Sugarcane Bioenergy Inquiry 2025

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7 October 2025

Mr Stephen Bennett MP
Chair
Primary Industries and Resources Committee
Member for Burnett
Parliament House
Brisbane QLD 4000

PIRC@parliament.qld.gov.au

Dear Mr Bennett,

RE: Inquiry into Sugarcane Bioenergy Opportunities in Queensland

As recognised by the announcement of this Queensland Government Inquiry, the sugar industry in Queensland is looking to increase profitability through diversification and at the same time, increase sustainability. Isis Central Sugar Mill Company Ltd (ICSM) and Wide Bay Pacific recently completed a project funded by Sugar Research Australia (SRA) that examined the feasibility of using the mill's waste streams to grow micro-algae for supplemental income.[1]

A significant emerging problem is the sustainability, cost and reliability of a diesel fuel supply to operate the harvesting, transport and processing of the cane crop. Diesel is required for the cane trains, transport trucks and the cane harvesters and haulers, as well as for farm machinery used to grow the crop. It is not feasible to re-capitalise all of this equipment for another fuel source e.g. by going electric or hydrogen. The cost of electrification would be far in excess of what the industry could afford. Renewable-diesel has been shown to be a sustainable and feasible substitute to enable the operation of these reliable diesel engines used for producing, harvesting, transporting and processing the crop.[2]

This season, approximately 34 millions tons of cane will be processed in Australia, from Queensland and northern NSW. For every ton of cane transported it has been estimated 1.1 litres of diesel is required, a total of ~37.4 million litres. At a conservative price of $1.60 per L, this costs nearly $60 million and represents ~2% of the industry's value. Imagine if all of that fuel could be produced sustainably and locally, near each of the 22 sugar mills, instead of relying on imported petrochemicals. Numerous publications state that current micro-algae production of bio-diesel is a minimum of ~1,500 gallons of fuel per acre per year (~14,000 litres per ha). In the case of ICSM, milling 1.5 million tons of cane per year, all of the bio-diesel fuel required for the harvest could be produced from just 117 ha of ponds, worth $2.4 million @ $1.60 per litre.

1 https://sugarresearch.com.au/publication/cane-matters-summer-2024-25/

2 https://farm-energy.extension.org/history-of-biodiesel/

Queensland's Zero Emission Vehicle Strategy recognises that "Biofuels provide an immediate decarbonisation option for heavy vehicles and long-haul freight and passenger transport (including within the rail, aviation and maritime sectors)". However, there are very few proposed developments under this strategy, in this field.[3]

It is well known that bio-diesel can be produced from micro-algae. Since the 1990's the governments of the USA and Europe have invested significantly into bio-fuel and jet-fuel sustainability programs and micro-algae research.[4] Many of these programs are coming to fruition and the bio-fuel industry in the USA has rapidly developed and has also expanded into new areas, most recently micro-algae.[5]

Not so well know is that Sustainable aviation fuel (SAF) can also be produced from micro-algae[6], which are rich in lipids that can be converted into biofuels like fatty acid methyl esters (FAME). Micro-algae are an attractive feedstock due to their rapid growth, ability to capture carbon dioxide during photosynthesis, and capacity to grow without competing for arable land, food or requiring large amounts of freshwater. The process typically involves cultivating microalgae, extracting the lipids, and then converting them into a jet fuel-compatible form, often using hydrothermal liquefaction (HTL) and hydrotreatment.

The cultivation of micro-algae basically requires four inputs; water, nutrients, carbon dioxide, energy (for processing) and sunlight. Four of these inputs are waste or sustainable energy streams from sugar mills and the last is free. When these mill waste streams are utilised to produce a very valuable product there are two benefits. Firstly, it makes a mill's operation more sustainable with respect to waste management; by reducing the level of nutrients and carbon dioxide being discharged. Secondly, the micro-algae product provides another valuable income stream for the mill and other potential benefits, which can include renewable-diesel production and/or other bio-fuels e.g. SAF.

During the crushing season the nutrient-rich waste-water produced by the ISIS Central Sugar Mill is in excess of 2 megalitres per week. At the moment this waste water is filtered through green-growth before settling in freshwater dams prior to release into the Gregory River catchment. Our SRA-funded study showed that this nutrient-rich waste water can be used to grow valuable freshwater species of micro-algae at very low cost, which would reduce the nutrient load prior to release sufficient to meet strict discharge controls. Excessive nutrient releases into the GBR catchments can result in expensive fines for sugar mills from the EPA.

