



**WORKING PAPER**

**THIRD CONFERENCE ON AVIATION ALTERNATIVE FUELS  
(CAAF/3)**

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**Agenda Item 4: Financing cleaner energy**

**FINANCING THE AVIATION ENERGY TRANSITION: AN INDUSTRY VIEW**

(Presented by the Air Transport Action Group (ATAG), Airports Council International (ACI), Civil Air Navigation Services Organisation (CANSO), International Air Transport Association (IATA), International Business Aviation Council (IBAC) and International Coordinating Council of Aerospace Industries Associations (ICCAIA))

**EXECUTIVE SUMMARY**

This Working Paper addresses the role of sustainable aviation fuel (SAF) finance in the transition to net-zero carbon emissions in aviation. To achieve net zero, substantial financing is required, estimated at between \$1.45 and \$3.2 trillion for SAF capital development. The finance community is considered capable of supporting this transition, with private capital investments in sustainable categories, significant institutional investor funds, and support from initiatives like the Net Zero Banking Alliance. Innovative financing mechanisms like blended finance can attract investment in emerging markets. ICAO's role is to facilitate matchmaking between States in need of SAF investment and various funding sources, contributing to the global aviation energy transition and adhering to the "No Country Left Behind" philosophy. ICAO also plays a role in engaging with multilateral development banks and UN agencies to address this challenge.

**1. INTRODUCTION**

1.1 At the 41st ICAO Assembly, ICAO adopted a sector-wide long-term global aspirational goal (LTAG) for international aviation of net-zero carbon emissions by 2050. In October 2021, the aviation industry, including the signatories to this paper agreed to strengthen the industry decarbonisation commitments first set in 2009, to a net zero 2050 goal.

1.2 Reaching our shared global aspirational goal will require a global effort including (alongside new technologies; and operational and infrastructure efficiencies) a significant and rapid shift towards new forms of sustainable energy, with a particular emphasis on drop-in renewable liquid hydrocarbon fuels commonly referred to as sustainable aviation fuel, or SAF.

1.3 This transition will require unprecedented and rapid collaboration and effort from a range of aviation and non-aviation stakeholders: governments, the aviation industry, energy providers and the finance community. The scale of the challenge is daunting, but the ICAO Conference on Aviation Alternative Fuels (CAAF/3) provides an important inflection point to steer global policy direction and financing for the transition.

1.4 This paper outlines the financing required to meet the transition, including the role of banks, institutional investors, blended finance and how ICAO can play a key role in assisting the finance elements of SAF deployment.

## 2. SCALE OF FINANCING NEEDED FOR THE SAF TRANSITION

2.1 Estimates vary of the financing required to fulfil the transition to meet net-zero emissions for the aviation sector, but the financing for the capital investment in SAF production is substantial. The ICAO *LTAG Report* analysis suggests a capital investment of \$3.2 trillion will be needed for SAF development before 2050<sup>1</sup>. The ATAG *Fueling Net Zero* analysis suggests \$1.45 trillion capital investment in new fuels<sup>2</sup>.

2.2 Though these are large numbers, they compare very reasonably to the typical annual capital expenditure of the global oil and gas industry. According to analysis by the International Energy Forum, \$499 billion was spent by the oil and gas industry on upstream infrastructure in 2022 alone, with an expected \$4.9 trillion capital expenditure between 2023 and 2030<sup>3</sup>.

2.3 Because of the nature of the transition and the current lack of enthusiasm from traditional energy providers, at least initial stages of the transition will be mainly driven through new energy companies which produce other renewable fuels already or focus specifically on SAF. Therefore, there is a need for significant interaction with the finance sector to ensure it is prepared for the necessary investments in the decades ahead.

