

Innovation: Powering Future Industries



MC: Dr Christine Williams



A/Professor Esteban Marcellin (UQ)



A/Professor Joshua Watts (QUT)



Dr Ruby Michael (Griffith University)



Mr David Johnston (General Manager, Jet Zero Australia)

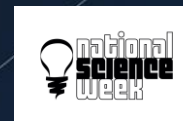


Professor Peter Talbot (Executive Director, Feline Pty Ltd)



Mr Chris Baker (Founder and Director, Sunshine Hydro)

Queensland Future Conversations



Re-building soil and plant ecosystems

Dr. Ruby Michael

Ecological Engineering Lecturer, School of Engineering and Built Environment

Founding Director Green Infrastructure Research Labs (GIRLS), Cities Research Institute

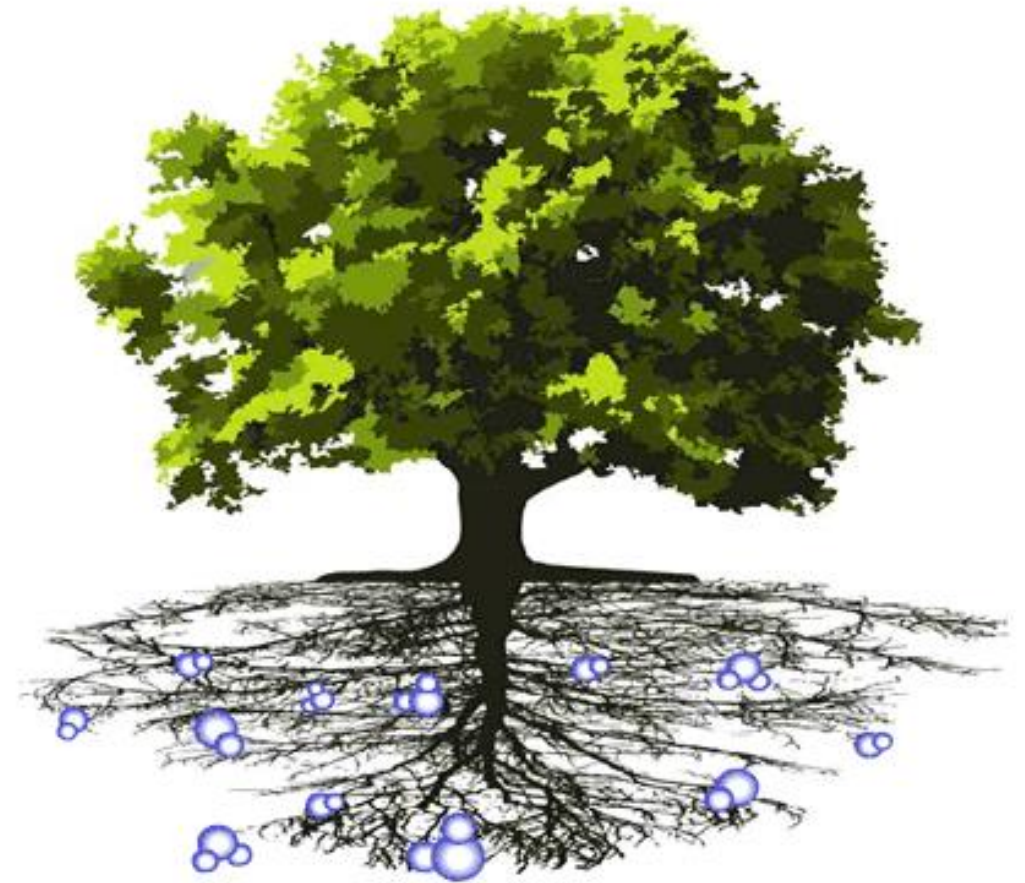
Griffith University

Queensland Future Conversations



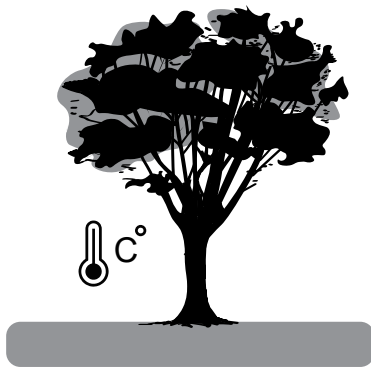
Today's conversation: **Powering Future Industries**

- Infrastructure / engineering performance and economic benefits
- Ecological / biodiversity / environmental / hydrological benefits
- Human connection / recreation / equity benefits





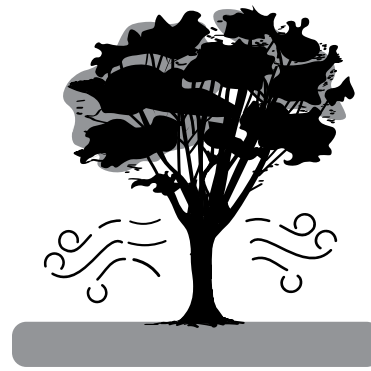
Shading



Cooling



Biodiversity



Air Quality



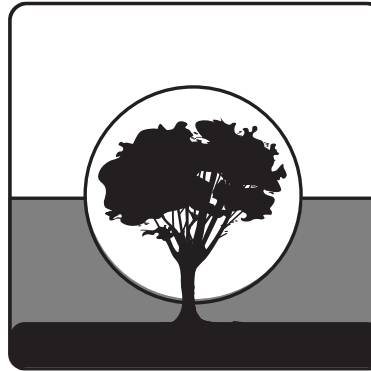
Aesthetics



Equity



Urban Resilience



Culture

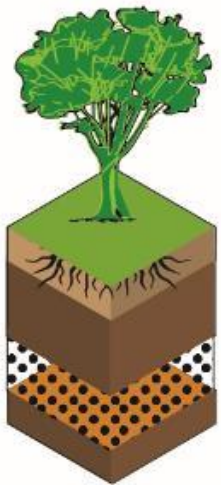
Benefits

- Water and air quality improvement
- Climate regulation and cooling
- Stormwater management and flood prevention
- Resilient local food production
- Safe waste containment
- Enhancement of regional character and sense of place
- Health and well-being, and connection to country

