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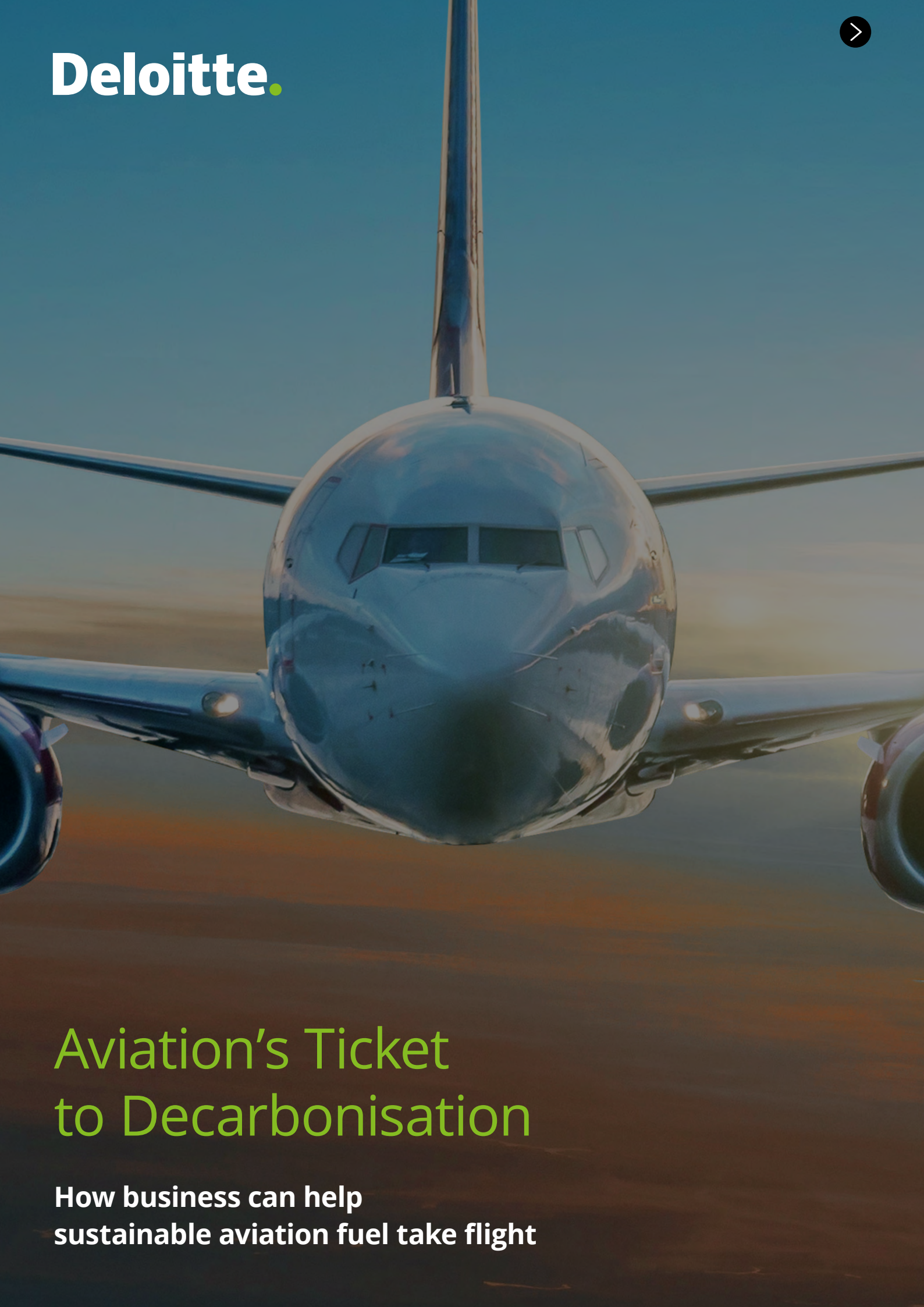


# Aviation's Ticket to Decarbonisation

**How business can help sustainable aviation fuel take flight**

# Foreword

Decades ago, when aviation was first envisioned, it left a compelling picture of a globally connected world without geographic boundaries in the hearts of millions. Today, aviation underpins our global economy. From tourism and travel, trade and commerce to foreign direct investments and economic growth, aviation plays a crucial role in facilitating global economic integration and cultural connection.

