fuel demand (~7.7 billion litres/year) (Australian Petroleum Statistics, DCCEEW). Even conservative estimates suggest ~5 billion litres of SAF could be supplied from diversified domestic feedstocks including sugarcane (CSIRO, 2023), demonstrating rapid impact capability. MicroBioGen’s yeast platform further enhances yield and sustainability, enabling production of both drop-in jet fuel (via ATJ) and single-cell protein to bolster energy resilience and food security (Bontinck & Grant, 2021; MicroBioGen, 2024).

Brazil’s Raízen has recently commissioned multiple second-generation ethanol facilities and is actively expanding commercial agreements, underscoring the scalability and market readiness of advanced ATJ technologies (Hydrocarbon Processing, 2024). The international credibility of sugarcane-derived ethanol is further reinforced by its designation as an advanced biofuel under U.S. sustainability criteria (U.S. Environmental Protection Agency, 2023) and by historical emissions reductions achieved through Brazil’s ethanol program (Brazilian Ministry of Mines and Energy, 2023).

All SAF pathways should adhere to the following sustainability principles:

- Minimise land-use change and avoid adverse environmental impacts
- Ensure no material reduction in food supply
- Protect local water resources
- Align with international sustainability frameworks, such as CORSIA (an international ‘Carbon Offsetting and Reduction Scheme for International Aviation’ that sets sustainability criteria for aviation fuels)

## Jobs and Regional Impact

By enabling domestic production of low-carbon liquid fuels, including ethanol and drop-in jet fuel via ATJ, along with functional single-cell protein (SCP) from industrial side streams, MicroBioGen's fuel-plus-food biorefinery model will contribute directly to Australia's employment and regional development goals.

- Direct R&D roles at our Sydney based laboratories, with potential regional expansion through industry partnerships
- Indirect employment opportunities in sugarcane supply chain and future SAF plant operations

Australia's feed markets remain exposed to global protein volatility, with soybean meal imports typically ~0.85-0.88 Mt/year (USDA PSD Data, 2025). MicroBioGen's fuel-plus-food biorefinery strengthens domestic feed security by producing yeast-based SCP alongside ethanol/SAF. SCP plants can be sited in cane regions, shortening supply chains and delivering a consistent, local protein with lower land and water footprints.

Beyond feed security, yeast-based SCP is a saleable feed ingredient for aquaculture and livestock, creating new revenue opportunities for ethanol producers their partners. Upgrading vinasse to SCP also reduces effluent treatment costs, improving plant economics while supplying local protein to regional feed mills. Under Australia's emerging Guarantee of Origin framework, certified low-emission coproducts can further support price premia (DCCEEW, 2025).

## Community Benefits

MicroBioGen actively supports workforce development and community-based principles by:

- Building talent pipelines through graduate employment and research partnerships with leading institutions such as UNSW and Macquarie University.
- Investing in skills development by funding postgraduate education for staff, strengthening Australia's advanced biotechnology capability.
- Promoting equity and resilience through annual university awards and prizes that provide financial assistance to students facing hardship.

These initiatives contribute to a skilled workforce for the emerging low-carbon fuels sector and align with the program's objectives to deliver social and economic benefits alongside technological innovation.

## Policy Recommendations

To accelerate SAF deployment and unlock Australia's low-carbon fuel potential, we recommend:

- 1. Production-Linked Incentives**

Introduce incentives tied to lifecycle carbon intensity reductions to reward pathways achieving >60% GHG reduction compared to fossil jet fuel.

- 2. Innovation Uplifts for Advanced Biotech**

Provide targeted support for TRL 7-9 projects that enable process intensification and use non-food feedstocks, prioritising technologies delivering dual outputs (e.g. fuel and protein).

- 3. Co-Funding for Scale-Up**

Expand ARENA and CEFC-backed grants and concessional finance to accelerate commercial deployment of SAF plants integrating Sugar-to-Ethanol fermentation and ATJ conversion, with co-production of protein.

- 4. Regulatory Certainty**

Establish clear blending mandates (e.g. 10% SAF by 2030) and fast-track adoption of international certification frameworks (e.g. CORSIA) to provide market confidence. Alternatively, align mandates to mirror large western economies such as Europe and the US.

- 5. Strategic Support for Alcohol-to-Jet SAF**

Prioritise ATJ SAF development by leveraging - and optimising - Australia's existing 440 ML/year ethanol capacity (Grain Central, 2025).

## Conclusion

Australia's abundant sugarcane resources, proven ethanol infrastructure, and advanced ATJ technology present a unique opportunity for national leadership in sustainable aviation fuel production. MicroBioGen's integrated biorefinery model maximises resource efficiency by utilising both primary and secondary feedstocks, including sugarcane juice, bagasse and vinasse. This approach reduces emissions and delivers both fuel and food security, aligning with national policy objectives and global sustainability standards. By deploying MicroBioGen's advanced yeast technology platform, Australia can accelerate the transition to low-carbon aviation and build a resilient, circular bioeconomy. We welcome the opportunity to collaborate with government and industry to realise Australia's SAF potential and deliver a globally competitive, sustainable future.

## Acknowledgement and Policy Context

MicroBioGen appreciates the opportunity to contribute to the Cleaner Fuels Program consultation and supports the Government's leadership in advancing low-carbon liquid fuels.

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