Freshwater micro-algae species that can be grown include those grown for nutraceuticals as well as their oil content; *Chlorella*, *Spirulina* and *Euglena.* Very valuable markets already exist for these products so a scale-up of production can initially aim at these high end markets. As production grows, new high volume markets can be unlocked, where algae could replace fossil feedstocks across food, feed, bioplastics, and SAF. That's where the real impact of this project will take place; providing significant supplemental income to the mills, and at the same time increase a mill's environmental sustainability by using its waste products; excess nutrients, CO2 and water.

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3 https://www.publications.qld.gov.au/dataset/zeroemissisonvehiclestrategy

4 https://afdc.energy.gov/fuels/laws/BIOD?state=US

5 https://farm-energy.extension.org/algae-for-biofuel-production/

6 https://uop.honeywell.com/en/news-events/2021/november/honeywell-technology-enables-first-jet-flights-with-sustainable-aviation-fuel-produced-by-microalgae

To efficiently grow microalgae, a source of ~ 100% clean CO_2 is required to maximise algae growth. While it is possible to use CO_2 from the flue gas, most large-scale algae farms use bottled CO_2, which becomes a major production cost (~ 50% of the cost of production). When micro-algae is grown on-site at the mill this cost is minimised, making the whole process more economically viable.

Along with other developments in the sugarcane bio-economy, e.g. where bagasse has become a valuable commodity for compost and related products, the economic sustainability of sugar production will be significantly enhanced by this project, with no impact on the current production systems. Production of renewable-diesel through growth of micro-algae using sugar mills' waste streams is an emerging commercial opportunity, to source natural and sustainable carbon-negative biological products which replace carbon-positive petrochemicals and other unsustainable products. The micro-algae oils become another source for the production of SAF and will fit neatly into other SAF production projects. In doing so, micro-algae will reduce the increase in greenhouse gasses by using and sequestering carbon dioxide through these bio-industrial processes. Investment in this project would be eligible for funding through the recently announced $5 billion Net Zero Fund.[7]

Thank you for the opportunity to submit our project to this inquiry. I would accept the opportunity to present in person to the Primary Industries and Resources Committee if requested, and look forward to the Committee reporting the results of this inquiry to the sugar industry of Queensland.

