Sugarcane Bioenergy Inquiry 2025

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Submission to the Queensland Parliamentary Inquiry into Sugarcane Bioenergy Opportunities

By MicroBioGen Pty Ltd - 21 August 2025

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Introduction

MicroBioGen thanks the Committee for the opportunity to contribute to this inquiry.

Based in Sydney, MicroBioGen is an Australian biotechnology company with over two decades of success improving the industrial capabilities of *Saccharomyces cerevisiae*[1], the world's most widely used microorganism. Our proprietary yeast strains are currently used in the production of more than 30 billion litres of ethanol globally each year, delivering higher yields, greater efficiency, and more sustainable use of feedstocks, natural resources and energy.

We welcome this inquiry into the sugarcane bioenergy sector and wish to highlight how targeted biotechnological innovation, particularly improvements to fermentation yeast, can contribute meaningfully to the development of cost-competitive, low-carbon liquid fuels and protein-rich by-products in Queensland.

MicroBioGen has actively contributed to Australia's bioenergy dialogue through over a decade of engagement with the Australian Renewable Energy Agency (ARENA), and regular participation in industry conferences.

Sugarcane-Based Ethanol as a Strategic National Asset

Sugarcane offers a unique opportunity for Queensland to lead in renewable fuel production, including sustainable aviation fuel (SAF) through the alcohol-to-jet (ATJ) pathway. Ethanol from sugarcane is already widely produced around the world and is a proven precursor to low-carbon jet fuel.

However, to remain globally competitive and ensure economic and environmental viability, the efficiency of sugar-to-ethanol conversion must improve. This is where optimised yeast plays a critical role.

[1] ***Saccharomyces cerevisiae*** is a well-characterised yeast species widely used in industrial biotechnology. It serves as a safe and efficient microbial platform for producing biofuels, pharmaceuticals and food ingredients, and is central to innovations in sustainable manufacturing and the bioeconomy.

MicroBioGen's Contribution

MicroBioGen has developed a suite of advanced industrial yeast strains that deliver major benefits to the bioethanol industry. Our robust yeast strains are designed to:

- Efficiently convert both first-generation (1G) sugar juice and second-generation (2G) biomass-derived sugars, improving the economics of existing infrastructure.
- Perform reliably under stressful conditions such as organic acid build-up, elevated temperatures, and osmotic stress, reducing plant interruptions and operational costs.
- Shorten fermentation times and tolerate higher ethanol levels, improving throughput and lowering operating expenses.
- Achieve more complete sugar conversion under stress, lowering residual sugars and reducing carbon intensity.
- Produce high-protein yeast biomass that contributes to Australia's protein supply with minimal additional land or water use.

In partnership with Novonesis (formerly Novozymes), MicroBioGen has already commercialised 11 yeast products for starch-based ethanol production worldwide. Building on this success, we are now developing strains specifically optimised for sugarcane and cellulosic feedstocks.

Pathways for Sustainable Ethanol in Australia

There are three viable pathways for producing sustainable ethanol in Australia, either for direct use in fuel markets or as feedstock for future "alcohol-to-jet" (ATJ) fuel production:

Pathway 1: Integrated Non-GM Biorefineries

Recent R&D by MicroBioGen has demonstrated at both laboratory and pilot scales that sugarcane processing residues (bagasse) can be converted into ethanol, high-protein yeast biomass, and potentially renewable process heat. This work presents a model for fully integrated, 2G non-GM "food and fuel" biorefineries[2] in regional Queensland, enabling the simultaneous production of fuel and food from non-food lignocellulosic sources. If adopted, this non-GM approach could position Queensland as the first region globally to deploy this innovative technology.

Pathway 2: GM Yeast for 2G Biorefineries

An alternative pathway mirrors successful international deployments in countries such as Brazil and India, where sugarcane residues are being commercially converted into ethanol using GM

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[2] **Non-genetically modified (non-GM) biorefineries** use microbial strains enhanced without genetic engineering. MicroBioGen's proprietary technology platform applies directed evolution to improve complex traits, such as heat and acid tolerance and growth on alternative substrates, that involve many genes and cannot be reliably engineered using conventional GM techniques.

yeast strains[3]. These 2G integrated biorefineries demonstrate both the technical viability and economic feasibility of producing ethanol as the primary output from lignocellulosic feedstocks. While these facilities are already operational and producing ethanol, the complexity of the process typically results in higher production costs compared to conventional ethanol derived from sugarcane juice alone.

Pathway 3: Optimising Existing Ethanol Facilities (1.5G)

MicroBioGen has developed innovative technology to improve ethanol production at existing facilities that use sugarcane juice. This approach, referred to as 1.5G, enhances first-generation processes by converting low-value side streams, such as vinasse[4] or dunder, into additional ethanol and high-protein yeast biomass. Proprietary yeast strains are cultivated on these residual streams and then used to recover remaining sugars that would otherwise be wasted. This results in a more cost-effective and sustainable ethanol production process, generating both fuel and valuable co-products, such as high-protein functional feed, without requiring major infrastructure changes.

MicroBioGen is actively exploring opportunities to deploy this technology in Queensland and welcomes collaboration with local growers, processors, and government stakeholders to establish pilot-scale biorefineries.