## 3. RESPONSE OF THE FINANCE COMMUNITY

3.1 There is sufficient investment capital to support the energy transition, even with the financing demands from other sectors as they decarbonise. With supportive policy conditions, the energy supply sector is seen as a stable, long-term investment and the climate-related aspects of the shift to SAF follow many of the guidelines being adopted by financial institutions as they shift portfolios to be net-zero and Paris Agreement-aligned.

3.2 The available capital is significant and covers a wide range of sources and financial mechanisms. Private capital investments in infrastructure reached \$172 billion in 2021, 60% of which were in green categories (mostly renewable energy)<sup>4</sup>. The OECD estimates that its members delivered \$204 billion in overseas development assistance in 2022<sup>5</sup>. It is estimated that institutional investors have some \$200 trillion in funds worldwide. The Net Zero Banking Alliance, bringing together more than 40% of global banking assets, is part of a wider group of financial market actors – the Glasgow Financial Alliance for Net Zero<sup>6</sup> which aims to coordinate efforts across all sectors of the financial system to accelerate the transition to a net-zero global economy.

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<sup>1</sup> ICAO LTAG Report, 2022: [www.icao.int/environmental-protection/LTAG/Pages/LTAGreport.aspx](http://www.icao.int/environmental-protection/LTAG/Pages/LTAGreport.aspx)

<sup>2</sup> Air Transport Action Group and ICF report *Fueling Net Zero*, September 2021: [www.aviationbenefits.org/W2050](http://www.aviationbenefits.org/W2050)

<sup>3</sup> International Energy Forum *Upstream Investment Report 2023*: [www.ief.org/focus/ief-reports/upstream-investment-report-2023/download](http://www.ief.org/focus/ief-reports/upstream-investment-report-2023/download)

<sup>4</sup> G20 Global Infrastructure Hub *Infrastructure Monitor 2022*: <https://cdn.gihub.org/umbraco/media/5262/gih-infrastructure-monitor-2022-report-may-2023.pdf>

<sup>5</sup> OECD, *ODA levels in 2022, preliminary data*, April 2023: [www.oecd.org/dac/financing-sustainable-development/ODA-2022-summary.pdf](http://www.oecd.org/dac/financing-sustainable-development/ODA-2022-summary.pdf)

<sup>6</sup> Glasgow Financial Alliance for Net Zero: [www.gfanzero.com](http://www.gfanzero.com)

3.3 A survey<sup>7</sup> of 20 major financial institutions has shown that two thirds of them have an active interest in investing in SAF, or are already doing so. When asked about the types of policy required to make the business case, two elements stood out: a long-term, stable policy environment; and early-stage risk-reduction measures such as government guarantee schemes and certainty of demand.

#### 4. ROLE OF INNOVATIVE FINANCING MECHANISMS

4.1 Whilst there is starting to be significant investment interest in developed economies where the early demand for SAF will be highest, if aviation at a global level will reach net-zero carbon, there will need to be SAF developed in countries all over the world. A vast majority of States will have opportunities to develop a SAF industry: improving energy security, creating new green energy sectors and in the processes supporting or transitioning an estimated 14 million jobs<sup>8</sup>. But not all States have the same levels of risk, so blended finance could be a way to create an investment case for SAF deployment.

4.2 Blended finance is a financing approach that combines public and private sector funding to mobilise additional investment in development projects and initiatives in emerging markets. The goal of blended finance is to attract private sector investment to projects and sectors that have a clear development impact but may not be considered commercially viable by investors. The most common form of blended finance is the use of public or philanthropic funds, such as development finance or grant funding, to de-risk or catalyse private sector investment. This can take the form of guarantees, credit enhancements, or other forms of risk mitigation. By reducing the perceived risk of the investment, blended finance aims to make it more attractive to private investors and encourage them to invest in projects that they may not have otherwise considered.

4.3 The transition will need a coordinated approach between public sources of finance (particularly in the early stages to de-risk investment because of nascent technology or processes; or to provide de-risking of investment in emerging markets) including multilateral development banks, public support from donor countries and some philanthropic investments. The significant scale-up which will be required can then be continued with private capital and institutional investors.

