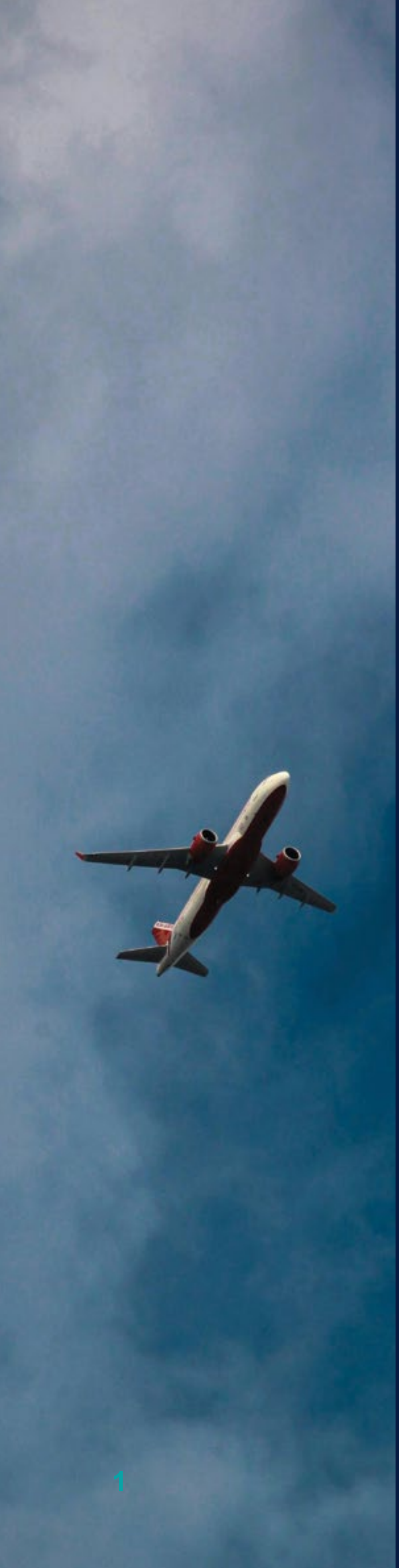
Cyan Ventures

Ready for take-off?

Exploring choices and economic impacts for sustainable aviation fuel in New Zealand

July 2025 Report

BOEING



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About Cyan Ventures

Cyan Ventures (www.cyanventures.com.au) is a specialist sustainability project development and advisory firm. We build and advise on the businesses and projects that will accelerate the shift to a green, low carbon economy. Our mission is to accelerate and broaden the transition to a low carbon, green economy. We aim to make 20 years progress on the sustainability transition in less than 10 years. We do this with an inter-disciplinary team of leading strategists, project developers, and researchers.

Acknowledgements

We would like to thank the many participants who kindly gave their time to this research, including airline manufacturers, aviation companies, fuel suppliers, project developers, and government officials. We would like to thank Air New Zealand and Boeing for their support for this project. The final report and conclusions are those of Cyan Ventures.

Sustainable Aviation Fuels (SAF)

SAF are an alternative to jet fuel made from fossil fuels and meet the same quality specifications. They are 'drop-in' fuels that do not require any changes to aircraft, engines, or infrastructure and do not affect safety or performance within globally specified blend limits. Their defining feature is that they are produced from non-fossil fuel feedstocks that have absorbed carbon dioxide (CO2) in their recent lifetime, such as waste oils and fats or forestry and crop residues. The industry is nascent, but more than 190 countries have agreed via the International Civil Aviation Organisation (ICAO) to expand the use of SAF, including New Zealand.

Scene Setting

Aviation is crucial for New Zealand's success as a geographically isolated market. Air-freighted trade is 16% of exports by value; tourism is over 6% of GDP and employs 1 in 9 New Zealanders.

Securing aviation fuel is therefore critical for New Zealand's economic success. National jet fuel use is expected to grow by more than 90% by 2050 to meet travel and trade needs.

New Zealand has an opportunity to secure aviation fuel from different feedstocks and countries. In future, up to 100% of national jet fuel needs could be met by a mix of Sustainable Aviation Fuel (SAF) produced from domestic feedstocks and imported from other countries ramping up their SAF supply.

New Zealand has an opportunity to support delivery of its aviation climate commitments. Over 190 governments, including the New Zealand government, have committed to net zero aviation emissions by 2050 via the United Nations. Progress towards this goal relies heavily on SAF.

Other countries are implementing SAF policies to advance their national interests. Around 45 countries are committed to SAF policies including all of New Zealand's top ten trading partners.

SAF use has economic risks and opportunities. SAF is currently more expensive than fossil jet fuel, but beyond the benefits to carbon emissions reduction, SAF can reduce the risk to New Zealand tourism and trade from sustainability-conscious consumers, and domestic SAF production can create benefits to fuel security, jobs and local economic activity.

However, inaction on SAF also has economic risks and opportunities. SAF is increasingly being tied to economic mechanisms and choices overseas. Inaction on SAF will deter some consumers.

New Zealand has choices about when and how to act on these risks and opportunities, which this report explores.

Key Findings

1

There is a strong economic case for New Zealand to use SAF.

The country can potentially safeguard NZD4.1 billion in tourism revenue and almost NZD200 million in trade revenue over the period to 2050 which could otherwise be at risk from climate-conscious consumers and businesses.

2

There is a strong economic case to produce SAF domestically.

Domestic production of 30% of jet fuel needs as SAF in 2050 would lead to over NZD1,300 million in Gross Value Added (GVA) and 5,700 jobs, and enhance fuel security.

3

In the short-term, the benefits to tourism and air cargo can outweigh costs.

Nationally, choosing to use 5% SAF by 2030, which aligns with other countries in the region, would add less than the cost of a coffee on one-way domestic travel. Attracting/regaining 1.2% of travellers would outweigh the impacts on fuel costs and traveller demand from higher fuel prices.

4

This is also true in the long-term; the benefits to tourism and air cargo can outweigh costs.

Four SAF ramp-up pathways were analysed representing different national choices. Nationally, choosing a ramp-up path to 30% SAF by 2050 with a focus on domestic production is currently the most economically attractive path. Attracting/regaining 3% of travellers would make all assessed pathways economically beneficial relative to a 'do nothing' case.

5

Delayed action on SAF is more risky and costly than implementing an effective policy.

A 5-year delay to the above path is estimated to cost NZD1.0 billion over the period to 2050 because New Zealand would likely face supply chain challenges in securing SAF and SAF feedstocks, and experience higher costs to produce SAF domestically due to delayed learning curves. At the same time, New Zealand's tourism and trade would also be placed at risk due to delayed actions.

6

There are 'no-regret' actions New Zealand could take now:

1. Create a strong demand and investment signal for SAF at least two years in advance;
2. Define and signal acceptable feedstocks and certification standards;
3. Link SAF to the national Emissions Trading Scheme (ETS);
4. Provide development incentives and/or support for first-of-a-kind projects, noting that the local economic benefits could be 4x higher than the costs of this support; and
5. Ensure strong and decisive leadership and coordination to maximise the long-term value to New Zealand of the multi-decade transition to SAF.

Overall, there is a clear case to act now and a clear set of potential steps to take.

Executive Summary

All of New Zealand's top ten trading partners have committed to Sustainable Aviation Fuel (SAF) policy, as have most countries which have flights to and from New Zealand. While multiple airlines which fly to and within New Zealand have already started buying and using SAF in other markets, New Zealand does not have a regulatory framework for SAF in the aviation sector. This report aims to outline market failures in relation to SAF and provide a fact base to help inform potential options for New Zealand.

Note: [1]Sources for all of the data presented in the Executive Summary are provided in the main sections of the report.

There are five key questions related to SAF that the report aims to answer:

01 Is there a case to justify New Zealand taking action on SAF?

02 Is there a case for New Zealand to act now on SAF, or to wait and follow later?

03 What are the short-term economic implications of action for New Zealand?

04 What are the long-term economic implications of action for New Zealand?

05 Where could New Zealand start in terms of actions?

Finding 1:

There is a case to justify New Zealand taking action on SAF

New Zealand has an opportunity to join the 45 countries covering more than 65% of global jet fuel use who are already implementing or considering SAF policy options (including Singapore, Japan, Australia, and China).

The private sector will invest in SAF. However, many airlines, fuel producers and investors are global businesses which face a choice about investing in multiple locations. They will likely only invest in locations which carry the lowest risks. Under current policy settings, this is not New Zealand.

A supporting regulatory framework on SAF is justified to address the following:

1. **Fuel security and macroeconomic stability in a geopolitically changing world.** All aviation fuel in New Zealand is currently imported, and aviation fuel use in New Zealand is expected to grow by more than 90% by 2050. Imported fuels represent roughly 8% of New Zealand's total imports and this share is likely to grow rapidly given the growth in aviation demand and fossil fuel prices likely rising due to the expansion of carbon pricing. Securing domestic or regional SAF supply could reduce dependency on vulnerable supply chains.
2. **Risks to tourism revenue.** Tourism is 6% of GDP and employs 1 in 9 New Zealanders. Not having SAF in New Zealand is a risk given the reputation and positioning of the country as an eco-friendly destination, especially given that other countries are decarbonising aviation faster. SAF will increasingly become the 'new normal' for airline passengers (39% of travel booking managers in US corporates are highlighting the importance of SAF during travel bookings). In particular, 44% of inbound tourists to New Zealand come from Australia, and 82% of Australians believe it's important to find ways to reduce carbon emissions produced by air travel.
3. **Risks to trade revenue in terms of cargo exports.** Air-freighted trade is approximately 16% of exports by value. Of the NZD2 billion in goods exported exclusively by air, about 70% are to countries that have either enforced carbon border adjustment schemes or are proposing carbon border adjustment schemes. While aviation is not currently in scope of these regulatory provisions, there is growing consumer and supplier pressure to decarbonise cargo transport, and this could affect market access for New Zealand exports or its attractiveness to international customers.
4. **Global, industry-wide market failures.** The SAF industry is nascent and faces market failures such as first mover disadvantages for projects, coordination failures such as offtakers needing a level playing field to procure the new product, and many unpriced externalities linked to not only carbon costs of conventional fuel but also fuel security and trade / tourism competitiveness.
5. **New Zealand-specific market failures.** The New Zealand Emission Trading Scheme (NZ ETS) is not currently being used to decarbonise domestic aviation and neither this scheme nor the global CORSIA scheme is enough to support the initial high cost of SAF production domestically. Even with regulatory changes, the NZ ETS will only cover 6% of the expected cost differential between conventional jet fuel and SAF in 2030.
6. **Risks to national decarbonisation efforts.** Domestic and international aviation could rise to represent 22% of New Zealand's gross emissions in 2050 (up from 5% in 2023) if no action is taken. The impact will become too big to ignore.
7. **Risks to New Zealand's international standing from not fulfilling UN agreements to which it is a signatory.** New Zealand agreed to the UN International Civil Aviation Organization (ICAO) goal in November 2023 to reduce the carbon intensity of aviation fuel by 5% by 2030. Given that around 45 countries are already acting, lack of efforts to support this goal could impede New Zealand's reputation and ability to negotiate good terms in future trade agreements.

Finding 2:

It is better to take action now than to wait

Given the current higher cost of SAF versus conventional jet fuel, there is an argument to wait to secure supply once technology learning curves bring down the cost of SAF. However, this research suggests that waiting would be a mistake for several reasons:

1. **New SAF facilities have multi-year lead times**, which means action is needed immediately to enable domestic production or secure supply which may come online in 2-5 years' time and to maximise the benefit from technology learning curves for local production.
2. **Risks of missing out on local feedstock supplies.** New Zealand feedstocks are potentially of interest to offshore investors in countries like Japan and Malaysia. Given the increasing global demand for SAF, if significant volumes of feedstocks are locked up for export and prevented from use in a domestic market, New Zealand will lose the ability to utilise these feedstocks to improve its own domestic fuel security.
3. **Risk of missing out on low-cost foreign supply.** There is an active focus from dozens of other countries on long-term SAF procurement and increasing competition for supply. New Zealand may only be able to access higher cost sources in future – higher costs which will flow down to travellers - as low-cost sources have already been locked up over multi-year timescales.
4. **Greater exposure to economic and environmental risks from inaction.** Reputationally, there is a risk to New Zealand's tourism and the strong eco-tourism credentials of New Zealand. Delay also creates risks to fuel security, macroeconomic stability, and decarbonisation efforts.

Delay creates risk.

Finding 3:

Initial action can mitigate short-term economic impacts

Choosing to aim for a 2030 SAF blend that is aligned to other countries in the region means the short-term potential impacts of SAF on fuel costs are manageable.

This analysis shows that a mechanism legislating a 5% blend of SAF in 2030 – in line with regional peers like Singapore and global government goals – would have a minimal impact on individual passenger costs. For example, for domestic routes, it would be less than NZD3 one-way in 2030 (Exhibit E1).

Research shows that globally 1-3% of travellers participate in voluntary offsetting programmes offered by airlines, and 46% of travel managers for US corporates have a strategy to assign emissions budgets to travel bookings. If the use of 5% SAF in 2030 attracts/regains just 1.2% of tourists due to sustainability affecting their travel choices, the economic benefits to New Zealand would outweigh the predicted costs of higher fuel prices and the impact on traveller demand from higher fuel prices.

Assumptions and implications:

- Low estimates based on SAF being 2x JetA1 price
- High estimates based on SAF 4x JetA1 price
- All scenarios assume 5% blend
- Assume 83% passenger load factor nased on IATA average
- The average cost is done on a simple per passenger average, but in reality, the cost imposiotion could vary by passenger type (e.g., higher for business class, lower for economy)
- Greatest sensitivity on costs for long-haul (beyond Australia).

The likely costs to consumers from SAF adoption are generally low.

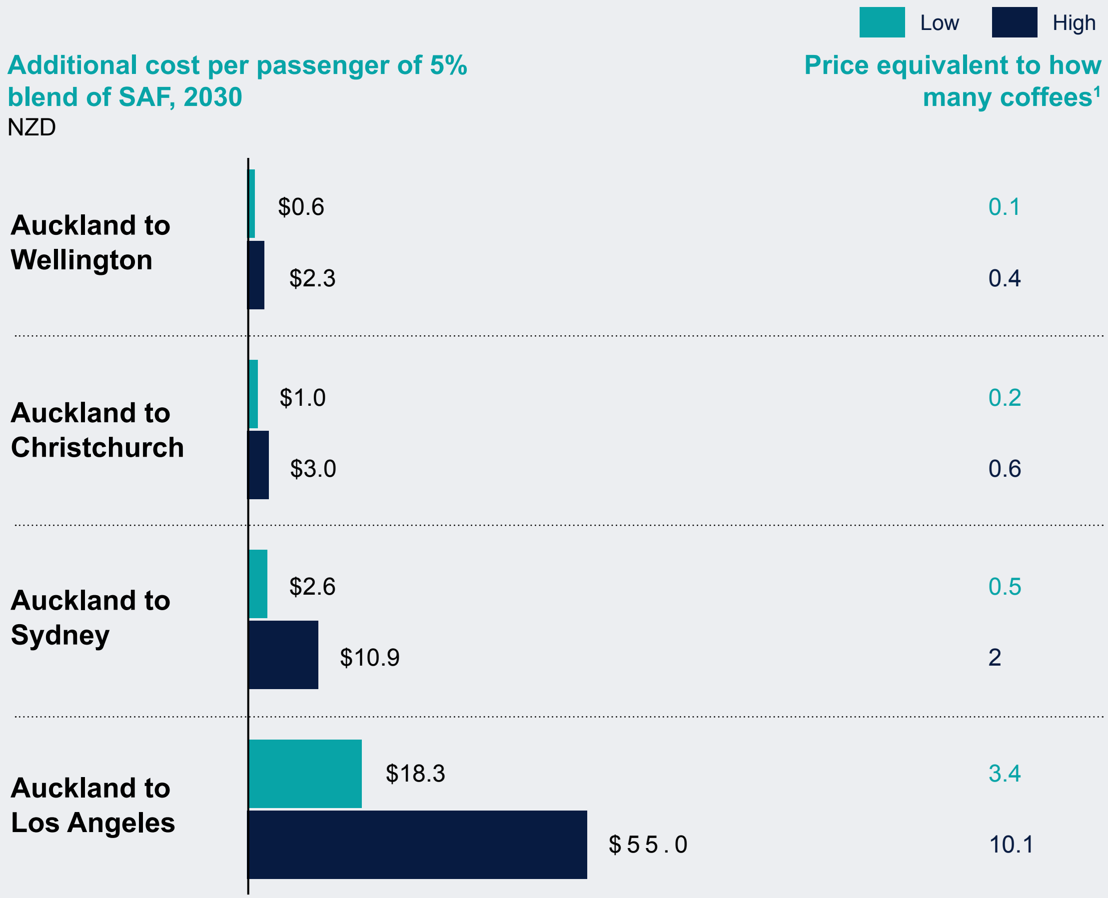


Exhibit E1

Source: Cyan Ventures analysis

[1] Average cost of coffee in Auckland CBD is NZD 5.40.

Finding 4:

Initial action can mitigate long-term economic impacts

The long-term economic impacts of acting now would primarily depend on the ramp-up pathway that New Zealand chooses.

The following four pathways represent the spectrum of key choices, relative to a ‘do nothing’ pathway.

	Degree of action on the procurement of SAF	
Source of SAF	**Minimum viable action (on SAF)**	**Focused action (on SAF)**
A SAF importer	**Pathway 1** 1% SAF in 2027 to 30% SAF by 2050, all imported SAF[2]	**Pathway 3** 1% SAF in 2027 to 70% SAF by 2050, all imported SAF[3]
A SAF producer	**Pathway 2** 1% SAF in 2027 to 30% SAF by 2050, all domestic SAF	**Pathway 4** 1% SAF in 2027 to 70% SAF by 2050, all domestic SAF

Table E1: SAF pathways for New Zealand in the context of acting now

[2] Similar to current minimum of regional peers like Indonesia and low range scenario of ICAO. The International Civil Aviation Organization (ICAO) is a specialized agency of the United Nations that coordinates the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth. In the low-end scenario for decarbonization, conventional jet fuel still accounts for two-thirds of fuel supply by 2050, with a further small share provided by lower carbon aviation fuels (LTAG-LCAF), which are drop-in fuels produced from petroleum resources. The remaining amount (approximately 30%) is from SAF. Further detail is available at: https://www.icao.int/environmental-protection/LTAG/Documents/ICAO_LTAG_Report_AppendixM5.pdf.

[3] Matching the EU targets and similar to ICAO’s middle range scenario. The EU targeted mandate is for SAF to be 70% of aviation fuel in 2050. In the ICAO mid-range scenario, fuel production technologies with medium attainability and readiness are considered. It results in 66% of aviation fuel being SAF by 2050. Further detail is available at: https://www.icao.int/environmental-protection/LTAG/Documents/ICAO_LTAG_Report_AppendixM5.pdf.