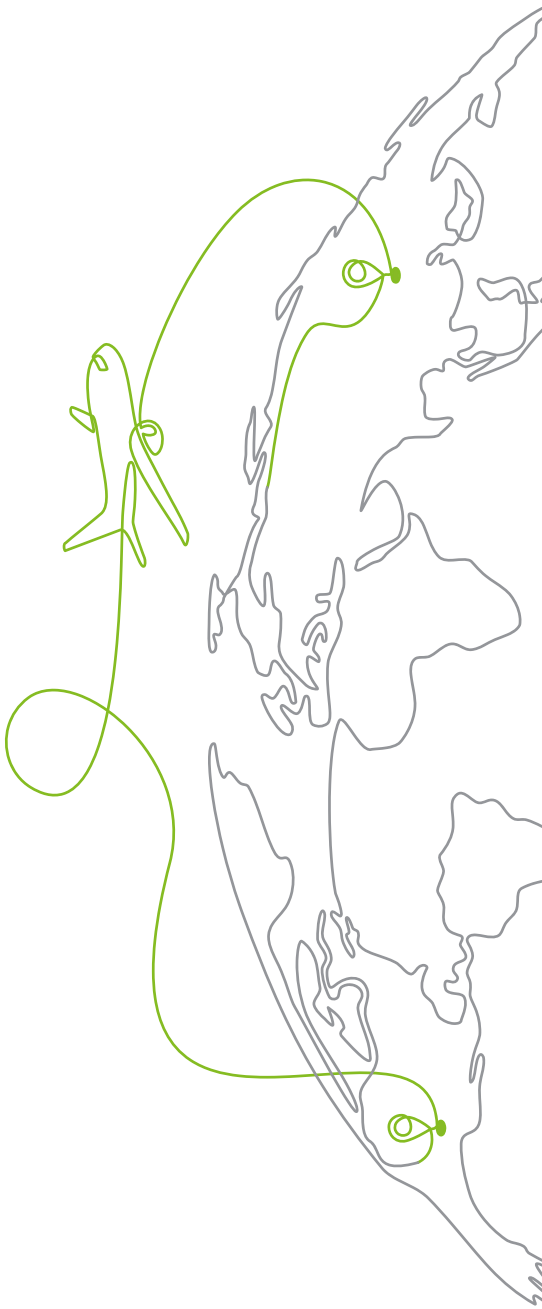
In Asia Pacific, 3.4 billion passengers[1] are expected to travel by flight in 2024, indicating a proximate return to pre-pandemic levels. Airports Council International (ACI) attributes this to a substantial increase in passenger traffic and an ongoing opening of the Chinese market. According to India's business news platform, The Economic Times, India is on its way to ranking fourth globally in travel expenditures by 2030 due to its surging demographic landscape, with 47% of its population[2] comprising the middle class by then. While these figures bode well for Asia's economy, the picture is alarming from a sustainability perspective, drawing concerns about massively increased emissions from surging air travel.

To curb these emissions, it is imperative to decarbonise them at source. While a small proportion of short-haul flights can be electrically powered, long-haul flights need a smarter solution. Owing to its potential to reduce emissions significantly, sustainable aviation fuel (SAF) emerges as a realistic, reliable and efficient near-term solution for reducing scope 3 emissions in the aviation industry.

### Our course is set. Our strategy is fuelled. It is time to act.

Asia Pacific is already home to the largest SAF production facility in the world. However, it is one of only 11 operational SAF facilities globally. Currently, SAF production is falling behind what is required for aviation to play its part in decarbonising our economies, accounting for only a small fraction of global jet-fuel use. Without a significant change in our regional policy environment, we are unlikely to get back on track. But we are optimistic.

Corporations can play a significant role in stimulating demand for sustainable aviation fuel by sharing the "green premium" with the airlines through financial contributions. This holds immense potential to enhance the economic viability of SAF. With the growing transparency, regulations and reporting mandates around scope 3 emissions, adopting SAF should be a core element of corporate air travel emission reduction initiatives.



Through its WorldClimate strategy, Deloitte helps accelerate SAF usage as a founding member of the Sustainable Aviation Buyers Alliance and through its involvement in WEF's Clean Skies for Tomorrow Coalition and First Movers Coalition, the firm is participating in aviation sector working groups to help enable design and implementation of SAF initiatives.

Deloitte is participating in the development of a chain of custody framework for transport decarbonisation through membership in the governing board of the Book and Claim Community, formed by the Smart Freight Centre and the Rocky Mountain Institute. We also purchased SAF from various participants in the market, both to signal demand for SAF and to deepen our own market knowledge.

These collaborations are a critical early step for the future of sustainable business travel—uniting the goals of a large business organisation seeking to reduce their carbon footprint with airlines, as well as with fuel producers upstream in the value chain that is shifting towards lower-carbon fuels.

