Giving BioJet Wings: Policy Instruments for a Carbon Neutral Aviation Sector

Harri Kalimo, Ólöf Söebech, Eleanor Reyes Mateo, & Filip Sedefov*

Sustainable Aviation Fuels ("SAFs") entered commercial markets a decade ago to replace fossil fuels. Unlike in road transport, where biofuels have been gradually deployed, the uptake of SAF in aviation has been very slow. The objective of this article is to explore how policymakers around the world have responded to the call to make aviation more sustainable through the use of SAF. The Article pursues this objective through a detailed analysis of five types of policy instruments, which are considered the most innovative worldwide in promoting the production and use of alternative jet fuels. The article assesses the potential of these instruments to advance the SAFs market and identifies bottlenecks that could hinder developments in the sector. It concludes that, as in a variety of other climate policies, developments in the aviation sector take place largely in dynamic,

*Harri Kalimo is a Senior Researcher and Research Professor who holds the Jean Monnet Chair at the Institute for European Studies ("IES") at the Vrije Universiteit Brussel. He is also a professor (part-time) at the University of Eastern Finland. Ólöf Söebech is a Project Researcher at the IES and the Department of Political Science at the Vrije Universiteit Brussel. Eleanor Mateo is a project researcher and PhD candidate at the Institute for European Studies and Faculty of Law and Criminology at the Vrije Universiteit Brussel. Filip Sedefov is an Environment, Health and Safety Consultant at Young and Global Partners and was formerly a project researcher at the IES. This paper was made possible by the funding from EU FP7 Project BFSJ (Production of Fully Synthetic Paraffinic Jet Fuel from Wood and Other Biomass), Grant nr. 612763 and EACEA Jean Monnet Chair of Professor Kalimo (rECOncile, Grant nr. 575718-EPP- 1- 2016- 1-BE-EPPJMO-CHAIR).

polycentric collaborative networks. The prevalent policy instruments in the sector are "soft" initiatives and voluntary collaborations, driven by proactive private and public actors with the help of external funding and expertise. Yet regulatory instruments are also gradually emerging and offer the first examples of promising policy pathways. Further synchronous development of both the voluntary and regulatory policy pathways will remain challenging because the instruments operate in complex systems of network governance. Involved actors will therefore need to rapidly undertake focused efforts to create the necessary policy impetus for SAFs to properly take off.

Table of Contents

INTRODUCTION

The first Sustainable Aviation Fuels ("SAFs") entered commercial markets a decade ago to replace fossil fuels. Unlike the gradual deployment of biofuels in road transport, however, the uptake of SAFs in aviation has been very slow. Currently, few initiatives are beyond the stage of small-scale pilots. No real market to speak of exists, despite the rapid increase in air transport[1] and the lack of short to medium-term

[1] ICAO forecasts indicate that air traffic volumes will grow by an average of approximately 4.5% annually over the next 15 years. *See Aviation Benefits 2017 Report*,

technological alternatives to liquid hydrocarbon, such as electricity or hydrogen in road and maritime transport.

For several plausible reasons, the greening of the aviation sector is particularly challenging. First, SAFs are attempting to enter a market where the pre-existing fossil-based product is supported globally by massive structural subsidies and offered by some of the largest incumbents in the world economy: the petrochemical industry.[2] Second, any new fuel products in the aviation sector need to pass multiple detailed requirements, including quality, safety, sustainability, or performance standards. The use and sustainability of biomass-based fuels are subject to careful scrutiny, partly because of the environmental and social drawbacks associated with first generation (i.e. crop-based) biofuels.[3] Third, technical research and development, as well as the construction of refineries, require substantial long-term investments, which are risky due to the volatility of the global fuel market and unattractive under current cost structures. The challenges facing the emergence of SAFs clearly call for leadership, support, and commitment from policy makers. This article explores whether and how policy makers around the world have responded to this call.

The Article proceeds in two steps. First, it offers an analysis of select innovative instruments that aim to promote the production and use of alternative jet fuels. Both instruments that have already been adopted as well as those that are being planned are analyzed. The instruments were selected for scrutiny based on an in-depth comparative analysis and benchmarking of aviation biofuel policies in ten countries[4] identified as leading nations in the field through twenty-four expert interviews and

---

INDUSTRY HIGH LEVEL GROUP (2017), https://www.icao.int/sustainability/Documents/AVIATION-BENEFITS-2017-web.pdf.

[2] *See* Harro Van Asselt & Kati Kulovesi, *Seizing the Opportunity: Tackling Fossil Fuel Subsidies Under the UNFCCC*, 17 INT'L. ENVTL. AGREEMENTS: POLITICS, LAW, AND ECON. 357 (2017).

[3] First-generation biofuels are crop-based, which means that they compete with food or feed crops. The use of first-generation biofuels was criticized for resulting in a net overall increase in greenhouse gas ("GHG") emissions, attributable to direct (converting forest land to agricultural land) and indirect land use change caused by the need to expand cultivation of these crops. The diversion in the use of certain food crops to produce fuels also threatened food security. Timothy A. Wise & Emily Cole, *Mandating Food Insecurity: The Global Impacts of Rising Biofuel Mandates and Targets* 1, 6 (Glob. Dev. and Env't Inst. Working Paper 15-01, 2015), http://www.ase.tufts.edu/gdae/Pubs/wp/15-01WiseMandates.pdf.; INT'L AIR TRANSP. ASS'N, IATA SUSTAINABLE AVIATION FUEL ROADMAP 33 (2015), https://www.iata.org/whatwedo/environment/Documents/safr-1-2015.pdf.