At this point in time, and based on a cost-benefit assessment, the optimal path for New Zealand is Pathway 2 **(Exhibit E2)**. This is the optimal path because it would lead to over NZD1.3 billion in GVA and 5,700 jobs by 2050 and because New Zealand also retains the option to revise up its ambition later if it observes favourable market developments.

The economic benefits from safeguarding tourism, fuel security, and air transport and local economic development are assessed as greater than potential higher fuel costs, potential demand reductions from higher fuel prices, and the potential costs for government to support development.

Producing and adopting SAF can bring NZD2.3 billion in net benefits to the New Zealand economy between now and 2050

Benefits and costs of producing and adopting SAF in New Zealand (Pathway 2)[1]
NZD billions (NPV terms)

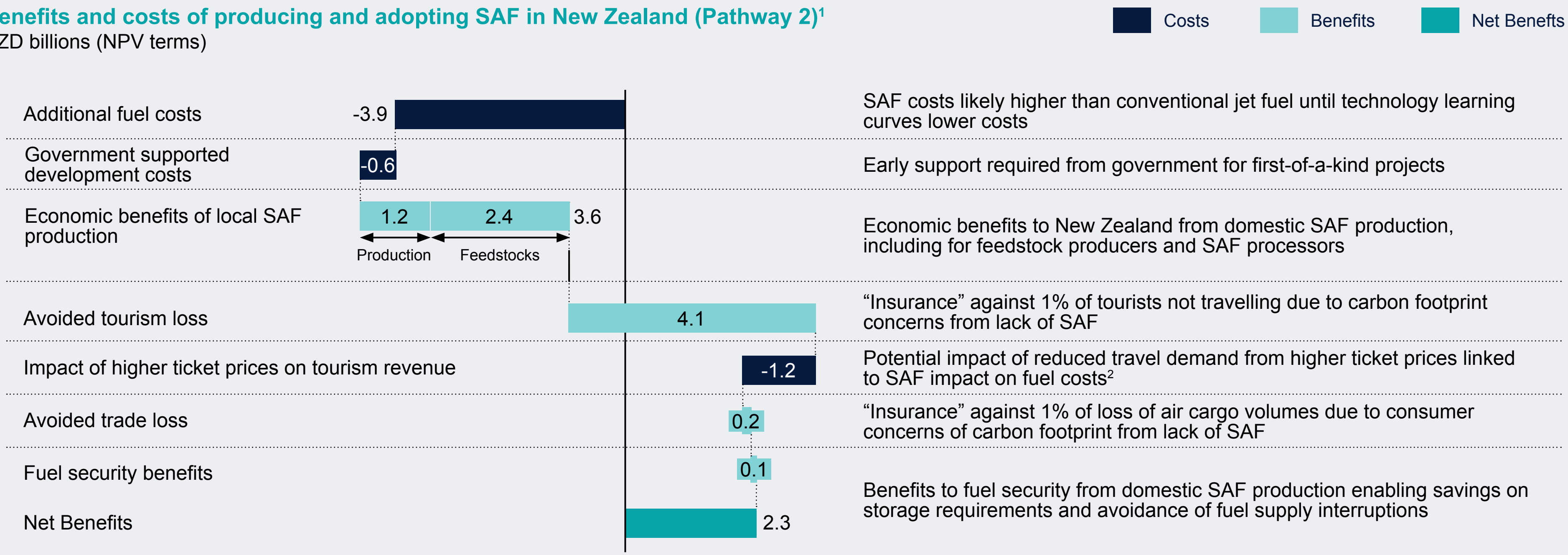


Exhibit E2

Source: Cyan Ventures analysis

[1] Assumes Pathway 2 (i.e., 30% SAF by 2050, all domestically produced). All values are NPV with an 8% discount rate over the period to 2050.

[2] Demand elasticity was assessed in line with the MBIE study- i.e., SAF cost impacts as a share of total trip cost rather just ticket cost.

Four pathways—conservative assumption

All four pathways are currently based on a conservative assumption of safeguarding just 1% of tourism and trade. If this was 3%, then all four SAF pathways would have a positive benefit-cost ratio. This analysis also assumes travel choices are based on overall trip spend not just airfares. In short, supplying SAF is a low-cost 'insurance' policy for New Zealand's tourism and air cargo sectors **(Exhibit E3).**

If using SAF could avoid just 1.2% of tourists not coming to New Zealand due to carbon footprint concerns, this would mitigate the higher fuel costs

Comparing fuel costs versus tourism benefits

NZD billions (NPV terms)[1]

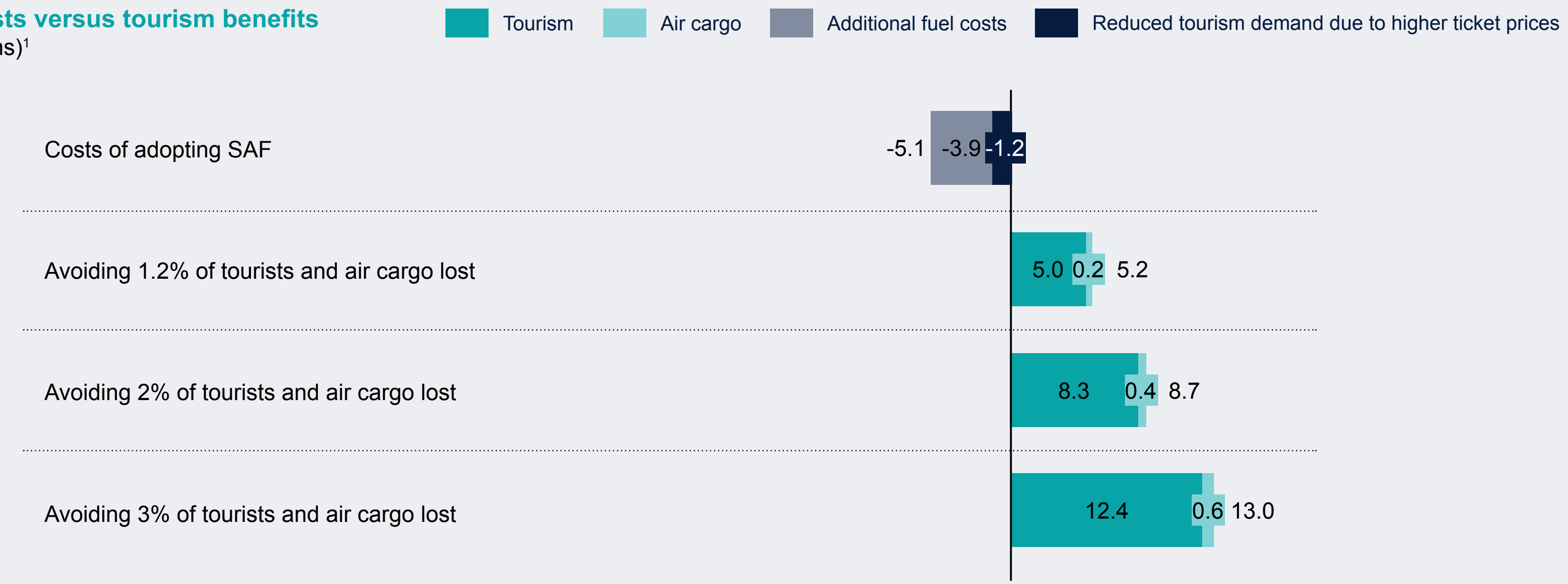


Exhibit E3

Source: Cyan Ventures analysis

[1] Fuel cost differential estimates assumes the level of production of Pathway.

[2] "30% SAF, all domestic SAF". All values are NPV with an 8% discount rate over the period to 2050.

Finding 5:

New Zealand can start action now

The SAF industry is nascent and SAF, like other new products, requires interventions to form the market and accelerate the 's-curve' of adoption. Initial (lower cost) action is recommended now to maximise economic gains and minimise risks across the next 25 years.

By taking modest initial action, New Zealand retains the option to raise its ambition levels later after monitoring developments linked to drivers such as global regulatory action and technology learning curves (which influence SAF prices).

There are five key areas recommended for immediate action:

1. **Create a strong demand and investment signal for at least two years in advance.** There are different ways of stimulating demand, ranging from subsidies through to public procurement. However, the most common national approach used overseas is a future SAF use volume requirement (often described as a mandate or levy), where airlines or fuel suppliers are required to purchase a certain share of their jet fuel use from certified sustainable supply chains (which is typically coupled with supply-side support to manage costs). SAF use volume requirements are also a clear signal to help support foreign direct investment into domestic production.

2. **Define and signal acceptable feedstocks and certification standards.** It is important that New Zealand adopts international standards such as CORSIA certification, but with considerations of any local concerns, such as unique feedstocks not adequately recognised in global frameworks.

3. **Link SAF to the NZ ETS.** Enabling SAF to be eligible to meet obligations under the NZETS (by resolving complications with tracking physical fuel through shared infrastructure) is a further important financial signal, even if it will only mitigate a small share of the SAF premium.

4. **Provide development incentives and/or support for multiple first-of-a-kind projects.** First-of-a-kind (FOAK) projects are projects that represent the first-ever implementation of a new technology or design at a significant scale, with the goal of proving its viability and potential for wider adoption. Given the uncertainties on New Zealand's potential SAF supply volumes and cost competitiveness, there is a need for low-cost support for feasibility studies, pilots and FOAK projects. This would also signal New Zealand's intent on SAF internationally and could help support foreign direct investment. This could be similar to the approach used by Australia's Renewable Energy Agency (ARENA) which has been allocated AUD250 million to support feasibility studies, pilots and FOAK projects related to low carbon liquid fuels. Another example is contracts-for-difference to mitigate merchant risk.

5. **Ensure strong and decisive leadership and coordination to maximise the long-term value of the transition to New Zealand.** Senior support and coordination across relevant government agencies is crucial and could include bolstering government participation on existing domestic or regional vehicles such as SAA (Sustainable Aviation Aotearoa) or establishing forums similar to the Australian Jet Zero Council or UK Jet Zero Taskforce. Participating in Asia-Pacific regional policy forums to shape SAF supply / demand in the region is also crucial.

Careful crafting of a supportive SAF policy package will be necessary to ensure its effectiveness. Detailed options are provided in this report to guide design choices. Opening up the design process to public consultation is recommended.

1 Context on jet fuel use in New Zealand

Key messages:

- Aviation is crucial for New Zealand's connectivity, trade and tourism and economic growth: air-freighted trade is 16% of exports by value; tourism is over 6% of GDP and employs 1 in 9 New Zealanders.
- All aviation fuel in New Zealand is currently imported and made from fossil fuels.
- Aviation fuel use in New Zealand is expected to grow by more than 90% by 2050, and without action, domestic and international aviation emissions could be 22% of New Zealand's gross carbon emissions by 2050 and one of the largest sources of emissions. It will become too big to ignore in New Zealand's decarbonisation processes.

Aviation is crucial for New Zealand's economy

Aviation is a cornerstone of New Zealand's economy, playing a critical role in its connectivity, trade, and tourism. New Zealand is one of the most geographically isolated destinations in the world, located more than 2,000 km from its nearest neighbour and much farther from major global markets. From a trade perspective, approximately NZD2 billion in goods are exported exclusively by air from New Zealand, and more than NZD3 billion in goods are imported by air freight into New Zealand[4] Tourism is also a significant driver of the New Zealand economy, contributing over 6% to GDP[5] and employing 1 in 9 New Zealanders.[6] International conferences were also worth NZD403 million to the economy in 2023.[7]

Aviation fuel is currently all imported and made from fossil fuels

Aviation fuel demand in New Zealand is likely to grow strongly in response to both domestic and overseas air passenger and cargo traffic. For example, aviation fuel demand between now and 2050 could grow by over 90% versus 2024 according to New Zealand's Climate Commission **(Exhibit 1)**.[8]

Aviation fuel demand could grow by over 90% by 2050.

[4] Export air freight data obtained from Sense Partners (2023), Facilitating prosperity: The economic contribution of Air New Zealand. Available at: https://www.tourismticker.com/wp-content/uploads/2024/01/The-economic-contribution-of-Air-New-Zealand.pdf. Import data is based on air freight representing 22% of import value, and current value of imports is NZD16.3 billion. Air freight represents 16% of the total value of exports. Data on shares of air freight from exports and imports from: Ministry of Transport (2022), New Zealand freight & supply chain issues paper, available at: https://www.transport.govt.nz/assets/Uploads/Freight-and-supply-chain-issues-paper-full-version.pdf

[5] Information accessed from: https://www.tia.org.nz/the-industry/quick-facts-and-figures

[6] Information accessed from: https://www.tourismnewzealand.com/insights/tourism-impact/

[7] Tourism New Zealand (July 2024), "Tourism New Zealand targets record $140m worth of conferences for Aotearoa". Available at: https://www.tourismnewzealand.com/news-and-activity/tourism-new-zealand-targets-record-140m-worth-of-conferences-for-aotearoa/

[8] Climate Commission (11 December 2024), Modelling and data: Final reports on the fourth emissions budget and 2050 target review. Available at: https://www.climatecommission.govt.nz/our-work/advice-to-government-topic/preparing-advice-on-emissions-budgets/advice-on-the-fourth-emissions-budget/modelling-and-data-final-report/

Aviation fuel demand could grow by over 90% by 2050, and become an increasing share of New Zealand's emissions

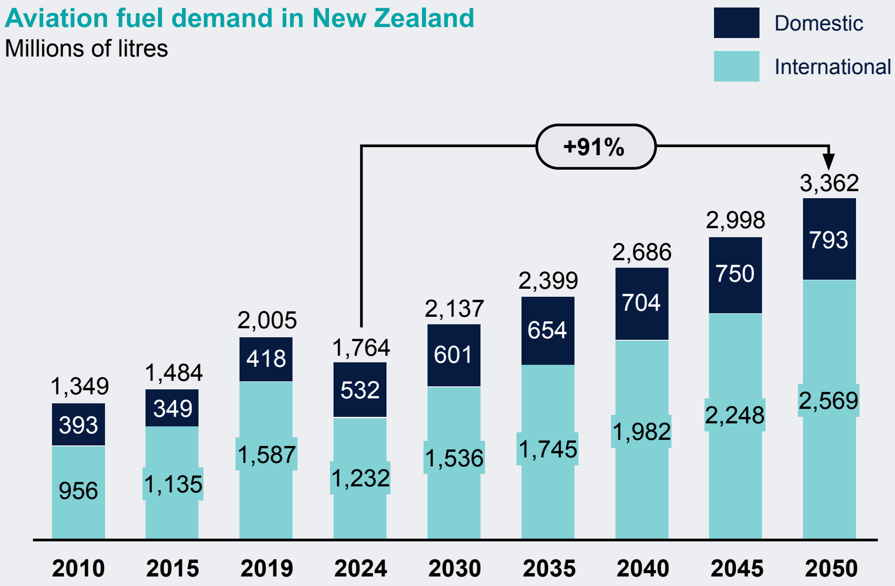


Exhibit 1

Sources: New Zealand Climate Change Commission Commission (April 2024), Technical Annex Modelling and analysis to support the draft advice on Aotearoa New Zealand's fourth emissions budget. Available at: https://www.climatecommission.govt.nz/public/Uploads/EB4/supporting-docs/Technical-Annex-Modelling-and-analysis-9-4.pdf

Implications:

- New Zealand, international aviation emissions are not yet included in net zero targets
- If international emissions were included, it could lead to a significant increase in emissions
- Domestic and international aviation combined could represent around 22% of New Zealand's net emissions by 2050, making action in this sector critical

Currently, New Zealand imports all jet fuel **(Table 1)**, mostly from South Korea and Singapore.[9] Given this fuel is imported, growing demand could also create risks to New Zealand's current account – imported fuels (of which aviation fuel is a key and growing component) represent roughly 8% of New Zealand's total imports and this share could rise significantly given the growth of fuel demand in New Zealand.[10]

In New Zealand, domestic aviation emissions are included in national Emissions Reduction Plans, budgets and long-term net zero targets, while international aviation emissions are not. If international emissions were included, it could necessitate a change in New Zealand's emissions reduction planning to deliver net zero.[11] Currently aviation emissions (both domestic and international) represent about 5% of New Zealand's total net emissions (from all gases). If no action is taken to reduce emissions from these sectors, by 2050 they will likely grow to be equivalent to almost 22% of the country's net emissions.[12] For comparison, this would be 10 times the forecasted emissions of the international maritime sector (based on bunker fuels uplifted here).

Overall, early action is critical as aviation will become too big to ignore in New Zealand's decarbonisation processes.

[9] In 2023, 70% of New Zealand's fuel supply came from Singapore and South Korea. Information obtained from MBIE (2025), Fuel Security Study. Available at: https://www.mbie.govt.nz/dmsdocument/30476-fuel-security-study-pdf

[10] Information on import categories obtained from: https://globaledge.msu.edu/countries/new-zealand/tradestats#source_1

[11] International aviation emissions are generally not included in Nationally Determined Contributions (NDCs). This is due to the difficulty of attributing these emissions to individual countries, as flights cross borders and involve multiple jurisdictions. However, the rising emphasis on net-zero targets has led some countries and blocs (e.g., the European Union) to advocate for broader inclusion of sectors like aviation in climate policies.

[12] Climate Change Commission (2024), Review of the 2050 emissions target including whether emissions from international shipping and aviation should be included. Information available from: https://www.climatecommission.govt.nz/public/Advice-to-govt-docs/Target-and-budgets-final-reports/Climate-Change-Commission-Target-and-ISA-Final-Advice-04Dec2024-with-errata-message.pdf

Fuel use and emissions

New Zealand aviation data points	Value
Share of SAF in jet fuel mix (2025)	0%
Domestic production of SAF (2025)	0
Share of jet fuel imported (2025)	100%
Aviation fuel demand in millions of litres (2024)[13]	1,764
Aviation fuel demand in millions of litres (2050)[14]	3,363
Potential aviation fuel share of net emissions from all gases (2050)[15]	21.7%

Table 1: Snapshot of New Zealand's aviation sector fuel use and emissions

[13] Climate Commission (11 December 2024), Modelling and data: Final reports on the fourth emissions budget and 2050 target review. Available at: https://www.climatecommission.govt.nz/our-work/advice-to-government-topic/preparing-advice-on-emissions-budgets/advice-on-the-fourth-emissions-budget/modelling-and-data-final-report/

[14] Climate Commission (11 December 2024), Modelling and data: Final reports on the fourth emissions budget and 2050 target review. Available at: https://www.climatecommission.govt.nz/our-work/advice-to-government-topic/preparing-advice-on-emissions-budgets/advice-on-the-fourth-emissions-budget/modelling-and-data-final-report/

[15] New Zealand Climate Change Commission (April 2024), Technical Annex Modelling and analysis to support the draft advice on Aotearoa New Zealand's fourth emissions budget. Available at: https://www.climatecommission.govt.nz/public/Uploads/EB4/supporting-docs/Technical-Annex-Modelling-and-analysis-9-4.pdf

2 The SAF opportunity for New Zealand

Key messages:

- While SAF is currently more expensive than conventional jet fuel, the prices could converge within the next 10-15 years subject to uncertainties related to technology learning curves on SAF and carbon pricing.
- New Zealand is fortunate to have high quality potential feedstocks to produce SAF, including woody biomass, electricity and CO2 sources for power-to-liquid, and could potentially supply 70% of its aviation fuel demand through domestic SAF production.
- New Zealand is fortunate to have high quality potential feedstocks to produce SAF, including woody biomass, electricity and CO2 sources for power-to-liquid, and could potentially supply 70% of its aviation fuel demand through domestic SAF production.
- New Zealand's policy settings for supporting SAF are currently lagging in comparison to regional peers such as Australia.