#### 5. ICAO ROLE IN FINANCING

5.1 Rather than fund the development itself, ICAO can play a very useful role in bringing together States in need of SAF investment with the sources of investment assistance, be they: multilateral development banks, institutional investors, philanthropic organisations or other forms of financing assistance. This ‘matchmaking’ service such as the proposed ICAO Finvest Hub will be vital in ensuring that the aviation energy transition is able to benefit States all over the world, in line with ICAO’s No Country Left Behind philosophy, whilst also fulfilling the investment needed in decarbonising the sector.

5.2 ICAO can also provide significant visibility for the challenge by engaging, at the highest level, with the global multilateral development banks and other UN system agencies.

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<sup>7</sup> ATAG and ICF survey of financial institutions in July 2023: [https://atag.org/media/oy3douye/survey-on-saf-financing\\_july-2023.pdf](https://atag.org/media/oy3douye/survey-on-saf-financing_july-2023.pdf)

<sup>8</sup> ATAG and ICF report *Fueling Net Zero*, September 2021: [https://aviationbenefits.org/media/167495/fueling-net-zero\\_september-2021.pdf](https://aviationbenefits.org/media/167495/fueling-net-zero_september-2021.pdf)

## 6. ACTION BY CAAF/3

6.1 The Conference is invited to:

6.1.1 Take note of the need for finance to be seen as a significant factor in the success of the aviation sector's global application of a net-zero carbon-aligned energy transition.

6.1.2 Promote and encourage the use of innovative financing mechanisms, such as blended finance, for capitalising the investment needed in SAF deployment in all countries around the world.

6.1.3 Encourage the ICAO Council to rapidly deploy the resources needed for bringing together the finance requirements for SAF – including the use of a matchmaking hub for SAF finance. High-level coordination, particularly with MDBs, is also encouraged.

## **APPENDIX A**

**[ATAG papers on SAF finance and blended finance]**

# HOW BLENDED FINANCE CAN SUPPORT THE AVIATION ENERGY TRANSITION IN EMERGING AND DEVELOPING ECONOMIES

Innovative instruments and equity finance are needed to enhance risk-sharing through public-private partnerships and maximise the impact of scarce public funds.

Analysis has shown that aviation's sector-wide long-term goal of net-zero carbon emissions by 2050 will require an energy transition away from fossil fuels and towards sustainable aviation fuels. The transition will need to be rapid – scaling-up supply of SAF from the 200,000 tonnes delivered in 2022 to potentially 445 million tonnes per year by 2050. This rapid deployment is estimated to require up to \$1.45 trillion in capital expenditure on new plants and processing and will be needed in countries all over the world.

This will present a significant opportunity for States to build green energy sectors, supporting economic development and potentially some 14 million jobs worldwide by 2050. But the capital expenditure needed will be extensive. Public sources of investment from developing or emerging economies will not be able to cover the scale required, and private sources are sometimes reluctant to undertake more risky investments in early-stage technologies or in some markets with higher risk profiles.

The use of blended finance can overcome some of these obstacles and pave the way for early-stage investment to underpin long-term private and institutional investment. In general terms, blended finance is the use of catalytic capital from public or philanthropic sources to increase private sector investment in sustainable development.

This paper explores the concept of blended finance in an aviation context and how it will be crucial to the energy transition in emerging markets as the global air transport sector works towards net-zero carbon by 2050. It also has two examples of blended finance in action for aviation:

1. de-risking investment in the first SAF facilities; and
2. bundling multi-country SAF sectors.

*The data in this report 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)



## Blended finance

Blended finance is a financing approach that combines public and private sector funding to mobilise additional investment in development projects and initiatives in emerging markets. The goal of blended finance is to attract private sector investment to projects and sectors that have a clear development impact, but may not be considered commercially viable by investors.