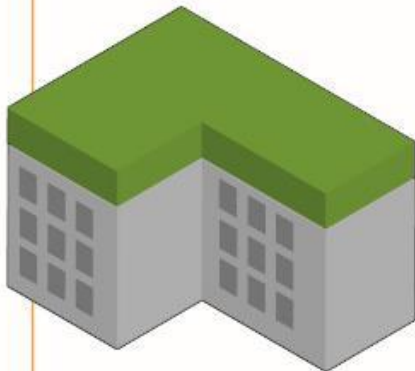
Green Infrastructure Research Labs (GIRLS)

“committed to the reinstatement of soil and plant ecosystems back into our cities, rooftops, former industrial sites and wastelands”

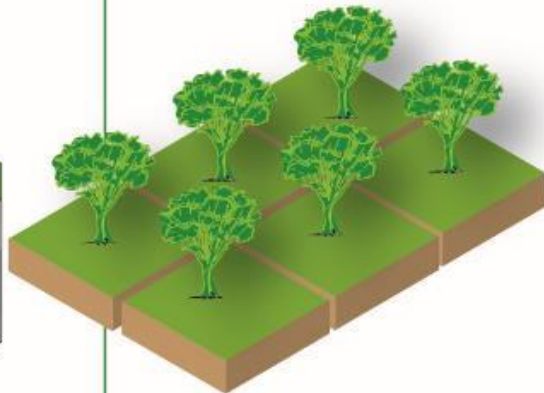
Phytocapping



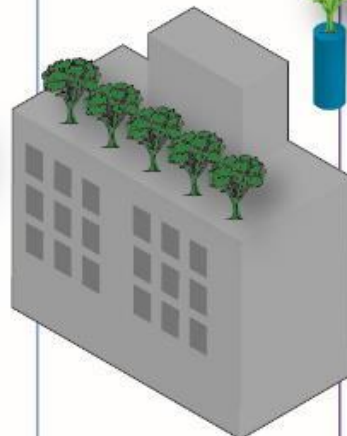
Green Roofs



Large scale Phytocapping



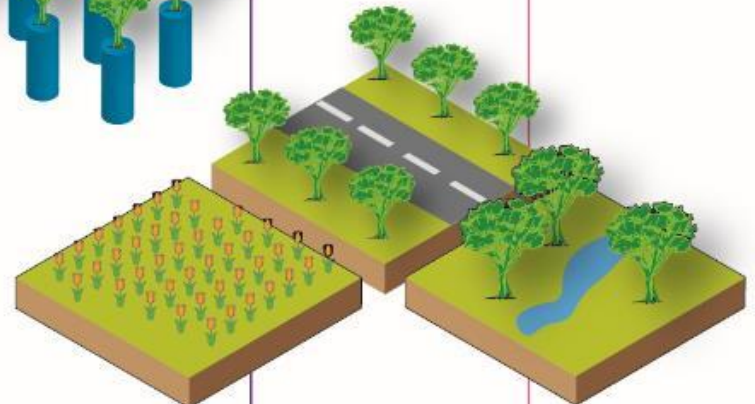
Trees on Buildings



Phytointerception



Wildflower Meadows



Bio-Retention Systems

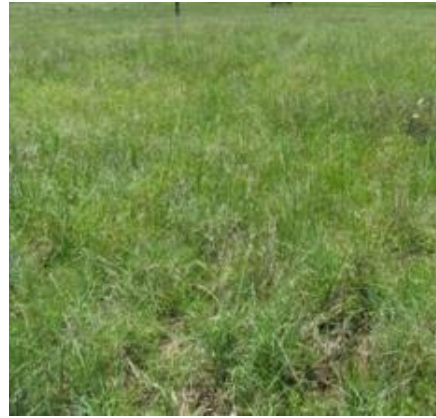
There are different shades of Green...



Fake grass



Blue couch



Native tussock
grassland



Unmowed grass



200 years to develop a
small hollow, bigger
hollows much longer

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→ Increasing ecological benefit

Phytocapping - a nature-based engineering solution that turns landfills into urban forests



Nov 2019



March 2021

Green Infrastructure



Urban Forest by Aria

3 Key Takeaways

We need to rebuild soil-plant ecosystems:

- 1. From the micro to the macro scale, with interconnections between them for movement of pollinators and fauna
- 2. There are different shades of green. We need to incorporate plants native to our region as the highest priority
- 3. We need ecology to be built into everything we do. **Retaining** the benefit and value we have and **re-building** what we have lost

Dr. Ruby Michael

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<https://www.griffith.edu.au/cities-research-institute/research/girls>

