November 29, 2023

Director, Aviation White Paper Project Office
Aviation White Paper
Department of Infrastructure, Transport, Regional Development, Communications, and the Arts

Via Email to aviationgreenpaper@infrastructure.gov.au

RE: Aviation Green Paper

Dear Director,

LanzaJet appreciates the opportunity to comment on the Aviation Green Paper and hopes that our responses are helpful in developing the forthcoming Aviation White Paper.

LanzaJet is an industry-leading sustainable aviation fuel (SAF) producer using a proprietary alcohol-to-jet (ATJ) process to convert any source of low-carbon ethanol into ASTM-compliant SAF and renewable diesel. Following a decade of technology development and demonstration, LanzaJet was launched in 2020 with a clear mission—to scale the SAF market and enable decarbonization of the aviation sector. To that end, we are finalizing construction of a first-of-a-kind, 38 million litres per year commercial scale SAF facility in Soperton, Georgia, U.S., with construction scheduled to be complete in late 2023. LanzaJet's equity investors include LanzaTech, Suncor, Mitsui, British Airways, and Shell, and financial support has been provided by ANA and Microsoft.

LanzaJet is keenly interested in the development of a domestic SAF industry in Australia. In partnership with Jet Zero Australia and with support from Qantas Group, Airbus, and the Queensland Government, we are developing a 100 million litres per year SAF production facility in Queensland, supporting emissions reductions in one of Australia's hardest-to-abate industries.[1] With this project, we have taken vital first steps toward:

- harnessing Australia's robust agricultural sector with new market opportunities;
- onshoring the economic benefits of domestic production of transportation fuels;
- job creation and investment in regional Queensland;
- increasing Australia's liquid fuel security; and
- helping Qantas meet its ambitious goal of using 10% SAF by 2030 and reaching net zero emissions by 2050.

But fully realizing these goals will require additional support from the Australian Government.

The SAF industry is still in its early stages. There are now eight ATSM certified pathways and another seven undergoing the certification process, but much remains to be done to commercialize those pathways and scale up production. LanzaJet's ATJ technology is currently one of the only fully scalable options ready to be deployed commercially. Building new industries that leverage innovations like ATJ is inherently risky and challenging, but the immense potential benefits to Australia's economy and environment—laid out in

[1] *See* https://www.lanzajet.com/sustainable-aviation-fuel-readies-to-take-flight-in-australia/

the Australian Renewable Energy Agency's (ARENA) Bioenergy Roadmap[2], the Aviation Green Paper, and the CSIRO Sustainable Aviation Fuel Roadmap[3]—justify necessary policy support at the federal level.

In the absence of policy, Australia is at a global disadvantage as project developers, investors, and capital are drawn to jurisdictions where SAF policy has been in place for some time and provides a significant incentive to develop and invest in projects. While that remains the case, Australia will continue to be largely an exporter of feedstock. By 2030, the global SAF industry is projected to be worth USD $20 billion.[4] However, this value will primarily flow to countries with policies that support the production and use of SAF.

The opportunity for Australia is well understood. By encouraging, through appropriate policy support, the development of SAF production capacity and the domestic use of that fuel, Australia stands to benefit from value added manufacturing, the creation of skilled and well-paid jobs, foreign investment, liquid fuel security, improved local air quality and the decarbonization of aviation – a hard to abate sector.

Moreover, time is of the essence. Pre-covid, the world consumed 360 billion litres of jet fuel annually, however in 2022 global SAF production totaled 450 million litres. For the aviation sector to achieve its 2050 net zero goals, 65 percent of emissions cuts will need to come from SAF.[5] To achieve this, a significant and rapid deployment of production capacity will be needed over the coming decades. The scale of this challenge cannot be achieved without strong policy support from governments around the world, including Australia.

Question: How can Government work with industry to ensure a strong and sustainable aviation sector that supports emissions reduction targets while growing jobs and innovation?

To build a successful domestic SAF industry—one that both produces and consumes SAF in Australia—LanzaJet recommends a four-pillar policy framework.

Policy Pillar 1: Access to grant funding for early-stage project development activities.
LanzaJet recommends that the Australian Government provide additional funding for the continuation of ARENA's Sustainable Aviation Fuel Funding Initiative. Doing so will provide important financial support to help advance SAF projects toward final investment decisions (FID). Project development, including front-end engineering design, is inherently risky, but especially so for newer innovations such as LanzaJet's ATJ process. As such, the market underprovides the necessary capital to move projects along. We applaud existing efforts to fill this gap—specifically the ARENA's SAF Funding Initiative[6]—and we encourage the Australian Government to continue and expand such programs. Furthermore, we encourage the Government to look to the UK Advanced Fuels Fund as an example of an effective program that appropriately prioritizes support for advanced technologies.[7]

LanzaJet recommends ARENA's SAF Funding Initiative be continued for a further five years with an annual funding commitment of $50 million.