SAF, like other new products require market formation & acceleration interventions to kick start the s-curve of adoption

The S-curve of adoption describes the typical trajectory of how new technologies, ideas, or innovations are adopted. It is characterized by distinct phases: Inception, Formation, Acceleration, and Deployment at Scale, as shown in **Exhibit 2**.

SAF, like other new products require market formation and acceleration interventions to kick stat the s-curve of adoption

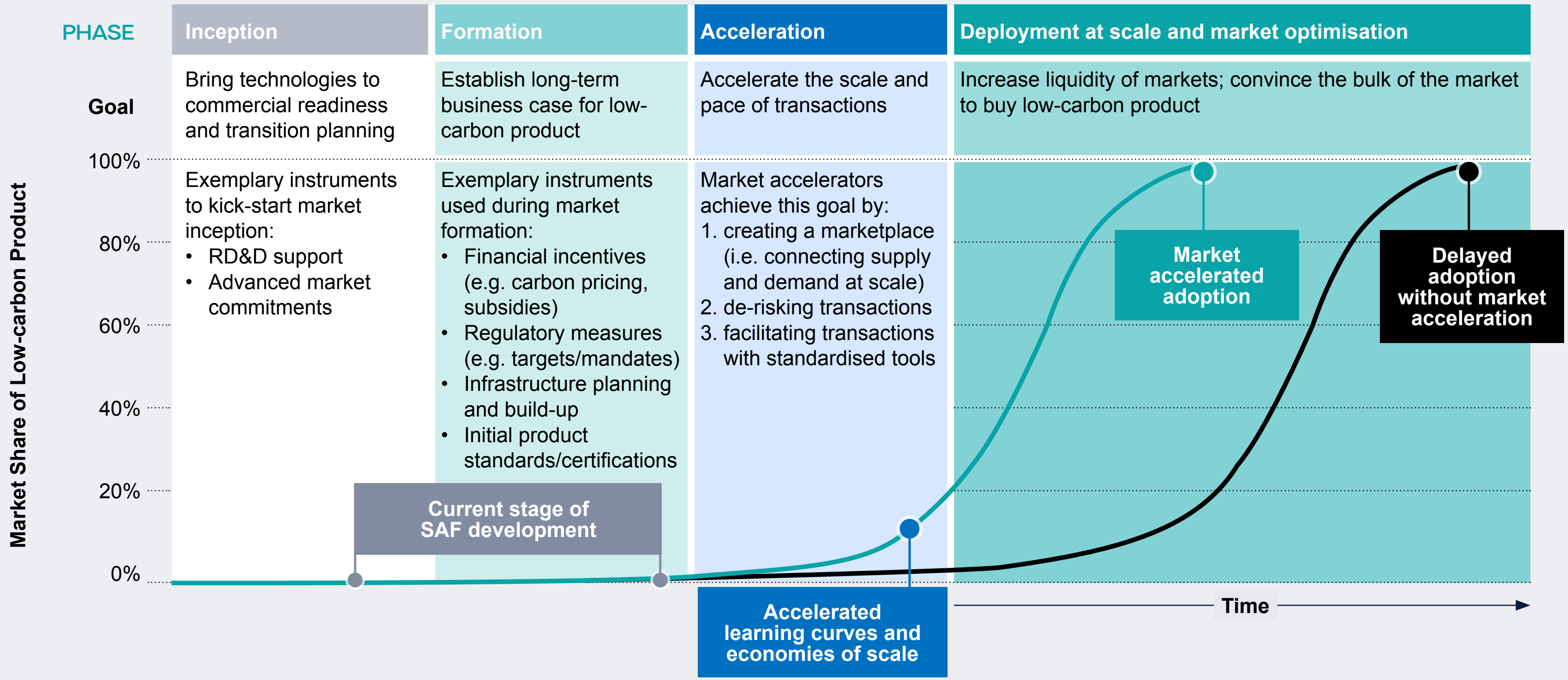


Exhibit 2

Illustrative

SAF is currently in the Inception and Formation stages of the S-curve. Specifically:

- **Inception** – SAF has emerged as a clear drop-in technology substitute for conventional jet fuels, however many technologies (e.g., Power-to-liquid) are still at a relatively low technology readiness level and require further R&D.
- **Formation** – SAF is graining traction with growing investment, regulatory support (e.g., mandates and targets), and validation of its potential to decarbonise aviation.

The key next stage of growth (Acceleration) is focused on scaling production capacity, costs decline, and global policies to drive demand.

Technology learning curves and future carbon prices shape the relative cost-competitiveness of SAF versus conventional jet fuel. **Exhibit 3** provides a review of international forecasts on SAF prices versus conventional jet fuel prices. It demonstrates the large uncertainties on the relative price competitiveness of SAF with conventional jet fuel. While currently SAF prices are 2-6x that of conventional jet fuel, in a scenario with high carbon prices and rapid development of SAF technology, certain SAF fuel sources could potentially become cost-competitive with conventional jet fuel in the next decade.

An international review of SAF price forecasts show the potential of SAF to be in the range of competitiveness with JetA1 post 2030

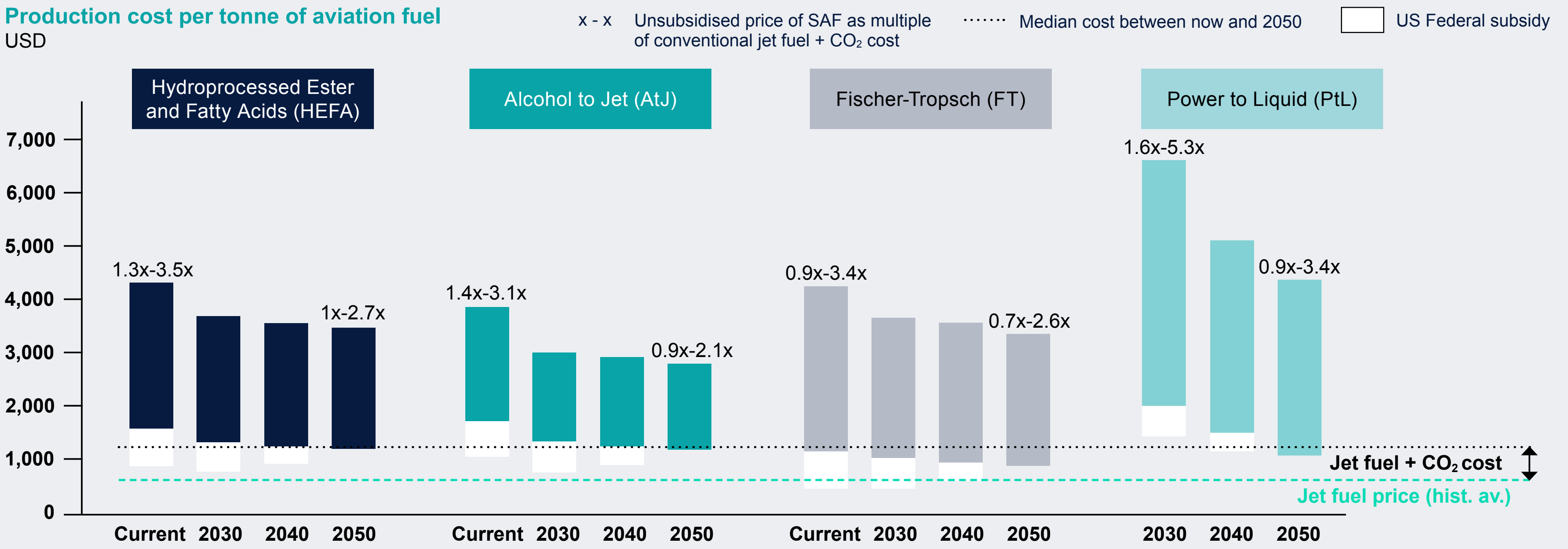


Exhibit 3

Source: MPP, US Department of Energy, Braun et al., Cyan Ventures analysis

Note: SAF prices are minimum selling prices, excluding any subsidy. CO2 cost is assumed to be USD250 per tonne of CO2, as per IEA's Global Energy and Climate Model Net Zero 2050 scenario. Jet fuel price is the historical average between October 2014 and February 2024. The historical high for jet fuel price in the last 10 years is USD1450/tonne. The level of subsidy reflects current US Federal support and is assumed to reduce over time.

New Zealand has an opportunity to produce SAF domestically

While the focus of this report is not on evaluating specific SAF sources in New Zealand, our analysis suggests that if all potential SAF feedstocks are developed, including forestry sources (such as sawmill residues), electricity and CO2 sources for power-to-liquid SAF, municipal solid waste and sustainably-managed energy crops, New Zealand could supply over 70% of its aviation fuel demand – 2350 million litres - through domestic SAF **(Exhibit 4)**.[16] This is significantly more than a 2021 high-level estimate[17] of 985 million litres.

Opportunities include:

- **Power-to-liquid (PtL).** Using renewable electricity and water with electrolysis to produce hydrogen, which is combined with CO_2 to make synthetic hydrocarbons. While currently the most expensive pathway to produce SAF, there is significant production potential (if New Zealand can develop sufficient renewable electricity and CO2 capture) and with strong learning curves, PtL could represent up to 35% of 2050 aviation fuel supply.[18] Current projects in development include Channel Infrastructure and Fortescue investigating a green hydrogen manufacturing facility at Marsden Point for PtL with initial production of more than 60ML annually.[19]

New Zealand could potentially supply around 70% of its 2050 aviation fuel demand from domestic SAF production

High-level estimates of SAF production sources for New Zealand
Millions of litres of aviation fuel, 2050

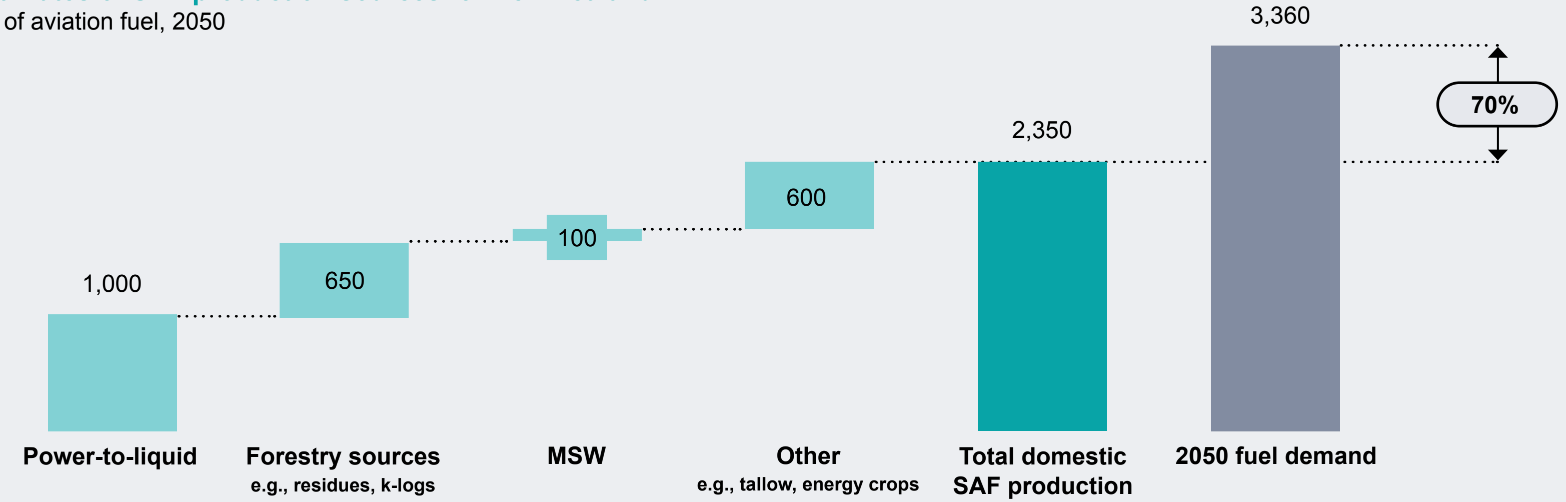


Exhibit 4

Sources: Fuel demand data from ENZ; Domestic SAF production based on interviews with technology providers, industry experts and literature review. Given the nascency of SAF development in New Zealand, these estimates should be seen as an illustrative pathway for SAF development, rather than a firm prediction of the industry's development.

[16] See Annex A1 for further details

[17] AirNZ SAF White Paper available here: https://p-airnz.com/cms/assets/PDFs/Airnz-sustainable-aviation-fuel-in-new-zealand-may-2021.pdf

[18] The European Union's ReFuelEU targets 70% SAF share of aviation fuel supply in 2050, with 35% from synthetic fuels. Further information available from: https://transport.ec.europa.eu/transport-modes/air/environment/refueleu-aviation_en

[19] Further information available from: https://www.aumanufacturing.com.au/forstecue-progress-plans-for-marsden-point-green-aviation-fuel-factory

- **Forestry sources.** New Zealand has significant opportunities from forestry residues and energy forests. For example, in 2024, Air New Zealand and LanzaJet announced the preliminary findings from a study into using woody waste residues and low-value wood products in New Zealand to produce SAF, with the potential to supply over 100ML of SAF annually and create 253 direct jobs and 386 indirect jobs in regional New Zealand, plus an annual NZD 428 million contribution to New Zealand's GDP.[20] There is also significant potential from short rotation bioenergy forests, although the sustainability impacts of these would need further research.[21]

- **Municipal Solid Waste (MSW).** There is the potential to divert MSW from landfill to produce high-quality fuels. For example, every year, more than 1.6 million tonnes of waste are sent to landfill in Auckland.[22] Based on waste streams viable for making SAF, there is enough waste to potentially produce around 100ML of SAF annually. The wider impacts of such a project on the national waste system may need further research.

- **Other sources.** SAF production is still nascent, and there are significant opportunities for bringing innovative new feedstocks into production which are well-suited to New Zealand environmental conditions. This could include energy crops such as miscanthus which require limited fertiliser and water. The supply potential from such sources is not yet quantified but have been identified in global research as potentially important sources of long-term supply.[23]

New Zealand could be globally competitive in SAF production

New Zealand has some significant advantages related to SAF production, which could provide a competitive advantage in fuel sourcing, but also create new economic opportunities from local production and potential exports:

- **Renewable potential** – renewable energy is around 56% of the total cost of power-to-liquid SAF, and New Zealand has some of the best potential renewable energy resources globally.

- **Land** – New Zealand has the potential to use woody biomass residues and has the potential for 240,000 hectares of dedicated bioenergy forest which could support further biofuel production (if the sustainability impacts were well-managed; further research needed).[24]

- **Logistics** – almost all jet fuel is imported with ships returning empty to refineries in (mostly) Asia, so the means of export are already in place.

- **Cost of capital** – New Zealand has a generally low weighted cost of capital and a low-risk premium.

Cyan Ventures has created a SAF competitiveness index, which uses publicly available data to analyse both short-term competitiveness of SAF (i.e., by 2030), as well as long-term SAF competitiveness (i.e., post 2030). While New Zealand ranks poorly on short-term competitiveness due to its low pipeline of current SAF development projects, it has strong long-term potential due to some of the factors highlighted above, but particularly land availability and the cost competitiveness of feedstocks like green hydrogen **(Exhibit 5)**.[25] This can create long-term competitive advantage for New Zealand in fuel supply, but also significant local economic opportunities.

While Australia is assessed in this index as having the potential to be slightly more competitive for SAF production, facilities in **both** countries are likely to be needed in future to meet high regional and global demand. IATA estimates that approximately 2,900-6,400 SAF facilities will be needed by 2050, up from around 40 facilities currently producing SAF.[26]

[20] Further information available from: https://www.airnewzealandnewsroom.com/press-release-2024-new-study-shows-local-production-of-sustainable-aviation-fuel-could-support-fuel-resilience-and-security-in-aotearoa-new-zealand

[21] Scion (December, 2021), Strategic review of short rotation bioenergy forests.

[22] Auckland Council (2023), A Literature Review of Interventions to Reduce Household Waste. Available from: https://www.knowledgeauckland.org.nz/media/2567/tr2023-02-literature-review-of-interventions-to-reduce-household-waste.pdf?

[23] See for example, World Economic Forum (2021), Clean Skies for Tomorrow: Sustainable Aviation Fuel Policy Toolkit. Available at: https://www3.weforum.org/docs/WEF_Clean_Skies_for_Tomorrow_Sustainable_Aviation_Fuel_Policy_Toolkit_2021.pdf

[24] Scion (2021), Strategic review of short rotation bioenergy forests.

