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SUSTAINABLE AVIATION FUEL IN BRAZIL: MARKET OPPORTUNITIES FOR INVESTORS, SPONSORS AND OFFTAKERS

Brazil is leading the way in the shift to Sustainable Aviation Fuel (SAF). It has introduced legislation requiring it to be used in the Brazilian aviation industry and has established a national SAF program. As industry explores ways to make the production of SAF more financially attractive to investors and sponsors, governments have begun to introduce mandates requiring the gradual incorporation of SAF into their aviation fuel mix. In contrast to jurisdictions that have opted for rigid blending thresholds, the Brazilian approach recognizes that carbon reduction can be achieved across the entire production and logistics pathway. This creates scope for project developers, refiners, airlines and fuel service companies to optimize compliance by locating investment, contracting offtake and arranging logistics in a manner that makes sense from both an environmental and a financial perspective. In this briefing we consider the key issues for investors, sponsors and offtakers in relation to SAF projects in Brazil.

KEY ISSUES

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Why SAF?

The aviation industry accounts for between 2.5-3% of energy-related carbon dioxide (CO₂) emissions per year globally. The sector is expected to grow at roughly 8% per year until 2030, compared with just 2.2% annual growth between 1990 and 2019. The International Energy Agency (IEA) has determined that the aviation industry, generally, is currently not on track to meet its Net Zero Emissions by 2050 Scenario targets.

While aviation players are looking at developing alternative methods of aviation propulsion, including electric aircraft and hydrogen cell-powered aircraft, these are still early technologies and, given the higher level of scrutiny on airworthiness and safety by international and national aviation authorities – are likely to be in the mid- to-long term. That said, an immediate short-term solution for reducing the aviation industry's carbon footprint is necessary. SAF is a commercially available technology that can function as a drop-in replacement for current jet fuel (Jet-A) and which could potentially reduce net carbon emissions in the aviation industry by up to 80%. This is possible because SAF usage can be based on a circular economy: plant-based feedstock is used to produce SAF, that SAF is used to fuel flights which generate CO₂, and that same CO₂ is then pulled out of the atmosphere by the plants used to make the SAF. Similarly, carbon capture storage and green hydrogen can be used to produce e-SAF. Depending on the feedstock and amount of SAF used, this cycle could potentially generate net negative carbon emissions.

While there are as many as eight distinct processes that can produce SAF, the three most widely used are (1) the hydroprocessing of esters and fatty acids (HEFA) process; (2) the Fischer-Tropsch synthesis process; and (3) the Alcohol-to-Jet (AtJ) process. Possible SAF feedstocks include carbon-containing off-gases, tallow and other animal fats, used cooking oil (UCO), yellow grease (a combination of UCO and other fats), bagasse and other crop residues such as plant husks or tree bark, and ethanol.

ProBioQAV: Brazil's SAF Mandate

To encourage SAF uptake by airlines and fuel suppliers, some countries, including Brazil, have begun implementing policies to either encourage or require the aviation industry to adopt SAF. Law 14,933/24 (Brazil's SAF mandate), the National Program for Sustainable Aviation Fuel (*Programa Nacional de Combustível Sustentável de Aviação* or ProBioQAV) came into force in October 2024, as one aspect of the Fuels of the Future Bill, a broad-sweeping law that addresses decarbonization more generally. The objectives of the ProBioQAV SAF mandate are four-fold: "the research, production, commercialization, and energy use in the Brazilian energy matrix" of SAF.

Brazil's policy is focused on the reduction of greenhouse gas emissions, and does not specify any minimum blending percentages. Instead, the law stipulates that all aircraft operators are required to reduce GHG emissions in their domestic operations by a certain percentage by using SAF.

For the first two years of the program, 2027 and 2028, the requirement is a reduction of 1% of the previous year's emissions total. In each subsequent year the requirement increases by 1%, until it reaches an upper limit of a 10% reduction of the previous year's emissions in 2037.

The annual reduction targets are as follows:

2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
1%	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%

This contrasts with other national and supranational mandates such as those implemented by the UK and the EU, which require the introduction of SAF into the Jet-A mix via SAF blending thresholds.

A major challenge facing would-be sponsors of SAF projects is the issue of market appetite and cost certainty. SAF mandates are expected to alleviate some of these concerns.

The extent to which this occurs, however, will depend on a host of factors: the potential for unintended consequences such as rising prices for vegetable oils and other biofuel feedstocks due to increased demand generated by the scaling up of SAF production (a phenomenon that is already underway as a result of increased demand for renewable diesel); the ability of third parties within the aviation industry (such as fuel producers) to adequately respond to mandates; and how quickly the cost of SAF can be made competitive with Jet-A, to name a few.

Cost volatility of feedstocks: HEFA v Alcohol to Jet

SAF is, generally, more expensive to produce than conventional Jet-A, and the costs associated with SAF production are spread across the production chain.