While rapidly accelerating the use of SAF is critical to meet Paris Climate Agreement targets, we must also ensure that this is not done at the expense of our biodiversity or food security.

Let's continue to travel on our collective journey from ambition to action with efficient solutions such as SAF accelerating our drive to decarbonisation.

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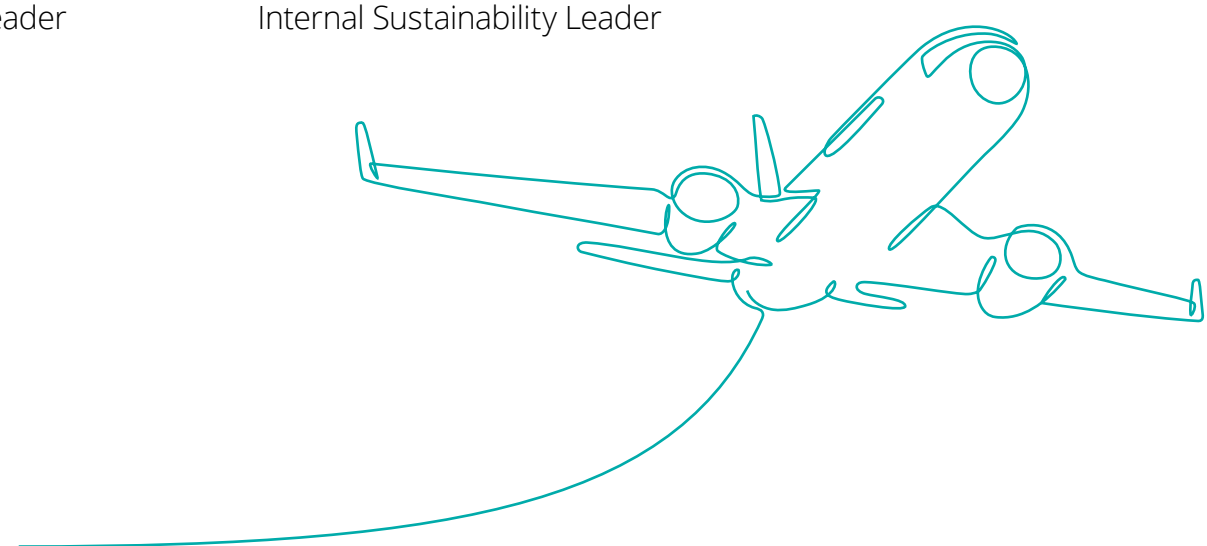


# Contents

# The impetus to address scope 3 emissions

## Emissions reduction is among the top challenges for organisations today.[3]

As of 2022, more than one-third of the world's largest publicly traded companies have committed to net-zero targets.[4] This trend is accelerating, with climate being a key factor in retaining and attracting key customers and shareholders. This shift is also being spurred by mandated sustainability reporting as per the International Financial Reporting Standards.

Emissions can be broken down into scope 1, 2 and 3 categories. Scope 1 emissions are direct emissions from a company's owned or controlled sources, whilst scope 2 emissions are indirect emissions from the generation of the company's purchased energy. Scope 3 emissions are all indirect emissions (not included in scope 2) occurring in the value chain of the reporting company, including both upstream and downstream emissions.[5]

## Aviation travel is a major single source of scope 3 emissions for most public and private sector organisations.

Travel stands as a prominent driver of scope 3 and broader organisational carbon footprints. For some, the largest single contributor to their total carbon emissions after scope 3 Purchased Goods and Services, is air travel. According to self-disclosure reporting, aviation can contribute as much as a third of a business's overall emissions.[6]

In 2018, the aviation industry was estimated to account for a total of 2-3% of global carbon dioxide equivalent ($CO_2e$) emissions[7]. However, as a hard-to-abate sector, aviation is projected to account for approximately 25% of the world's remaining carbon budget, the total amount of $CO_2e$ that can be emitted over the coming decades to limit global warming to 1.5 degrees[8].

The aviation industry through, the International Air Transport Association (IATA) and the Air Transport Action Group (ATAG), has committed to net-zero by 2050.

Aviation emissions are not just a scope 3 emissions risk for organisations, but also a scope 3 emissions risk for an organisation's customers and suppliers. Increased focus on transparency and reporting of scope 3 emissions will drive greater pressure on businesses to reduce air travel emission.