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[2] *See* https://arena.gov.au/assets/2021/11/australia-bioenergy-roadmap-report.pdf
[3] *See* https://www.csiro.au/en/research/technology-space/energy/sustainable-aviation-fuel
[4] *See* Coherent Market Insights Report, July 2023
[5] *See* IATA - Sustainable Aviation Fuel (SAF)
[6] *See* https://arena.gov.au/funding/sustainable-aviation-fuel-funding-initiative/
[7] *See* The UK Advanced Fuels Fund

Policy Pillar 2: Access to low-cost, deployment focused capital for pioneer projects.
LanzaJet encourages the Australia Government to establish a dedicated funding program (administered by ARENA) to support the deployment of scalable SAF production capacity and get the first projects financed and built. SAF production facilities are capital intensive and, like any new technology, command a risk premium from investors. Australia has already invested heavily in solutions for other sectors, such as carbon capture and green hydrogen.[8] LanzaJet urges the Government to consider establishing such a grant program with funding equivalent to the $2 billion Hydrogen Headstart initiative that was announced in the 2023-24 Federal Budget.

Large capital grants play a pivotal role in reducing investment risk, catalyzing additional private capital, and getting the first commercial-scale SAF projects built. For example, the USD $50 million (AUD $75 million) grant that LanzaJet received from Breakthrough Energy Catalyst for our Freedom Pines Facility in Georgia was critical to financing our facility, maintaining construction timelines, and speeding up LanzaJet's journey to commercialization in the United States. Furthermore, had LanzaJet needed to otherwise finance that capital, it would have added USD $0.80 per gallon (AUD $0.32 per litre) to the cost of production.

As noted by the CSIRO Sustainable Aviation Fuels Roadmap, SAF supply chains are complex regional partnerships of actors, materials, technologies, and infrastructure. They are not immediately easy to replicate in other contexts. We believe that grants should be made available to enable these pioneering projects.

Policy Pillar 3: An enduring mandate or incentive to ensure Australia is globally competitive.
To ensure that SAF produced in Australia is also consumed in Australia, LanzaJet encourages the Australian Government to send a strong, durable demand signal. As noted in the Aviation Green Paper, an Australian SAF industry will develop in an international context. Some markets, such as the United States, Europe, and others, have already established demand-side policies that draw SAF and feedstock supply from around the world, and others will soon follow. As a result of these policies, Australia is a large exporter of SAF feedstocks. Australian airlines—in particular Qantas—have strongly signaled their ambition and desire to incorporate SAF into their operations through their procurement abroad and investments in production at home. Ensuring that Australian airlines can compete for supply domestically requires that Australia be globally competitive and follow other developed economies by establishing either an appropriate SAF mandate or stackable production incentive. Without a demand-side policy, any SAF produced in Australia is likely to be exported to markets with such policies in place and offer greater value.

A volumetric blending mandate is simpler and most likely the quickest to implement. In the interest of time, the Australian Government should consider whether this is a good starting point with a policy that transitions to more flexible credit-based mechanism that offers low cost of abatement.

In this context, the gold standard is a low carbon fuel standard (LCFS) requiring carbon intensity reductions coupled with a volumetric requirement. Both pieces are essential to effective policy design. The carbon intensity mandate establishes a performance-based and technology neutral eligibility mechanism. The volumetric requirement ensures that the policy stimulates demand and supply of SAF, rather than out-of-sector alternatives like offsets or renewable fuels for ground transportation.[9] For an example of an LCFS

[8] *See* here for an overview of recent budget appropriations.
[9] Support for renewable diesel is important—both for decarbonizing ground transport and because they are a byproduct of SAF production. However, because renewable diesel is a mature technology, it is typically cheaper to produce and can pull investment away from SAF.

coupled with a volumetric mandate, we suggest that the Department review the new regulations soon to be enacted in British Columbia.[10] Alternatively, an aviation LCFS can be sector-specific, in which case volumetric SAF requirements would not be needed so long as the policy requires compliance units only within via aviation fuels.

An LCFS with a modest SAF blending requirement has three key advantages. First, an LCFS creates a level playing field among buyers, so that willing leaders like Qantas can move toward their ambitious goals without the threat of being undercut by competitors when market conditions shift. Second, if calibrated correctly, LCFS credit prices can draw supply—both foreign and domestic—to ensure that Australian airlines can compete for access in the global market. And third, because mandates create planned increases in market size over the long term, they contribute to the investment signal, supporting not just domestic consumption but also domestic production.