HEFA remains the dominant pathway globally, with over 90% of SAF projects worldwide using the process. Because the technology for the conversion process itself is often covered by third-party proprietary IP, the sponsor will typically have to pay a licensing fee. Many of the SAF facilities in Brazil that are either currently under construction or approaching the construction phase have licensed HEFA process technologies.

However, the process relies on fats and waste oils, such as tallow, used cooking oil and yellow grease, that are finite, face competition from other sectors, and exhibit price volatility linked not only to the immediate feedstocks but also to the underlying commodity inputs and collection costs which, together, can undermine long-term cost certainty and make bankability more challenging without strong offtake support or price-stabilizing mechanisms.

By contrast, the AtJ route aligns with Brazil's natural resources. Although essentially every SAF feedstock is available to Brazilian SAF producers, the country is a leading producer of sugarcane and bagasse, and is one of the world's largest producers and exporters of ethanol, with hundreds of ethanol plants already in operation and more under development.

Repurposing or retrofitting portions of existing bioethanol capacity offers a pathway to scale that may be faster and, in certain cases, cheaper than greenfield HEFA, particularly where logistics and feedstock sourcing can be integrated on a regional basis and strategic location of facilities can make use of existing export infrastructure.

That said, it's worth noting that AtJ technology is still in its infancy – particularly when looking to scale up to commercial levels – although there are a number of high-profile projects about to come online in the near future (particularly in the United States), which will provide more comfort to investors and financiers.

Legal considerations in relation to the ProBioQAV mandate¹

Regulatory certainty

If there is regulatory uncertainty around a mandate, or the monitoring systems are not accurate enough to allow industry participants to see a

¹ The information regarding ProBioQAV provided below is based on public information and our experience with international markets, and does not constitute legal analysis. It is provided for informational purposes only and should not be construed as advice on Brazilian or any other laws.

return on their investment, it will be more difficult to obtain the investment needed for growth. Another important factor concerns what mechanisms will be available to countries to enforce their mandates, and their willingness to do so. Brazil intends to address this issue by empowering the National Agency of Petroleum, Natural Gas and Biofuels (ANP), which already acts in an enforcement role in relation to Brazil's biofuel program, to levy fines and penalties for non-compliance with ProBioQAV.

Rewards based on emissions reduction

Sponsors should also consider the extent to which the specifics of the mandate open the sponsor to potential liability. Both the EU and the UK have initiated *blending* mandates, which require a minimum amount of SAF to be incorporated into the Jet-A mixture. Navigating different mandates could pose more risk to sponsors, both due to potential differences between each mandate and because the term "SAF" can be applied to a range of aviation fuels which, while meeting the definition of SAF, might not meet a given jurisdiction's eligibility requirements. This will be a particularly important consideration if the facility is looking to export SAF to other jurisdictions in addition to having a portion of the product available on its local domestic market.

Although minimum quality standards for SAF are set by IACO and ASTM International, those standards speak only to technical specifications such as the chemical composition of the fuel, rather than to the criteria set by a given mandate relating to feedstock or GHG emissions reductions.

Fuel defined as SAF by one mandate, therefore, may not qualify as such under a different mandate. The EU, for example, only permits SAF made from certain listed feedstocks. This means that, regardless of where the SAF was produced, sponsors looking to sell SAF under the EU mandate must ensure their product conforms to those requirements. Similarly, California's Low Carbon Fuel Standard (LCFS) places specific requirements on both the types and sources of qualifying biomass feedstocks.

SAF producers, therefore, must be careful to comply with the mandate to which the offtaker is subject, in order to avoid falling foul of the consumer protection laws of the jurisdiction, or contractual claims brought by the offtaker against the producer.

Brazil, in contrast, has opted for a mandate that imposes a reduction in GHG emissions on the aviation industry through the use of SAF. From a legal risk perspective, Brazil's emissions-based design appears to help mitigate some of the liabilities that can arise under strict blending mandates. Unlike a strict blending mandate, which requires a non-negotiable percentage of SAF to be provided to offtakers, reductions in GHG emissions can be obtained at every point along the production pathway. Projects located closer to the production sites of the feedstock utilized by the facility, or on sites that have easy access to transmission infrastructure, will potentially be able to benefit from emissions reductions in a way that would not be possible under a strict blending mandate.

Book-and-claim system

A key aspect of the ProBioQAV policy that both sponsors and offtakers should look to take advantage of is the decision to permit a book-and-claim system. Under this system, a "receiving party" can claim (and pay for) a specified amount of SAF, whether or not that party receives the SAF itself. The claimed amount is then offset against the amount of SAF that has been "booked" nationwide. For airlines and fuel service providers, the practical implication of this system is that compliance planning becomes an exercise in portfolio optimization rather than a narrow procurement task: some obligations can be met through direct physical supply where SAF is available at competitive prices, while others can be achieved through book-and-claim certificates. The benefit of this system is to

reduce both transportation costs and supply issues. A clear chain of custody and efficient tracking are critical for this type of system to work effectively, and a successful test of the system was conducted in 2024.