Best regards,

Dr Clive Keenan

Managing Director

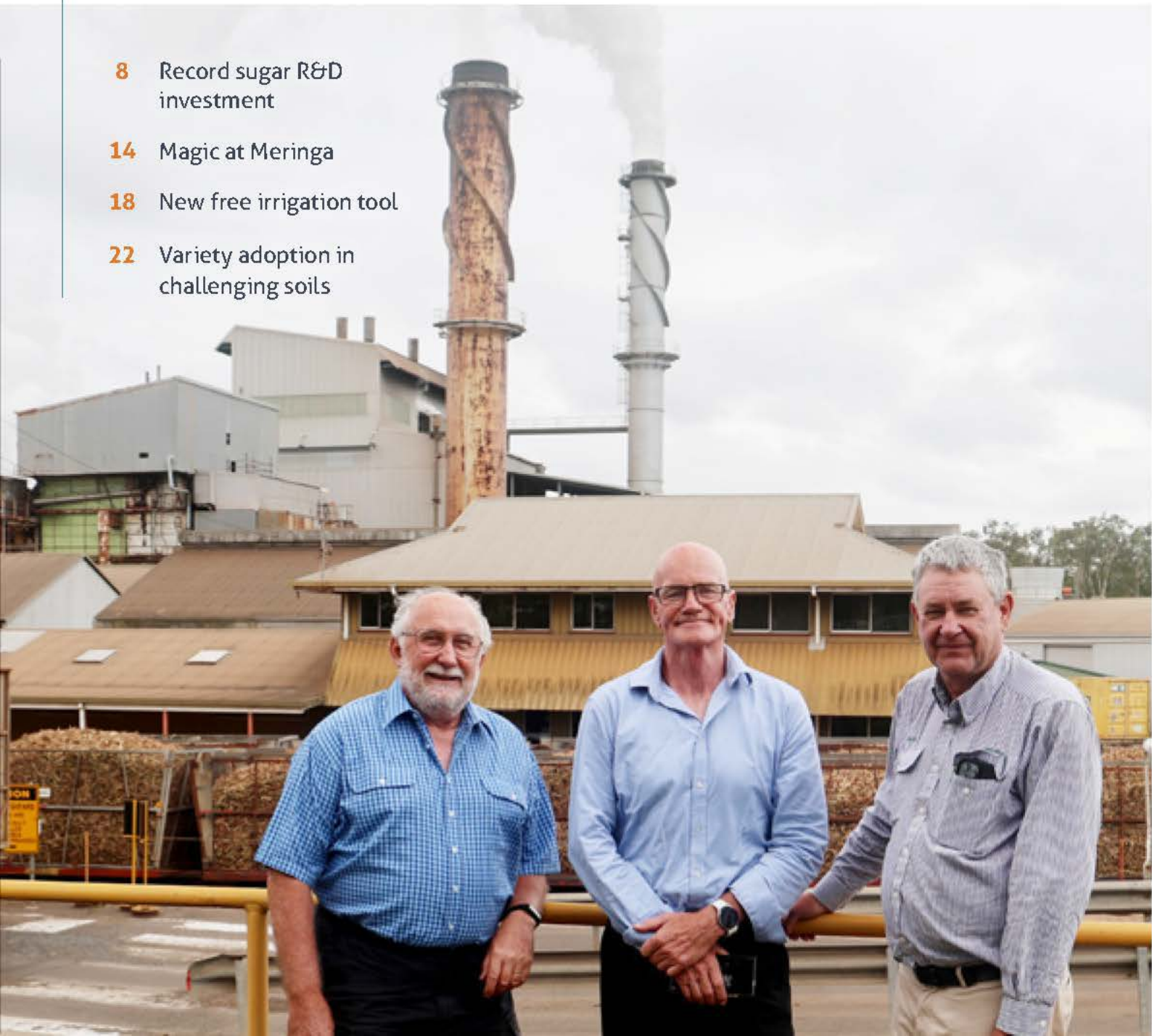
Wide Bay Pacific Pty Ltd

7 https://www.innovationaus.com/canberra-tips-5b-into-industrial-net-zero-push/

Sugar Research Australia

Cane Matters

Summer 2024/25



PROMISING START TO A MICRO-ALGAE PRODUCTION PROJECT

Sugar mills in some regions are addressing the challenge of declining cane volumes by investigating alternative sources of income to assist the business to meet maintenance and operational requirements.

Isis Central Sugar Mill Co. Ltd (ICSMC) has been considering a number of diversification options with the proviso that they do not affect core sugarcane milling operations and are able to provide financial and operational synergies within the existing business.

This includes finding projects that assist in using existing waste streams to provide profitable outcomes beneficial to the business or to solve existing problems. In Isis Mill's case, waste streams do not include bagasse which is used in the co-generation of electricity for the grid.

However, the Gregory/Burrum River catchment has been classified as a catchment of the Great Barrier Reef, and standards of discharge water quality must always meet the federal government's Reef 2050 Water Quality Improvement Plan targets.

After careful examination of many alternatives, ICSMC determined that algae production was a feasible option for a diversification project that would provide two useful functions for Isis Mill.

Freshwater algal species can absorb excess phosphorus and nitrogen in waste water. In addition, among many useful products made from algae, it can be grown to make biofuels i.e. renewable diesel which can be used to operate harvesters and transport equipment used in processing the sugarcane crop and farm machinery used to grow the crop.

Renewable diesel can be integrated into the mill's existing distribution infrastructure as an alternative to fossil fuel diesel with only minor diesel engine modifications.

In addition, production of algae would not affect the Isis Mill's core sugarcane processing operations.

A number of successful algae production factories are already underway overseas.

ICSM proposed an algal biomass and low-carbon liquid fuel (LCLF) production model to diversify and add value to its operations.

The mill approached Wide Bay Pacific Pty Ltd, a company actively involved in algae production in the Bundaberg region to assist in assessing this idea.

ICSM wants to use both the mill's wastewater and flue gas to support microalgae production for protein-rich biomass for human and stock food, and for biofuel production.

Step one in the project was to investigate if the opportunity was a way to address existing bottlenecks for algal biomass and bio-diesel production in the current market.

An additional project will be needed to use process modelling software to evaluate material and energy balances.

Overall, the results of modelling studies highlighted the potential for scaled-up production of biomass, biofuels and protein products by cultivating high-protein microalgae.