## Reducing aviation emissions is the path to net-zero.

To retain market credibility and competitiveness, it is important for organisations to take active steps to decarbonise corporate travel. By embracing the opportunity to reduce carbon emissions from travel, businesses can reap strategic advantages that will set them up as market leaders into the future. Due to its significant emissions reduction potential and relative commercial viability, **Sustainable aviation fuel (SAF) is an optimal near-term decarbonisation mechanism** to drive meaningful scope 3 emissions reductions in the aviation industry in the near term. As a drop-in fuel, there is no need to redesign aircraft or airport infrastructure.

An overreliance on carbon offsets can perpetuate business-as-usual thinking and can enable increased operational emissions, negating the purpose of the offsets to lower the overall emissions in the atmosphere.

Insetting emissions reduction across an organisation's value chains, through procuring SAF or other green transport solutions (e.g., hydrogen and electric technologies), is an important mechanism for achieving sustainable emissions reductions. SAF is one part of the solution to decarbonise travel. A portfolio approach could be best to reduce collective aviation emissions. Partnering with green transport providers for travel choices and reporting, combined with sustainable investment in solutions across the entire value chain, low-carbon travel policies and travel emission budgets could result in a collective decrease in emissions across the airline industry. As seen in the pandemic, corporate policy can help reduce or avoid employee air travel. However, the experience of many demonstrated that some level of air travel will always be required to conduct business.

# Decarbonising aviation

## Offsetting: A solution to neutralise but not decarbonise

Aviation industry emissions are hard-to-abate for a number of reasons, including the long lifespan of aircraft and high costs and limited viability of alternative technology [9]. Short-term solutions such as carbon offsetting have become common practice for businesses to reduce their emissions from corporate travel. However, there are limitations to offsetting, including:

1. Net-zero commitments made under the Science Based Targets initiative (SBTi) as 1.5°C-aligned, means that **carbon offsets may only be used to reduce up to 10% of baseline emissions in the year of net-zero claim.**[10]

2. Overreliance on offsets can **perpetuate business-as-usual thinking and can enable increased operational emissions, negating the purpose of the offsets** to lower the overall emissions in the atmosphere.

3. Many carbon offsets are considered to have **low credibility and will not enable the significant reductions required to meet net-zero.** Offset quality varies between carbon offset certifiers noting that, without detailed due diligence, it can be difficult to distinguish which offsets are credible when purchasing via a voluntary carbon marketplace.

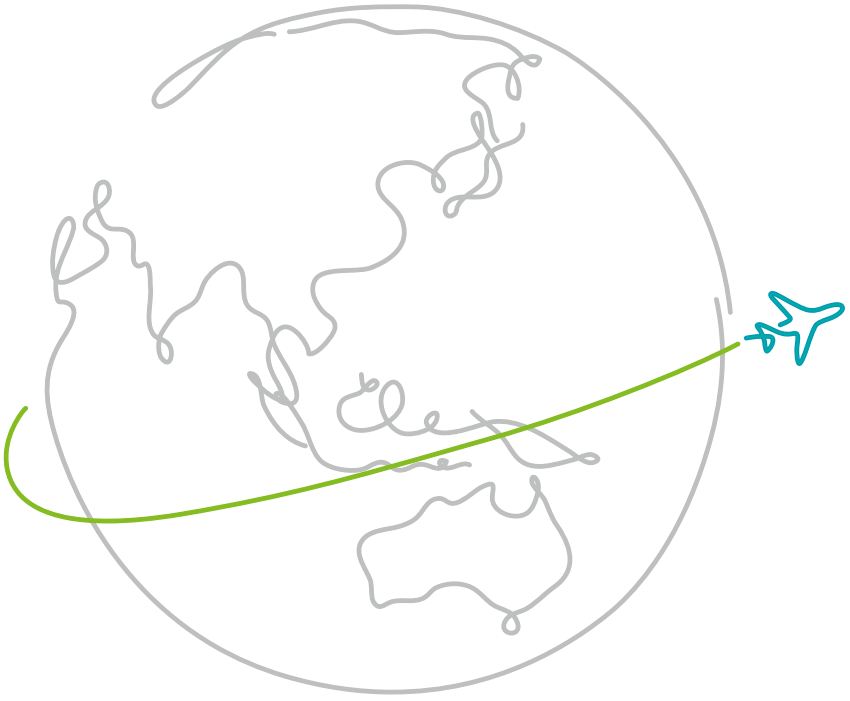
4. **Record high carbon prices set by governments** across the world are anticipated to put upward pressure on the cost of offsets in the carbon credit market in the coming years.[11]

## Insetting: A course correction to net-zero

Given the limitations of carbon offsetting, there is need to prioritise solutions that directly address the emissions source. As opposed to offsetting, insetting involves the development of carbon-avoidance or-removal projects to reduce absolute emissions. In the context of reducing aviation emissions, one insetting option includes the pre-purchasing of SAF.

