



CONFERENCE ON AVIATION AND ALTERNATIVE FUELS

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Agenda Item 2: Financing and assistance programmes for aviation alternative fuels

FINANCIAL SOURCES FOR SUSTAINABLE AVIATION FUELS PROJECTS

(Presented by the ICAO Secretariat)

SUMMARY

This paper identifies current financial sources available for sustainable aviation fuels projects, highlighting their importance to the development of the sustainable aviation fuels industry.

Action by the Conference is in paragraph 10.

1. INTRODUCTION

1.1 As a new industry, the SAF industry must overcome a variety of initial market hurdles throughout its development cycle, such as:

- Confirming availability and quality of appropriate feedstocks;
- Developing knowledge of process chemistry, infrastructure requirements, transportation networks, and environmental impacts;
- Proving the design of new SAF production technologies;
- Constructing demonstration scale facilities to produce small quantities of SAF for fuel testing and certification, followed by scale-ups for commercial deployment;
- Gaining technical certification of new fuels;
- Proving the short-term and long-term market for SAF;
- Confirming the life cycle environmental benefits of the new fuel;
- Competing with the established Conventional Aviation Fuels (CAF) industry, and facing the volatility in CAF prices in the international market.

1.2 Each step in the production pathway presents different risks and financial needs. Many States have an array of programs and funding sources available to developers, however, more funding is required to meet the broader needs of new SAF production. This paper provides information on funding and incentives available for SAF development projects.

2. RESEARCH AND DEVELOPMENT FUNDING

2.1 Fundamental research into SAF production and use is commonly funded by States either in whole or on a cost shared basis with industry. Funding often comes from different agencies to meet needs related to feedstock supply, scientific understanding of a process or combustion chemistry, or identifying barriers to SAF development and use. Essential participants for providing research and development funding are States and industry.

2.2 In the U.S. several agencies provide research and development funds to support a growing bioeconomy. These include, among others, the U.S. Department of Energy¹, the U.S. National Academy of Sciences' Airports Cooperative Research Program (ACRP)², the U.S. Biomass Research and Development Initiative (BRDI)³, and the U.S. Federal Aviation Administration (FAA) through the Center of Excellence for Alternative Jet Fuel and Environment (ASCENT)⁴ and the Continuous Low Energy, Emissions, and Noise (CLEEN) Program⁵.

2.3 The E.U. has funded Horizon 2020, a large research and innovation programme to drive sustainable and inclusive economic growth and create jobs. Horizon 2020 is the financial instrument implementing the Innovation Union, an Europe 2020 flagship initiative aimed at securing Europe's global competitiveness. It is viewed as a means to drive economic growth and create jobs by coupling research and innovation. Horizon 2020 emphasizes excellent science, industrial leadership, and tackling societal challenges. The goal is to ensure Europe produces world-class science, removes barriers to innovation, and makes it easier for the public and private sectors to work together in delivering innovation⁶.

3. VENTURE CAPITAL INVESTMENT PROGRAMS

3.1 Venture capital is a form of financing that firms can provide to developers that have high growth potential. Venture capital firms invest in newly developing companies in exchange for an ownership share. Venture capitalists take on the risk of financing new companies that are usually based on an innovative technology or business model.

3.2 Amyris, Fulcrum Bioenergy, Gevo, Kior, LanzaTech, and Red Rock Biofuels have all used venture capital to develop their SAF production technology. Among venture capital firms, Khosla Ventures has invested in Amyris, Gevo, Kior, and LanzaTech and Flagship Pioneering has invested in Red Rock Biofuels.

4. MULTILATERAL FUNDING INSTITUTION SUPPORT

4.1 States and international financial institutes have a key role to play in incentivizing and providing finances to accelerate development and deployment of credible and sustainable alternative fuels. At the global level, the World Bank can be instrumental in developing a plan for more investments in clean energy in the developing world, in cooperation with other international financial institutions. This effort can help in tapping new business opportunities for developing countries and helping them cope with new risks. At regional levels, financial institutions such as the Inter-American Development Bank

¹ <https://science.energy.gov/sbir/funding-opportunities>

² <http://www.trb.org/acrp/acrp.aspx>

³ <https://nifa.usda.gov/funding-opportunity/biomass-research-and-development-initiative-brdi>

⁴ <https://ascent.aero>

⁵ https://www.faa.gov/about/office_org/headquarters_offices/apl/research/aircraft_technology/cleen/#afa

⁶ <http://ec.europa.eu/programmes/horizon2020/en/what-horizon-2020>

(IADB) and the Asian Development Bank (ADB) can play the same role that the World Bank plays at the global level.

4.2 In this regard, the Sustainable Energy for All (SE4ALL) partnership between the World Bank and the United Nations is helping to build partnerships and unlock finance to achieve universal access to sustainable energy⁷.

5. LOAN GUARANTEE PROGRAMMES

5.1 Loan guarantees are important means for developers to mitigate project risk and attract other funding, either equity or debt. Essential participants for providing loan guarantees are States and regional development banks. Examples of loan guarantee programmes include Business & Industry loan guarantee program⁸ funded by the U.S Department of Agriculture (USDA), and the U.S. Department of Energy's (DOE) Loan Guarantee Program⁹, which enhances the availability of private credit by guaranteeing loans for businesses in eligible areas.