Relevance to the Inquiry Terms of Reference

Term 1: Sugar cogeneration

While MicroBioGen does not directly operate cogeneration assets, our yeast solutions improve the value extracted from sugarcane, making co-located bioenergy generation (electricity and fuels) more commercially attractive.

Term 2: Barriers to bioenergy production

Fermentation performance is a key constraint. Many conventional yeasts cannot fully utilise the range of sugars available from sugarcane (especially 2G sugars) and are prone to failure under industrial stress. MicroBioGen strains overcome these barriers, reducing process downtime and increasing biofuel yield. Globally, several large-scale facilities have successfully implemented 2G ethanol production from sugarcane residues, validating the technical and economic potential of these pathways. MicroBioGen is also the only company in the world that has developed the “fuel and feed” biorefinery concept for 2G processes or sugarcane juice biorefineries.

[3] **Genetically modified (GM) biorefineries** use microorganisms engineered to introduce specific traits, such as expressing foreign enzymes or novel pathways. This approach is complementary to MicroBioGen’s non-GM platform technology, and MicroBioGen’s collaboration with Novonesis demonstrates how combining non-GM robustness and versatility with GM precision can deliver world-leading industrial yeast performance.

[4] **Vinasse** is a liquid byproduct from the distillation of ethanol, typically from sugarcane or sugar beet. When derived from sugarcane, it's also called dunder.

Term 3: Defence fuel needs

Ethanol-derived jet fuel (ATJ) offers a scalable pathway to domestic SAF production. Our yeast technology boosts ethanol output per tonne of cane, which directly supports Defence resilience objectives and domestic fuel security. MicroBioGen's yeast strains also enable the economic use of second-generation feedstocks, addressing sustainability concerns around first-generation ethanol.

Term 4: De-risking investment

MicroBioGen's success in attracting over A$8 million in Australian Government R&D funding over the last decade or so demonstrates how targeted support can unlock innovation and deployment. Future policy could include:

- R&D and commercialisation grants
- SAF blend mandates or procurement incentives
- Credit mechanisms for low-carbon fuels and co-products

Term 5: R&D agenda

Yeast strain development for diverse, low-cost feedstocks is essential. MicroBioGen's R&D pipeline focuses on:

- Utilisation of bagasse, xylose[5], glycerol and other 2G or side streams
- Protein-rich by-product development
- Fermentation optimisation to reduce water and energy usage

Term 6: Strategic land use and regional development

MicroBioGen's yeast strains enhance sugarcane conversion efficiency, enabling greater economic output from existing land without expanding agricultural area or competing with food production.

Key benefits include:

- Higher ethanol yields per tonne of cane
- Co-production of high-protein yeast biomass
- Enhanced sustainability and lower cost ethanol from 1G sugar juice with the valuable high value single cell protein as a by-product.
- Improved utilisation of lignocellulosic residues like bagasse
- Alignment with global benchmarks, where integrated sugarcane biorefineries have demonstrated the commercial viability of second-generation ethanol and co-product recovery

These innovations support regional development by boosting processing value, job creation, and export potential, without requiring land-use change.

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[5] **Xylose** is a type of sugar found in the fibrous parts of plants, especially in hemicellulose, a major component of plant cell walls. Unlike glucose, which is easily fermented by most yeasts, xylose is more challenging to convert into ethanol.

Term 7: Grower benefits

More efficient ethanol production increases the value per tonne of cane, benefiting growers and processors alike. Co-product opportunities such as high-protein yeast biomass open diversification pathways that do not compete with land or food crops.

Term 8: Food vs fuel

MicroBioGen's platform supports "food and fuel" models by producing both biofuel and high-protein food or feed from sugarcane residues. For example, one study estimated that a single sugar mill using this approach could produce as much protein as 15,000 hectares of soybeans.

Conclusion

Queensland is well positioned to lead in the development of integrated, sustainable sugarcane bioenergy systems. MicroBioGen's innovations in yeast biotechnology offer proven, low-risk tools to improve efficiency, reduce emissions, and diversify outputs. Global precedents in 2G ethanol production from sugarcane residues confirm that the technologies proposed by MicroBioGen are not only innovative but also commercially deployable.

This submission has been authorised by MicroBioGen's Chief Executive Officer and reflects the position of the company's executive leadership. MicroBioGen consents to the publication of this submission, including the names of the authorised contacts, on the committee's inquiry webpage.

Summary of Recommendations

Focus Area	MicroBioGen's Contribution
Strategic Value	Yeast innovation enhances ethanol yield and supports SAF production from sugarcane.
Technology Pathways	1. Non-GM 2G biorefineries 2. GM yeast for 2G ethanol 3. 1.5G side stream optimisation
Grower & Regional Benefits	Higher cane value, protein-rich co-products, no land-use change, regional job creation
Food vs Fuel	"Food and fuel" model: ethanol + high-protein yeast biomass from sugarcane residues
Defence & Fuel Security	Supports domestic SAF via ATJ pathway; boosts resilience with 2G feedstock utilisation
Barriers Addressed	Overcomes fermentation inefficiencies and industrial stress limitations
Policy Recommendations	R&D grants, SAF mandates, low-carbon fuel credits
R&D Priorities	Strain development for bagasse, xylose, glycerol; fermentation efficiency; protein co-products