## The SAF ecosystem

SAFs are predominantly drop-in fuels that can be directly used in existing aircraft and infrastructure as a substitute to traditional jet fuels. However, unlike fossil fuels, **SAF recycles $CO_2$e emissions straight from the atmosphere** and has been shown to reduce **up to 80%** of $CO_2$e life-cycle emissions compared to fossil fuels.[12]



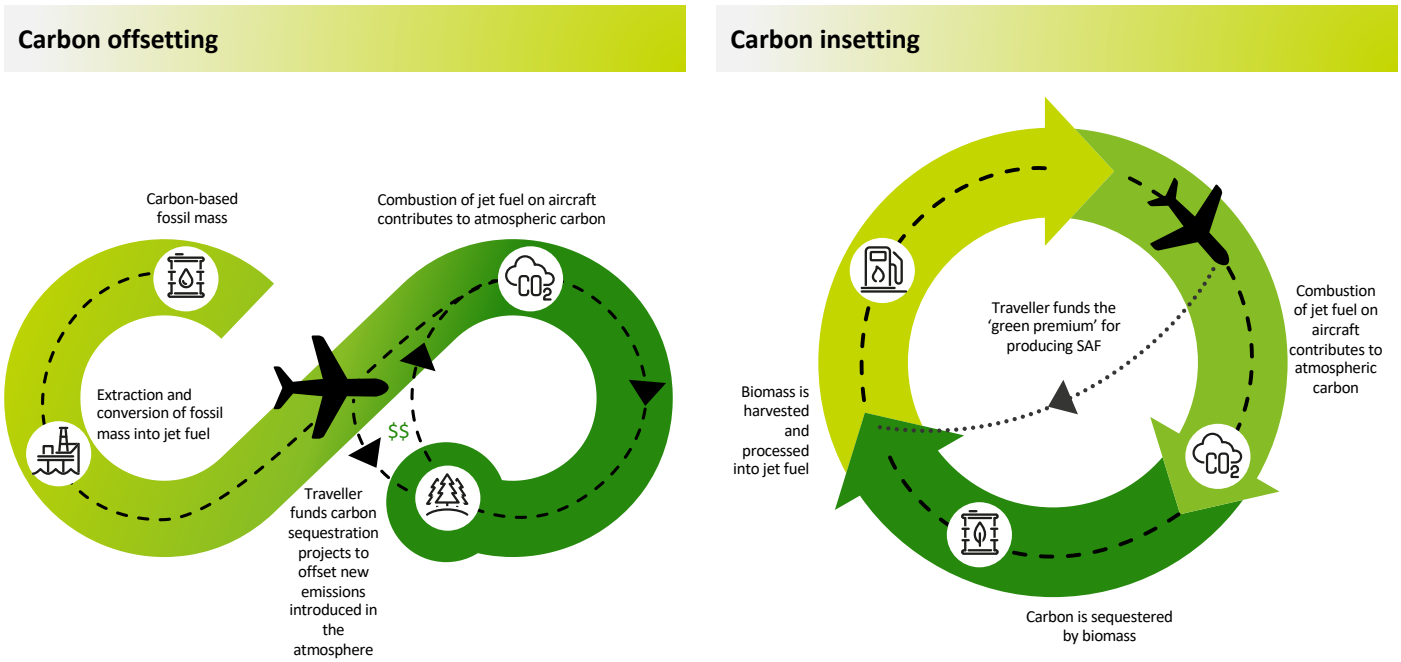
There are currently three main variants of SAF technology:

| | Biomass based SAF | | Waste based SAF | E-fuels |
|---|---|---|---|---|
| **Technology** | Hydro-processing Esters & Fatty acids (HEFA) | Alcohol to Jet (ATJ) | Fischer Tropsch (FT) | Power to liquid (PtL) |
| **Process** | Involves hydrotreatment and hydrocracking of fatty acids to produce SAF | Involves the catalytic dehydration of ethanol to ethylene, followed by other processes to produce jet fuel | Involves gasification of biomass into syn-gas, which is catalytically converted to SAF | Involves use of captured $CO_2$ and Green $H_2$ to make SAF |
| **Feedstock** | Crops, plant oils, used cooking oil, animal fat, algae | | Agricultural residues, municipal solid wastes | Point Source & Direct Carbon Capture |
| **Potential emission reduction**[13] | Can reduce emissions by up to 50-85% compared to conventional jet fuel. | | Can reduce emissions by up to 75-95% compared to conventional jet fuel. | Can potentially achieve emissions reduction of up to 100% |
| **Potential Risks** | Long term effects on soil, water security & land use changes due to cropping, threats to food security in the longer term, impacts on biodiversity due to monoculture & loss of natural habitats, effects on labor & local communities due to over-exploitation, economic viability & market stability of SAF. | | | |