[25] Short term SAF competitiveness is assessed based on the current pipeline of SAF projects in each country from the ICAO database. It includes two sub-metrics of 1) total number of facilities; and 2) cumulative expected volume of production. Long term SAF competitiveness is assessed using two sub-metrics: 1) Available land per capita (as this influences the ability to develop large-scale biofuels and PtL projects); and 2) current cumulative volume of green hydrogen projects planned (from the IEA Green Hydrogen Database), in terms of Kt H2 / year. This second metric reflects the potential for development of power-to-liquid fuel supplies for SAF. This analysis does not consider broader enablers such as government policy support

[26] IATA (September 2024), Finance Net Zero CO2 Emissions Roadmap. Available at: https://www.iata.org/en/programs/sustainability/reports/financeroadmap2024/

New Zealand has the potential to be a globally competitive in production of SAF

Short-term and long-term competitiveness in SAF

Location of dots indicates relative ranking of country

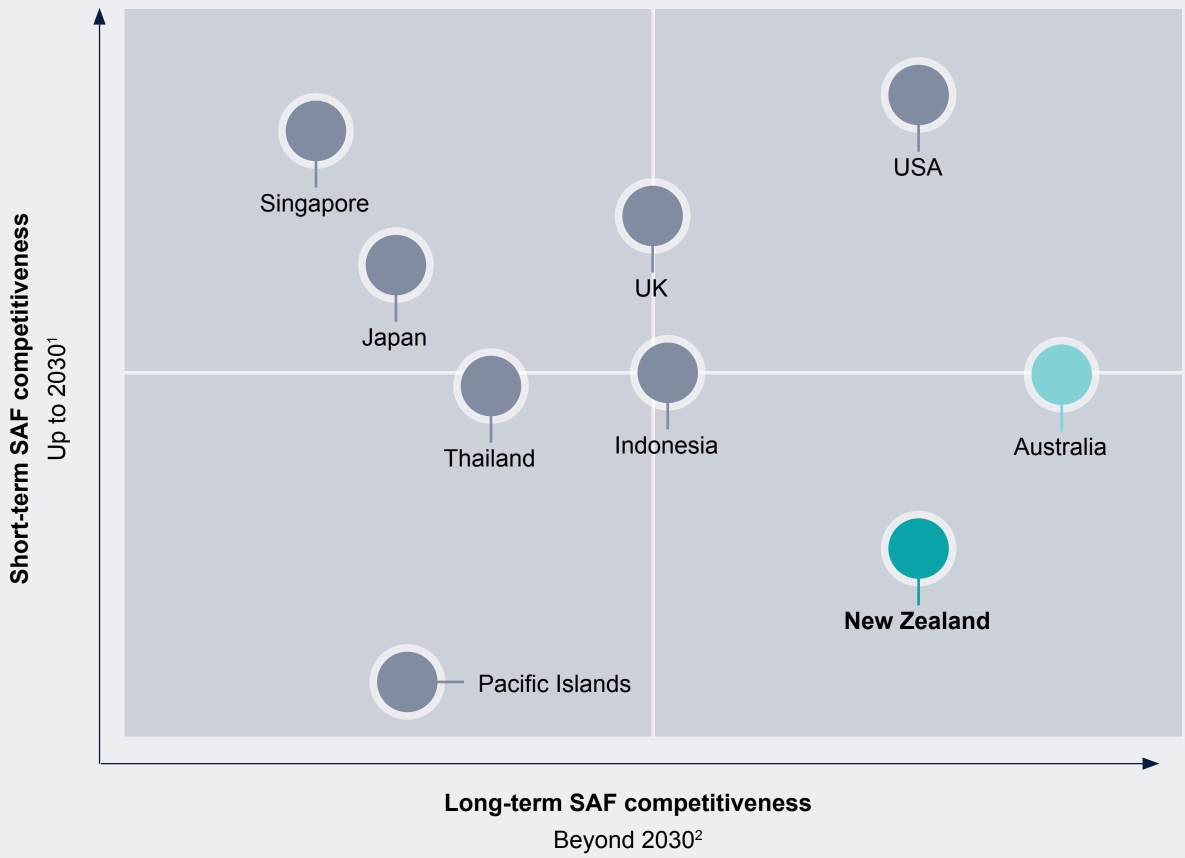


Exhibit 5

Sources: ICAO Dashboard of SAF production facilities, IEA Green Hydrogen Databases

[1] Short term SAF competitiveness = current pipeline of SAF projects in each country from the ICAO database. It incudes two sub-metrics of 1) total number of facilities; and 2) cumulative expected volume of production.

[2] Long term SAF competitiveness = two sub-metrics: 1) Available land per capita (as influences ability to develop large-scale biofuels and PtL projects); and 2) current cumulative volume of green hydrogen projects planned (from the IEA Green Hydrogen Database), in terms of Kt H2 / year. This second metric reflects the potential for development of power-to-liquid fuel supplies for SAF. This analysis does not consider broader enablers such as government policy support

New Zealand competitiveness and economic opportunity in SAF

Short-term competitiveness

- Weak at present due to limited number of production facilities or close to operational plants.

Long-term competitiveness

Strong due to four important drivers:

- **Renewable potential:** renewable energy is around 56% of the total cost of power-to-liquid, and NZ has some of best wind resources globally.
- **Land:** NZ has about 1.8 million hectares of dedicated plantation forestry.
- **Logistics:** almost all jet fuel is imported with ships returning empty to refineries in (mostly) Asia, so the means of export are already in place.
- **Cost of capital:** New Zealand has a generally low weighted cost of capital and a low-risk premium.

New Zealand is currently lagging in its policy settings to support SAF, compared to regional peers such as Australia

Australia, while still at a nascent stage of SAF development, has signalled strategic intent to drive future growth in the majority of five key enabling areas (Table 2). The impact of this action has been an acceleration of a domestic SAF industry, with at least twelve projects in planning stages.[27] The important lesson for New Zealand from this comparison is that early action is important.

Area	Australia	New Zealand
Demand signalling	• Committed AUD1.5 million over 2 years from 2024-25 to undertake a regulatory impact analysis of the costs and benefits of introducing mandates or other demand-side measures for LCLF. • Australian Defence Force has also outlined commitment to SAF procurement as part of its future energy strategy.[28]	No action
Regulatory support	• Committed AUD18.5 million over four years to develop a certification scheme for SAF	No action
Linking SAF to carbon markets	• N/A as no carbon markets (although potential future link to Australia's Safeguard Mechanism)[29]	No action, SAF not eligible to be used within the NZ ETS
Development support	• Allocated AUD33.5 million to ARENA in 2023 to support the development of a domestic SAF industry. • A further AUD250 million has been announced in March 2025 to accelerate the pace of Australia's growing domestic Low Carbon Liquid Fuels (LCLF) industry.[30] • Growing state-based development support in states such as New South Wales and Queensland.	Minimal action (e.g., NZD0.8 million[31] to support feasibility studies)
Governance	• Jet Zero Council – a public-private forum with senior level government representation (the Chair being the Minister for Infrastructure, Transport, Regional Development and Local Government).	Sustainable Aviation Aotearoa, a public-private forum coordinated by Ministry of Transport but no ministerial involvement

Table 2: Comparison of Australia and New Zealand on action areas

[27] Information from ICAO SAF project tracker, accessed on May 6, 2025. Available at: https://www.icao.int/environmental-protection/GFAAF/Pages/Production-Facilities.aspx

[28] Australian Government (2024), Future Energy Strategy. Available at: https://www.defence.gov.au/about/strategic-planning/defence-future-energy-strategy

[29] The Safeguard Mechanism primarily focuses on large industrial emitters and includes provisions for carbon offsetting, but further regulations may be required to explicitly include SAF in the system, particularly around how emissions reductions from SAF are quantified and verified.

[30] Information available from: https://minister.dcceew.gov.au/bowen/media-releases/joint-media-release-low-carbon-liquid-fuels-future-made-australia

[31] The New Zealand Government has already invested NZD765,000 in 2 studies to determine the feasibility of producing sustainable aviation fuel in New Zealand. For further information, see: https://www.mbie.govt.nz/about/news/studies-fuel-investigation-into-sustainable-air-travel

3 Is there a case to justify New Zealand taking action on SAF?

Key messages:

- Global SAF use and demand is growing rapidly - in 2024, SAF production reached 1 million tonnes (1.3 billion litres), **more than double** the amount from the previous year. This volume is expected to double again in 2025 and the International Air Transport Association (IATA) forecasts that global SAF production could reach **449 billion litres** by 2050.
- There is significant international momentum – around **45 countries** covering over **65%** of global jet fuel use, including all of New Zealand's top trading partners, are currently implementing or considering SAF policy options.
- New Zealand's Emission Trading Scheme (NZ ETS) is not enough to drive SAF uptake even if SAF became eligible– it would only cover **7%** of the expected cost differential between conventional jet fuel and SAF in 2030.
- New Zealand also has an opportunity to also take action on SAF, and there are multiple reasons to support this:
  1. Improving fuel security and macroeconomic stability (from reduced purchases of imported jet fuel);
  2. Reducing risks to tourism revenue;
  3. Reducing risks to trade revenue in terms of cargo exports;
  4. Addressing global industry-wide market failures;
  5. Addressing New Zealand-specific market failures;
  6. Reducing risks to decarbonisation efforts;
  7. Reducing risks to New Zealand's international standing from not fulfilling UN agreements to which it is a signatory.

SAF production and demand are growing strongly globally

Global SAF production volumes, while small, are growing strongly. In 2024, SAF accounted for 0.3% of global jet fuel production and 11% of global renewable fuel.[32] However, SAF production also doubled, reaching 1 million tonnes (1.3 billion litres), versus the 0.5 million tonnes (600 million litres) produced in 2023. The International Air Transport Association (IATA) forecasts that global SAF production needs to be 449 billion litres to meet 2050 Net Zero targets **(Exhibit 6)**.[33] While current production is focused on Europe and North America, the largest demand is likely to be in Asia in the future given travel growth **(Exhibit 7)**. This is relevant to New Zealand as there will be increasing competition to secure cost-efficient SAF in the region. Global SAF demand in 2050 could be over 130 times New Zealand's jet fuel needs.

[32] IATA (2024), "Disappointingly Slow Growth in SAF Production". Available at: https://www.iata.org/en/pressroom/2024-releases/2024-12-10-03/

[33] IATA (2024), Net zero 2050: sustainable aviation fuels. Available at: https://www.iata.org/en/iata-repository/pressroom/fact-sheets/fact-sheet---alternative-fuels/

In 2024,
SAF production reached

1.3 billion litres[2]

which is

4x higher than 2022 (300 million litres)

representing 0.3% of global jet fuel use

To reach net zero in 2050, up to 449 billion litres of SAF could be needed by 2050, and there is strong demand-side momentum

Expected SAF required for Net Zero in 2050[1]

Billions of litres

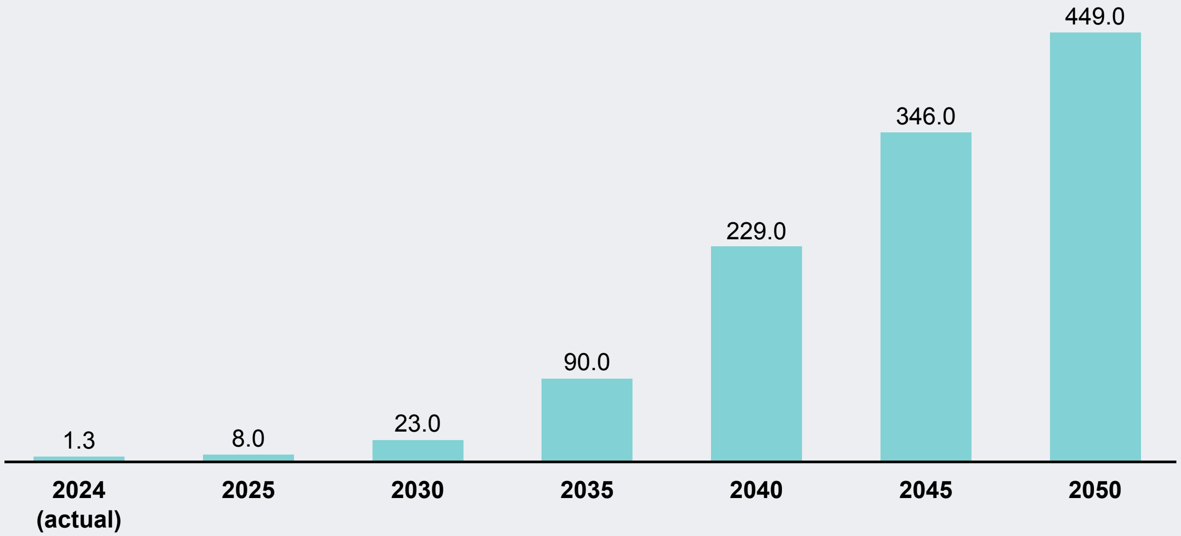
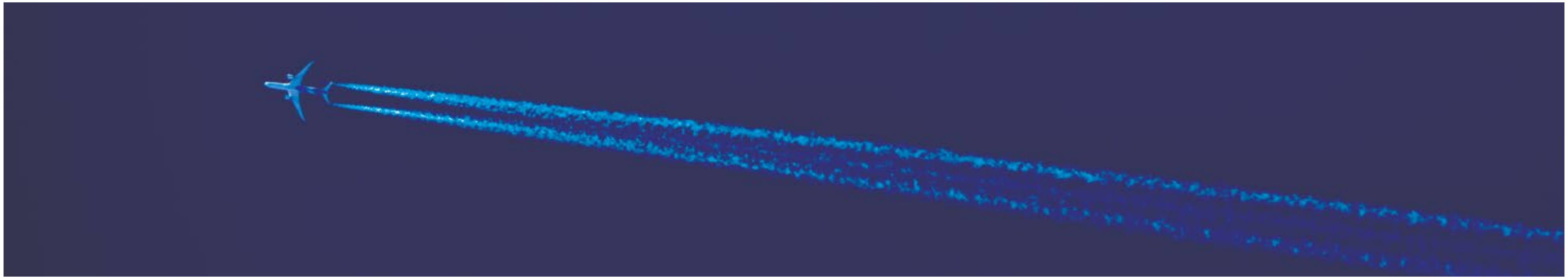


Exhibit 6

Sources: IATA (2024). [1] "Net zero 2050: sustainable aviation fuels",
[2] IATA (December, 2024), "Disappointingly Slow Growth in SAF Production"



While current SAF production is focused on Europe and the Americas, it will be Asia where supply needs to scale up

While most of 2030 supply is expected to come from Europe and the Americas...

Expected 2030 SAF supply[1]
Millions of tonnes

... by 2050 the focus will be on serving supply needs in Asia

Expected 2050 SAF demand[2]
Millions of tonnes

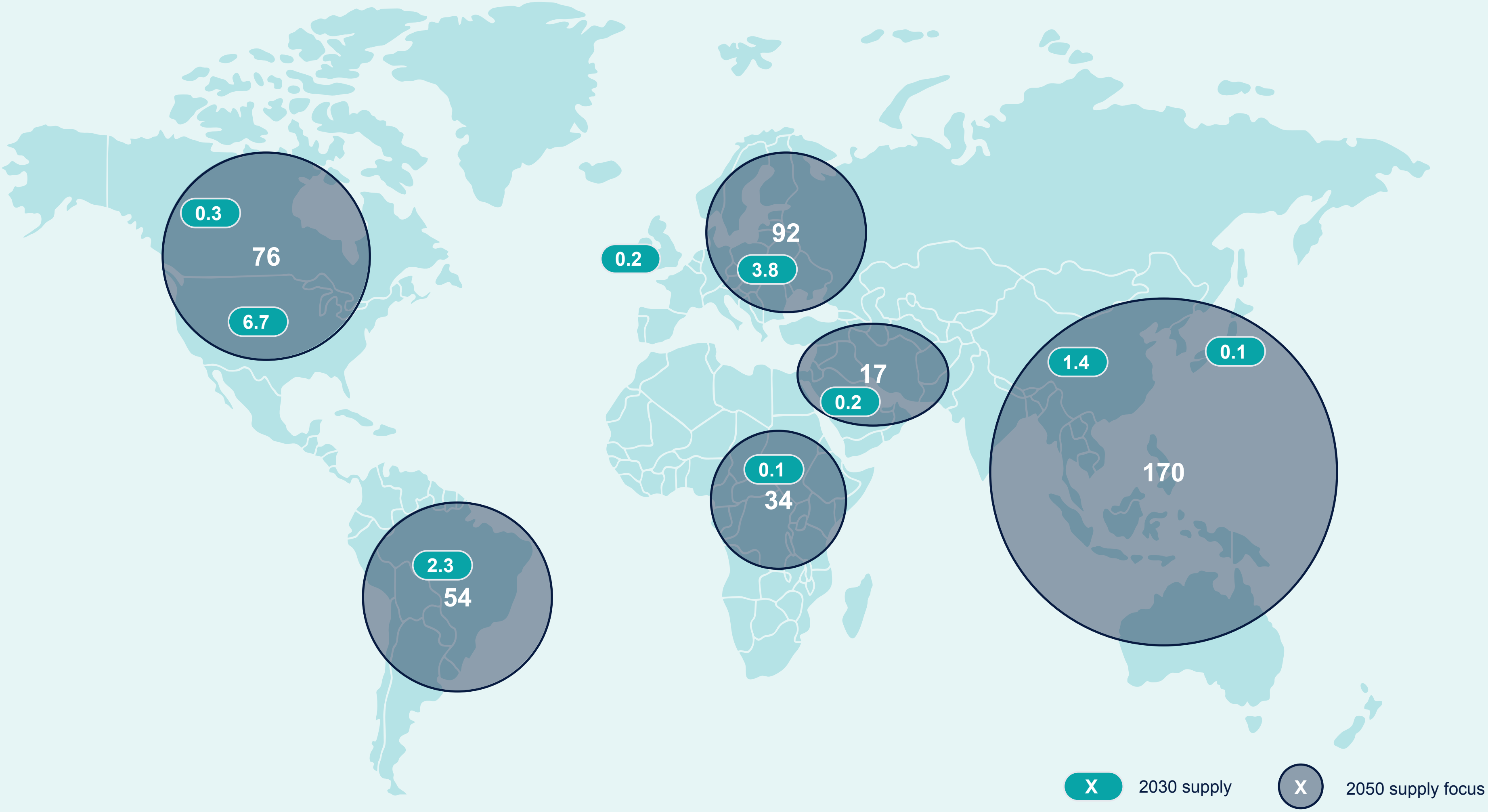


Exhibit 7

Sources: [1] Analysis from SkyNRG Market Outlook 2024, [2] Waypoint 2050 (2021), Fueling Net Zero

Other countries are implementing SAF policies to advance their national interests

The International Civil Aviation Organization (ICAO), of which New Zealand is a member, agreed to a collective vision in 2023 for aviation fuel in 2030 to be 5% less carbon intensive than fossil fuel used today by the industry.[34] Supportive regulatory frameworks are also being rapidly put in place – around 45 countries covering over 65% of global jet fuel use are currently implementing or considering SAF policy options.[35] This includes all of New Zealand's top ten trading partners and nine countries around the Asia-Pacific region. From those with detailed policy measures, over 20Mt of SAF would likely be required in 2030 to meet their goals.

Multiple countries have adopted the regulatory approach of requiring a gradual ramp-up in SAF use. The EU Commission is using the instrument of a mandate to require fuel suppliers to ensure that 2% of fuel made available at EU airports is SAF in 2025, rising to 6% in 2030, 20% in 2035 and gradually to 70% in 2050.[36] The UK has also adopted a mandate that will start in 2025 at 2% of total UK jet fuel demand, increase on a linear basis to 10% in 2030 and then to 22% in 2040.[37] In Asia, Singapore (1% in 2026, 3-5% in 2030), Japan (10% in 2030), Indonesia (1% in 2027, 30% in 2050) and Malaysia (1% pre-2030, 47% in 2050) are among those with mandated targets or levies which gradually increase. **Exhibit 8** provides a snapshot of some of the announced targets of different countries in the region, with many starting at 1-2% SAF between 2025-28. More details on SAF policy design are in Table 10 in Chapter 7.