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Building Better Batteries

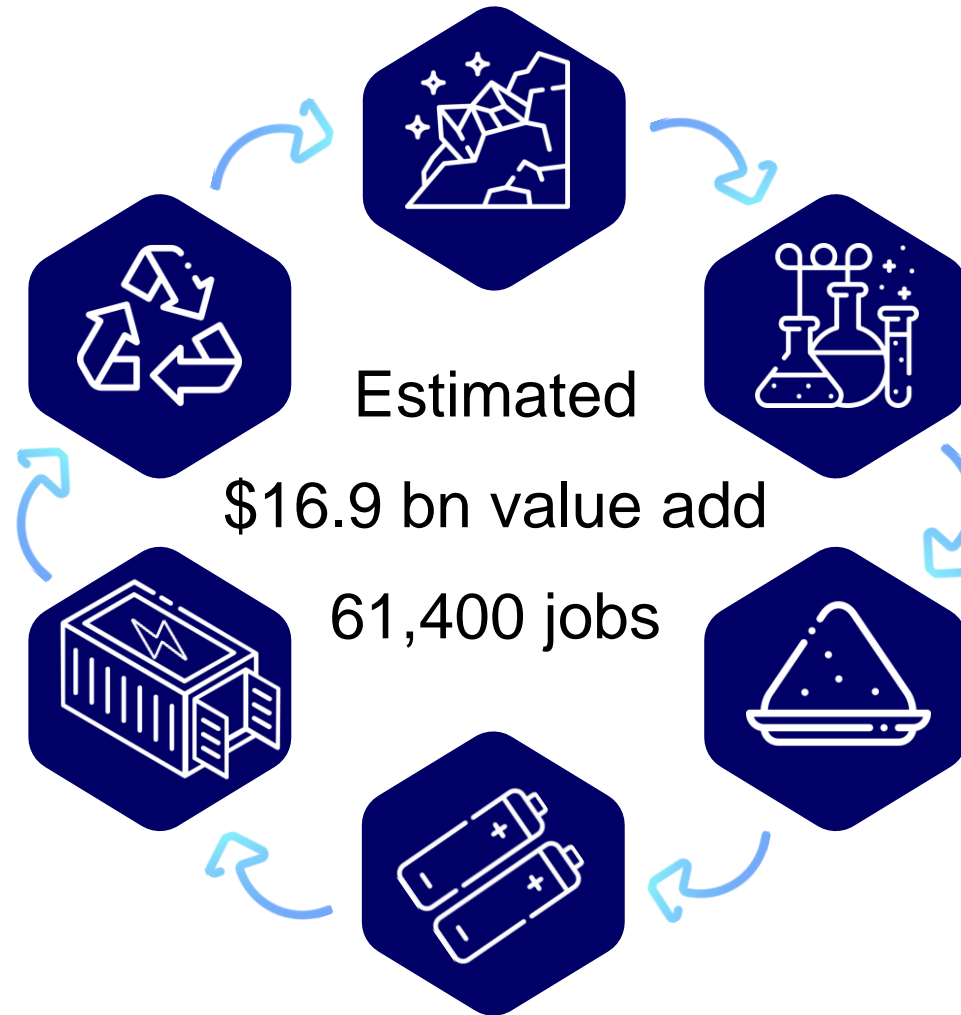
A/Prof Joshua Watts

QUT Energy Storage Research Group

Queensland Future Conversations



Queensland's Opportunity to Innovate



QUT Advanced Battery Facility (ABF)



Laboratory and pilot-scale synthesis capabilities for battery active materials e.g. LFP, NCM, solid-state electrolytes



Fabrication/prototyping of standardised cell formats at pilot-scale – coin, cylindrical, single/multilayer pouch



Battery materials/cells/systems research, development, testing and qualification – Li-ion, Na-ion, SSEs, RFBs etc



A renewable energy Battery Testing Microgrid (BTM) with a 100 kW roof-top solar PV array – up to 250 kW testing