By focusing on verified emissions outcomes and allowing emissions reductions to be achieved across the lifecycle, ProBioQAV gives producers and offtakers a wider toolkit to structure compliance and to allocate risk contractually, provided that verification, reporting and registry processes are clear and reliable. Nevertheless, because bankable projects depend on stable measurement and monitoring frameworks, sponsors will still need to focus on regulatory certainty and the practical application of book-and-claim accounting. Of particular importance are questions of double counting and traceability, and the interoperability of tracking systems with airport fuel-farm operations and international schemes such as CORSIA, where relevant.

It's worth noting that such a system will be jurisdiction specific and might not be relevant for export markets. For example, under EU regulations, SAF needs to be physically uplifted – so book-and-claim systems are not suitable.

Financing

Financing structures continue to reflect the realities of early-stage markets: lenders typically look for long-term offtake with clear compliance value, credible feedstock strategies that are resilient to price shocks, and risk-sharing mechanisms that address technology, construction and policy uncertainty.

Blended finance solutions that align multilateral lenders and private capital providers have already proven effective in some jurisdictions, demonstrating that, with the right allocation of risk and independent verification of environmental performance, limited-recourse project finance might still be achievable to some extent even where the policy framework is still maturing.

For sponsors contemplating AtJ built on Brazil's ethanol platform, the opportunity to leverage existing logistics arrangements by contracting with established agro-industrial suppliers and siting facilities close to feedstock sources can translate into meaningful advantages in emissions reduction and lower delivered-cost variability, both of which matter for compliance economics and credit approval.

Brazil as an Export Market

While the Brazilian mandate is of course important and useful to incentivizing the local aviation market to use SAF, we understand that the domestic market is too small to be solely relied on for larger utility scale projects. As such, larger Brazilian SAF producers are looking to export SAF to other jurisdictions, as well as using some of the output for the local domestic market.

As noted above, Brazil's existing position as one of the largest global exporters of bioethanol, as well as its access to cheap and clean power, is helping the country position itself as a future leading exporter of SAF and other ethanol-based fuel products. That said, care still needs to be taken concerning the regulatory treatment of such products in the import market and what requirements need to be fulfilled during the project development stage in order for SAF to be eligible for export to a range of different international markets.

Clifford Chance's SAF experience

Clifford Chance is one of the few international law firms with a subgroup focusing on green fuels including sustainable aviation fuel – actively advising SAF developers, investors and financiers on a number of SAF, biofuels and e-fuels projects globally.

We are at the forefront of legal developments in the SAF sector, with experience spanning a wide range of jurisdictions, technologies and stakeholders.

The Clifford Chance team has experience of advising on all elements of SAF projects and businesses, including:

- construction structuring, procurement and contracting;
- offtake and feedstock structuring and contracting;
- project financing;
- project and topco equity raising;
- buy-side and sell-side equity investments;
- regulatory advice; and
- tax and incentive structuring and advice.

Clifford Chance teams are currently advising SkyNRG on the structuring, development and financing of the 100ktpa DSL01 SAF project being developed in Delfzijl in the Netherlands, including structuring, drafting and negotiating offtake contracts (SAF, bio-LPG, bio-naphtha), feedstock arrangements, construction and licensing, real estate and permitting, regulatory, commercial contracts, equity structuring, shareholder arrangements, corporate structuring and project financing – combining our existing strong sector knowledge with real life challenges and problem solving.

We are also advising on HEFA SAF projects in Uruguay and Paraguay, and have recently advised:

- Asian Development Bank (ADB) and the International Finance Corporation (IFC) on the financing of a 200 ktpa HEFA SAF facility to be constructed and operated by SAFCO Venture Holdings Limited (SAFCO Ventures) in Sheikhpura, Pakistan; and
- the US Department of Energy's Loan Programs Office (DOE LPO) in its US\$1.46 billion conditional commitment to Gevo to help finance the Net-Zero-1 alcohol-to-jet fuel facility in Lake Preston, South Dakota, which is expected to double sustainable aviation fuel (SAF) capacity in the United States.

In Brazil, we are actively advising on one of the country's largest SAF projects, as well as being engaged in supporting a number of other SAF-related initiatives, leveraging the firm's deep understanding of the country's economic, business and financial landscape. Our experience in Brazil includes advising a private energy company on the development of a 20 kbpd HEFA SAF facility, including in negotiating feedstock supply agreements and offtake contracts for the sale of SAF into the US and EU.

With Brazil's recent implementation of the ProBioQAV mandate, Clifford Chance is well-positioned to advise on project structuring and financing. Our experience in navigating complex regulatory frameworks and aligning international stakeholders makes us a strategic partner for SAF development in Brazil's rapidly evolving energy transition.

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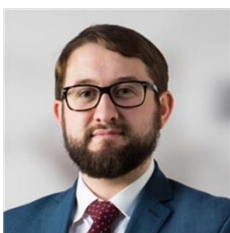
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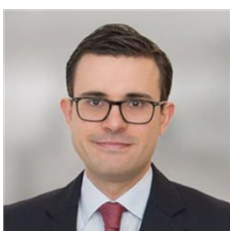
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