[4] The EU Seventh Framework Programme (FP7) BFSJ The Legal and Policy Framework for Aviation Biofuels. Deliverable 8.1.1 Comparative Benchmarking and Country Overviews. This report has been submitted to the European Commission and will be made publicly available in the future.

desktop research.[5] This initial step in the analysis defined policy instruments as "innovative" when they were entirely new, or new to the specific field of SAFs. These instruments, according to the interviewed experts, offer the most promising prospects for promoting sustainable development of the field. Five of these most innovative types of instruments in the promotion of SAF are scrutinized in detail in Parts II through VI: blending mandates, tradeable certificates, reduced landing fees at airports, voluntary public procurement, and the establishment of national, regional, and international cooperation networks.[6]

Second, this Article reflects on the potential of these instruments to advance the SAF market and identifies bottlenecks that may prevent the instruments from being effective. The Article concludes that the most innovative policies tend to either timidly borrow and adapt currently used policies in other sectors, or are small-scale experimental pilot initiatives and voluntary networks that are driven by genuinely engaged proactive private and public actors. Innovations are predominantly initiated by the industry and research facilities, supported by governments, and facilitated by funding and expert intermediaries. Yet, more prominent regulatory instruments are gradually emerging and may play an important role in developing the SAF sector further. Thus, there is a need to strive for a synchronous and complementary development of voluntary and regulatory biofuel policies as complex network governance conditions allow. There is no time to lose if the rapidly increasing emissions of the aviation sector are to be tackled seriously.

---

[5] The twenty-four interviews were conducted in two rounds. The first round of more general questions took place from March to May 2016, and the second round took place between December 2017 and April 2018. The second round of interviews was more focused on specific key instruments or initiatives that we had found particularly innovative and promising. At the start of the research, the goal was to identify and gain an overview of the alternative fuels for aviation environment in selected jurisdictions. This research was done in the framework of BFSJ, a research project funded under the European Union's FP7 programme. Based on desktop research and the research team's network of experts (built through the project), initial interviewees were identified and interviewed. Based on the snowballing method—asking each interviewee for further suggestions—further interviews were conducted.

[6] Jeremy De Beer, *Network Governance of Biofuels*, *in* THE LAW AND POLICY OF BIOFUELS 375 (Yves Le Bouthillier et al., eds. 2016); *See* Marie-Hélène Labrie, *An Industry Perspective: Government Policies to Accelerate the Development and Commercialization of Advanced Biofuels in Canada*, *in* THE LAW AND POLICY OF BIOFUELS 359 (Yves Le Bouthillier et al., eds. 2016); *See* Warren E. Mabee et al., *Trends in Government Incentives for Biofuels*, *in* THE LAW AND POLICY OF BIOFUELS 339 (Yves Le Bouthillier et al., eds. 2016).

I. BLENDING MANDATES: COMMAND-AND-CONTROL INSPIRATION FROM ROAD TRANSPORTS

A. Blending Mandates as a Means to Promote Biofuels

Blending mandates are policy instruments that oblige fuel suppliers to blend a predetermined minimum percentage of biofuel together with their supply of fossil-based kerosene. In the road transport sector, the introduction of blending mandates and quota obligations has been an effective way for governments to implement objectives related to commercial-scale biofuel production and use.[7] The European Union ("EU"), the United States, and Brazil are the most prominent examples of countries with blending obligations in the road transport sector.[8] Many other regions and countries have implemented or plan to implement similar mandates with the aim of meeting their increasing road transport fuel needs with alternative options such as bioethanol and biodiesel.[9]

Blending mandates generally require a proportion of the fuel consumed in the transport sector to be biofuel, calculated as a percentage of total consumption. The notable exception is the United States, where the mandate defines the production volume of biofuel that is to be blended into the fuel supply.[10] The targets in blending mandates generally increase the required biofuel percentage over time.[11] In order to support the transition to biomass-based fuel inputs through blending targets, governments often operate in parallel subsidy schemes that help producers meet the demand created by the blending mandate.[12]

---

7 J.M. Cansino, et. al., *Promotion of Biofuel Consumption in the Transport Sector: An EU-27 Perspective*, 16 RENEWABLE AND SUSTAINABLE ENERGY REVIEWS 6013, 6018 (2012).

8 Jim Lane, *Biofuels Mandates Around the World 2018*, BIOFUELS DIGEST (Jan. 1, 2018), http://www.biofuelsdigest.com/bdigest/2018/01/01/biofuels-mandates-around-the-world-2018.

9 *Id*.

10 In the United States, the production volume requirement set for each renewable fuel (except for biomass based diesel) is expressed in terms of its ethanol equivalent based on energy content. Wise & Cole, *supra* note 3; Renewable Fuel Standard Program: Standards for 2019 and Biomass-Based Diesel Volume for 2020. 83 Fed. Reg. 63704. (Dec. 11, 2018) (to be codified at 40 C.F.R. pt. 80).

11 *See* Giovanni Sorda, et. al., *An Overview of Biofuel Policies Across the World*, 38 ENERGY POLICY 6977 (2010).

12 Ivetta Gerasimchuk, et. al., *State of Play on Biofuel Subsidies: Are Policies Ready to Shift?*, THE INT'L INST. FOR SUSTAINABLE DEV. 30 (2012), https://www.iisd.org/gsi/sites/default/files/bf_stateplay_2012.pdf.