Overseas, SAF demand & policy is being driven by a number of factors:

- **Ensuring fuel security.** Globally there are concerns on the resilience of supply chains for imports (from solar panels through to batteries). This is also true for fuels. Countries see SAF use and production as helping to boost fuel security. For example, in Australia, the Defence Force has recently released a Future Energy Strategy where it notes that "the transition from fossil fuels to alternate energy sources for our deployable capabilities presents significant opportunities to improve our energy security, preparedness and resilience".[38]

- **Meeting decarbonisation commitments.** In 2022 aviation accounted for over 2% of global energy-related CO2 emissions (almost 800 Mt CO2e), having grown faster in recent decades than other forms of transport, such as road, rail or shipping.[39] Over 190 countries, including New Zealand, have committed to net-zero aviation emissions by 2050. Progress relies heavily on SAF; while electric, electric-hydrogen and hydrogen-powered aircraft could support decarbonisation in aviation, challenges such as lower energy density and higher weight requirements affecting flight range and the need for extensive new infrastructure mean that these solutions will only be a small share of the answer.[40] According to IATA, 70% of emissions reductions for the aviation sector to deliver net zero emissions by 2050 would come from widespread use of SAF.[41]

- **Supporting national competitiveness.** Ensuring cost competitive access to SAF is seen as key as demand pressures increase, and to avoid future supply shortfalls.

- **Supporting economic development.** Many countries are positioning SAF as a new sector growth opportunity, which can stimulate investment, jobs and improve the competitiveness of local aviation. In Asia, countries like South Korea, Malaysia and Singapore see economic opportunities from SAF policy. As another example, the US Government announced the 'Sustainable Aviation Fuel Grand Challenge' in September 2021, which includes funding to demonstrate fuel and aircraft technologies. It aims to support domestic innovation and ensure US companies are at the forefront of SAF technologies to secure a competitive edge in the emerging global market for sustainable fuels.

[34] IATA (November 23, 2023), "Strengthened Global Framework for Accelerating Aviation's Decarbonization". Available at: https://www.iata.org/en/pressroom/2023-releases/2023-11-24-01/#:~:text=CAAF%2F3%20delivered%20critical%20agreement,used%20today%20by%20the%20industry

[35] Air Transport Action Group (November 2024), Sustainable aviation fuel: financing the scale-up. Available at: https://www.icao.int/Meetings/CALAF3/Presentations/Session%20II_Sustainability_ATAG%20slides%20CALAF_26-11-2024.pdf

[36] World Economic Forum (2023), Climate goals: airlines are pinning their hopes on sustainable aviation fuel. Available at: https://www.weforum.org/agenda/2023/12/airlines-sustainable-aviation-fuel-carbon-targets/

[37] Hansard (April 24), Sustainable aviation fuel mandate. Available at: https://hansard.parliament.uk/commons/2024-04-25/debates/24042546000008/SustainableAviationFuelMandate#:~:text=The%20mandate%20will%20start%20in,greater%20certainty%20regarding%20SAF%20supply

[38] Australian Defence Force (October 2024), Future Energy Strategy. Available at: https://www.defence.gov.au/about/strategic-planning/defence-future-energy-strategy

[39] International Energy Agency (2023), Tracking Aviation. Available at: https://www.iea.org/reports/aviation

[40] IATA (April 2025), Aviation Net Zero CO2 Transition Pathways. Available at: https://www.iata.org/contentassets/8d19e716636a47c184e7221c77563c93/nz-roadmaps.pdf

[41] ATAG Waypoint S2. IATA (April 2025), Aviation Net Zero CO2 Transition Pathways. Available at: https://www.iata.org/contentassets/8d19e716636a47c184e7221c77563c93/nz-roadmaps.pdf

Development of SAF policies and mandatory targets in key regions

Country/ Region	In NZ network[1]	Political commitment	Focus of policy	Policy Stage	2025	2026	2027	2028	2029	2030	2035	2040	2045	2050	2060
EU	No	Mandate	SAF volume	Legislated	2%					6%	20%	34%	42%	70%	
UK	No	Mandate	SAF volume	Legislated	2%					10%	15%	22%			
Thailand	No	Mandate	SAF volume	Planned but not final		1%	2%	2%	2%	5%	8%				
Singapore	Yes	Passenger levy	SAF volume	Legislated		1%				5%					
Brazil	No	Mandate	SAF volume	Legislated			1%	1%	2%	3%	8%				
Indonesia	Yes	Mandate	SAF volume	Announced			1%			2.5%		12.5%		30%	50%
South Korea	Yes	Mandate + subsidies	SAF volume	Announced			1%								
India	No	Target	SAF volume	Planned but not final			1%	2%							
BC, Canada	Yes	Mandate	SAF volume	Legislated				1%	2%	3%					
Taiwan	Yes	Target	SAF volume	Announced						5%					
UAE	Yes	Policy	SAF volume	Established						1%					
USA	Yes	Aspirational target	SAF volume	Public ‘SAF Grand Challenge’						10%				100%	
Japan	Yes	Mandate + subsidies	GHG saving	Legislated						10%					
California	Yes	Target plus incentives	SAF volume	Announced							4%			100%	
Chile	Yes	Mandate	SAF volume	Announced										50%	
Malaysia	Yes	Mandate	SAF volume	Planned but not final										47%	
Australia	Yes	Funding production	tbc	Consultation completed											
China	Yes	tbc	tbc	Announcement planned in 2025											
Hong Kong	Yes	Target (tbc)	tbc	Announcement planned in 2025											

Exhibit 8

Source: Literature Review

[1] Refers to direct flight connections to or from New Zealand.

There are multiple reasons to justify New Zealand taking action on SAF

New Zealand also has an opportunity to act on SAF. A supporting regulatory framework is justified to address the following:

1. **Fuel security and macroeconomic stability in a geopolitically changing world.** Aviation fuel demand increasing by up to 90% by 2050 (as mentioned in Chapter 1) and lack of local supply could increase fuel security risks for New Zealand. Refining NZ previously ran New Zealand's only oil refinery at the Marsden Point site between 1964 and 2022, predominantly importing crude oil from the Middle East and also some parts of Asia but closed in 2022 due to falling refining margins and converted to an import terminal. In 2023, 70% of New Zealand's fuel supply came from Singapore and South Korea.[42] As a result of this change, New Zealand is particularly vulnerable to disruptions in South-East and East Asia, due to the reliance on refineries located there and the shipping routes to New Zealand. A study prepared for the Ministry of Business, Innovation and Employment showed that international disruptions to jet fuel could have significant negative economic impacts linked to passenger disruption costs and impact of higher fuel prices on travel demand.[43] For example, 2017 fuel supply interruption at Auckland Airport led to costs of around NZD8.7 million. Under current requirements, there is only a 10-day cover for jet fuel.[44] The New Zealand Government has introduced a Fuel Resiliency Policy Package in 2022 to safeguard supply, but this introduces costs such as a levy to cover costs.[45] Fuel security is also a major consideration for Defence, given the dependency on fuel imports.

   The expenditure on foreign imported fuel and possibly foreign-sourced carbon offsets (under CORSIA) could worsen macroeconomic instability and the current account deficit. Imported fuels, of which aviation fuel is a key and growing component, represent roughly 8% of New Zealand's total imports,[46] and are likely to grow rapidly given the growth in aviation demand and global fuel prices being likely to rise due to the expansion of carbon pricing.

2. **Risks to tourism revenue.** Not having SAF in New Zealand is a risk given the positioning of the country as an eco-friendly destination, in a region which is moving to decarbonise travel faster. Tourism is critical for New Zealand's economic growth: tourism is over 6% of GDP and employs 1 in 9 New Zealanders. International conferences attracting business travellers were also worth NZD403 million to New Zealand in 2023.[47] For airline passengers, SAF usage will increasingly become the 'new normal'; for example, 39% of US corporate travel booking managers are highlighting the importance of SAF during travel bookings.[48] 82% of Australians believe it's important to find ways to reduce carbon emissions produced by air travel,[49] which is also crucial for New Zealand given 44% of inbound tourists to New Zealand come from Australia. For business travellers, there is an increasing focus on reducing the climate impact of flights, which are more than 80% of the carbon footprint of conferences.[50] While specific data on the value of the sustainable tourism market for New Zealand is lacking, some anecdotes point to the importance of the environment in travel choices. For example, just under half (43%) of international visitors to New Zealand visited one or more National Parks.[51] It is worth noting that most of the travellers and tourists coming to New Zealand by 2030 will be flying on airlines which have uplifted SAF in their departing countries so the risk to tourism relates to the full carbon impact of a return trip.

3. **Risks to trade revenue in terms of cargo exports.** Air-freighted trade is approximately 16% of exports by value. Of the NZD2 billion in goods exported exclusively by air, about 70% are to countries that have either enforced carbon border adjustment schemes or are proposing carbon border adjustment schemes.[52] While aviation is not currently in scope of these regulatory provisions, there is growing consumer and supplier pressure to decarbonise cargo transport, and this could affect future market access for New Zealand exports. For example, China – New Zealand's top export destination - introduced a carbon-labelling system in 2018 to quantify the level of greenhouse gas emissions of goods throughout their life cycle, including production, delivery, and consumption. Some recent academic work from China suggests that there is consumer interest in using this to inform their consumption choices.[53]

4. **Global, industry-wide market failures.** SAF development has some analogies to electric vehicles and solar development – high initial costs of deployment, but with strong learning curves that can bring down costs. This

process can be accelerated with concerted policy action to address market failures such as first mover disadvantages for projects, coordination failures such as SAF offtakers needing a level playing field to procure fuel, and many unpriced externalities linked to not only carbon costs of conventional fuel but also fuel security and trade / tourism competitiveness. Table 3 provides an overview of some of these market failures related to SAF.

Market failures	Description
Externalities	• Externalities are costs and/or benefits associated with the production or consumption of a good, which are not directly experienced by the agents taking part in a transaction. • Greenhouse gases emitted from the production and combustion of kerosene are a negative externality as they contribute to climate change and a range of associated impacts including rising sea levels and increased risk of extreme weather events. • Market-based mechanisms, such as the NZ ETS and CORSIA, encourage GHG emissions reduction at cheapest cost. However, carbon prices, under both the NZ ETS and CORSIA, are currently low when compared to the cost of abatement for solutions like SAF and do not effectively drive action to address externalities.
Public goods	• Knowledge creation, such as the effective use of new SAF production technologies, often has characteristics of public goods. Once developed, this knowledge can be used by others, leading to underinvestment by private entities in the early stages of industry development due to the difficulty of capturing full returns on research and development.
First mover disadvantage	• Describes the challenges that a business may face when it's the first to enter a new market or introduce a new product. This includes high development costs, educating the market, and uncertainty of customer response. • Few SAF projects have reached financial close, and there are barriers to early-stage development due to first mover disadvantages linked to technology learning curves and economies of scale.
Information asymmetry	• Airlines, fuel producers, and consumers may lack clear, verified information about the environmental benefits or lifecycle emissions of SAF compared to conventional fuels. This can result in scepticism or reduced adoption of SAF.
Market power	• The aviation fuel market is dominated by large, established suppliers of conventional jet fuel, which may limit competition and innovation in SAF production. Market power in the fossil fuel industry can also lead to lobbying against SAF subsidies or policies.
Capital market failures	• SAF production facilities often require significant upfront investment in infrastructure and R&D. Capital markets may be hesitant to fund SAF projects due to perceived risks, such as uncertain future demand, regulatory changes, or competition from conventional fuels.
Coordination failures	• Scaling up SAF production and adoption requires coordination among multiple stakeholders, including governments, airlines, fuel producers, and investors. Without effective coordination, infrastructure for SAF production, distribution, and use may not develop efficiently.
Incomplete markets	• There is currently no robust, globally accepted market mechanism to value and trade the emissions reduction benefits of SAF. However, 'book and claim' registries such as IATA's SAF registry are emerging.

Table 3: Market failures related to SAF which can be addressed via policy action

[42, 43] Castalia and Envisory (2025), Fuel security study. Available at: https://www.mbie.govt.nz/dmsdocument/30476-fuel-security-study-pdf

[44] Further details available at: https://www.argusmedia.com/en/news-and-insights/latest-market-news/2688626-new-zealand-approves-rules-to-raise-jet-fuel-storage

[45] Further information available at: https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/energy-generation-and-markets/liquid-fuel-market/fuel-security-in-new-zealand

[46] Information on import categories obtained from: https://globaledge.msu.edu/countries/new-zealand/tradestats#source_1

[47] Tourism New Zealand (July 2024), "Tourism New Zealand targets record $140m worth of conferences for Aotearoa". Available at: https://www.tourismnewzealand.com/news-and-activity/tourism-new-zealand-targets-record-140m-worth-of-conferences-for-aotearoa/

[48] Deloitte (2024), Corporate travel outlook. Available at: https://www2.deloitte.com/us/en/insights/focus/transportation/corporate-business-travel-survey-2024.html

[49] Tourism and Transport Forum (2024), "Tourism needs government support for green fuel to fly high". Available at: https://ttf.org.au/tourism-needs-government-support-for-green-fuel-to-fly-high/

[50] Perga et al. (2024), "The elephant in the conference room: reducing the carbon footprint of aquatic science meetings". Available at: https://aslopubs.onlinelibrary.wiley.com/doi/10.1002/lol2.10402#:~:text=Eighty%20percent%20of%20the%20carbon,ton%20of%20another%20greenhouse%20gas)

[51] New Zealand Department of Conservation (September 2023), Understanding 2022/23vvisitor activity. Available at: https://www.doc.govt.nz/globalassets/documents/about-doc/role/visitor-research/understanding-2022-23-visitor-activity.pdf

[52] Sense Partners (2023), Facilitating prosperity: The economic contribution of Air New Zealand. Available at: https://www.tourismticker.com/wp-content/uploads/2024/01/The-economic-contribution-of-Air-New-Zealand.pdf

[53] Jingyang Duan et al. (2023), "Study on Consumers' Purchase Intentions for Carbon-Labeled Products". Available at: https://doi.org/10.3390/su15021116

5. **New Zealand-specific market failures.** The New Zealand Emission Trading Scheme (NZ ETS) is not currently being used to decarbonise domestic aviation and neither this scheme nor the global CORSIA scheme is enough to support the initial high cost of SAF production domestically. Even with regulatory changes, the NZ ETS will only cover 6% of the expected cost differential between conventional jet fuel and SAF in 2030.

6. **Risks to national decarbonisation efforts.** Domestic and international aviation could rise to represent 22% of New Zealand's gross emissions in 2050 (up from 5% in 2023) if no action is taken. If international aviation emissions are to be included in Nationally Determined Contributions (NDCs) in the future, then delivery of New Zealand's net zero prospects would be challenging if there was no development of SAF.

7. **Risks to New Zealand's international standing from not fulfilling UN agreements to which it is a signatory.** New Zealand agreed to the UN International Civil Aviation Organization (ICAO) goal in November 2023 to reduce the carbon intensity of aviation fuel by 5% by 2030. Given that around 45 countries are already acting, lack of efforts to support this goal could impede New Zealand's reputation and ability to negotiate good terms in future trade agreements.

New Zealand's ETS and the international CORSIA offset programme are insufficient to make SAF cost competitive

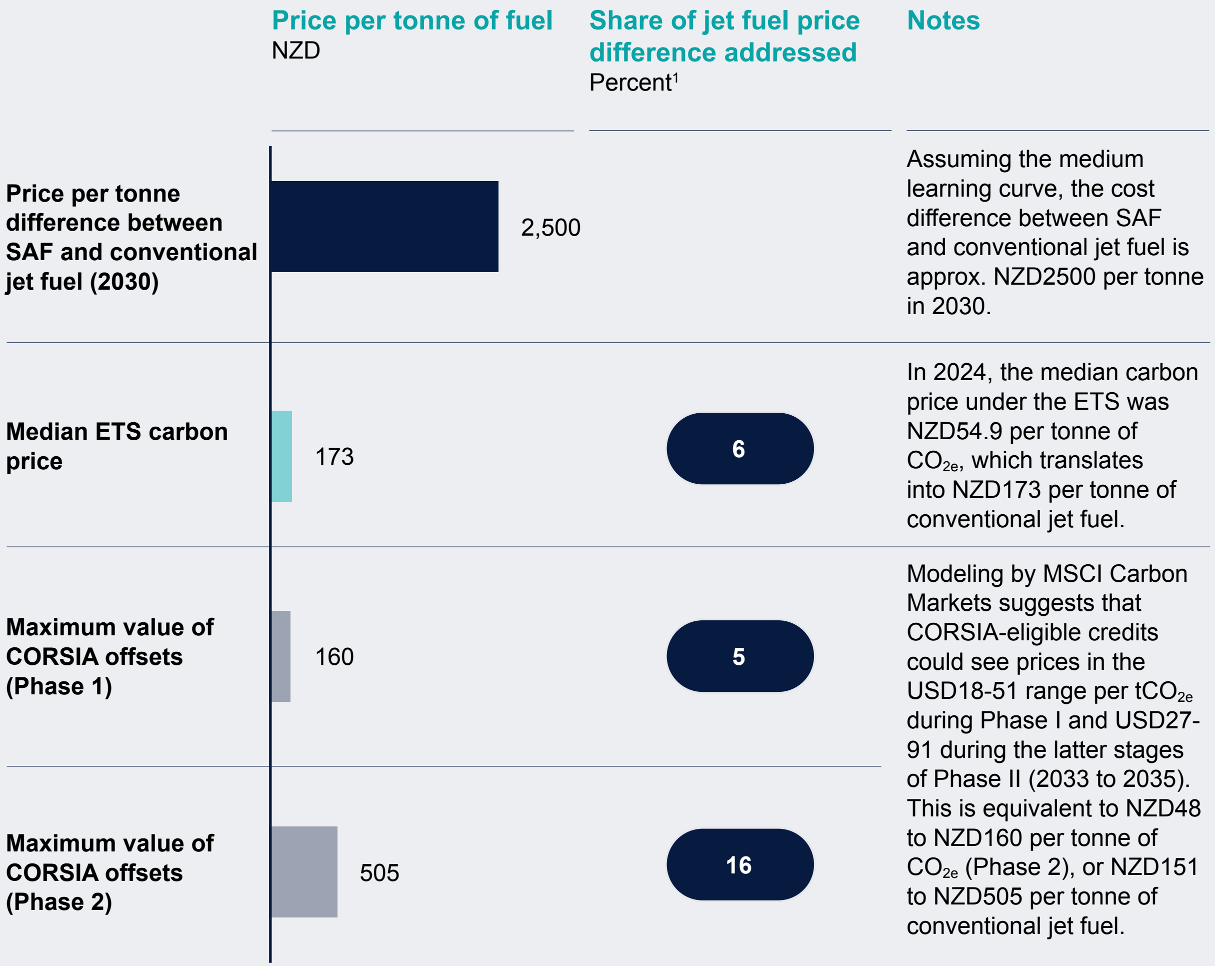


Exhibit 9

Sources: MSCI Carbon Markets; Cyan Ventures analysis

[1] Given lifecycle emissions reduction for SAF is around 80% (versus conventional jet fuel), the share of jet fuel price addressed is adjusted for this (i.e., only take 80% of the carbon price per tonne of jet fuel and compare this to the price differential).

