

# ACCELERATING ADOPTION OF SUSTAINABLE AVIATION FUEL: FINANCING AND RELATED ISSUES

Follow-up notes from an informal ICAO Council briefing in June 2022 by CDPQ<sup>1</sup> with questions by ATAG<sup>2</sup>

Since the air transport industry's adoption of a 2050 net zero carbon goal last October, a key issue is the acceleration of a programme of effective emission reduction, energy transition and innovation in the industry. A critical element is the availability and use of fuels that have a lower carbon footprint: sustainable aviation fuel (SAF). Two major challenges for accelerating the provision and adoption of SAF are (i) the large and growing size of the jet fuel market and hence significant financial outlays that are required (including for storage and distribution), and (ii) the hurdles created by cost of SAF which is higher than petroleum-based jet fuel. This briefing note discusses a number of issues related to these challenges and the likely options for meeting them.

*The SAF data in this briefing is drawn from the Waypoint 2050 report and its accompanying analysis in Fueling Net Zero.*

Waypoint 2050 can be found:  
[www.aviationbenefits.org/W2050](http://www.aviationbenefits.org/W2050)

## Is there adequate capital to finance the move to SAF to meet the net zero goal?

There is no doubt that the move to SAF to meet the net zero goal will require significant outlays. While estimates vary somewhat, investments totalling up to \$1.45 trillion<sup>3</sup> will be needed between now and 2050 for the infrastructure to deliver the needed quantities of SAF. This averages out at \$48bn a year, compared to typical oil and gas capital expenditure of around \$420bn a year. The cost of purchasing that SAF by airlines also needs to be considered as part of the operational aspects of decarbonisation (potentially around \$5.3 trillion over the period<sup>4</sup> - by comparison, airlines have spent some \$4.3 trillion on fuel over the last 30 years). This reflects the fact that the global demand for jet fuel is likely to more than double over the next thirty years (from 320 million tonnes in 2019 to nearly 700 million tonnes by 2050), and despite the likely technological innovations, a very significant increase in SAF production would be needed.

The required outlays are large. But these are over a period of almost thirty years, thus for any given sub-period the investment requirements would be correspondingly smaller. More importantly, these outlays should be seen in the context of available resources globally. While public sector resources in most countries are constrained, very large amounts are potentially available from the private sector for investments in SAF.

The latest estimates from the Financial Stability Board suggest that the private institutional sector has over \$225 trillion in assets and these assets are likely to more than double by 2050. Thus, even a small proportion of investments by the private institutional sector (sometimes known as non-bank financial institutions, or NBFIs) can finance the outlays needed for a significant acceleration in the production and utilisation of SAF.

## Global financial assets<sup>5</sup>

Financial Stability Board: Global Monitoring Report on Non-Bank Financial Intermediation 2021 (USD)

	Total global financial assets	Central banks	Banks	Public financial institutions	Institutional (NBFIs) sector
Size at end-2020 (USD Trillion)	468.7	41.9	180.4	19.9	226.6
Share of total global financial assets (%)	100.0%	8.9%	38.5%	4.2%	48.3%
Growth in 2020 (y/y, %)	10.9%	32.3%	11.1%	7.7%	7.9%
Growth 2014-2019 (annualised, %)	5.0%	6.9%	3.7%	4.5%	5.9%

## Why would investments in SAF be attractive to the private sector?

There are several reasons why investments in SAF can be potentially attractive to the private institutional sector:

1. Investment in SAF would help institutional investors meet their objectives regarding green energy. The net zero commitment has increased markedly across a wide range of institutions over the past five years and is now widespread. Private financial institutions already have large infrastructure investments globally, and many – for instance, members of groupings such as GFANZ, the Institutional Leadership Network (ILN), Sustainable Markets Initiative (SMI), and Global Investors for Sustainable Development (GISD) Alliance – are helping the move to the transition to a net-zero economy. Investments in SAF would be thus highly complementary to these commitments. The Glasgow Financial Alliance for Net Zero (GFANZ) by itself brings together 450 firms managing \$130 trillion in assets. These investors, together with governments and official agencies, are attaching significant importance to climate change investments.
2. The private institutional sector has a strong preference for projects that yield a steady stream of cashflows and acceptable risk return-calculus. As discussed below, risk-return trade-off for investing in SAF will become increasingly attractive as the countries' governments take measures to improve the policy environment, the public sector undertakes measures to ameliorate excessive risk, and as the market for SAF expands. In this regard, the role of the private sector investment in turbo-charging other renewables especially solar energy is striking.
3. SAF can offer important diversification benefits as an asset class. In other words, the strong likelihood that returns to SAF investments are not correlated with returns to equities or fixed income markets in other sectors and products would help stabilize the overall returns to a portfolio that has SAF as an asset. Similarly, there could be geographical diversification benefits in that SAF investments may occur in countries where investors' exposure in other assets is limited.
4. Such investments would also provide an additional opportunity to work with domestic agencies and governments to help meet their own goals for green investments and jobs and support the adaptation of strategic assets and activities (such as airports and airlines). Additionally, the positive addition of energy security would be an attractive benefit for many governments, particularly those that have relied on energy imports. For institutional investors, with long investment horizons and often the need or the desire to coinvest with the public sector in other areas, especially in emerging economies, this can constitute an important benefit.
5. SAF projects can afford future-proofed investment opportunities with the impending emergence of nature-based mechanisms for green finance. COP15 in Montreal saw over 190 member states sign on to the Global Biodiversity Framework (GBF) initiative for 2030. The GBF builds upon a growing momentum behind accountability for not only an entities' carbon footprint, but their broader impact on biodiversity and nature. As mechanisms like the GBF and those recommended via the Taskforce for Nature-related Financial Disclosures (TNFD) become embedded in green finance, high impact regenerative and/or restorative SAF projects become an increasingly compelling pitch as long-term, future-proofed, bankable avenues for investment.

## What are the supply and cost calculus for accelerated development of SAF?

There is no doubt that the realisation of net zero target by the aviation industry is highly dependent on airlines sourcing more sustainable aviation fuel and become less reliant on traditional fossil-based jet fuel. But then the supply of expected SAF that would be needed to achieve net zero by 2050 would require a quantum increase.

Currently SAF is more expensive than traditional jet fuel. However, costs are expected to come down for advanced SAF pathways as technology and processes mature.

In order to accelerate the decarbonisation of the sector, large quantities of sustainable aviation fuel at reasonable prices are needed in the near and medium term and beyond. Policy measures, as well as support for investment in the production facilities are required to help kick-start the transition away from fossil fuels. Moreover this will bring other benefits, aside from the carbon reductions: currently, around 22 countries supply over 90% of global oil. SAF presents

**Profits** from the 10 largest oil companies in the world in 2022 alone:

**\$450 billion**

(annual average capital expenditure on SAF scale-up around \$48bn)

an opportunity for new energy industries to be established in many other countries worldwide making use of local feedstock resources (waste streams, solar other renewables, limited non-food crops, etc). Importantly, it is also estimated that such a global shift could support or sustain 14 million jobs in a new energy economy, as well as boost energy security for many countries<sup>6</sup>.

Sustainable aviation fuel is currently in short supply. The biological and non-biological resources such as oil crops, sugar crops, algae, waste oil, waste gases, municipal solid waste, hydrogen and low-carbon electricity etc., that are the raw materials that play an important role in the entire production chain of SAF need to be expanded significantly. Investment also needs to be made in production plants – some would be greenfield opportunities, but there are many existing oil and gas production facilities that could usefully be retro-fitted into SAF-compatible units. Repurposing existing or mothballed fossil fuel plants to generate low-carbon fuels is an excellent opportunity to retain jobs and make use of existing facilities.