More mature and currently available → Less mature technology still in development

Due to its significant emissions reduction potential and relative commercial viability, **SAF is a critical near-term** decarbonisation mechanism to drive meaningful scope 3 emission reductions in the aviation industry. The advantages of SAF include the fact that it is a 'drop-in' fuel that is compatible with existing aircraft and infrastructure when blended with conventional jet fuel. Additionally, unlike fossil fuels which release additional carbon, SAF recycles $CO_2e$ emissions that were previously emitted, as demonstrated in the example below of a biomass-based SAF.

Figure 1 – Comparison of offsetting to insetting




## A dual opportunity to bridge the nature - business divide.

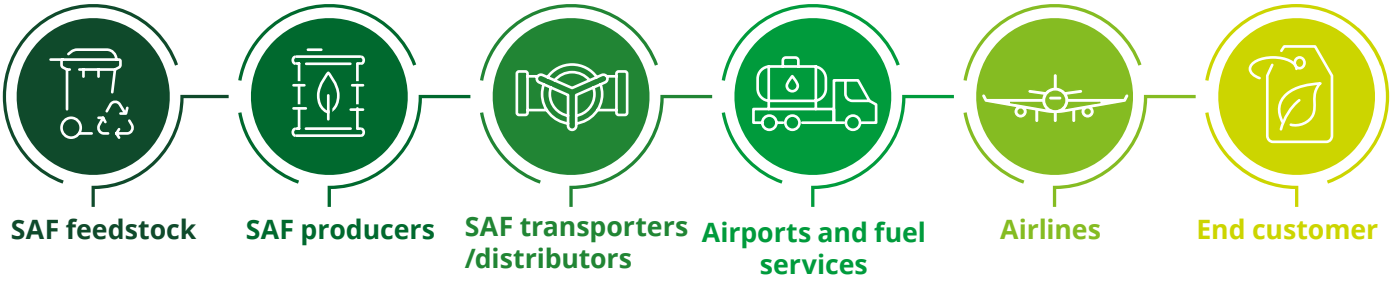
SAF has complex supply chains. Most pathways currently depend on biomass production with implications for nature, such as biodiversity and water usage. With greater focus on nature related financial disclosures,[14] sustainably and ethically sourced SAF can present an opportunity to reduce an organisation's impact on nature by protecting ecosystems and natural resources. However, not all SAF is sustainably produced. The unsustainable production of some biofuels can have adverse impacts on endangered species leading to a loss of biodiversity and increased threat to water security of the region. Transparency and accountability across the supply chain is critical to ensure SAF can maximise benefits across climate and nature.

# Corporate businesses can help catalyse Asia Pacific's SAF industry

## The SAF ecosystem and aviation fuel value chain

The aviation fuel value chain spans the existing jet fuel value chain and the nascent but growing SAF value chain which involves SAF production, certification and distribution. There are several key market actors within the SAF ecosystem.

Figure 2. SAF Value Chain




| Such as agricultural waste and collectors of municipal waste for conversion to SAF | Can be existing jet fuel producers (as SAF production can repurpose and leverage existing crude oil infrastructure and refineries) | Who use pipelines and related capabilities to move fuel to downstream consumers | Operate fuelling services and infrastructure for airlines and aviation consumers | Who are the major SAF consumers on behalf of their end customer | Such as individuals and companies who purchase airline tickets. |
|---|---|---|---|---|---|

**Industry enablers**

Governments and regulators who set SAF policies, and non-government organisations who set market standards and regulations.

### SAF production currently falls short of rising demand.

The SAF industry has experienced significant investment in recent years but must grow at an 18% compound annual growth rate (CAGR) to meet global industry net-zero goals by 2050.[15] Demand for SAF is primarily being driven by airlines, aviation bodies, biorefinery producers and corporate customers. The largest acceleration is expected in the 2030s as policy support becomes global, SAF becomes competitive with fossil aviation fuel, and credible carbon offsets become scarcer.

To meet rising demand SAF production is increasing globally, with considerable development in the Americas and Europe. In 2022, it was estimated that global SAF production reached 300–450 million litres, an overall increase of 200% from the year prior.[16] Despite this growth, SAF production only accounts for a small fraction of global jet fuel use.