“

Carbon prices, under both the ETS and CORSIA, are currently low when compared to …the cost of investment in solutions like SAF

UK Department of Transport, 2024

Overall, action on SAF is likely to **minimise downside risks** to New Zealand far beyond decarbonisation. The next chapter will explore the question of whether New Zealand can delay this action, or if it needs to **act now**.

4 Is there a stronger case for New Zealand to act now on SAF or wait and follow later?

Key messages:

- Delayed action on SAF is risky and costly. New Zealand would likely face supply chain challenges in securing SAF and SAF feedstocks and experience higher costs to produce SAF domestically due to delayed learning curves. At the same time, New Zealand's tourism and trade would be placed at risk due to delayed actions.
- A 5-year delay is estimated to cost NZD1.0 billion over the period to 2050.

There is a potential argument for delaying action on SAF

As shown in Chapter 2, SAF is currently more expensive than conventional fuel. Given the large technology learning curves in the industry, an argument could be made that New Zealand should delay action on SAF procurement until SAF becomes more cost competitive with conventional jet fuel. This could not only keep short-term fuel costs lower but also avoid potential negative impacts on tourism from higher airline ticket prices (linked to the higher fuel costs) and reduce the need for government intervention.

However, a delay in action is likely to be risky and costly for New Zealand

These potential benefits from delayed action are likely outweighed by the potential risks and costs associated with such an approach. This is due to the following reasons:

1. **New SAF facilities have multi-year lead times,** which means action is needed immediately to enable domestic production or secure supply which may come online in 2-5 years' time and to maximise the long-term benefit from technology learning curves for local production. Initial SAF projects are essential for technological learning and cost reductions on future projects. As production scales, economies of scale and improved processes can lead to significant price declines.

2. **Risks of missing out on local feedstock supplies.** New Zealand feedstocks are potentially of interest to offshore investors in countries like Japan and Malaysia. Given the increasing global demand for SAF, if significant volumes of feedstocks are locked up for export and prevented from use in a domestic market, New Zealand will lose the ability to utilise these feedstocks to improve domestic fuel security.

3. **Risk of missing out on low-cost foreign supply.** There is an active focus from dozens of other countries on long-term SAF procurement and increasing competition for supply. China, for instance, is redirecting used cooking oil exports to Europe due to new mandates, potentially limiting availability for other regions. The risk is that New Zealand is only able to access higher cost sources in future – higher costs will flow down to travellers – as low-cost sources have already been locked up over multi-year timescales; and

4. **Greater exposure to economic and environmental risks from inaction.** As mentioned in Chapter 3, reputationally, inaction poses a risk to New Zealand's tourism and the strong eco-tourism credentials of New Zealand. Delay also creates risks to fuel security, macroeconomic stability, and decarbonisation efforts.

Potential benefits from delayed action are likely outweighed by the potential risks and cost assocated with such an approach

The cumulative cost of a 5-year delay is estimated at NZD1.0 billion over the timeframe to 2050. This is because New Zealand may face supply chain challenges in securing SAF and SAF feedstocks, and experience higher costs to produce SAF domestically due to delayed learning curves. At the same time, New Zealand's tourism and trade revenue would be placed at greater risk. See the next chapter for more detail on cost-benefit analysis.

	SAF production comes online in 2030	SAF production comes online in 2035
Net Present Value (NZD millions)	2,350	1,310

Table 4: Cumulative impact of delayed action (NZD millions)

Note: The difference between the NPVs of the two scenarios is the cost of delayed action. Both relate to Pathway 2 in the next chapter.

In the next chapter, the costs and benefits of different approaches to SAF for New Zealand are analysed to explore the economic impacts of action.

5 What are the short-term economic impacts of action for New Zealand?

Key messages:

- The short-term potential impacts on fuel costs are manageable. A mechanism legislating a 5% blend of SAF in 2030 – in line with regional peers like Singapore and global government goals – would have a minimal impact on individual passenger costs. For example, for domestic routes, it would be less than NZD3 one-way in 2030 and could be a similar order of magnitude for flights to and from Australia.
- The short-term potential economic impacts could be positive. The economic benefit from attracting or regaining 1.2% of travellers would outweigh the costs from more expensive fuel and the demand impacts from higher fuel prices.

The short-term costs to travellers of SAF adoption are minimal

A key advantage of SAF is that it can be blended with conventional jet fuel in existing refuelling systems. The share of SAF in the jet fuel mix can be adjusted and it is possible to choose a low SAF blend in the short-term (e.g., next 5-10 years) when SAF costs are much higher than conventional jet fuel. This analysis shows that a mechanism legislating a 5% blend of SAF in 2030 – in line with regional peers like Singapore and global government goals – would have a minimal impact on individual passenger costs. For example, for domestic routes, it would be less than NZD3 one-way in 2030 **(Exhibit 10)** and could be as low as NZD3 for flights to and from Australia, which represents 44% of inbound tourists.

These low impacts are not an argument for leaving implementation to the market. The private sector will invest in SAF. But many airlines, investors and fuel producers are global businesses which face a choice of investing in SAF in multiple locations. They will likely only invest in locations where they face the lowest risks. Under current policy settings, this is not New Zealand, so policy mechanisms will be needed to enable short-term SAF use.

It should also be noted that the economic benefits of SAF use in 2030 could outweigh the costs if it leads to attracting/regaining just 1.2% of tourists. This is assessed as reasonable in future given that globally 1-3% of travellers participate in voluntary offsetting programmes offered by airlines[54], and 46% of travel booking managers for US corporates have a strategy to assign emissions budgets to travel bookings46,[55] indicating a higher share of travellers who are willing to change their behaviours due to emission concerns.

[54] Information available from: https://aviationbenefits.org/media/167226/fact-sheet_11_voluntary-carbon-offsetting_3.pdf

[55] Deloitte (2024), Corporate travel outlook. Available at: https://www2.deloitte.com/us/en/insights/focus/transportation/corporate-business-travel-survey-2024.html

The likely short-term costs to consumers from SAF adoption are low

Exhibit 10

Sources: Cyan Ventures analysis

[1] Average cost of coffee in Auckland CBD is NZD 5.40

Assumptions and implications:

- Low estimates based on SAF being 2x JetA1 price
- High estimates based on SAF being 4x JetA1 price
- All scenarios assume 5% blend
- Assume 83% passenger load factor based on IATA average
- The average cost is done on a simple per passenger average, but in reality, the cost imposition could vary by passenger type (e.g., higher for business class, lower for economy)
- Greatest sensitivity on costs is for long-haul (beyond Australia).

The next chapter explores these longer-term economic implications in further detail.

6 What are the long-term economic impacts of action for New Zealand?

Key messages:

- The long-term economic impacts depend on the path New Zealand chooses in relation to SAF production and use.
- Of the spectrum of action pathways analysed below, Pathway 2 is the most economically attractive relative to a 'do nothing' pathway and has higher expected benefits than costs. These pathways are:
  - Pathway 1: 1% SAF in 2027 to 30% SAF by 2050, all imported SAF
  - Pathway 2: 1% SAF in 2027 to 30% SAF by 2050, all domestic SAF
  - Pathway 3: 1% SAF in 2027 to 70% SAF by 2050, all imported SAF
  - Pathway 4: 1% SAF in 2027 to 70% SAF by 2050, all domestic SAF
- Producing SAF domestically in line with Pathway 2 would lead to over NZD2.3 billion in net benefit to the economy and 5,700 jobs by 2050.

The long-term economic impacts depend on the path New Zealand chooses in relation to SAF production and use

As discussed in Chapter 2, there are still some large uncertainties on long-term economic impacts, as technology learning curves and future carbon prices will affect the relative price competitiveness of SAF with conventional jet fuel. Most countries taking action on SAF now are managing the cost impacts of this uncertainty by requiring the use of 1-2% SAF blends between 2025-28 and then gradually increasing their required percentages over time. If New Zealand were to align with this approach, There are a range of different pathways for SAF use based on New Zealand's choices in two areas:

- Degree of action on procurement of SAF: New Zealand could work to ensure moderate access to SAF to avoid potential risks to competitiveness, exposure to regulatory action or risks from losing sustainability-minded travellers. Alternatively, New Zealand could opt to become more ambitious with SAF adoption, aligning with more proactive regions (e.g., Europe), which may be more aligned with future global standards.
- Source of SAF use: New Zealand can either choose to become an importer of SAF, working with global partners to secure SAF supplies or become a producer of SAF, developing a domestic SAF industry to take advantage of local feedstock supplies. Related to this is a choice to be made on whether to use SAF feedstocks for domestic production or look to export these feedstocks internationally (although this is out of scope for this analysis).

These pathways are in contrast to a 'do nothing' approach, where New Zealand continues to rely on conventional jet fuel. The key characteristics of these four pathways are described in **Table 5**. While in reality there is a continuum of choices between these four archetype pathways, these pathways have been used in the analysis to illustrate the extreme spectrum of potential outcomes for New Zealand.

SAF

Pathway 2 is the most economically attractive pathway

This cost-benefit assessment shows that Pathway 2 – conservative SAF adoption with a focus on domestic production – has higher expected benefits to New Zealand than costs **(Table 6)**. Note that if 3% of tourists could be attracted/ regained due to the use of SAF, then all pathways would have higher economic benefits than costs.

	Degree of action on the procurement of SAF	
Source of SAF	**Minimum viable action (on SAF)**	**Focused action (on SAF)**
A SAF importer	**Pathway 1** 1% SAF in 2027 to 30% SAF by 2050, all imported SAF[57]	**Pathway 3** 1% SAF in 2027 to 70% SAF by 2050, all imported SAF[58]
A SAF producer	**Pathway 2** 1% SAF in 2027 to 30% SAF by 2050, all domestic SAF	**Pathway 4** 1% SAF in 2027 to 70% SAF by 2050, all domestic SAF

Table 5: SAF pathways for New Zealand in the context of acting now

Note: Many other countries in the region – such as Singapore, Thailand, India, South Korea and Indonesia – will have started their respective SAF ramp-ups by 2027.

SAF pathways linked to different choices	Pathway 1	Pathway 2	Pathway 3	Pathway 4
Cost				
Additional fuel cost[59]	4,030	3,860	8,070	10,110
Government supported development costs	0	610	0	1,440
Impact of higher ticket prices on tourism revenue	1,380	1,190	2,380	4,730
Total costs	**5,410**	**5,660**	**10,440**	**16,290**
Benefits				
Economic benefits to the SAF industry	0	1,180	0	2,940
Economic benefits to feedstock and other suppliers	0	2,400	0	6,200
Avoided tourism loss*	4,150	4,150	4,150	4,150
Avoided trade loss	200	200	200	200
Fuel security benefits	0	90	0	90
Total benefits	**4,350**	**8,010**	**4,350**	**13,560**
Net benefit	**-1,060**	**2,350**	**-6,100**	**-2,730**

Table 6: Cost-benefit assessment of different choices on SAF pathways (NZD million, in net present value terms)

Note: Results are relative to a "do nothing" pathway of using conventional jet fuel. Numbers may not add up due to rounding.

* Assumes that 1% of travellers (business and domestic) may be deterred due to carbon footprint concerns from a lack of SAF. This is seen as conservative.

[57] Similar to current minimum of regional peers like Indonesia and low range scenario of ICAO. The International Civil Aviation Organization (ICAO) is a specialized agency of the United Nations that coordinates the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth. In the low-end scenario for decarbonization, conventional jet fuel still accounts for two-thirds of fuel supply by 2050, with a further small share provided by lower carbon aviation fuels (LTAG-LCAF), which are drop-in fuels produced from petroleum resources. The remaining amount (approximately 30%) is from SAF. Further detail is available at: https://www.icao.int/environmental-protection/LTAG/Documents/ICAO_LTAG_Report_AppendixM5.pdf

[58] Matching the EU targets and similar to ICAO's middle range scenario. The EU targeted mandate is for SAF to be 70% of aviation fuel in 2050. In the ICAO mid-range scenario, fuel production technologies with medium attainability and readiness are considered. It results in 66% of aviation fuel being SAF by 2050. Further detail is available at: https://www.icao.int/environmental-protection/LTAG/Documents/ICAO_LTAG_Report_AppendixM5.pdf

[59] Fuel costs depend on both the total volume of SAF versus conventional jet fuel used, and the type of SAF. For example, for Pathway 4, for New Zealand to increase supply to meet the higher SAF demand, there would be greater reliance on Power-to-liquid which is currently foreseen as a more expensive production pathway in the short-term (e.g., next 10 years). Similarly, in Pathway 2, New Zealand production could come from more short-term cost efficient sources (e.g., HEFA), which may not necessarily scale to the levels needed in Pathway 4.

Benefits	Description
Economic benefits of the SAF industry and upstream suppliers to the economy	Developing the SAF industry domestically contributes to New Zealand's economy, providing jobs and income to New Zealand citizens and businesses. This contribution to the economy comes from both SAF producers and upstream suppliers who provide feedstock and inputs into the SAF production.
Avoided tourism loss	If New Zealand does not decarbonise aviation emissions, there is a risk that travellers may reduce or stop travelling due to aviation emission concerns. Adopting SAF to reduce aviation emissions is one way to mitigate this risk.
Avoided trade loss	Adopting SAF can benefit New Zealand's trade by ensuring the country's exports remain attractive to international buyers who are increasingly concerned about embedded emissions of products (associated with their transport).
Fuel security benefits	By producing SAF domestically, New Zealand can avoid spending on storage for fuel security and reduce costs caused by major disruptions.
Costs	**Description**
Additional fuel cost	The additional fuel cost accounts for the price gap between conventional jet fuel, assumed at NZD871 per tonne through to 2050, and SAF, estimated to be 2-5 times higher than conventional jet fuel.[60]
Development costs	In the pathways in which New Zealand becomes a SAF supplier, New Zealand is expected to incur development costs to initiate the industry. This includes feasibility studies, permits, site selection, legal services and design. Note that the impact of development costs could be reduced by attracting foreign investment.
Impact of higher ticket prices on tourism revenue	If the additional fuel cost is reflected in higher ticket prices, some consumers may opt not to travel, leading to a potential decline in tourism revenue.

Table 7: Explanation of benefits and costs assessed

The economic development benefits from local SAF production are large

For example, 70% domestic production would lead to **NZD3.6 billion in GVA and 14,800 jobs in 2050**. Given that the SAF industry today is non-existent in New Zealand, action is needed to encourage feasibility tests, pilots and first-of-a-kind projects to properly assess the economics and strategic value of imports versus domestic supply.

Economic benefits	Pathway 2	Pathway 4
Volume of SAF produced (ML)	2,350	1,310
Potential jobs in 2035	1,700	4,100
Potential jobs in 2050	5,700	14,800
GVA in 2050 (NZD millions)	1,300	3,570

Table 8: Potential economic benefits for New Zealand from SAF production (NZD millions)

Note: Potential jobs are the number of people employed to run the SAF facilities and construct the facilities, and those in upstream agriculture, waste, energy and logistics industries.

14,800 potential jobs in 2050.

[60] Cyan Ventures estimates.

Improving the attractiveness of New Zealand tourism from SAF adoption could create extremely large economic benefits

Regaining just 1.2% of travellers who might not travel due to the absence of SAF would more than outweigh potential costs. **(Exhibit 11)**. This is assessed as reasonable given that today 1-3% of travellers globally participate in voluntary offsetting programs offered by airlines, indicating a higher share of travellers who are willing to change their behaviours due to emission concerns.[61] As shown in Exhibit 11, the benefits could be substantially higher for New Zealand if a higher share (e.g., 3% of travellers) would otherwise not travel if SAF were not available.

It is reasonable to assume the percentage could rise over time. For example, a survey carried out in early 2022 revealed that 46% of consumers worldwide are likely to stop flying or replace some flights with train or bus journeys to limit their contribution to climate change.[62] In China, which is New Zealand's third-largest source of tourists and grew to be the biggest tourism source market in the world prior to the pandemic,[63] around 68% of respondents stated that they would likely replace flights with a more sustainable option, making it the country with the highest willingness to change on this matter.

In short, supplying SAF is a low-cost 'insurance' policy for New Zealand's tourism and air cargo sectors.

If using SAF could avoid just 1.2% of tourists not coming to New Zealand due to carbon footprint concerns, this would mitigate the higher fuel costs

Comparing fuel costs versus tourism benefits
NZD billions (NPV terms)[1]

Exhibit 11

Source: Cyan Ventures analysis

[1] Fuel cost differential estimates assumes the level of production of Pathway. [2] "30% SAF, all domestic SAF". All values are NPV with an 8% discount rate over the period to 2050.

[61] TAG (2020), Voluntary Carbon Offsetting. Available at: https://aviationbenefits.org/media/167226/fact-sheet_11_voluntary-carbon-offsetting_3.pdf

[62] Statista (2022), "Share of consumers trying to replace flights for climate change worldwide 2022". Available at: https://www.statista.com/statistics/1310614/consumers-trying-to-replace-flights-with-more-sustainable-options-for-climate-change/

[63] Information accessed from: https://www.unwto.org/news/unwto-looks-to-re-write-tourism-history-at-official-re-opening-of-china

The expected government costs are low

The government-supported development costs or incentives are the assumed costs related to development work support (not construction) that the government may need to invest in to create a local SAF industry. The above analysis is based on benchmarks from Australia, where the Australian Renewable Energy Agency (ARENA) funds around 9% of the development capital expenditure for bioenergy projects.[64] It is important to note that the government costs are more than offset by the potential economic benefits from a local SAF industry. For example, the economic benefits of SAF production domestically are over 4 times as large as the required government support costs.

Overall, there are pros and cons to the different SAF pathways

Table 9 on the next page provides an overall assessment of some of the key assumptions, pros and cons associated with each SAF pathway for New Zealand. Note that each pathway represents an extreme on the spectrum of possible actions; the national path is likely to be some hybrid of these options.