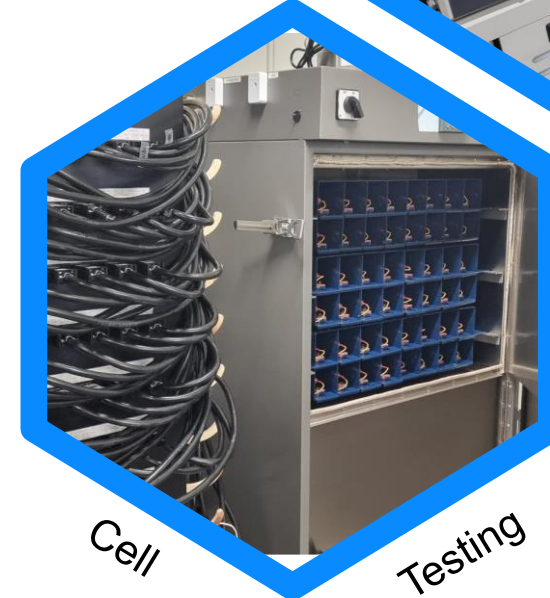
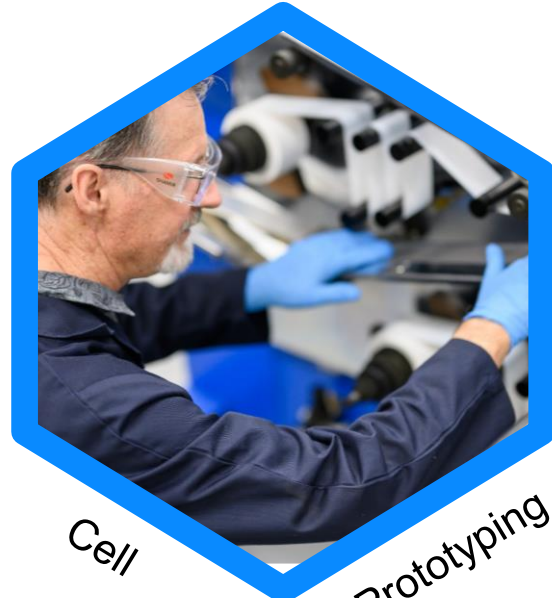
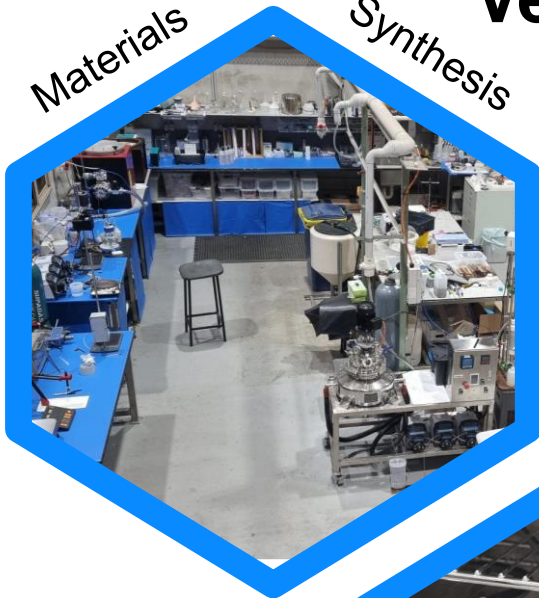
A training facility for Li-ion and RFB battery component and cell production, prototyping and testing



A curated test results database for battery materials/cells/systems performance under standardised conditions



Vertically Integrated Battery Value Chain at Pilot Scale



Si-PV 99kW



125 kW/400 kWh
Lithium-ion BESS



Gas Generator



Wind



AC Load Bank



Battery Testing Microgrid

Power Grid – Level 1

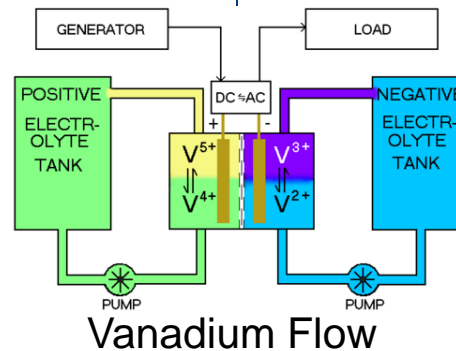
Battery Testing Grid – Level 2



Lithium



Sodium Sulfur



Vanadium Flow



Iron Flow



Zinc Bromine

Queensland Energy Storage Technology Hub – QUEST Hub



- ~\$50M total project value – cornerstone action of the Queensland Battery Strategy
- Develop world-class energy storage research facilities in support of battery industries
- Focus on battery materials/component research, development and testing

- Redox flow battery testing and qualification laboratory enabling research and development on vanadium and iron-based electrolytes from Australian mineral resources
- R&D and scale-up support for production of Li-ion cathode materials made from Australian critical minerals
- Development of membranes for enhanced safety Li-ion batteries and redox flow batteries to enable domestic manufacturing improved membrane products
- Dedicated industry incubator spaces for industry partners to work with QUT staff to develop prototyping and pilot-scale manufacturing capabilities for translation to large-scale commercial operation
- Development of enhanced power conversion systems
- Generation of a destructive battery testing facility in collaboration with QFES located at the Whyte Island Live Fire Campus
- Training and graduate programs in battery energy storage and clean energy practices



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3 Key Takeaways

1. *Queensland has a strong opportunity to value add and innovate along the way*
2. *Queensland has nation-leading battery research and testing capabilities*
3. *Queensland can lead the way and support nationally*



Thank You!

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Enabling the Bioeconomy:

a path to Sustainable Aviation fuel in
Queensland

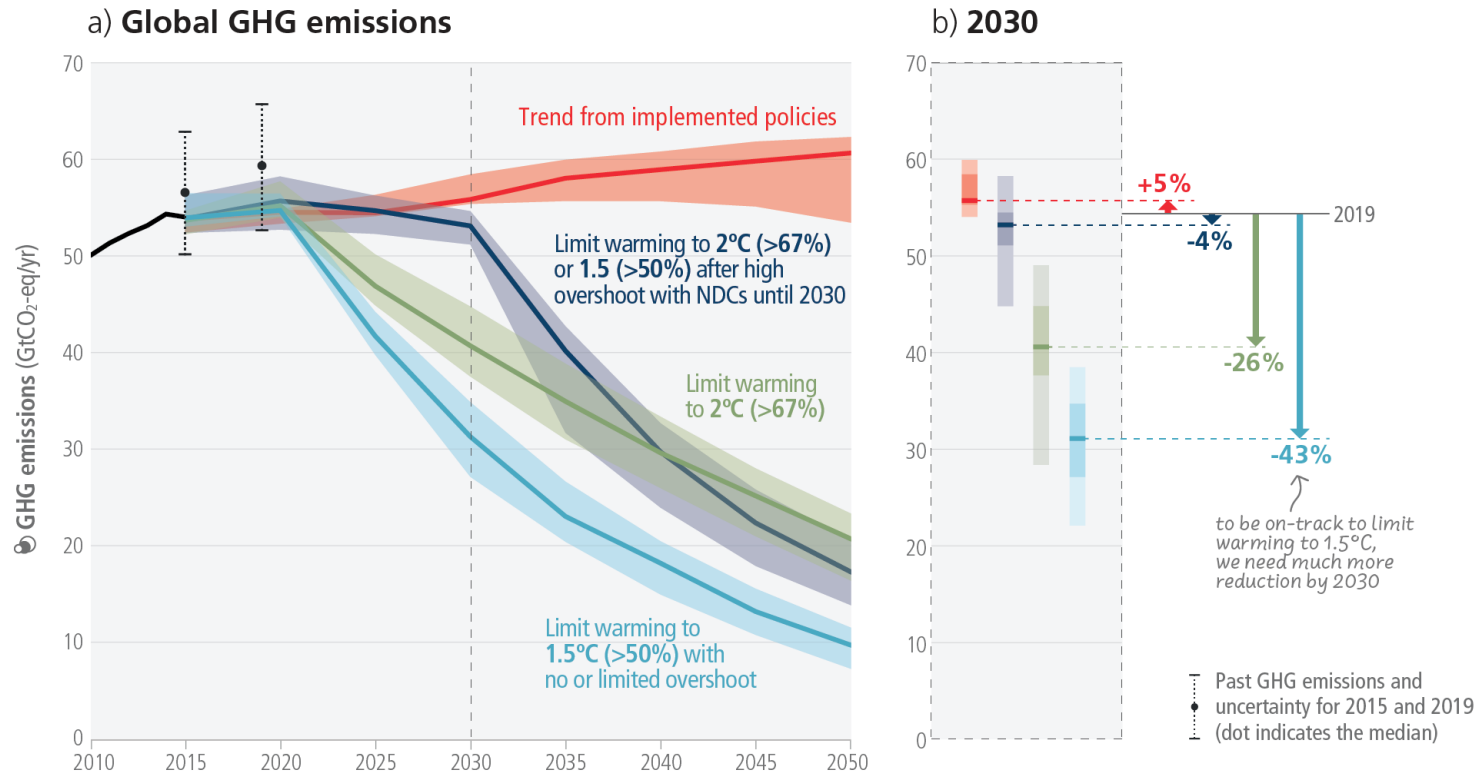
A/Prof. Esteban Marcellin

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Global warming of 2°C will be exceeded during the 21st century unless deep reductions in CO2 and other GHG emissions occur in the coming decades.

Projected global GHG emissions from NDCs announced prior to COP26 would make it *likely* that warming will exceed 1.5°C and also make it harder after 2030 to limit warming to below 2°C



IPCC AR6 SYR

Decarbonizing aviation

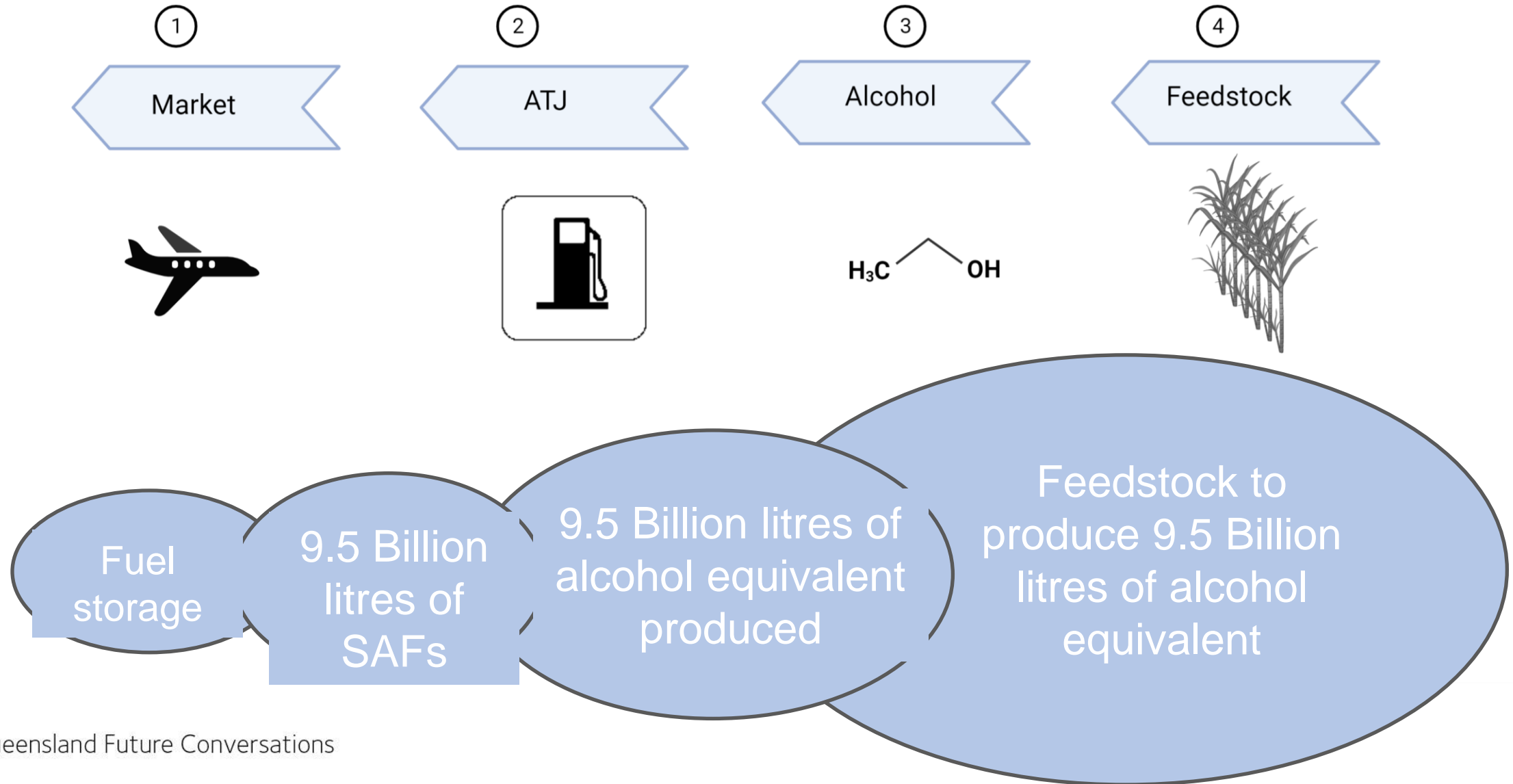
- The sector is hard to abate because of unique requirements, including weight and size constraints, long innovation cycles, prioritization of safe operations, and because key technologies, such as SAFs, are relatively costly and have not been adopted at scale.