Although no country currently enforces blending mandates specifically targeted at the aviation sector, such instruments are being planned in several jurisdictions. With the development of alternative jet fuel technologies, blending mandates (or drop-in mandates) offer a possible way of stimulating demand to create a market for SAFs. In enacting these requirements, governments can rely on their previous experience with these policies in the road transport sector. For example, the Swedish Energy Agency and the Swedish Transport Agency are exploring the possibility of introducing a renewable fuel quota system in the jet fuel market[13]—although no decisions or commitments have been officially published yet. As discussed further below, Norway and Indonesia provide the most prominent examples of where blending mandates for SAF are being discussed, planned, or implemented as discussed further below.

B. Blending Mandates in the Promotion of SAF

In Norway, issues related to carbon emissions in the aviation sector have been high on the political agenda for almost a decade. Because aviation is very important to the country's domestic transport system, Norway aims to reduce emissions from the sector while still allowing for growth.[14] In addition to the EU's Emissions Trading System ("EU ETS") operating in Norway, the Norwegian government has been collecting a carbon dioxide (CO_2) tax on fuel used for domestic aviation for close to 20 years.[15] In June 2017, the Norwegian Parliament adopted the National Transport Plan for the 2018–2019 period, which includes a proposal for a mandatory drop-in[16] requirement of 1% aviation biofuel starting in 2019.[17] A drop-in mandate differs from a blending mandate; instead of *all* supplied fuel containing a predetermined blend of biofuel, fuel suppliers must instead certify that a certain percentage of their annual supply of fuel

13 Erik C. Wormslev, et. al., *Sustainable Jet Fuel for Aviation: Nordic Perspectives on the use of Advanced Jet Fuel for Aviation*, TERMANORD 75 (2016).

14 Telephone Interview Number 4-1, Norwegian civil servant – airport expert (May 4, 2018); Wormslev, *supra* note 13, at 75–77.

15 The tax is about 1 NOK (Norwegian krone) per liter of fuel, which roughly represents 20% of a typical airline's fuel cost. Telephone Interview with Norwegian civil servant – airport expert, *supra* note 14.

16 *Id*.

17 NOR. MINISTRY OF TRANSP. AND COMMC'NS, *National Transport Plan 2018–2029: Meld. St. 33 (2016-2017) Report to the Storting (white paper) English Summary* 30 (2017).

overall is biofuel.[18] Drop-in mandates allow for more flexibility on when and where biofuel is supplied.[19]

The policy is new and innovative, as evidenced by the fact that the exact details of the proposal have just been hashed out in parliamentary hearings.[20] Unsurprisingly, stakeholder groups are already divided on the issue. Many of Norway's political parties came out in support of the policy, as did green civil society groups.[21] However, responses on the industry side were mixed, with airlines fervently opposing such measures and producers taking various positions depending on their future objectives and economic interests.[22] The policy makers, for their part, sought to garner the necessary scientific insight on the potential effects of such measures. For example, the Norwegian Civil Aviation Authority and Avinor (the country's airports operator) were tasked with assessing the feasibility and impacts of a drop-in requirement.[23] This information assisted the Ministry of Climate and Environment ("the Ministry") in fine-tuning the details of the measure in terms of its scope of application. The feasibility study also provided a better overview of the mandates' interaction with other instruments in place, such as the carbon tax and the EU ETS.[24] The process was led by the Ministry, which also handles the corresponding blend-in mandate for road transport.[25]

In October 2018, the Ministry announced that a quota requirement of 0.5% of advanced biofuel in aviation will be introduced, beginning in 2020.[26] This drop-in mandate is set to steadily increase to 30% by 2030,

---

18 Telephone Interview with Norwegian civil servant – airport expert, *supra* note 14.

19 Id.

20 The public hearing documents can be found on the website of the Norwegian Environment Agency (only available in Norwegian). NORWEGIAN ENVIRONMENT AGENCY, *Innføring av omsetningskrav for luftfart (2018/6537)*, NORWEGIAN ENVIRONMENT AGENCY (June 13, 2018), http://www.miljodirektoratet.no/no/Horinger/Regelverk/Innforing-av-omsetningskrav-for-luftfart-20186537.

21 Telephone Interview with Norwegian civil servant – airport expert, *supra* note 14.

22 *Id*.

23 Email Interview Number 6, Norwegian civil servant – policy expert (Dec. 20, 2017).

24 *See National Transport Plan 2018-2029: Meld. St. 33 (2016–2017) Report to the Storting (white paper)*, *supra* note 17, at 15.