The analysis in this chapter shows there is a strong economic case for early action on SAF. The specifics of how SAF adoption and production in New Zealand could be supported are explored in the next chapter.

[64] ARENA (2021), Australia Bioenergy Roadmap. Available at: https://arena.gov.au/assets/2021/11/australia-bioenergy-roadmap-report.pdf

SAF pathway	Assumptions for pathway to be optimal selection	Pros	Cons
Pathway 1	• New Zealand can procure SAF from overseas. • Lower aspirations on SAF are sufficient to deter risk related to sustainability-focused consumers.	• Limited government funding requirements. • Demonstrating good faith action on international commitments (CAAF/3). • Emissions reductions on domestic network can be recognised by New Zealand in its GHG inventory. • Some energy diversification benefits.	• Lack of support for domestic production could mean New Zealand faces fuel supply risk or higher prices. • If SAF develops quickly in the region, then the New Zealand industry would be left uncompetitive when domestic production finally begins.
Pathway 2	• New Zealand can produce SAF competitively with limited competition for feedstocks from other sectors • Lower aspirations on SAF are sufficient to deter risk from regulatory penalties / traveller backlash.	• Only moderate government funding required. • Other pros as above. • Contribution to jobs, local and national economic benefits, some fuel security.	• The SAF industry in New Zealand today is non-existent. This is subject to SAF producers being able to develop a cost-effective supply from New Zealand's wealth of feedstocks.
Pathway 3	• New Zealand can procure SAF from overseas • SAF technology develops quickly • World moves to strong mandates / targets, and New Zealand would be negatively impacted if not aligned.	• Reduce significant amount of aviation emissions. • Avoid damages to New Zealand's reputation as a sustainable destination.	• Lack of support for domestic production could mean New Zealand faces significant fuel supply risk or higher prices. • If SAF develops quickly, then New Zealand industry would be left uncompetitive when production finally begins.
Pathway 4	• New Zealand can produce SAF competitively. • SAF technology develops quickly, lowering the cost of adoption.	• Reduce significant amount of aviation emissions. • Avoid damages to New Zealand's reputation as a sustainable destination. • Jobs, economic benefits. • Fuel resilience.	• The SAF industry in New Zealand today is non-existent. This is subject to SAF producers being able to develop a cost-effective supply from New Zealand's wealth of feedstocks. • Greater government funding required to provide initial support to industry.

Table 9: Risk-return assessment for all pathways

7 Where should New Zealand start in terms of policy actions?

Key messages:

- Five key actions are outlined in this research where immediate government policy action is critical.
- Careful crafting of a supportive SAF policy framework will be necessary to ensure its effectiveness. A public consultation on options is likely to be needed in advance of agreeing a potential SAF policy package.

There are some low-risk actions that New Zealand should consider now

The SAF industry is nascent and SAF, like other new products, requires interventions to form the market and accelerate the 's-curve' of adoption. Initial (lower cost) action is recommended now to maximise economic gains and minimise risks across the next 25 years. Even if initial action is modest, by acting now New Zealand retains the option to raise its ambition levels later after monitoring developments linked to drivers such as global regulatory action and technology learning curves (which influence SAF prices).

There are five key areas recommended for immediate action:

1. **Create a strong demand and investment signal for at least two years in advance.** There are different ways of stimulating supply and demand, ranging from subsidies through to public procurement. However, the most common national approach used in other countries overseas is a future SAF use volume requirement (often described as a mandate or levy), where airlines or fuel suppliers are required to purchase a certain share of their jet fuel use from certified sustainable supply chains (which is typically coupled with supply-side support to manage costs). SAF use volume requirements are also a clear signal to help support foreign direct investment into domestic production. **Table 12** provides some details of how such as demand signal could be structured for New Zealand. As noted in Chapter 5, a 5% blend mandate for SAF would have a minimal impact on passenger costs.

2. **Define and signal acceptable feedstocks and certification standards.** It is important that New Zealand adopts international standards such as CORSIA certification, but with considerations of any local concerns, such as unique feedstocks not adequately recognised in global frameworks. This approach has been used by neighbouring countries. For example, in the 2024-25 Federal Budget, the Australian Federal Government announced A$18.5 million over four years to develop a certification scheme for low carbon liquid fuels.

3. **Link SAF to the national ETS.** Enabling SAF to be eligible to meet obligations under the NZ ETS (by resolving complications with tracking physical fuel through shared infrastructure) is a further important financial signal, even if it will only mitigate a small share of the SAF premium.

4. **Provide development support for multiple first-of-a-kind projects.** First-of-a-kind (FOAK) projects are projects that represent the first-ever implementation of a new technology or design at a significant scale, with the goal of proving its viability and potential for wider adoption. Given the uncertainties on New Zealand's potential SAF supply volumes and cost competitiveness, there is a need for low-cost support for feasibility

studies, pilots and FOAK projects. This would also signal New Zealand's intent on SAF internationally and could help support foreign direct investment. This could be similar to the approach used by Australia's Renewable Energy Agency (ARENA) which has been allocated AUD250 million to support feasibility studies, pilots and FOAK projects related to low carbon liquid fuels.

5. **Ensure strong and decisive leadership and coordination to maximise the long-term value of the transition to New Zealand.** Senior ministerial support and coordination across relevant government agencies is crucial and could include bolstering government participation on existing domestic or regional vehicles such as SAA (Sustainable Aviation Aotearoa) or establishing forums similar to the Australian Jet Zero Council or UK Jet Zero Taskforce. Participating in Asia-Pacific regional policy forums to shape SAF supply / demand in the region is also crucial.

New Zealand has many options for the design of potential SAF policies. Key aspects and recommendations are outlined in **Table 10** over the next two pages.

Design options	Description	Recommendation for New Zealand	Rationale
Responsible entity for procurement	Whether the procurement of SAF is done by an airport with pass through of costs to airlines (e.g., Singapore), fuel suppliers or done directly by airlines.	• Fuel suppliers – same as EU and UK policy frameworks.	• Given the large number of airports (5 international airports, 26 regional airports), procurement is difficult to be done at the airport level. • Targeting fuel suppliers simplifies compliance by focusing on the entities that physically supply fuel to the market and encourages supply investment.
Proof of meeting obligations	How entities responsible for procurement of SAF can demonstrate they are meeting mandates.	• Fuel suppliers must apply for certificates from the Administrator and provide sufficient evidence that the fuel is eligible and sustainable. They can either use these certificates to show they have met their obligation, trade them to other parties, or pay a buy-out price.	• Same as UK approach.
Fixed or variable target for blending obligation/ mandate	Whether a blending target is fixed at a certain percentage (e.g., 5%) or varies depending on SAF prices (e.g., Singapore targets 3-5%, based on a targeted SAF price, which may increase or decrease the mandated amount).	• Fixed, but with cap on maximum price (similar to the UK).	• A fixed target provides certainty. • At low blend levels, the cost impacts are generally not significant for most trips. • A buy-out mechanism can be included (similar to the UK) which puts a maximum price that would have to paid (which can be modelled to ensure the scheme is cost competitive).
Domestic vs international traffic	Whether a blending obligation/mandate applies to international and/or domestic traffic.	• Both (similar to the UK which places the requirements on fuel suppliers within the country).	• International flights are the largest contributor to New Zealand's aviation emissions. • Domestic flights, while a smaller contributor to New Zealand's emissions, are a contributor of New Zealand's emissions, and included in the New Zealand's government carbon targets. Domestic flights are also shorter than international, and the cost impacts of SAF blend are less. • Domestic fuel uptake demand alone would not be enough to support production economies of scale and the significant SAF investment and production costs. • Differentiating between domestic and international travel could also lead to competitive distortions.

Table 10: SAF policy design options

Design options	Description	Recommendation for New Zealand	Rationale
Target level blend	Blending target for SAF (as a share of total aviation fuel) over time.	• 1% in 2027. • 5% in 2030.	• 1% is signal of intent (and matches regional mandates such as Korea and Indonesia); 5% is in line with ICAO. • 2027 start date is in line with other countries in the region which start requiring SAF between 2025-28. • Provides signal to tourists that New Zealand cares about decarbonisation. • Provides demand signal to encourage local supply. • Low cost.
Target review period	How often blending targets are reviewed.	• In 2030. • Every 5 years thereafter based on market developments on costs, performance, etc.	• This is similar to the UK approach.
Technology agnostic or specific	Some targets have sub-targets for specific types of SAF (e.g., Power to Liquid in case of EU) or caps on fuels (e.g. HEFA for UK). Aim is to encourage broad-based investment, even in technologies which are currently higher cost but have potential breakthroughs.	• Announce intention to set technology-specific target post 2030 (once greater understanding of technology costs in New Zealand), but the exact target to be established over the next 5 years.	• The UK and EU have set a minimal amount for PtL in their mandates, but given the cost competitiveness of PtL, a post 2030 mandate may be more relevant for New Zealand. Importantly, government could signal willingness to do this post 2030.
Volumetric or carbon intensity target	Some targets are by volume, others distinguish by carbon intensity (e.g., Japan).	• By volume but put minimum requirement on minimum GHG emissions reductions.	• In-line with most of the current SAF targets. • Initially simpler as science is still being developed and can be revised later. • In multiple schemes, SAF must achieve minimum GHG emissions reductions relative to a fossil fuel comparator of 89gCO2e/MJ: CORSIA is 10%, the UK is 40%, the EU is 65%.
Funding	Funded through direct charge to travellers, through government, or industry.	• Fuel suppliers are required to provide a certain blend of SAF. They can then determine how much is passed through to airlines who can in turn determine pass through rate to consumers.	• Provides flexibility to airlines, taking account of price elasticity of demand on different routes. • Monitoring by the New Zealand Commerce Commission can ensure that airlines do not pass through more costs than those related to SAF.

Table 10: SAF policy design options (continued)

Annex

A1. Understanding New Zealand's potential supplies of SAF

While the purpose of this report is not to investigate specific sources of domestic SAF available to New Zealand, the team has reviewed past work in this area, as well as interviewed many project proponents. Broadly, SAF pathways cluster into two groups based on the feedstock that is used **(Exhibit A1)**:

- **Biogenic feedstocks,** where biological residues are treated and transformed to SAF
- **Power-to-Liquid (Power-to-Liquids) feedstocks,** where electricity is used to make green hydrogen that is in turn used in concert with carbon dioxide captured from industrial sources or the atmosphere to produce SAF

The different SAF feedstocks vary in terms of their technology readiness levels (TRLs), as well as their commercial readiness levels (CRLs). However, this research suggests that even with a focus on more mature TRL pathways, such as sawmill residues and municipal solid waste (MSW), and then eventually potentially short-rotation forests (if the sustainability impacts were well-managed), there is the potential to supply over 30% of 2050 aviation fuel demand through domestic sources in New Zealand. Expansion of other pathways, such as power-to-liquid and energy crops (such as miscanthus), which may have longer technology learning curves, could add further to this supply.

Given the nascent stage of development of the SAF industry in New Zealand, there are several important aspects to note. In particular, the relative cost efficiency of New Zealand produced SAF (versus both conventional jet fuel and other forms of SAF from overseas markets) is still to be established. For example, building costs are generally 15% lower in Australia than in New Zealand (due to less required structured steel and concrete linked in part to more earthquake activity in New Zealand) and biomass sources tend to be cheaper, however New Zealand has greater cost efficiency on labour and water.[66] This uncertainty reinforces the need for first-of-a-kind projects to be prioritised in New Zealand to understand their feasibility in greater detail.

Table A1 has an overview of potential SAF sources in New Zealand. Overall, developing biomass sources with high technology readiness (e.g., sawmill residues, MSW) are assessed to supply approximately one quarter of New Zealand's 2050 SAF demand. If all potential SAF sources are developed, including short rotation forestry, power-to-liquid and energy crops, New Zealand could supply over 70% of its aviation fuel demand through domestic SAF.

[66] Based on Woodbeca analysis.

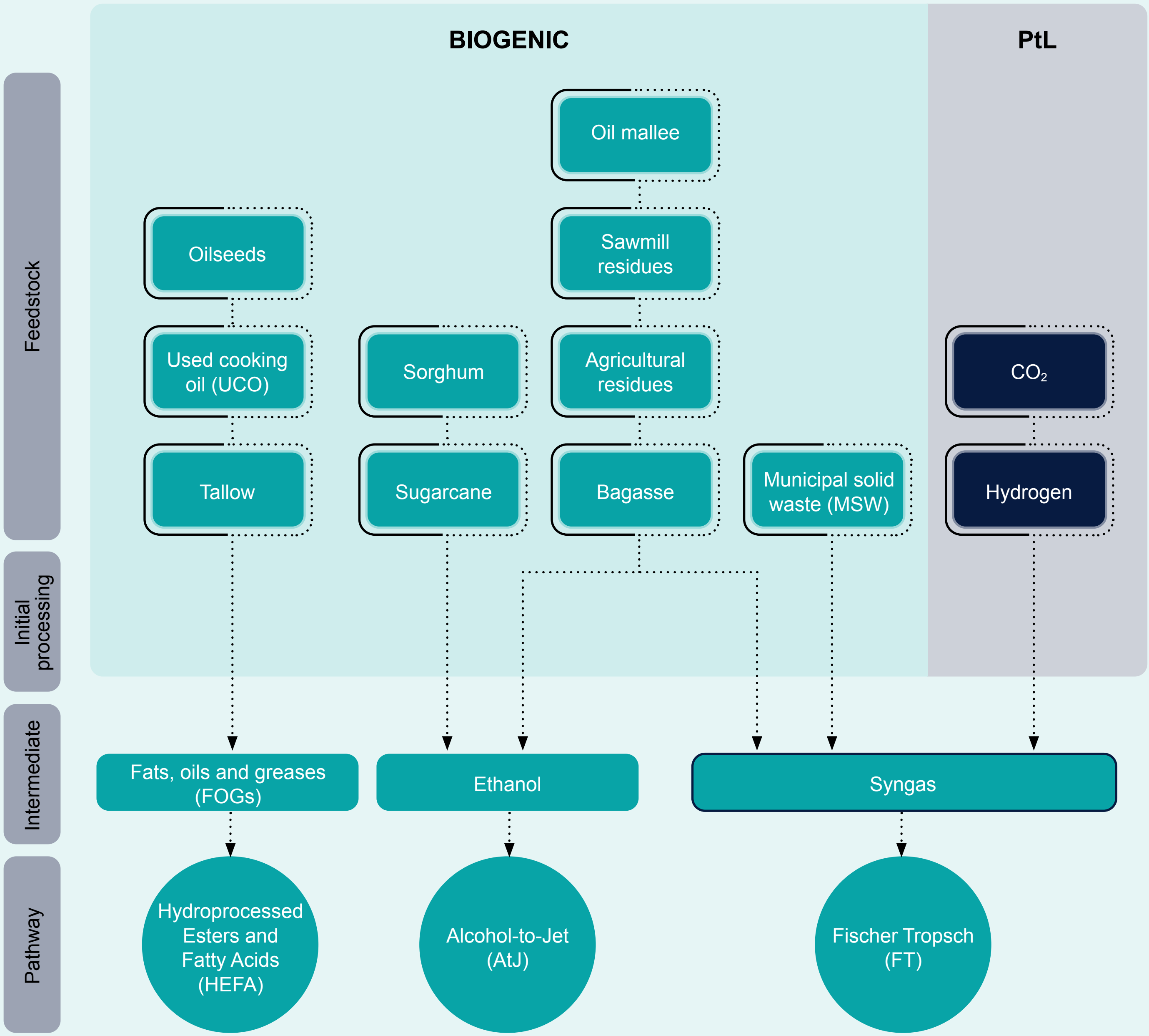


Exhibit A1[67]

[67]Map adapted from CSIRO (2023), Sustainable Aviation Fuel Roadmap.

SAF pathways cluster into two groups based on the feedstock that is used.

Overview of SAF pathway	Carbon reduction (compared to conventional jet fuel)[68]	Technology Readiness Levels (globally)	Current development in New Zealand	Long-term potential supply in New Zealand
Power-to-liquid	78-99%	Full prototype at scale	Some projects (e.g., Marsden Point)[69] at feasibility stage	Potentially as much as 1,000 ML by 2050, but dependent on technology learning curves.
Forestry sources (i.e., sawmill residues, plantation forests)	91%	Pilot / demonstration plants	Feasibility study by LanzaJet and Air New Zealand in the Bay of Plenty[70]	Around 650ML of total potential supply by 2050. This includes 150-200 ML of potential supply from sawmill residues and k-logs (lower quality grade logs). There is a large potential supply in the Bay of Plenty, although logistical challenges influencing recovery. This also includes over 500ML of further potential supply from k-logs or dedicated bioenergy forests. Potential to have 240,000 hectares of dedicated short rotation bioenergy forest (subject to sustainability concerns being well-managed)[71] Given 4-year development timeline and 16-year growth cycle, will take around 20 years for first supply.
Municipal Solid Waste gasification	46%	Pilot / demonstration plants	Feasibility study completed by LanzaJet and Air New Zealand	Around 100ML of potential SAF supply. Capacity is currently capped at 1.2 million tonnes of waste in Auckland, of which 800,000 tonnes are likely recoverable. Note that use of MSW for SAF has several challenges including a variable carbon intensity, as the balance of plastics and organic matter changes, and unknown impacts on waste recovery efforts.
Other (e.g. energy crops, and second-generation feedstocks, tallow, canola)	74-100% plus (depending on crop)	Varies by crop type – early pilots	Some previous work on Miscanthus	Potentially up to 600ML, but further feasibility work is required. New Zealand produces around 150 kt of tallow per year. A large volume of this is currently exported, while the remaining 20% is consumed in domestic markets for animal feed, soap and margarine. Competition for existing use and tallow often being too costly as a factor limiting their potential as a feedstock.[72] Energy crops such as miscanthus have limited focus to date but could potentially be scaled significantly if sustainability and land-use impacts are well-managed.

Table A1: Potential sources of New Zealand SAF supply

[68] CSIRO and Boeing (2023), Sustainable aviation fuel roadmap. Available at: https://www.csiro.au/en/research/technology-space/energy/sustainable-aviation-fuel

[69] For further detail, see: https://reneweconomy.com.au/fortescue-may-convert-nz-oil-refinery-to-green-hydrogen-production-facility/

[70] For further information, see: https://www.airnewzealandnewsroom.com/press-release-2024-new-study-shows-local-production-of-sustainable-aviation-fuel-could-support-fuel-resilience-and-security-in-aotearoa-new-zealand

[71] Scion (2021), Strategic review of short rotation bioenergy forests.