Given that, as noted above, adequate funding can be available, what is needed is a virtuous cycle to create and expand the market, which will then, given the technology breakthroughs that are occurring by the day, entice as much funding, on attractive terms, as needed.

### **What can be done to accelerate private sector investments in SAF?**

Institutional investors have the resources that could help unlock the scale-up needed. What is required is the enabling environment that is conducive to a material increase in the market for SAF. A key element in this regard is improving expectations regarding the demand for SAF: long-term contracts with creditworthy agencies or airlines could play a critical role. This can play an important role in kick-starting the industry. At the same time, regulatory and legal frameworks that are transparent and predictable, as well as economic and financial stability at the macro level would be helpful.

As noted above, long-term institutional investors (comprising public pension funds, for example) have a stake in the developments of the economies they operate in. While risk-return calculus is relevant given their fiduciary duties, these are not investors that are focused only or even primarily on obtaining excessive returns, or only on the short-run. Nonetheless, given the rapid pace of innovation in SAF, and the long-term nature of investments there can be risks that private sector may be unable or unwilling to take.

Measures and policies that can help reduce the risks can thus accelerate private investments. This is particularly so in emerging and developing economies. Just as important, there has to be an adequate development of pipeline of projects. In the latter context, capacity building and showing significant demand signals – either with government policy, or airline commitments to purchase SAF – is key.

Risks and uncertainties related to exchange rates, and regulatory and legal factors can constitute additional constraints. Were these constraints to be reduced or eliminated, large amounts of capital would be forthcoming.

### **What role can governments and multilateral development banks (MDBs) play in accelerating SAF?**

Governments and MDBs are in theory well-suited to take the range of risks entailed in infrastructure investments, many over long-term. However, they do not have adequate resources, nor are the incentives and constraints necessarily consistent with mobilising the quantum of needed investment for the scale-up that will be required. Nonetheless they can play an important role in facilitating the acceleration of private sector investments in SAF in several ways.

They can help ameliorate the risk-return nexus (via for instance blended finance – see below). But just as important is project preparation and the availability of project pipeline. Financing per se can only proceed if there are adequate, financeable projects available. This is an area that requires particular attention in many of the developing economies, and where MDBs and development finance institutions (DFIs), such as the Industrial Finance Corporation of India (IFCI), Industrial Development Finance Corporation of US (DFC), and Development Finance Institute (DFI) in Canada can play a constructive role.

With regard to governments, predictable policies that offer long-term visibility build market confidence. The experience with other renewables underlines this: for example in India, by

setting up various government and state entities to help bolster the solar market, resolving congestion issues, and mitigating off-take risks, India sent a strong signal to investors about their commitment to harnessing the country's significant solar potential. Capital flowed in quickly, and India has since become a global leader in solar power. Similarly in the case of Chile, established regulatory framework and the presence of strong off-takers have been key to the rapid scale-up of solar investment in the country. Coupled with their commitment to decarbonisation, Chile is credited to be one of the most attractive emerging markets for clean energy investment.

### **What is blended finance and how can it be helpful?**

» *See also the ATAG briefing on Blended Finance for SAF*

Blended finance combines private funding with concessional public funds to mobilize capital that may not be forthcoming on strictly commercial terms. It is still in its early stages, despite having grown rapidly in the past decade<sup>7</sup>. Blended finance uses relatively small amount of public funding to rebalance a project's risk profile, helping mobilise private funding. In other words, limited public funds act as a "catalyst" for eliciting much larger amounts of private funds.

This type of financing is particularly suited for projects, as in SAF production, when investors perceive the risks to be such that either because of the pioneering nature of a project or a challenging environment, returns have to be commensurately high. The use of blended finance can help ease investor concerns by including the right combination of debt, equity or grant financing, the right seniority of investors in terms of absorbing losses and earning returns, and appropriate risk-mitigation products. Blended financing for instance may seek to leverage long-term subordinated debt, a portion of which may be provided at concessional terms, to ameliorate the investment and crowd-in commercial senior debt at more competitive terms. Given that external investors want the returns in their currency, blended finance can also help deal with the foreign exchange risk; and assist in the general development of a menu of instruments to modify or attenuate risks.