Absent mandates, LanzaJet encourages Australia to provide incentives for SAF production. Production-based incentives, such as the tax credits in the U.S. Inflation Reduction Act (IRA) can help bolster the voluntary SAF market, especially when stacked with other state and local incentives. To be most effective, incentives must be stackable with state-based incentives,[11] stable—lasting at least ten years—and they must match, as closely as possible, the incentives provided for SAF in competing markets abroad.

While the Aviation Green Paper identifies both mandates and incentives as potential policy options, LanzaJet believes that mandates in the form of an LCFS offer more benefits. From a policy design perspective, market-based regulatory programs like LCFS programs tend to offer the benefits of durability—providing a long-term investment and supply contracting environment—while also retaining flexibility. In California, the long standing LCFS program has been instrumental in driving uptake of renewable fuels for ground transport (and may soon obligate jet fuel as well[12]). Much of its success lies in the fact that the California Air Resources Board has amended the program—for example, adjusting rules, increasing pace and ambition—in response to changing market conditions. Incentives, by contrast, are difficult to set at the outset, given volatility of prices for both conventional jet fuel and credit markets abroad, and tend to be more rigid because they are less responsive to market conditions and often require further legislative support for extension or adjustment.

LanzaJet also believes that some of the concerns with mandatory targets are overstated. Specifically, the Aviation Green Paper identified criticisms that mandatory targets might impose "unnecessary costs on industry given the current SAF pricing differential."[13] It is our view that at the very minimal initial blend levels imposed by SAF mandates in many jurisdictions, the additional cost of procurement will be minimal within the volatility of jet fuel prices. A recent study by LEK Consulting determined that even assuming SAF costs remain twice as high as conventional jet fuel in 2050, a 65% SAF requirement would only impact ticket prices by 18%. Accordingly, a much more modest initial mandate in Australia—in the range of 2-10% by 2030, in line with EU and UK proposals--could be expected to have minimal impacts on jet fuel

[10] *See* British Columbia Aviation Fuel Regulation Intentions Paper. The regulations go before Cabinet in December 2023, and if approved will be in force in January 1, 2024.
[11] For example, the NSW Government is considering the inclusion of SAF in an expanded NSW Renewable Fuel Scheme.
[12] *See* the 2023 CARB Standardized Regulatory Impact Assessment review of the impacts of obligating intrastate jet fuel obligation.
[13] *See* Aviation Green Paper, page 86.

costs and consumer prices when considered across the entire jet fuel pool in Australia.[14] Further, as airlines are primarily concerned with paying the same price as jet fuel as their competitors, a SAF mandate creates a level playing field in the Australia market and will not result in competitive distortions. LanzaJet encourages the Australian Government to collaborate with airlines and other stakeholders to undertake more rigorous analysis of the market impacts of potential policy options. We are happy to support efforts to build the record on this front.

Other mechanisms that the Australian Government may consider is the design of a reverse auction scheme similar to that recently announced for Australia's electricity market to replace the Renewable Energy Target. Such an approach has the advantage of shifting the cost burden from end customers (and passengers) to the Government's budget.

Policy pillar 4: A technology-agnostic, performance-based mechanism for qualifying SAF

LanzaJet recommends that the Australian Government ensure that the way SAF is qualified under any new mandate or incentive is performance based and technology neutral.

LanzaJet believes that the standard for SAF performance should be carbon intensity, and that carbon intensity should be measured using existing models and standards that rely on updated data. Early SAF policies in many jurisdictions have seen extended debates over model choice, sub-mandates for particular production pathways, or exclusion of certain feedstocks due to concerns around indirect land use change. However, existing models like Argonne National Lab's Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET) model[15]—the basis of the California LCFS--already incorporate those impacts into their calculations, ensuring that performance-based policies will not incentivize the commercialization of pathways with significant indirect impacts. The effect of excluding certain feedstocks independent of their GHG performance has not been to boost SAF performance; rather, it has incentivized continued investment in the ground transportation sector and delayed the scale-up of the SAF industry by injecting uncertainty and, in some cases, excluding the earliest and only viable SAF options from the market at the outset.

We recommend that the Government learn from these experiences in order to avoid them. Specifically, we suggest working closely with industry, and particularly with companies like LanzaJet that have experience building SAF production facilities, as well as with other governments that have experience regulating them, to create eligibility schemes that are performance-based and aligned with international markets. The Australian Government should also ensure that existing national schemes, such as the Guarantee of Origin (GO) scheme and the National Greenhouse and Energy Reporting (NGER), align with standards in other jurisdictions.

[14] See https://www.lek.com/insights/sus/global/sr/fuelling-future-aviation

[15] See GREET: The Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model | Department of Energy

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Thank you for the opportunity to comment on the Aviation Green Paper. Please don't hesitate to reach out if you have any questions.

Sincerely,

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