25 Email Interview with Norwegian civil servant – policy expert, *supra* note 23.

26 *Norway to introduce 0.5% sustainable aviation fuel quota from 2020*, BIOENERGY INT'L (Oct. 5, 2018), https://bioenergyinternational.com/policy/norway-to-introduce-0-5-sustainable-aviation-fuel-quota-from-2020; *Norway's government introduces 0.5 per cent blending mandate for advanced aviation biofuels from 2020*, GREENAIR ONLINE (Oct. 11, 2018), http://www.greenaironline.com/news.php?viewStory=2532; Email Interview with Norwegian civil servant – policy expert, *supra* note 23.

on the condition that there is sufficient technical production capacity—and thus market availability—of SAF.[27]

Leaving potential issues of sustainability aside here, it can be observed that the Indonesian Ministry of Energy and Mineral Resources ("MEMR") has also been active in experimenting with blending mandates for SAF. MEMR has promulgated a regulation that provides for an ambitious SAF blending requirement over the 2018–2025 period.[28] In line with this regulation, the government is currently in the process of setting up a progressively increasing blending requirement for aviation biofuels which would begin with a 2% and 3% target for 2018 and 2020, respectively, and would culminate in a 5% blending obligation by 2025.[29] Though Indonesia originally aimed to achieve the 2% blending target in 2016,[30] the implementation date was eventually moved to 2018.[31] Historically, Indonesia's biofuel blending mandates have not been strictly enforced, and the mandated levels have not been fully achieved.[32] While there are penalties for noncompliance with the general blending requirements for biofuels, these penalties have not been meted out.[33]

As in Norway, it has been challenging for the Indonesian blending mandates to evolve from innovative proposals to a stage of practical implementation. Experiences from the parallel road transport sector also highlight potential problems with creating a functioning and fair market at the global level. In the road transport sector, Indonesia supports its mandatory biofuel blending requirements through biofuel subsidies. In 2013, Indonesia introduced new subsidies for road transport biofuels for

---

27 *Contributions from Airports to the Supply of Sustainable Aviation Fuels (SAfs)* at ¶ 1.4 (Int'l Civil Aviation Org., Working Paper No. CAAF/2-WP/22, 2017) https://www.icao.int/Meetings/CAAF2/Documents/CAAF.2.WP.022.2.en. pdf; Olav Mosvold Larsen, *Aviation Biofuels at Oslo Airport*, (Feb. 8, 2017), https://www.icao.int/Meetings/altfuels17/
Documents/Olav%20Mosvold%20Larsen%20-%20Avinor.pdf.

28 Ministry of Energy and Mineral Resource (MEMR) Regulation 12/2015.

29 *Id*.

30 Almuth Ernstring, *Aviation Biofuels: How ICAO and Industry Plans for 'Sustainable Alternative Aviation Fuels' could lead to Planes Flying on Palm Oil* 13-14 (2017), http://www.biofuelwatch.org.uk/docs/Aviation-biofuels-report.pdf.

31 *Indonesian Aviation Biofuels and Renewable Energy Task Force (ABRETF)*, INT'L CIVIL AVIATION ORG., https://www.icao.int/environmental-protection/GFAAF/Pages/Project.aspx?ProjectID=40 (last visited Feb. 2, 2019).

32 Anastasia Kharina et al., *Biofuels Policy in Indonesia: Overview and Status Report*, INT'L COUNCIL ON CLEAN TRANSP. [ICCT] 12 (2016), http://www.theicct.org/sites/default/files/publications/Indonesia%20Biofuels%20Policy_ICCT_08082016.pdf.

33 *Id*.

bioethanol and biodiesel.[34] Presidential decree 61/2015 authorized Indonesia's Oil Palm Estate Fund ("Fund") to collect a levy on exports of palm oil and palm oil based products and utilize this levy to support biodiesel subsidies.[35] The Fund redistributes the levy, as subsidies, to biofuel producers that sell their products domestically for the purpose of the biodiesel blending mandate.[36] While potentially beneficial for the evolution of a local SAF market in Indonesia, the implications of such tools may disadvantage foreign producers competing against subsidized SAF. The implications of any discriminatory instruments are thus problematic from a broader international perspective. Governments and adjudicators worldwide are struggling with this conundrum: How do we reconcile policies to support the renewable energy sector with a level playing field that allows the most efficient of the environmental solutions to prosper?[37]

C. Concerns Regarding Cross-Sectoral and International Competitiveness

Blending or drop-in mandates can be a useful tool to stimulate demand for SAF on the aviation fuel market. Although the mandates have traditionally been a widely used tool in promoting biofuels production and use in other sectors, they remain largely under-utilized in the aviation sector.

Current blending mandates in road transport and other energy sectors demonstrate the existing precedent for political support for renewable energy. However, preexisting mandates could also prove to be a challenge for the promotion of SAF because the existing support schemes may prioritize the use of biomass in road transport and energy production over jet fuel. Furthermore, as a nascent industry, developing the SAF supply chain requires substantial investments in technology (e.g., feedstock conversion technologies) and commercial facilities.[38] In contrast, well

---

34 INT'L ENERGY AGENCY, *Indonesia 2015: Energy Polices Beyond IEA Countries* 124 (2015).

35 STATE MINISTRY OF SECRETARIATS, *Republic of Indonesia, Presidential Reg. 61, Concerning the Construction and Use of Palm Oil Plantation Funds* (2015).

36 Kharina et al., *supra* note 32, at 11.

37 WORLD TRADE ORGANIZATION, *Canada – Certain Measures Affecting the Revewable Energy Generation Sector/Canada – Measures Relating to the Feed-In Tariff Program* (2013) (reports of the Appellate Body); *See, e.g.*, Ålands Vindkraft AB v. Energimyndigheten, 2014 E.C.R. 2037 (2014); Essent Belgium NV v. Vlaams Gewest, 2017 C.M.L.R. 39 (2016).