The studies also found that challenges in income, fuel yields, operating costs and carbon intensities for algal systems could be significantly improved by using the mill's wastewater and CO_2.

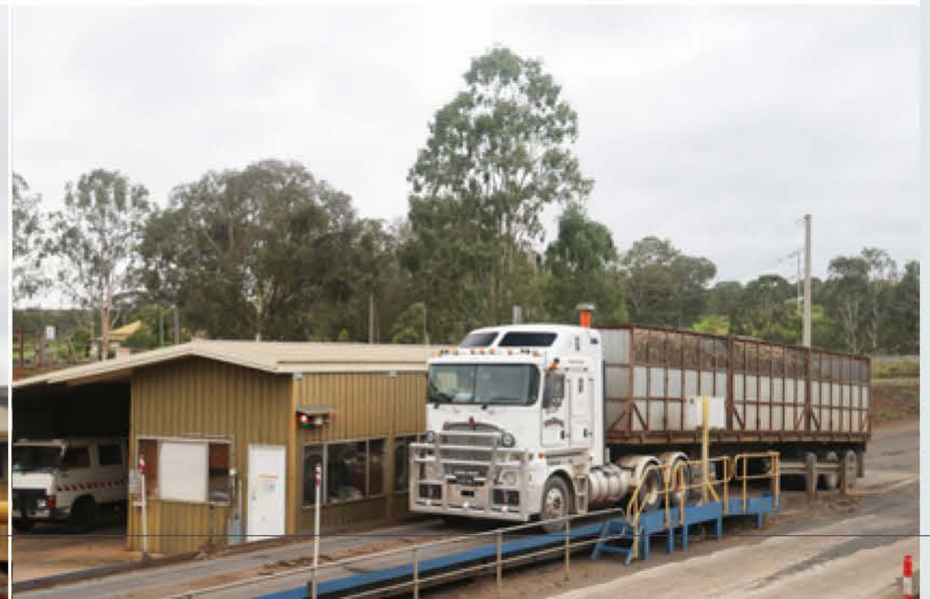
They concluded that the production of lipid extracted algae protein was an important factor to lower the mean biofuel selling price.

A financial model predicted the establishment costs for a 10 hectare farm and associated processing plant to be about $4 million with income from production after the second year assisting in the capital costs of establishing a 105 ha micro-algae farm with production bringing in an annual profit of $12.4 million after 2030.

A joint venture has been proposed between ICSM and WBP but details have not yet been finalised.

A fully developed Life-Cycle Assessment, Mass and Energy Balance assessments and full Techno-Economic Analysis was outside the scope of this project.

Pictured below (L-R) Wide Bay Pacific consultants Clive Keenan and Malcolm Prowse, with Isis Central Sugar Mill CEO Craig Wood at the Isis Mill.



HARVEST MATE: FREE ONLINE TRAINING AVAILABLE NOW

Free online training is now available for Harvest Mate – the free best practice support tool designed to help cane growers and harvesting contractors to capture additional cane and sugar yield through harvesting practice change.

Available online and via a smartphone app, Harvest Mate was developed and funded over three years by Sugar Research Australia (SRA) and the Department of Primary Industries (DPI) with the support and input from hundreds of sugarcane growers.

It looks at yield improvements and lowering harvesting costs in green cane harvesting, by identifying the harvest practice which is the most profitable and suitable for growers' and harvesting contractors' businesses.

The tool is based on the findings from green cane harvesting trials across the industry and has been met with positive responses from growers and harvesting contractors. If you'd like to try Harvest Mate but don't know where to begin, free online training is now available.

All you need to do is to log into SRA's Learning Management System (LMS) which is hosted on the platform Talent LMS.

You may already have login details from undertaking the Online Sugarcane Nutrient Management program. Otherwise, you will have to set up your login. The course is listed in the catalogue next to SIX EASY STEPS®. There are only two courses on offer at the moment – but more are coming!

The training is introductory and simply guides growers and contractors on how to use the app.

SRA encourages growers and contractors to use Harvest Mate to help identify more profitable harvesting options. For more information, please visit: https://sugarresearch.com.au/research-development/harvest-mate-project/

SRA acknowledges the invaluable research contribution by economists from the Queensland Department of Primary Industries (DPI) for the development of this tool, as well as funding from DPI for its delivery.

Queensland Government