[72] CSIRO (2023), Sustainable Aviation Fuel Roadmap. Available at: https://www.csiro.au/en/work-with-us/services/consultancy-strategic-advice-services/csiro-futures/energy/sustainable-aviation-fuel-roadmap

A2. Description of SAF pathways

Below is a table describing the assumptions on the pathways in regard to choices New Zealand could make related to SAF demand and domestic supply. All pathways assume action is taken in the next two years to enable a SAF ramp-up starting in 2027, aligned with other countries in the region and providing some lead-time for industry to prepare.

	2027	2030	2035	2040	2045	2050
SAF demand and supply as % of New Zeland aviation fuel demand						
Pathway 1						
SAF demand	1%	5%	10%	15%	20%	30%
NZ SAF supply	0%	0%	0%	0%	0%	0%
Pathway 2						
SAF demand	1%	5%	10%	15%	20%	30%
NZ SAF supply	0%	5%	10%	15%	20%	30%
Pathway 3						
SAF demand	1%	6%	20%	34%	42%	70%
NZ SAF supply	0%	0%	0%	0%	0%	0%
Pathway 4						
SAF demand	1%	6%	20%	34%	42%	70%
NZ SAF supply	0%	6%	20%	34%	42%	70%
SAF demand (ML)						
Pathway 1 & 2	20	110	240	400	600	1,010
Pathway 3 & 4	20	130	480	910	1,260	2,350

Table A2: Pathway assumptions; Percent of New Zealand aviation fuel demand relative to SAF and domestic SAF

The assumptions for this are based on the following:

SAF demand in Pathways 1 and 2 grows to 30% in 2050 which is equivalent to currently announced target of Indonesia and similar to the ICAO low range scenario. Assume a linear build up, but with slower build in initial years given higher cost.

SAF demand in Pathways 3 and 4 follows the EU mandates of 70% SAF adoption by 2050, but with a slower ramp-up in 2027 and 2030 than the EU mandate to reflect the lack of a robust current pipeline of local projects. These percentages are also similar to the ICAO mid-range scenario.

A3. Description of cost-benefit modelling approach

This study uses a Cost-Benefit Analysis (CBA) approach to assess the potential returns of four alternative pathways that New Zealand could choose related to sustainable aviation fuel. The goal is to determine for each pathway that New Zealand could choose, whether the benefits outweigh the costs and by how much.

A summary of benefits and costs considered in this analysis and whether they have been quantified is provided in Table 6 in the main report. The benefits and costs of these four pathways have been evaluated against a do nothing pathway, in which New Zealand is assumed to continue using fossil fuel as the only source of jet fuel as a result, airlines departing New Zealand would need to procure CORSIA offset/removal projects from overseas to offset emissions not mitigated by SAF.

Details on quantification of costs

- **Additional fuel cost:** The additional fuel cost reflects the cost difference between using conventional jet fuel and using SAF. The cost of using jet fuel includes the cost of jet fuel (estimated at NZD0.7 per litre of jet fuel, the median cost of jet fuel between October 2014 and February 2024) and the cost of offsets.[73] The cost of offsets has been informed by MSCI CORSIA price forecast and IEA's Announced Pledges Scenario, assuming that one tonne of jet fuel produces around 3.15 tonnes of CO2.[74, 75] Adopting SAF has a potential to reduce carbon emissions by 80%, and the cost of offsets when using SAF is reduced by 80% to reflect this reduction in emissions.[76] The cost of producing SAF has been informed by the estimates of the United States Department of Energy and the Mission Possible Partnership.[77, 78] The United States Department of Energy's report provides the latest estimates of the cost range for producing SAF across different pathways in 2030. This range has informed the low and high estimates for the SAF cost in this analysis. The medium has been estimated as the average of the low and high estimates. The cost of SAF after 2030 is estimated using the learning curve provided in the Mission Possible Partnership's report. The differences in additional fuel cost across the four pathways reflect different assumptions on how SAF are produced in New Zealand and overseas. In Pathways 1 and 3, the cost of SAF is the international median cost of production. For Pathways 2 and 4, the international median costs of production have also been used, but they are applied to the anticipated SAF fuel production mix in New Zealand, which will likely differ from international production mixes due to different availabilities of feedstock. In pathway 2, it has been assumed that about 12% of the 1010ML of SAF produced by 2050 is produced by HEFA technology, and the remainder is split equally between AtJ and FT technologies. In pathway 4, it has been assumed that 8% and 37% of the 2,350ML of SAF produced by 2050 is produced by the HEFA and PtL technologies respectively, and the rest is produced by the AtJ and FT technologies.

- **Development costs:** In the pathways in which New Zealand becomes a SAF supplier, New Zealand is expected to incur development costs to initiate the industry. This includes feasibility studies, permits, site selection, legal services and design. The portion of these costs paid by SAF producers is accounted for in the additional fuel cost as SAF producer accounts for the development efforts in SAF price. Only the government-supported portion of these development costs is accounted for to avoid double-counting. It is based on benchmarks from Australia, where the Australian Renewable Energy Agency (ARENA) covers around 9% of the development capex for bioenergy projects.

[73] Index Mundi (2024), Jet Fuel Monthly Price. Available at: https://www.indexmundi.com/commodities/?commodity=jet-fuel&months=120&currency=nzd

[74] MSCI (2024) CORSIA: costs and implications for the airline industry. Available at: https://www.msci.com/documents/10199/1a941171-8829-145f-db45-99afc3f9d444

[75] International Energy Agency (2024), Global Energy and Climate Model Documentation 2024, IEA, Paris.[76] X

[76] IATA (2025), Developing Sustainable Aviation Fuel (SAF). Available at: https://www.iata.org/en/programs/sustainability/sustainable-aviation-fuels/

[77] U.S. Department of Energy (2024), Pathways to Commercial Liftoff: Sustainable Aviation Fuel. Available at: https://liftoff.energy.gov/sustainable-aviation-fuel-2/

[78] Mission Possible Partnership (2022), Technical Appendix of Making Net Zero Aviation Possible. Available at: https://3stepsolutions.s3-accelerate.amazonaws.com/assets/custom/010856/downloads/MPP-Aviation-Transition-Strategy_Technical-Appendix82.pdf

- **Impact of higher travel cost:** In the short-term (e.g., next 10 years), SAF costs are likely to be significantly higher than conventional jet fuel, and SAF procurement will increase total fuel costs, some of which will be passed through to end consumers. This analysis assumes that 75% of the additional fuel cost would be passed onto ticket prices.[79] The impact of higher ticket prices on tourism revenue is based on the elasticities of tourism demand published by the Ministry of Business, Innovation & Employment.[80] According to this study, the largest market segments of New Zealand tourism, domestic demand and demand from Australia, are price inelastic. A 1% increase in the cost of travelling will therefore lead to a smaller proportional decline in tourism revenue.

- **Increased competition for labour and raw materials (not quantified in this analysis):** Theoretically, producing SAF domestically may increase competition for labour and raw materials. The demand for specialised labour in the SAF industry can create competition with other sectors that require similar skills, such as chemical engineering, biotechnology, and plant operations. This could potentially drive-up wages and create labour shortages in these industries, affecting their overall productivity and growth. However, the expected labour requirements are minor compared to the size of the New Zealand labour force. For example, this analysis estimates that under pathway 2, producing SAF in New Zealand can create up to 5,700 jobs, which is just 0.2% of New Zealand's current labour force. Similarly, while the competition for raw materials, such as feedstocks, could lead to increased costs for other industries reliant on these materials (e.g., biodiesel, logging exports), this is unlikely to be significant as SAF production would involve creating new sources of supply (such as new plantation forests).

Details on the quantification of benefits

- **Avoided tourism loss:** If New Zealand does not decarbonise aviation emissions, there is a risk that some travellers may stop travelling due to aviation emission concerns. Adopting SAF to reduce aviation emissions is one way to mitigate this risk. Quantifying the potential tourism loss to New Zealand, however, remains challenging due to the absence of evidence on the number of visitors who would change their plans due to aviation emission concerns. In the main report, data points have been provided on the share of travellers who currently offset their carbon emissions on their travel and survey evidence of consumers who indicate their willingness to reduce air travel due to climate concerns. In the absence of clear data, a conservative 1% assumption is used in this analysis for the potential risk of travellers (business and domestic) that may stop travelling in the absence of SAF usage. This assumption is multiplied by the tourism expenditure spent by international visitors and domestic air travellers to estimate the potential loss in tourism revenue. In 2023, international visitors spent approximately NZ$10.8 billion in New Zealand.[81] Domestic visitors spent NZ$26.8 billion, of which approximately 57% comes from trips enabled by air travel.[82] Tourism expenditure between now and 2050 is assumed to grow at the same rate as it did between 2016 and 2019 for international visitors and 2018 and 2023 for domestic visitors.

- **Value added to the SAF industry:** Developing the SAF industry domestically contributes to New Zealand's Gross Value Added (GVA), providing jobs and income to New Zealand citizens and businesses. Value added represents the economic contribution of an industry to the overall economy. It is a measure of the difference between the value of goods and services produced (output) and the value of intermediate goods and services

[79] Department of Transport (2024) Sustainable Aviation Fuel Mandate Final Stage Cost Benefit Analysis, page 83. Available at: https://assets.publishing.service.gov.uk/media/66601969dc15efdddf1a872d/uk-saf-mandate-final-stage-cost-benefit-analysis.pdf

[80] Ministry of Business, Innovation & Employment (2018) Economic impact analysis – The impact of the proposed International Visitor Levy and Electronic Travel Authority fee on inbound tourism. Available at: https://www.mbie.govt.nz/assets/a01a4d5703/eta-ivl-economic-impact-analysis.pdf

[81] Stats NZ (2024), Tourism Satellite Account YE March 2023. Available at https://www.stats.govt.nz/information-releases/tourism-satellite-account-year-ended-march-2023/

[82] StatNZ (2024). National accounts input output tables: Year ended March 2020. Available at: https://www.stats.govt.nz/information-releases/national-accounts-input-output-tables-year-ended-march-2020/

used in the production process (inputs).

Value added includes:

- Compensation of employees (wages, salaries, benefits).
- Operating surplus (profits of businesses).
- Taxes on production minus any subsidies received.

Since the SAF industry does not currently exist in New Zealand, this analysis has assumed the ratio of the value added of the SAF industry, relative to the value of production, is the same as the value relative to production of the petroleum and coal product manufacturing industry. In the Year ended March 2020, New Zealand manufactured NZD7.2 billion of petroleum and coal products, of which NZD1.3 billion (18%) is the value added to the New Zealand economy.[83]

- **Value added to feedstock producers and other upstream industries:** Producing SAF domestically increases demand and economic benefits for upstream industries such as feedstock producers. This analysis has used the Input-Output approach to estimate the value added to upstream industries. The input-output approach is a macroeconomic modelling technique that analyses the flow of goods and services between different sectors of an economy, focusing on the interdependencies between them. It helps understand how a change in one sector's output impacts other sectors, and ultimately, the entire economy.

- **Jobs:** The development of a domestic SAF industry will create jobs for the New Zealand people, both in the SAF industry as well as in upstream industries. The number of jobs facilitated by a domestic SAF industry has been estimated by dividing the potential for labour income by the average income per employed person for the manufacturing sector in New Zealand. In 2023, the average income in the manufacturing sector in New Zealand was estimated at NZD73,036.[84] This estimate has been used to estimate the number of jobs created in the SAF industry. Estimating the jobs created in upstream industries follows a similar approach.

- **Avoided trade loss:** Adopting SAF can significantly benefit New Zealand's trade by ensuring the country's exports remain attractive to international buyers who are increasingly concerned about emissions. In the year to June 2023, up to NZD11.7 billion of New Zealand's goods exports were carried by air, of which NZD2 billion were goods exported exclusively by air.[85] Of the NZD2 billion in goods exported exclusively by air, about 70% are to countries that have either enforced carbon border adjustment schemes or are proposing carbon border adjustment schemes.[86] If New Zealand fails to adopt SAF, overseas buyers might switch suppliers to competitors in other countries to reduce transport emissions. Conversely, adopting SAF could maintain New Zealand's competitiveness in the global market. The value of avoided trade loss has been placed at 1% of total air cargo exports (the same as the assumption for the travel impact).

- **Fuel security:** Domestic production of SAF offers significant benefits for fuel security. By producing SAF locally, New Zealand can reduce its reliance on imported fuels. This means the country is less vulnerable to global price fluctuations, geopolitical tensions, and supply chain disruptions, which can impact the availability and cost of aviation fuel. Quantifying the value of fuel security presents significant challenges. For a geographically isolated country like New Zealand, aviation fuel security is critical for ensuring accessibility and connectivity with international destinations and across different parts of New Zealand. The immense value

[83] StatNZ (2024). National accounts input output tables: Year ended March 2020. Available at: https://www.stats.govt.nz/information-releases/national-accounts-input-output-tables-year-ended-march-2020/

[84] Cyan Ventures estimates based on data from the 2023 Census and National account input-output tables.

[85] Sense Partners (2023), Facilitating prosperity: The economic contribution of Air New Zealand. Available at: https://www.tourismticker.com/wp-content/uploads/2024/01/The-economic-contribution-of-Air-New-Zealand.pdf

[86] Cyan Ventures analysis based on overseas merchandise trade statistics, The Aotearoa Circle's Protecting New Zealand's Competitive Advantage report, and AirNZ's Facilitating Prosperity The Economic Contribution of Air New Zealand report

[87] Castalia and Envisory (2025), Fuel Security Study. Available at: https://www.mbie.govt.nz/dmsdocument/30476-fuel-security-study-pdf

of maintaining these vital connections is undeniable, yet it remains difficult to measure in precise economic terms. A conservative approach has been used in this report, drawing on a recent report prepared for the Ministry of Business, Innovation and Employment.[87] The fuel security benefits have two components: 1) The avoided annual storage costs to mitigate minor disruptions (estimated at NZD8 million annually); and 2) the expected impact of major disruptions. Disruption to 50% of New Zealand's jet fuel supply is estimated to create a negative GDP impact of NZD456 million in the New Zealand fuel security study and be a 1 in 40-year event. The expected annual cost is therefore NZD19.4 million.

- **The value of avoided emissions (not quantified):** Adopting SAF can significantly reduce carbon emissions, with the potential to reduce lifecycle CO2 emissions by up to 80% compared to traditional jet fuels.[88] The full social value of avoided emissions through SAF adoption is immense, encompassing environmental benefits such as reduced climate impact and improved air quality, as well as long-term economic value such as avoiding damages from extreme weather events. The value of avoided emissions has not been quantified in this cost-benefit analysis because the primary focus of the analysis is on the financial benefits and costs. By concentrating on tangible economic factors, such as additional fuel costs, GDP contribution, and market dynamics, the analysis aims to provide a clearer and more immediate understanding of the financial implications of adopting SAF. Nevertheless, the broader value of avoided emissions, encompassing environmental sustainability and public health benefits, remains crucial and complementary to the economic outcomes assessed.

Cost of delayed action

This analysis also considers the costs of delayed action on SAF in New Zealand. A 5-year delay scenario was modelled to estimate the cost of delayed action. In this scenario, New Zealand does not adopt SAF until 2032.

In the 5-year period of no action, New Zealand faces the potential tourism, trade and fuel security losses highlighted earlier, but avoids higher costs of fuel and potential demand impacts (linked to higher fuel prices from SAF adoption). After 5 years, progress is then made on SAF (and the losses above no longer occur), but New Zealand faces a higher cost of procuring SAF due to missing out on preferential supply agreements on imported SAF and delayed learning curves on domestic SAF. For example, the cost of producing SAF in 2032 is assumed to be 4.3-8.4 times the cost of using A1 jet fuel in the delayed action scenario, higher than 3.0-5.3 times the cost of using A1 jet fuel if New Zealand acts today.

[88] IATA (2024), Net zero 2050: sustainable aviation fuels. Available at: https://www.iata.org/en/iata-repository/pressroom/fact-sheets/fact-sheet-sustainable-aviation-fuels/?form=MG0AV3

[89] UK Department for Transport (April 2024), Sustainable Aviation Fuel Mandate: Final stage Cost Benefit Analysis. Available at: https://assets.publishing.service.gov.uk/media/66601969dc15efdddf1a872d/uk-saf-mandate-final-stage-cost-benefit-analysis.pdf

[90] ICF (November 2023), Developing a SAF industry to decarbonise Australian aviation. Available at: https://www.qantas.com/content/dam/qantas/pdfs/qantas-group/icf-report-australia-saf-policy-analysis-nov23.pdf

A4. Comparison of results to other cost-benefit analyses

While there has not been a similar analysis of cost-benefits of SAF pathways in New Zealand, there have been studies in other countries.

- **UK.** The UK Department of Transport has conducted a cost-benefit analysis for SAF and found a similar result to this research that the benefits generally outweigh the costs.[89] However, there are significant differences in the methodology used. For example, they do not include benefits related to economic development of SAF domestically, but they do include a much larger value for carbon benefits (based on a high assumed social value of carbon reductions).

- **Australia.** ICF has conducted analysis (on behalf of Airbus and Qantas) to examine economic benefits of SAF production in Australia.[90] The research finds that SAF production has the potential to contribute approximately AUD13 billion in GDP per year by 2040, while supporting nearly 13,000 full-time equivalent jobs in the feedstock supply chain and creating 5,000 new high-value jobs to construct and run the facilities. However, this study is not a cost-benefit analysis as it does not consider the costs related to fuel differences or government support, nor examine broader benefits (e.g., tourism) linked to SAF usage.

A5. Areas of future research

The global SAF industry will continue to develop rapidly over the next few years. There are several areas where further research will be important for informing industry and policy decisions relevant to New Zealand. These include exploration of:

- The benefits of a local SAF industry: while this study did an initial quantification of economic benefits for New Zealand from domestic SAF production, further analysis would be useful, particularly being able to distinguish different types of SAF production technologies, which may vary significantly in capital investment and labour intensity.

- The potential SAF supply in New Zealand: while not the focus of this report, further work is needed into the potential domestic supply for SAF in New Zealand, the likely sources and the cost efficiency of those respective sources. This could be a similar detailed focus to the CSIRO study for Australia.

- Granularity on benefits and costs: there are some benefits and costs of adopting SAF that have not been quantified in this cost-benefit analysis. These include:
  - the benefits of adopting SAF to New Zealand's international standing
  - the benefits of adopting SAF to the aviation industry's access to finance
  - the value of avoided emissions
  - the impact of the SAF industry on competition for labour and raw materials
  - the impact and opportunity cost of domestic feedstocks being exported.

[91] CSIRO (2024), Sustainable Aviation Fuel Roadmap. Available at: https://www.csiro.au/en/work-with-us/services/consultancy-strategic-advice-services/csiro-futures/energy/sustainable-aviation-fuel-roadmap

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