The most common form of blended finance is the use of public or philanthropic funds, such as development finance or grant funding, to de-risk or catalyse private sector investment. This can take the form of guarantees, credit enhancements, or other forms of risk mitigation. By reducing the perceived risk of the investment, blended finance aims to make it more attractive to private investors and encourage them to invest in projects that they may not have otherwise considered.

Blended finance can also leverage the expertise and technical assistance from development organisations to help make projects more attractive to private investors. This can include support for project preparation, structuring, and implementation. Many development organisations and multilateral financial institutions also have a long track record of working with local experts to ensure best opportunities for each market.

Blended finance is often used in sectors such as infrastructure, energy, and sustainable development, where private sector participation can be critical to achieving development impact but where commercial returns may be uncertain or low.

*Some blended finance projects will tap in to two or more of these institutions, and some may have fewer players. There will also be a number of SAF projects and incentive schemes which bring in financing from MDBs or IFIs directly. The below provides a high-level illustration of the ways in which different institutions may play a role in SAF deployment globally.*

(Illustrative scale of relative involvement)





## Examples of blended finance at work in SAF facility development

Blended finance has the potential to catalyse the large amounts of investment required to help scale-up SAF production to levels needed for the decarbonisation of air transport. Here are two examples of how blended finance can be used in different ways to finance SAF projects in emerging economies:

### Example 1

#### De-risking investment in the first SAF facilities

An in-country initiative set up by government, aviation and energy industry and other stakeholder groups has identified several feedstocks and pathways that could be potential sources of SAF in the country. A feasibility study was commissioned, with funding for the study provided by a donor country through the ICAO ACT-SAF initiative. Several sites have been identified that would be perfect for the first couple of SAF production facilities – close to the sources of agricultural waste and municipal waste, as well as being close to airports that could use the finished SAF.

The first plant, in a semi-rural area close to both forestry and sugar cane production has the potential to produce 65,000 tonnes of SAF per year with supply to a local airport. It would also create 900 jobs – 100 running the plant itself and the rest in the collection of the raw waste feedstock from local farms. Hundreds more jobs would be created during construction. The capital expenditure for the plant would be \$700 million with a payback period of 15 years.

The second facility would partially re-use a soon-to-be-closed fossil fuel refinery close to the capital city, retrofitting it to be able to process waste oils and fats from the city to produce 400,000 tonnes of SAF for use at the country's main hub airport. Some 2,000 jobs would be created, with two thirds being transferred from the existing fossil fuel plant. The capital costs are estimated at \$400 million. The feasibility study also concluded that there was potential for at least seven other SAF facilities to be established over the coming decade.

Now, the country is looking to help finance the construction of these plants. Limited funds are available from a local infrastructure investor, but the country's regional development bank is able to provide seed financing to help de-risk the investment in the two SAF facilities with additional financing secured from a consortium of international pension funds. Part of the investment package included several policy measures from the country, including de-risking of the construction costs, tax reduction on both construction and the use of the SAF product by airlines and support in accelerating regulatory approval for construction of the facility.

### Example 2

#### Bundling multi-country SAF sectors

One of the challenges with financing nascent industries in many developing and emerging economies is the risk profile of those markets. One option to help overcome this is to 'bundle' projects across several countries.

A group of four small Central American states all benefited from the ICAO ACT-SAF initiative and, working together, identified an initial 12 potential feedstocks and sites for SAF production across the countries. They worked with the Inter-American Development Bank to fund a four-country feasibility study to determine the best options for the first tranche of investment. Six facilities were chosen, at least one in each country, with financing of a total of \$1.8 billion required for the facilities which range from 50,000 to 130,000 tonnes of SAF per year. Up to 7,000 jobs in the four countries are expected to be generated.

Some local investment and a supportive policy environment from the four countries ensured that a consortium of multilateral development banks, institutional and private investors invested in the process. A multinational energy company, which already had retail facilities in one of the countries, also invested. The fact that four countries were involved helped to lower the risk for the international investors, by creating a more stable regional policy environment and ensuring that short-term political or economic changes in one country was able to be balanced across this portfolio.