McKinsey 2022

Let's look at some numbers

- Australia consumed a maximum of 162.55 thousand barrels per day in 2018, that is ~9,500,000,000 L of Aviation fuel.
- In 2017 Australia produced a record 317 million liters of ethanol in 2017, down last year to 175 million.
- So to replace only ten percent of Australia's Aviation fuel requirement we need to triple Australia's record ethanol production. Unfortunately that calculation considers that all ethanol is converted into SAF, but that is wrong. The number is likely to be in the order of 6 times.

Australian Aviation fuel demand



Waste resources

- Agricultural waste



- Industrial waste



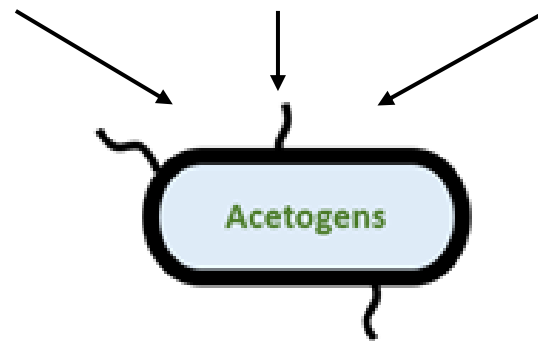
- Municipal waste



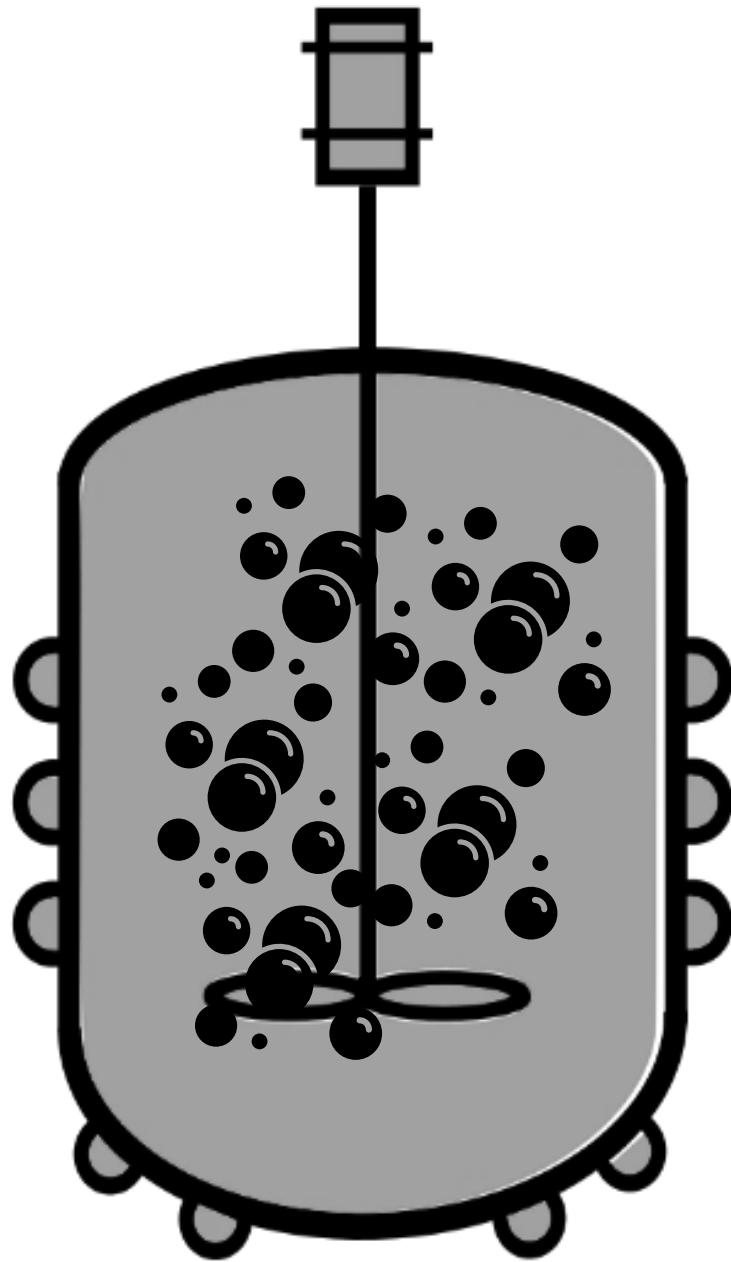
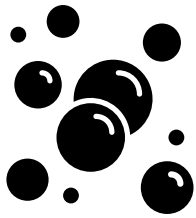
CO