38 *See* THE NATIONAL ACADEMIES OF SCIENCES, ENGINEERING, AND MEDICINE, *Commercial Aircraft Propulsion and Energy Systems Research Reducing Global Carbon Emissions* 80–84 (2016).

established biofuel technologies and production capacity for road transport likely make this option easier and more attractive from an economic and financial point of view. The exact design of the policy can of course influence interest toward producing SAFs. For instance, setting mandatory blending requirements specific to aviation fuels ensures that a percentage of biomass used for energy production is directed torwards SAFs. This guarantees supply and demand for SAF, thus creating a market. Considering the costs and expenditure involved, however, such a measure must go hand in hand with strong public support, political will, and guarantee of industry actors' participation.

Blending mandates and drop-in requirements for aviation fuels can thus, if properly designed and implemented, drive the market opportunities for this sector. A growing market benefits countries with supply-side industries because they are in a position to sell their products locally and to export them abroad. This is the case in Norway which has an abundant supply of wood-based feedstock and Indonesia with palm oil.[39] Both countries are in different phases of implementing mandates.[40] However, as is often the case, the inherently international nature of air travel might constitute an obstacle to the adoption of such measures in the aviation sector. Currently, airlines fear that the imposition of SAF mandates would entail absorption of costs for them, and consequently oppose the mandates.[41] As buyers/end-users of fuel, they would have a vital role in the proper operation of these instruments. Implementing mandates in specific countries may, from an airline's perspective, also lead to an unequal playing field between those obligated to purchase more expensive blended fuel and those not subjected to such an obligation. The mandate thus could harm the airline's international competitiveness, which makes it a politically delicate issue. In light of these challenges, a global or international drop-in mandate would be ideal: in addition to creating a level playing field through a common objective, the flexibility of the drop-in mandate would allow airlines to optimize efficiencies in their SAF purchases anywhere in the world.

Although several studies have implied that the final added cost of low blends is minimal,[42] industry actors remain wary of potential upward

---

39 ERIK C. WORMSLEV ET AL., *Sustainable Jet Fuel for Aviation: Nordic Perpectives On the Use of Advanced Sustainable Jet Fuel for Aviation* 110-12 (2016); JEFFREY SKEER ET AL., *Biofuel Potential in Southeast Asia: Raising Food Yields, Reducing Food Waste, and Utilising Residues* 10–14 (INT'L RENEWABLE ENERGY AGENCY, 2017).

40 *See* GREENAIR ONLINE, *supra* note 26; BIOENERGY INTERNATIONAL, *supra* note 26; Ministry of Energy and Mineral Resource (MEMR) Regulation 12/2015.

41 Telephone Interview with Norwegian civil servant – airport expert, *supra* note 14.

42 WORMSLEV ET AL., *supra* note 39, at 92–93; INTERVISTAS, *Estimating Air Travel Demand Elasticites* 38 (2007).

adjustments in blending quantity requirements, which might follow more easily once a policy is in place. Attaching subsidy schemes to the mandate could be a way around this. However, uncertainties on whether these schemes are prohibited under international (World Trade Organization) and regional (EU) rules might be factors dissuading countries from deploying them.[43]

II. TRADABLE CERTIFICATES: UNTAPPED POTENTIAL TO BRIDGE THE PRICE GAP

A. Biofuels in Tradable Certificate Schemes

Tradable certificate systems form an important part of emissions reduction and renewable energy policies worldwide. These systems aim to facilitate emissions reductions by making use of market efficiencies. Biofuels can be a part of these schemes by, for example, being assigned a "zero-emissions" rating in the system, and attributing tradable certificates for biofuel production and use.[44] When actors produce and blend more biofuel than they are legally required to, they are then allowed to sell the ensuing certificates to underperforming actors.[45] The inclusion of biofuels in trading certificate programs creates certain flexibilities for supply and demand in the markets, and income from the certificates can be an important supplementary incentive to produce and supply biofuels.

B. Promotion of Aviation Biofuels through Tradable Certificate Schemes

Three major applications of tradeable certificates are being planned or have been implemented where suppliers of aviation biofuel can

---

43 *See* Harri Kalimo, et. al., *Market Definition as Value reconciliation—the Case of Revewable Energy Promotion Under the WTO Agreement on Subsidies and Countervailing Measures (SCM)*, 17 INT'L ENVTL. AGREEMENTS: POLITICS, LAW AND ECON. 427 (Mar. 24, 2017).

44 *Directive 2003/87/EC of the European Parliament and of the Council Establishing a Scheme for Greenhouse Gas Emission Allowance Trading Within the Community*, 2003 O.J. (L 275) 44 (EC); *See* Hazariah M. Noh, et.al., *Study of the Current Incentive Rules and Mechanisms to Promote Biofuel Use in the EU and Their Possible Application to the Civil Aviation Sector*, 46 TRANSP. RESEARCH PART D 298, 300 (2016).

45 *See, e.g.*, *Participants – Energy for Transport*, DUTCH EMISSIONS AUTHORITY, https://www.emissionsauthority.nl/topics/general—-energy-for-transport/participants—-energy-for-transport (last visited Jan. 25, 2019); U.K. DEP'T FOR TRANSP., *Renewable Transport Fuel Obligation Guidance Part One Process Guidance Year 11:* 15/4/18 *to* 31/12/18, 7–8 (2018).

voluntarily participate; the Hernieuwbare Brandstofeenheid ("Renewable Energy Unit" or "HBE") system in the Netherlands, the Renewable Identification Numbers ("RINs") system in the US, and the Créditos de Descarbonização ("Decarbonization Credits" or "CBIOs") system in the recent RenovaBio bill in Brazil.