## Finance sources and institutions

Although exact definitions vary, in this paper, we have used the following definitions of finance institutions and sources

Institution type	Definition	Examples
<b>Public finance</b>	Finance provided by a government from either tax revenues or by issuing debt on the bond market, for use in its own country, or as a group of countries working together. Additionally, policy support can be given in the form of de-risking investment in SAF-type projects, providing tax breaks and assisting with reducing regulatory hurdles to development of climate initiatives.	
<b>Public finance (donor)</b>	Finance provided by donor governments from national treasuries, provided directly through official development assistance (ODA) or other mechanisms; or via other international arrangements (including the international financial institutions or funds). Data from the OECD suggested that around \$150 billion in ODA was delivered from its members to low-income countries in 2019.	<ul style="list-style-type: none"> <li>» USAID</li> <li>» GIZ</li> <li>» UK DFID</li> </ul>
<b>Philanthropic funding</b>	Several large global foundations exist to help catalyse the investment in climate smart technology and energy production. Whilst these institutions would likely not invest in the capital expenditure on a large scale, they are often able to work together to look at in-country opportunities, feasibility studies and to fund collaborative partnerships that will help access the capital needed for development in the long term.	<ul style="list-style-type: none"> <li>» Breakthrough Energy</li> </ul>
<b>Global international financial institutions (IFIs)</b>	Organisations that provide financial assistance and support to countries for economic development and poverty reduction. These institutions provide loans, technical assistance, and policy advice to their member countries, often with a focus on specific sectors or regions. They also play a key role in promoting global economic stability and cooperation, and in providing a forum for international economic policy coordination.	<ul style="list-style-type: none"> <li>» International Monetary Fund</li> <li>» World Bank</li> </ul>
<b>Other Multilateral development banks (MDBs)</b>	A type of international financial institution that provides funding and support for economic development and poverty reduction in developing countries. MDBs often have a specific mandate to promote economic development and reduce poverty and a specific focus on infrastructure development and investment in a particular region, sector or theme.	<ul style="list-style-type: none"> <li>» African Development Bank</li> <li>» Asian Development Bank</li> <li>» Inter-American Development Bank</li> </ul>
<b>Institutional investors</b>	Institutional investors are organisations that invest funds on behalf of a group of individuals or other organisations. They include pension funds, mutual funds, endowments, insurance companies, and sovereign wealth funds. These organisations typically have large pools of capital and invest in a wide range of financial assets, including stocks, bonds, real estate, and private equity. They may also engage in other financial activities such as lending, derivatives trading, and risk management. They have fiduciary responsibilities and need to have certain returns with limitations on the risks they can undertake. They also tend to have a long-term investment horizon and are less likely to engage in short-term trading activities. Additionally, they often have a professional staff of analysts and portfolio managers who can conduct in-depth research on investment opportunities and make informed investment decisions. It is estimated that institutional investors look after over \$200 trillion in funds worldwide.	<ul style="list-style-type: none"> <li>» Pension and retirement funds</li> <li>» Sovereign wealth funds</li> <li>» Mutual funds</li> <li>» Insurance companies</li> </ul>
<b>Private investors / private capital</b>	The large commercial retail and investment banks have access to billions of dollars of capital. According to the McKinsey Global Banking Annual Review, in 2021 the volume of clean-energy project finance rose to \$164 billion and private-equity firms invested \$76 billion in renewable energy, sustainable mobility, and carbon technologies in 2021.	<ul style="list-style-type: none"> <li>» HSBC</li> <li>» Standard Chartered</li> <li>» JP Morgan Chase</li> <li>» Bank of America</li> <li>» Deutsche Bank</li> <li>» UBS</li> <li>» Société Générale</li> </ul>

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# 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