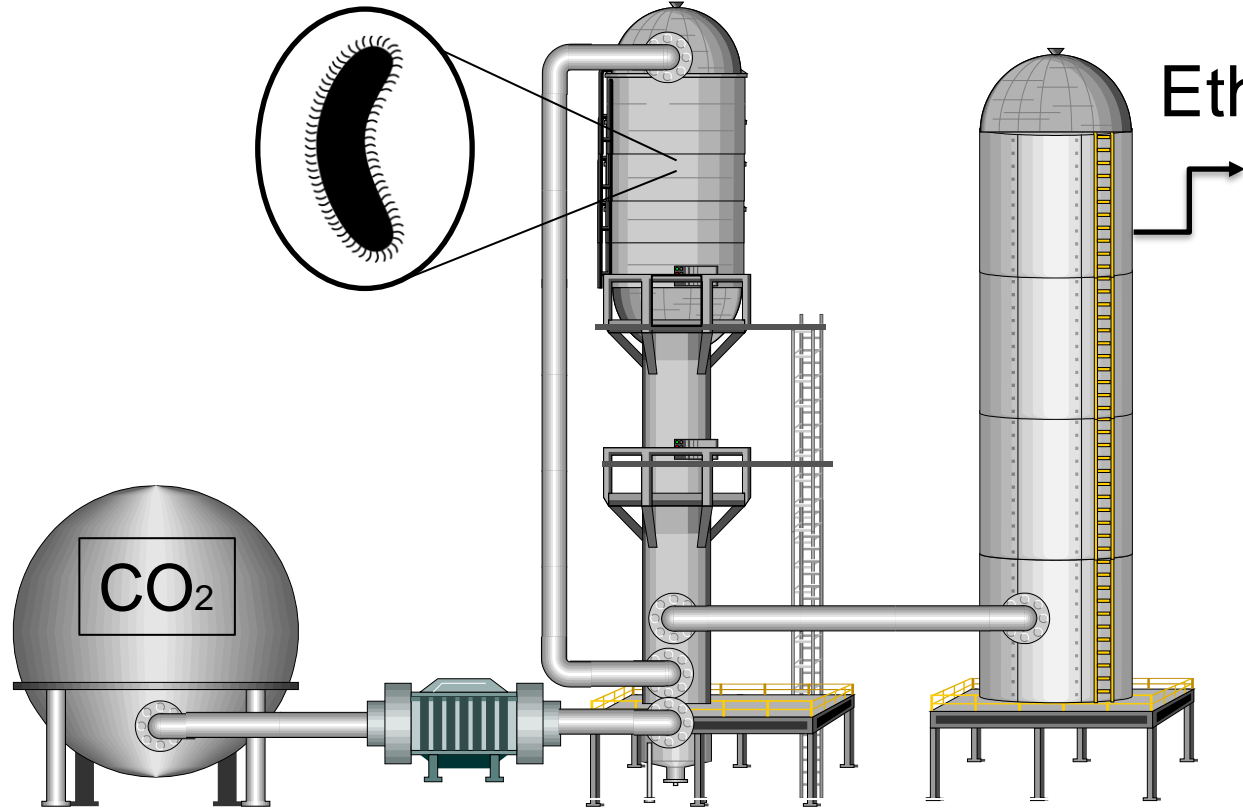
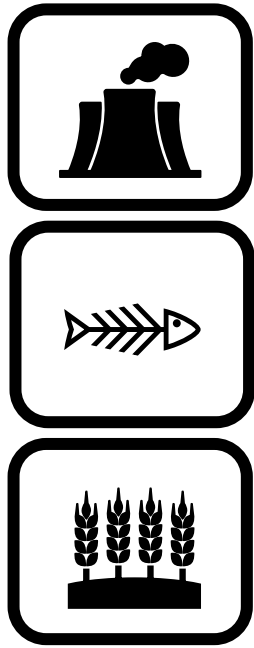
CO₂