1. Netherland's HBE System

The aviation sector is subject to the EU ETS.[46] The scheme indirectly stimulates SAF development by setting a cap on greenhouse gas emissions from flights within the EU, while assigning an emissions factor of zero to flights using biofuel.[47] Unfortunately, no tradable certificate schemes apply to aviation biofuels specifically. European biofuel producers and suppliers may nevertheless opt into national, general ETS schemes where they exist.

The EU's Renewable Energy Directive ("EU RED") sets a binding 10% target by 2020 for renewables in the transport sector.[48] The target includes not only biofuels, but all forms of renewable energy in the transport sector.[49] Most Member States have established policies aimed at ensuring their 10% target is achieved and biofuels are the main renewable source contributing to achieving this target.[50] In the Netherlands, the HBEs were implemented in 2015[51] to meet obligations under the

46 Directive 2008/101/EC of the European Parliament and of the Council of 19 November 2008 amending Directive 2003/87/EC so as to include aviation activities in the scheme for greenhouse gas emission allowance trading within the Community, 2008 O.J. (L 8) 3.

47 *Id.* at 18; EUROPEAN COMMISSION 2012, *Biomass issues in the EU ETS, MRR Guidance Document No. 3*, 6 (Nov. 27, 2017), https://ec.europa.eu/clima/sites/clima/files/ets/monitoring/docs/gd3_biomass_issues_en.pdf.

48 "Each Member State shall ensure that the share of energy from renewable sources in all forms of transport in 2020 is at least 10 % of the final consumption of energy in transport in that Member State." Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, 2009 O.J. (L 140) 16, 28.

49 *Id.*

50 *Renewable Energy Statistics*, EUROSTAT, http://ec.europa.eu/eurostat/statistics-explained/index.php/Renewable_energy_statistics#7.25_of_renewable_energy_used_in_transport_activities_in_2016 (last visited July 2, 2018).

51 Renewable Energy for Transport Act 2015, Official Gazette 2014, No. 455. HBEs replaced the Biotickets that were trading at the time (without including the Aviation sector). *See* also Summary Yearly Report Energy for Transport 2015, DUTCH EMISSIONS AUTH., https://www.emissionsauthority.nl/topics/reports—-energy-for-transport/summary-yearly-report-energy-for-transport-2015 (last visited Feb. 19, 2019).

Renewable Energy for Transport compliance mechanism,[52] which stems from the country's obligations under the EU RED. One HBE corresponds to 1 gigajoule ("GJ") of renewable energy supplied to the Dutch transport sector.[53] The annual obligation to supply renewable energy for transport applies only to companies who deliver petrol, diesel, liquid biofuels, and/or renewable liquid fuels to road or rail vehicles in the Netherlands.[54] The Dutch Emissions Authority ("DEA") sets annual targets of HBEs that Dutch road transport fuel suppliers must meet.[55] This obligation can be met by road transport suppliers either by producing their own biofuels, purchasing biofuels for blending, or directly purchasing HBEs from suppliers who have a surplus.[56]

For the aviation sector, there is no annual renewable energy obligation. Hence, there is no obligation to participate in the HBE market. However, voluntary use of SAF can generate HBEs.[57] The Netherlands is currently the only EU country where SAF usage counts toward the national target for renewables in the transport sector.[58] This creates a significant incentive for the SAF sector to participate in the system. The market value of HBEs is $230– $400 per tonne,[59] which could be crucial in bridging the price gap between conventional aviation fuels and biofuels. In order to register for the system, a potential participant must meet certain

---

52 Renewable Energy for Transport Decree 2015, Official Gazette 2014, No. 460; *Renewable Energy Units*, DUTCH EMISSIONS AUTHORITY, https://www.emissionsauthority.nl/topics/general—-energy-for-transport/renewable-energy-units (last visited Feb. 15, 2019).

53 "HBEs are created when claiming the delivery of renewable energy in the Registry". *Renewable Energy Units*, DUTCH EMISSIONS AUTHORITY, https://www.emissionsauthority.nl/topics/general—-energy-for-transport/renewable-energy-units (last visited Feb. 15, 2019).

54 *Participants – Energy for Transport*, DUTCH EMISSIONS AUTHORITY, https://www.emissionsauthority.nl/topics/general—-energy-for-transport/participants—-energy-for-transport (last visited Feb. 2, 2019).

55 Oskar Meijerink, *The Voluntary RED Opt-in for Aviation Biofuels: Identifying Opportunities within the 28 EU member states*, SKYNRG 17 (2016).

56 *Id*.

57 The annual obligation to supply renewable energy for transport applies only to companies who deliver petrol, diesel, liquid biofuels, and/or renewable liquid fuels to road or rail vehicles in the Netherlands. *Id*.

58 *Id*. at 8. The voluntary RED opt-in for aviation biofuels: Identifying opportunities within the 28 EU member states. *Id*.