Increased SAF production is critical to aviation achieving net-zero $CO_2e$ by 2050, but current supply of SAF is considered 'insufficient everywhere'.[17] This supply shortfall is expected to continue to grow as demand for SAF rises.

### Limited supply and high prices present a 'chicken and egg' dilemma for SAF.

The private sector is reluctant to invest significant capital in SAF scale-up when there is uncertainty about market demand and regulation. Some potential SAF consumers are unwilling to commit to adopting SAF due to high prices consummate with an emerging industry. **SAF prices are currently two to five times higher than jet fuel**,[18] with ranges as high as eight times for advanced production pathways in some regions.[19] As production scales up in the long term, SAF prices are anticipated to match, if not become cheaper than, jet fuel.

**As global SAF policies stimulate scale up, Asia Pacific is falling behind.**

Unlike the United States and Europe, the Asia Pacific region has limited clear SAF policies, delaying adoption. Financial support in the United States addresses a large portion of the price gap between traditional jet fuel and SAF, leading investors and developers to prioritise projects in the United States and has drawn the potential investment in and use of resources away from the Asia Pacific.

Today, only one of 11 operational SAF production facilities is located in Asia Pacific. Neste's Singapore facility is the largest SAF production facility in the world, with capacity of around one million tonnes per annum. Despite limited policy support, accessible and affordable resources provide Asia Pacific with a strong competitive advantage in the production of SAF. The Asia Pacific region has a large agricultural footprint and significant variation in terms of the availability of feedstocks which can help to minimise the cost of production.[20] This is complemented by strong manufacturing and processing capabilities.

**Corporate businesses can help address barriers by sharing the "green premium" with airlines, essentially contributing financially to make SAF more economically viable.**

This involves corporate entities making commitments to support the establishment of SAF demand. Business and procurement models are quickly evolving and precedents being established in the United States and the European Union. This includes initiatives lead by airlines, producers and also corporate buyer models.

All models are expected to be underpinned by a SAF certificate (SAFc), which represent the environmental benefits of using SAF. In establishing frameworks to increase the demand of SAFc there will be an expected uplift in support for the development of the SAF market and stimulate supply in Asia Pacific. SAFc are a tradable certificate that represent the environmental benefits of producing and using SAF instead of conventional jet fuel.

While there is not yet a standardised approach for air travellers reporting SAF usage and claiming corporate scope 3 emissions reductions, various initiatives are underway to create frameworks to support this process. Namely, the SBTi's Aviation Sector Guidance in 2021[21] and the World Economic Forum Clean Skies for Tomorrow's Sustainable Aviation Fuel Certificate Emissions Accounting and Reporting Guidelines.[22] Further guidance expected from the Greenhouse Gas Protocol (GHGP) will provide greater certainty to flyers that SAF is a credible approach to reducing scope 3 aviation emissions.