Blended finance guarantees can help mitigate demand risk also. Blended finance has achieved notable success in Sub-Saharan Africa, financing climate-smart agribusiness and energy investments. It can for instance help with risk mitigation measures, such as long-term power purchase agreements in the case of off-grid solar energy.

To stimulate large amounts of private funding, governments, DFIs, MDBs and philanthropic organisations need to make private capital mobilisation a core part of their strategies. Blended finance can be mobilised through a platform approach, whereby a particular investment strategy for mixing public and private capital is used across a group of countries to catalyse increased private capital. Thus public resources can be used to modify the risk profile or blend private financing opportunities. These efforts complement support to governments for policy and business climate reforms.

Importantly, MDBs should assist governments with the creation of a pipeline of investible bankable projects; and encourage co-investing between the private sector and MDBs. We also need other innovative approaches: one of these is to complement the important country-specific approach to sustainable infrastructure with cross-country platforms.

The public sector can also be a catalyst in accelerating technological innovation by, for instance, exploring novel use of non-traditional raw materials (including carbon oxides, deconstructed plastic etc.) that will help cost competitiveness.

### **Can government subsidies help?**

To the extent that government subsidies help with redressing the risk-return trade-offs, public sector subsidies could certainly play a useful role, especially in the early stages. In this context it is helpful to draw some lessons from the evolution of other renewables in many countries – ranging from India, China, EU, Japan, USA (which were subsidised initially by governments)<sup>8</sup>.

These subsidies helped address market failures, such as to deal with the price disparity with fossil fuels when environmental costs are not accounted for. Moreover, spill-over benefits from research and development and economies of scale justified subsidies in early years.

By increasing the deployment of renewables, subsidies played an important role in accelerating adoption and ramp up production to more rapidly bring scale and reduce reliance on fossil fuels and as well as greenhouse gas emissions.

The results of subsidies that played an important role in creating demand and stimulating technological breakthroughs are instructive: the cost of renewable energy has drastically fallen since 2010. Over the past 10 years, the price of solar electricity dropped over 90%, and the price of onshore wind dropped 70%. The price of solar photovoltaic power (from solar panels) reduced from around \$360 per megawatt hour to \$40, the cheapest of any of the power options. Over the same time period, the price of coal barely shifted, from \$111 per megawatt hour in 2009 to \$109 in 2019.

In 2009, building a new solar farm was 225% more expensive than building a new coal plant. Now, it has flipped: Electricity from a new coal plant is 175% more expensive than electricity from new solar panels (on a levelized basis – that is cost of electricity generation for a generator over its life-time). What caused the switch? Huge leaps in technological advancement, and like other technologies, the more that was produced, the cheaper it became to produce<sup>9</sup>.

In the case of SAF, and depending on the country, the private financial sector would not necessarily need the subsidies on the same long-term scale. They could of course help in the early stages of development but what is really needed is to create and expand the market at the same time we create the technology and production facilities. As investors see the expanding market they will invest in all stages of the production chain of SAF. There are a range of policy measures that could help the acceleration: these have been explored reports such as the *Sustainable Aviation Fuel Policy Toolkit*<sup>10</sup>.

### **What other factors could help facilitate investment?**

There is a critical need to ensure transparency and reduce uncertainties in the regulatory and legal environment. The governments have to set the right framework for action. To reduce the risk profile, countries need to make significant progress; upgrade their macro policy frameworks; have more macro stability and appropriate regulatory as well as legal frameworks; but many of these factors, and the related variables that go into credit ratings are slow moving (including institutional and economic profile, fiscal positions, debt stocks)<sup>11</sup>. Blended finance is a useful tool to help mitigate the excessive risks; goal of blended finance is to create “market equivalent” investments to mobilise private sector investment for climate (and SDG) projects.