6. PRODUCTION FACILITY GRANT SUPPORT

6.1 Grants to support production facilities are important due to capital requirements of new commercial facilities. Each grant tends to be large, in order to have a meaningful impact on an expensive project. Example production facility grants include:

6.1.1 USDA Biorefinery Assistance Program¹⁰, which assists in the development, construction, and retrofitting of new and emerging technologies by providing loan guarantees for up to \$250 million, which are backed by the Federal government, for biorefinery development.

6.1.2 InnovFin Energy Demonstration Projects (EDP)¹¹ provides loans or loan guarantees to first-of-a-kind commercial-scale demonstration projects for renewable energy, helping to bridge the gap from demonstration to commercialization.

6.1.3 NextGen Biofuel Funds¹² support the establishment of first-of-a-kind large demonstration-scale facilities for production of next-generation renewable fuels, which require high capital expenditure to support larger demonstration-scale activities.

7. AIRPORT SAF SUPPLY INITIATIVES

7.1 Following the pioneering SAF deployment initiatives at Oslo Gardermoen Airport (OSL), Los Angeles International Airport (LAX), and Stockholm Arlanda Airport (ARL), as mentioned in CAAF/2-WP/05, more airports are becoming involved in efforts to fund SAF development and use. These airport SAF supply initiatives bring together multiple entities to organize and coordinate SAF supply links to source and deliver SAF from fuel production facilities to airport fuel tanks. Examples of new SAF supply initiatives at international airports include: Amsterdam Airport Schiphol (AMS) – SkyNRG,

⁷ <http://www.se4all.org/>

⁸ <https://www.rd.usda.gov/programs-services/business-industry-loan-guarantees>

⁹ <https://energy.gov/savings/us-department-energy-loan-guarantee-program>

¹⁰ <https://www.rd.usda.gov/programs-services/biorefinery-renewable-chemical-and-biobased-product-manufacturing-assistance>

¹¹ <http://www.eib.org/products/blending/innovfin/products/energy-demo-projects.htm>

¹² <https://www.sdte.ca/en/funding/funds/nextgen>

an independent company whose mission is to help create and accelerate development of a market for SAF, joined with KLM Airline to purchase SAF, which is delivered to the airport. Participant airlines pay a premium over the cost of CAF to receive this SAF as part of their corporate commitments to sustainability.

7.1.1 Sweden's Karlstad Airport (KSD) – SkyNRG worked with the airport to develop the Fly Green Fund, with the aim of facilitating the deployment of SAF at the airport.

7.1.2 Seattle Tacoma International Airport (SEA) is collaborating with the Carbon War Room and SkyNRG to evaluate specific funding mechanisms to cover the cost difference between SAFs and conventional fuels.

7.1.3 Montreal Pierre Trudeau International Airport (YUL) – is partnering with SkyNRG, GARDN, Air Canada, and Transport Canada, along with educational institutions and other organizations to develop a complete alternative fuel supply chain for the airport.

8. OFF-TAKE AGREEMENTS

8.1 Several international airlines have committed to purchasing SAFs from new fuel producers as a way to establish and guarantee a market for these fuels. Typically an airline will enter into an agreement with a company proposing to build a fuel production facility, promising to purchase a significant quantity fuel at a defined price over a defined period. This allows the plant developer to prove the market as it seeks to borrow funds for plant construction. It reduces the risk for the lender in a case where there isn't an established market. Several off-take agreements have been announced in the past few years, as summarized in Table 1.

Table 1. Announced off-take agreements.

Producer	Purchaser	Off-take production per year		Start/Length of agreement (years)
		(million gal.)	(Mt)	
AltAir	United Airlines	5	0.015	2016 / 3
	Gulfstream/World Fuel	N/A	N/A	N.A. / 3
	SkyNRG/KLM	N/A	N/A	2016 / 3
AltAir/Neste	KLM/SAS/Lufthansa/AirBP	0.33	0.001	N.A. / 3
Fulcrum	Cathay Pacific	35	0.106	N.A. / 10
	United Airlines	90-180	0.274-0.547	N.A. / 10
	Air BP	50	0.152	N.A. / 10
RedRock	Southwest	3	0.009	N.A./N.A.
	FedEx	3	0.009	N.A. / 7
Amyris/Total	Cathay Pacific	48 A350 deliveries at 10% blend		
SG Preston	Jet Blue	10	0.030	2019 / 10
Gevo	Lufthansa	8	0.024	N.A. / 5
TOTAL		204.33 to 294.33	0.621 to 0.894	

9. CONCLUSION

9.1 Financial support is essential throughout the development cycle to ensure the establishment and growth of a new SAF industry. International, national, and regional programmes have provided initial support for development of SAF production technologies and facilities. However, available funding to date is not sufficient to grow SAF production and deployment at the rate needed to

meet the industry's goals for using SAF. It is essential to significantly expand the funds available to SAF technology developers and especially fuel producers. By accessing different funding sources at different phases of the development cycle, fuel producers may be able to acquire greater funding at lower cost.

10. **ACTION BY THE CAAF2**

10.1 The CAAF2 is invited to:

- a) acknowledge the importance of a variety of funding sources throughout the development cycle of the SAF industry, as described in paragraph 1.1; and
- b) encourage States to evaluate available funding sources, advertise the need for investing in SAF production and opportunities to invest, and ensure funding sources appropriate to development needs are accessible.

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