This article was published in The Canberra Times on 14 October 2025.
Read the published version here: https://www.canberratimes.com.au/story/9086209/australias-e-fuel-opportunity-leading-the-green-shift/

The secret to making Australia a green fuel export superpower

Bin Lu, Kate Lawrence

ANU Institute for Climate, Energy & Disaster Solutions

E-fuels made from sunlight could do more than cutting emissions from aviation and heavy-duty transport. They could open a new export industry, positioning Australia as a global leader in green fuels and speeding up the world's transition towards net zero emissions.

Petroleum fuels have long underpinned our modern economy. Each year, Australians use about 50 million tonnes[1] of oil, mostly to keep cars, trucks, planes, and ships moving. Transport contributed nearly 100 million tonnes of carbon emissions in 2024–25, accounting for 22% of the nation's total emissions.

Electric vehicles are growing rapidly, with about 75,000 sold in Australia over the first three quarters of 2025. They will help cut demand for petrol and diesel. But planes, ships, and heavy trucks are a different story. They still rely on fuels with high energy density to travel hundreds to thousands of kilometres. For aviation, in particular, there's no scalable substitute for jet fuel yet.

The Federal Government has just released its *Transport and Infrastructure Net Zero Roadmap and Action Plan*. The roadmap sets out how transport could decarbonise over the coming decades. It points to several transition pathways for aviation: battery-powered aircraft, hydrogen-powered aircraft, and sustainable aviation fuels (especially biofuels from crops, wastes, and agricultural residuals).

This is a welcome step in mapping aviation's low-carbon transition. Yet in the long term, the most promising pathway to net-zero emissions in the aviation industry is using e-fuels, not biofuels. As solar electricity keeps getting cheaper, these synthetic fuels could become commercially viable at scale, driving a deep cut in aviation emissions.

What are e-fuels?

Think of e-fuels as fuels made from sunlight. They're synthetic hydrocarbons made by converting renewable electricity into liquid fuels using power-to-liquid technologies. E-fuels can go straight into today's jet engines as a drop-in substitute for jet fuels.

The key ingredients of e-fuels are hydrogen and carbon dioxide (CO_2). Hydrogen comes from splitting water via electrolysis, while CO_2 is captured either directly from the air or from industrial sources, such as cement factories.

---

[1] Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2025

E-fuels are close to carbon-neutral when powered entirely by renewable energy. Hydrogen and CO_2 are combined to produce hydrocarbons that release roughly the same amount of carbon during fuel combustion as was captured during fuel production.

E-fuels vs. batteries, hydrogen and biofuels

One big advantage of e-fuels is that they work with today's aircraft. E-fuels can be used as a direct replacement for existing fuels. Airlines could continue using the same engines and refuelling infrastructure. That makes them much easier to adopt across existing fleets than alternatives including batteries or hydrogen.

Battery- and hydrogen-powered aircraft would require entirely new designs, and they remain impractical for long-haul flights due to their lower energy density by volume compared to existing fuels.

E-fuels also benefit from abundant raw materials. Hydrogen feedstock is made from sunlight (solar electricity) and water. It requires only a small amount of water compared to fossil fuel production. Carbon feedstock can be sustainably sourced in various ways, particularly from direct air capture.

In contrast, aviation biofuels are constrained by limited feedstock. Growing energy crops competes with food and feed production for land. Importantly, biomass is far less efficient at turning sunlight into usable energy. Crops capture about 1% of solar energy. By comparison, photovoltaics can convert more than 20% into electricity, which means e-fuels offer a far more efficient way of turning sunlight into jet fuel.

Can e-fuels ever be affordable?

Right now, e-fuels are still expensive. Making them is energy intensive. Both ingredients, CO_2 and hydrogen, require large amounts of energy to obtain. Because of this, energy costs account for about three-quarters of the production cost of e-fuels. Today, synthetic jet fuel costs €6.8–9.4 per kilogram (A$12–17/kg).[2] That's roughly 10 times the price of conventional jet fuel, which is under €1 per kilogram.

But this could change dramatically. Over the past 15 years, solar electricity has fallen in price by 90% globally.[3] Australia's ultra-low-cost solar initiative aims to cut costs even further to 30 cents per watt by 2030, just one-fifth of today's level. If achieved, it could slash the cost of e-fuels and bring them closer to cost parity with conventional jet fuels.

There's one more challenge: e-fuel production needs energy supply around the clock, not just when the sun is shining. The solution is to combine solar generation with energy storage. Solar electricity can be stored as hydrogen or heat, both far cheaper than using

---

[2] European Union Aviation Safety Agency (EASA), 2024
[3] International Renewable Energy Agency (IRENA), 2025

big batteries at industrial scale. By coupling ultra-low-cost solar with these cheap storage options, Australia could unlock a low-cost reliable energy supply chain that makes e-fuels economically viable at scale.

How big could the e-fuel market become?

The potential is enormous. Today, Australia uses about 10 million tonnes of petroleum fuels each year for aviation, shipping, and some heavy road transport. By 2050, as the population rises to 32–38 million projected by the Australian Bureau of Statistics, the demand could reach 15 million tonnes a year.

Replacing those fossil fuels with e-fuels would require about 400 terawatt-hours of electricity, twice the total consumption in today's National Electricity Market. That, in turn, could drive the need for 200 gigawatts of solar panels, compared with 42 gigawatts installed at the time of writing.

And that's only to meet Australia's own demand. With its vast land and world-class solar resources, Australia could take it a step further by building a 1000-gigawatt solar industry to support e-fuel exports.

Reference List

Department of Climate Change, Energy, the Environment and Water. 2025. Australian Energy Update 2025. Available at: https://www.energy.gov.au/publications/australian-energy-update-2025

European Union Aviation Safety Agency (EASA). 2024. 2024 Aviation Fuels Reference Prices for Refuel. Available at: https://www.easa.europa.eu/en/document-library/general-publications/2024-aviation-fuels-reference-prices-refueleu-aviation

International Renewable Energy Agency (IRENA). 2025. Renewable Power Generation Costs in 2024. Available at: https://www.irena.org/Publications/2025/Jun/Renewable-Power-Generation-Costs-in-2024