H₂



Gas fermentation facility

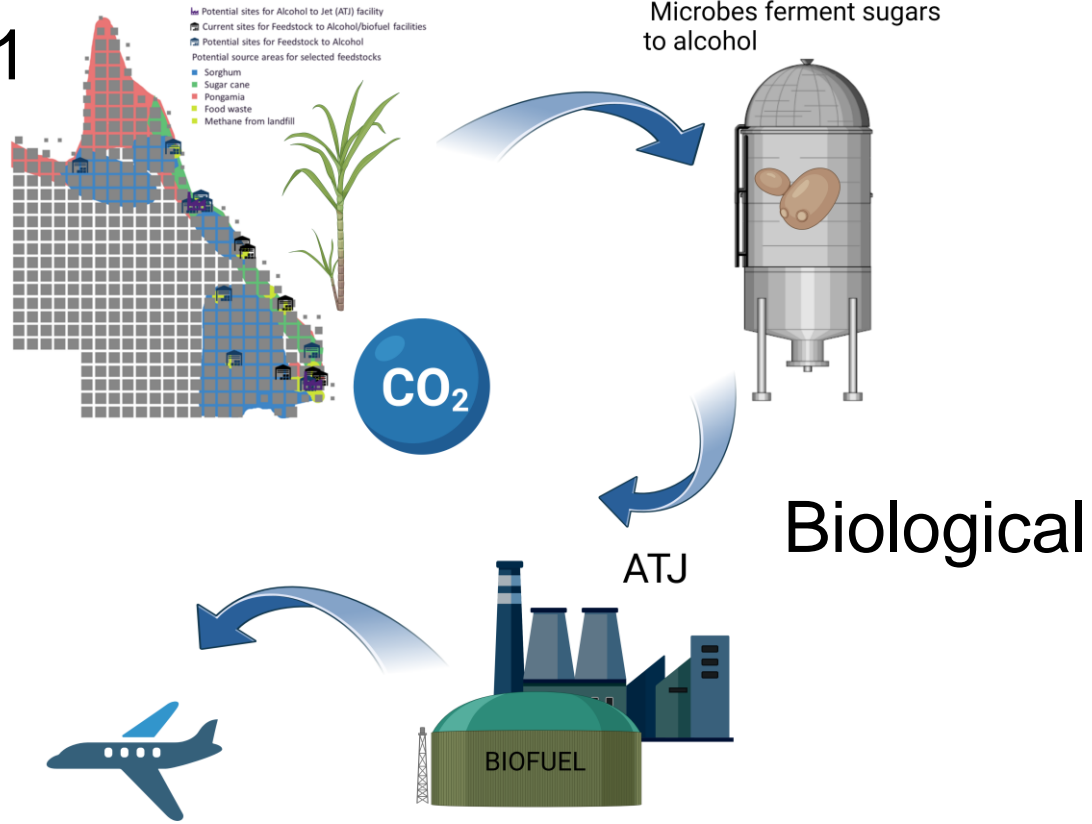




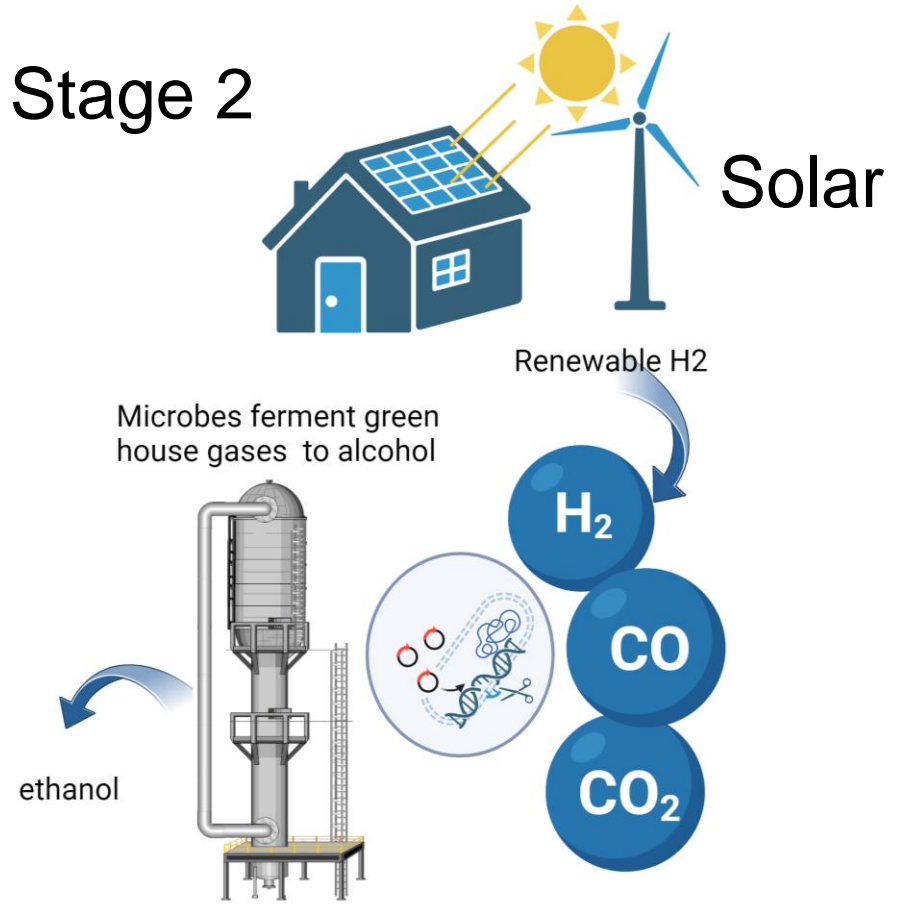
Gas fermentation

A possible path to SAFs in Queensland

Stage 1



Stage 2



Catalytical

Why Queensland?

- Access to abundant feedstocks
- Sucrose is one of the most cost-effective feedstocks for synthetic biology as it is immediately utilisable/ digestible by microorganisms engineered for industrial production.



- Supporting Infrastructure
- Full network of facilities that can support the entire design-build-test cycle of synthetic biology



- Research Expertise
- Home to leading Universities in research and commercialization.



3 Key Takeaways

- *The aviation sector is a challenging sector to decarbonize and we need strong legislation that set targets to enable the transition.*
- *Queensland is uniquely positioned to produce Sustainable aviation fuels for Australia and the world with the correct support.*
- *A combination of Biological, catalytical, and solar solutions are needed to produce the amount of SAF needed which can only be achieved through a collaboration between industry, the government, and research institutions.*



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Queensland Future Conversations



Expert Q&A



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