### **What role can global cooperation play, and how can we ensure that capital doesn't just flow to the developed world and large developing markets?**

There are many areas where global cooperation can play an important role in helping emerging market and developing countries accelerate the deployment of SAF. A low-hanging fruit is simply sharing knowledge, information and expertise in the development of SAF projects pipelines. Capacity building – through the ICAO ACT-SAF process as well as others – is very important as part of the means of implementation. There can be fruitful cooperation in the regulatory environment that is most conducive to SAF. Understanding what has worked, what hasn't and how to improve the framework within which the private sector will invest can be helpful. More generally, the pursuit of appropriate macro, financial and sectoral policies that will help SAF, and green infrastructure more generally, can be facilitated by global cooperation, bilaterally and multilaterally.

The global cooperation can play a role in setting common standards (including standardised long-term contracts), and in the case of multi-country platforms for blended finance, helping with the risk-return nexus, and the adoption of policies that can help ameliorate risks. These global cooperation measures, as well as measures noted above to improve the risk-return trade-offs, blended finance, and an improvement in domestic economic, financial and regulatory environment can go a long way towards ensuring that adequate capital is available for developing and emerging market economies. In the case of smaller economies, the portfolio approach, whereby strategies are developed for groups of countries (e.g. the Caribbean region, groups of Commonwealth countries, etc) can ensure that country size is less of a hindrance to the flow of capital.

## References

<sup>1</sup> Caisse de dépôt et placement du Québec is an institutional investor that manages several public and parapublic pension plans and insurance programs in Quebec with assets of nearly \$400 billion. Answers drafted by Manmohan S Kumar for CDPQ

<sup>2</sup> Air Transport Action Group: [www.atag.org](http://www.atag.org)

<sup>3</sup> Air Transport Action Group Waypoint 2050 and Fueling Net Zero analysis: [www.aviationbenefits.org/W2050](http://www.aviationbenefits.org/W2050)

<sup>4</sup> Air Transport Action Group fact sheet on the cost of meeting net zero: [www.atag.org/component/attachments/?task=download&id=1008:FACT-SHEET\\_15\\_cost-of-net-zero-transition](http://www.atag.org/component/attachments/?task=download&id=1008:FACT-SHEET_15_cost-of-net-zero-transition). International aviation alone is estimated by the ICAO LTAG analysis to be around \$4 trillion.

<sup>5</sup> Financial Stability Board: Global Monitoring Report on Non-Bank Financial Intermediation 2021.

<sup>6</sup> Air Transport Action Group Fueling Net Zero analysis: [www.aviationbenefits.org/W2050](http://www.aviationbenefits.org/W2050)

<sup>7</sup> "The State of Blended Finance 2021" Convergence 2021: [www.convergence.finance/resource/0bbf487e-d76d-4e84-ba9e-bd6d8cf75ea0/view](http://www.convergence.finance/resource/0bbf487e-d76d-4e84-ba9e-bd6d8cf75ea0/view)

<sup>8</sup> Energy Subsidies, International Renewable Energy Agency 2020: [www.irena.org/publications/2020/Apr/Energy-Subsidies-2020](http://www.irena.org/publications/2020/Apr/Energy-Subsidies-2020)

<sup>9</sup> "Why did renewables become so cheap so fast", Max Roser in Our World in Data (Online science publication in partnership with Oxford University), December 2020)

<sup>10</sup> World Economic Forum and Energy Transitions Commission: [www.weforum.org/reports/clean-skies-for-tomorrow-sustainable-aviation-fuel-policy-toolkit/](http://www.weforum.org/reports/clean-skies-for-tomorrow-sustainable-aviation-fuel-policy-toolkit/)

<sup>11</sup> For a recent summary of the measures government can take to improve their creditworthiness and prospects of attracting foreign capital, see a note by the head of IMF Kristalina Georgieva, and Tobias Adrian, "Public sector must play a major role in catalyzing private finance", IMF, August 18, 2022