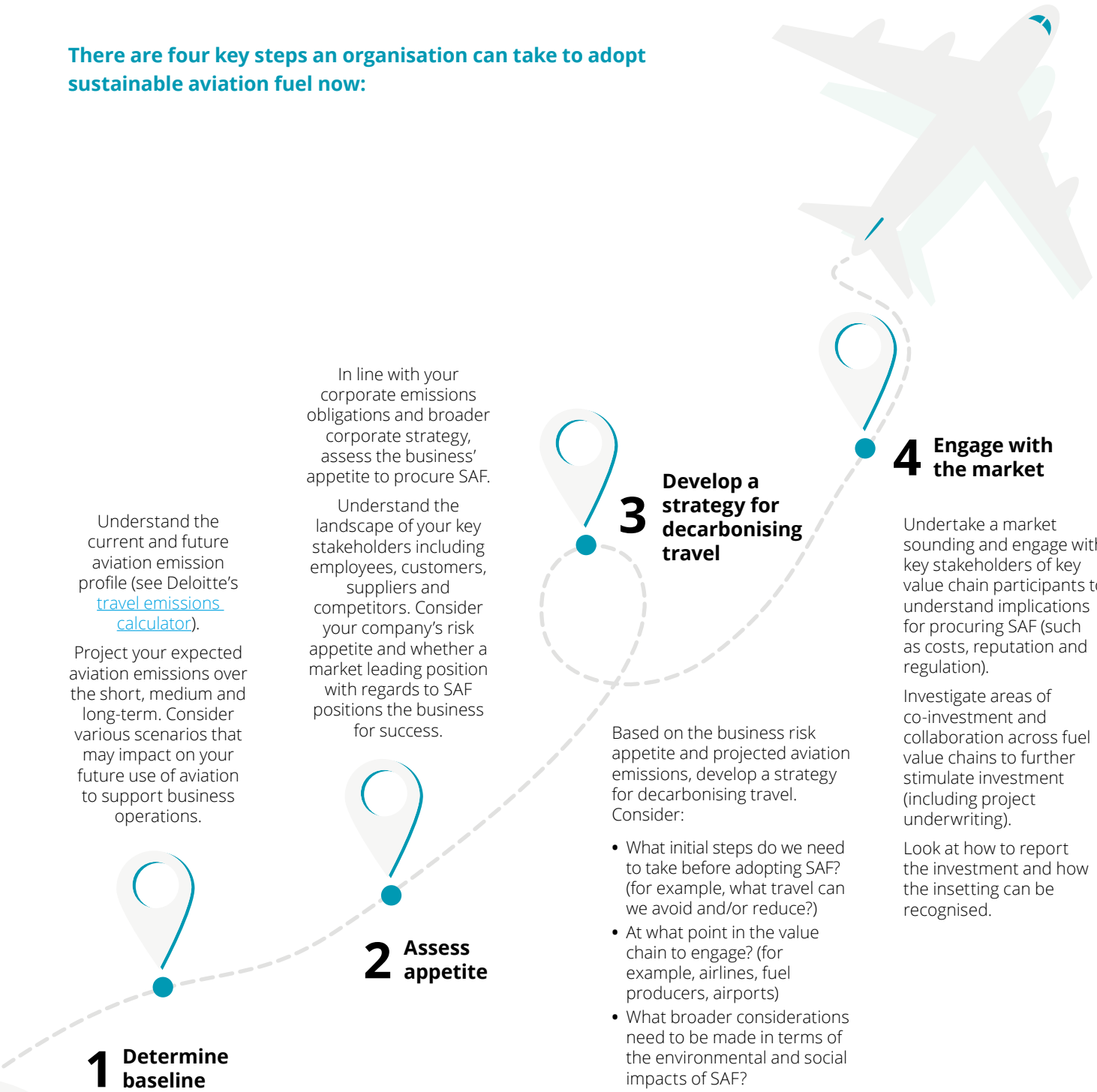
**Book-and-claim systems are critical to corporate accessibility to the SAFc market.**

Book-and-claim systems and accompanying digital registries provides organisations with the tools needed to register, transfer, and retire the entitlements to claim SAF's environmental attributes with integrity. This environmental attribute certificate system is akin to the Renewable Energy Certificate in the United States or the Guarantee of Origin in the European Union.

For more information see the Rocky Mountain Institute.

# The pathway to adopting sustainable aviation fuel

## There are four key steps an organisation can take to adopt sustainable aviation fuel now:



### 1 Determine baseline

Understand the current and future aviation emission profile (see Deloitte's travel emissions calculator).

Project your expected aviation emissions over the short, medium and long-term. Consider various scenarios that may impact on your future use of aviation to support business operations.

### 2 Assess appetite

In line with your corporate emissions obligations and broader corporate strategy, assess the business' appetite to procure SAF.

Understand the landscape of your key stakeholders including employees, customers, suppliers and competitors. Consider your company's risk appetite and whether a market leading position with regards to SAF positions the business for success.

### 3 Develop a strategy for decarbonising travel

Based on the business risk appetite and projected aviation emissions, develop a strategy for decarbonising travel. Consider:

- What initial steps do we need to take before adopting SAF? (for example, what travel can we avoid and/or reduce?)
- At what point in the value chain to engage? (for example, airlines, fuel producers, airports)
- What broader considerations need to be made in terms of the environmental and social impacts of SAF?
- Which value chain participants do you want to partner with? (for example, fuel producers, airlines and/or alternative technology and service providers)

### 4 Engage with the market

Undertake a market sounding and engage with key stakeholders of key value chain participants to understand implications for procuring SAF (such as costs, reputation and regulation).

Investigate areas of co-investment and collaboration across fuel value chains to further stimulate investment (including project underwriting).

Look at how to report the investment and how the insetting can be recognised.

**Air-travel will continue to be a fundamental component of future business.**
As will the interconnected nature of business operations with a greater focus on regional development.

The adoption of SAF can enable the systemic decarbonisation critical to reaching global net-zero targets.

By being an early mover, businesses can demonstrate proven, tangible commitment to decarbonisation targets, while gaining valuable experience and induce price reductions through economies of scale.

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