59 This was the market value in July 2018. HBEs are traded bilaterally and thus price fluctuates. On average the value is estimated at around 7-8 EUR per HBE. Email Interview Number 7, Dutch aviation biofuel industry expert (July 10, 2018).

requirements set out in the Environmental Management Act.[60] Within the SAF supply chain, four actors are potential registrants: airport fuel suppliers, airlines, bio-refinery operators, and SAF suppliers. A special permit is necessary for an enterprise to participate in the HBE system.[61] The entity must also be a Dutch company, hold a certified biofuel title, and be able to prove that the supplied biofuel is certified under a sustainability scheme recognized by the EU RED.[62] By mid-year 2018, one Dutch company had registered to the Emissions Authority and held a permit for trading HBEs specifically generated from the supply of SAF.[63]

2. The United States' RIN System

The United States Congress established the U.S. Renewable Fuel Standard ("RFS") under the Energy Policy Act of 2005.[64] The RFS is a federal policy implemented by the U.S. Environmental Protection Agency ("EPA") that sets annual targets for blending biofuel with gasoline until 2012.[65] The RFS was expanded to RFSII under the Energy Independence and Security Act of 2007,[66] which sets annual biofuel volume targets that must be achieved by blending with transportation fuel sold or introduced in the United States until 2022.[67] Within the RFSII, tradable certificates called Renewable Identification Numbers ("RINs") were implemented.[68] RINs are credits used to demonstrate compliance with RSFII.[69] Obligated parties must obtain sufficient RINs for each target category in order to demonstrate compliance with the annual volume standard.[70] In practice, RINs are generated by the producer or importer of biofuel,[71] and they are

60 Paul Deane & Steve Pye, *Stimulating the Uptake of Liquid Biofuels in Aviation Through Renewable Energy Support Schemes*, *INSIGHT_E* 10 (2016).

61 Meijerink, *supra* note 55, at 6–8. The voluntary RED opt-in for aviation biofuels: Identifying opportunities within the 28 EU member states. *Id.*

62 Meijerink, *supra* note 55, at 19; Paul Deane & Steve Pye, *supra* note 60, at 10.

63 Telephone Interview with Dutch aviation biofuel industry expert, *supra* note 59.

64 42 U.S.C. § 15801 (2005)).

65 *Id*.

66 Energy Independence and Security Act of 2007, Pub. L. No. 110-140, § 202, 121 Stat. 1521 (2007).

67 *Id*. at § 202(a)(2).

68 40 C.F.R. § 80.1425 (2013).

69 40 C.F.R. §§ 80.1425, 80.1427 (2013).

70 The EPA converts the annual volume standard into a percentage based on the renewable fuel volume requirement and the projection of gasoline and fuel production for the coming year. 40 C.F.R. § 80.1407 (2013); U.S. Envtl. Prot. Agency, *Overview for Renewable Fuel Standard*, https://www.epa.gov/renewable-fuel-standard-program/overview-renewable-fuel-standard (last updated June 7, 2017).

71 40 C.F.R. § 80.1406 (2013).

regularly traded between obligated parties.[72] Obligated parties can either buy renewable fuel with RINs attached or buy RINs separately on the market.[73]

RFSII does not currently set any mandatory volume target for the supply of SAF.[74] However, SAF can generate RINs, as long as it qualifies as renewable fuel in accordance with the sustainability criteria set out in the RFS policy.[75] Currently, only one SAF producer is generating RINs in the United States as a commercial-scale producer in the market.[76] Unfortunately, small-scale producers do not consider the system cost-effective.[77] RINs that are generated with advanced biofuels[78] have a value of around sixty cents per RIN. Around 1.6 RINs are generated per gallon, which translates to a credit of about one U.S. dollar per gallon, a relatively low figure. Cellulosic fuel[79] is of higher value, close to two dollars per RIN.[80] With the fluctuation of the biofuel markets, producers cannot depend on these incentives to secure sufficient financing.[81]

States can also add their own schemes to supplement the federal RFSII. For instance, the California Low Carbon Fuel Standards ("LCFS") is very demanding in terms of new technology. It sets an additional incentive for producers who want to sell to the California market, because

---

72 U.S. Envtl. Prot. Agency, *Overview for Renewable Fuel Standard*, https://www.epa.gov/renewable-fuel-standard-program/overview-renewable-fuel-standard. (last visited Feb. 2, 2019).

73 Obligated parties can carry over unused RINs between compliance years. They may carry a compliance deficit into the next year. This deficit must be made up the following year. *Id.*

74 40 C.F.R. § 80.1405 (2013).

75 Max S. Jansson & Harri Kalimo, *De Minimis Meets "Market Access": Transformations in the Substance – and the Syntax – of EU Free Movement Law?,* 51 Common Market L. R. 2, 523-558 (2014).

76 Telephone Interview Number 1, 4 American civil servants – policy experts (Apr. 3, 2018).

77 *Id*.

78 Under the RFS II, advanced biofuels are defined as renewable fuel that have a life cycle greenhouse gas emissions that is less than at least 50% of the average emissions of gasoline or diesel, whichever is being replaced by the fuel.

79 Cellulosic biofuel is a category of renewable fuel under RFSII with a life cycle greenhouse gas emissions of at least 60 percent less than the average emissions of gasoline or diesel. Cellulosic biofuels have higher GHG emissions savings than advanced biofuels under the RFSII.

80 Telephone Interview with 4 American civil servants – policy experts, *supra* note 76.

81 *Id.*

the producers can leverage both the RFSII and the LCFS credits on top of each other to help with the cost of production.[82]

3. Brazil's CBIOS System

In December 2017, the National Congress of Brazil approved Law No. 13.576/2017, establishing a new National Biofuels Policy, called RenovaBio.[83] RenovaBio establishes a market-based mechanism to promote the expansion of the biofuels industry in Brazil.[84] Obligated parties under the policy include fuel distributors and importers, who are each attributed an annual greenhouse gas ("GHG") emissions reduction target that they can meet either by producing or purchasing biofuels, or by purchasing so-called Decarbonisation Credits ("CBIOs") on the market from producers that have a surplus.[85] CBIOs are equivalent to a reduction of one ton of CO_2 per unit.[86] The amount of credit units issued to biofuels producers for each batch that they sell to a distributor varies depending on the life-cycle analysis-based environmental efficiency of the batch.[87] This life-cycle analysis together with the producers' sustainability certification will ultimately determine the environmental effectiveness of the program.[88]

In addition to selling biofuels, producers are also able to sell the credits. The CBIOs are expected to finance the expansion of existing biofuels production and also incentivize the expansion of new, cleaner technologies.[89] Banks and other financial institutions also have the possibility of entering the CBIO market, which could increase the market's liquidity.[90]

The RenovaBio tradable certificate policy applies in principle to SAF. Indeed, all fossil fuels, including those used in aviation, can generate

---

82 Telephone Interview Number 17, American civil servant – policy expert (Apr. 1, 2016).

83 Bruno Triani Belchior et al., *Brazil: RenovaBio – New biofuel policy*, MAYOR – BROWN – TAUIL – CHEQUER (Jan. 5, 2018), https://www.mayerbrown.com/brazil-renovabio—-new-biofuel-policy-01-05-2018.

84 Email Interview Number 5, Brazilian civil servant – policy expert. (May 4, 2018).

85 Belchior et al., *supra* note 83.

86 Brazil Federal Decree No. 9.308, Art. 3 § 2; *Renovabio – The New Brazilian Biofuels Policy*, BIOFUTURE PLATFORM, http://biofutureplatform.org/wp-content/uploads/2018/06/RenovaBio-Mechanism-Policy-and-Instruments.pdf (last visited July 3, 2018). A tool called Renovacalc is being developed to calculate a biofuel's carbon intensity and to determine the facility's environmental grade.

87 Brazil Federal Law No. 13/576/2017, Art. 18; *Renovabio*, *supra* note 86.

88 Email Interview Number 5, Brazilian civil servant – policy expert. (May 4, 2018).

89 *Id*.

90 *Id*.

a deficit under the system. The RenovaBio legislation specifies that when setting annual targets for the CBIOs, the authorities must take into consideration the availability of biofuels on the market during earlier time periods.[91] The effectiveness of RenovaBio in promoting biofuels will depend greatly on its targets. In 2018, Brazil's National Council for Energy Policy (CNPE) approved a 10.1 percent GHG emissions reduction target for transportation fuels by 2028.[92] The technical committee dealing with RenovaBio has yet to offer its advice on how the policy will impact aviation fuels, allowing the National Council for Energy Policy to decide on the issue. The possible inclusion of aviation fossil fuel in the computation of annual reduction targets would increase the distributors' GHG emissions reduction target. There is a concern that this might cause a disproportionate increase in aviation fuel prices in Brazil, because current availability of SAF is limited.[93] Another option would be to follow other existing trading schemes and allow SAF to generate CBIOs without subjecting the aviation sector to a compulsory emissions reduction target.[94]

C. A Call for Streamlined, Aviation Specific Schemes

The production or purchase of SAF can, in principle, generate tradable certificates. Even the most advanced and innovative schemes in the Netherlands, the U.S., and Brazil do not target the aviation industry specifically. Therefore, the benefits of the tradable permits are largely dependent on the producers themselves and whether they consider it inherently valuable to be a part of such a system. Like the situation with blending mandates, competition with biofuels for the road transport sector may pose issues for tradable certificate programs. Supply for road transport remains the economical option, though it generates identical credits. A solution to overcome this barrier is to either provide more credits (in absolute or relative terms) specifically to the suppliers of SAF, or to include the aviation fuel sector as an obliged participant. In any case, streamlining the system is crucial to allow smaller elligible parties to get involved.

---

91 Brazil Federal Law No. 13/576/2017, Art. 6.

92 This is equivalent to a reduction of 591 million metric tons of $C0_2$ emissions from transportation fuel by 2028. *Brazil Biofuels Annual 2018,* USDA FOREIGN AGRICULTURAL SERVICE. (2018), https://gain.fas.usda.gov/RecentGAINPublications/BiofuelsAnnual_Sao Paulo ATO_Brazil_8-10-2018.pdf (last visited 18 February 2018); M.C.B. Grassi & G.A.G Perreira, *Energy-cane and RenovaBio: Brazilian vectors to boost the development of Biofuels,* 129 Industrial Crops and Products, 201–205, 203 (2019).

93 *Id*.

94 *Id.*

III. REDUCED LANDING FEES: INCENTIVIZING THE DEMAND SIDE OF SAF MARKETS

A. Taxes and Fees on Air Traffic

Airlines, as major stakeholders in the complicated and vast value chain of air transport, are heavily regulated due to various safety, environmental, and logistical reasons. The airlines rely on—and pay for—the availability of sophisticated airport infrastructure.[95] Landing fees are charges or taxes that airlines are subjected to when landing their aircraft at an airport. These fees vary between airports and are based on factors such as aircraft size, capacity, and weight.[96] Some airports have linked their fees to sustainability objectives by taking aircraft emissions into account in the charges. For instance, in certain German airports, air ticket taxes introduced in 2011 include supplementary charges for nitrogen oxide ("Nox") and hydrocarbon ("HC") emissions.[97] In Norway, domestic aviation is subjected to a CO_2 tax.[98]

B. Promoting the Demand of SAF Through Reduced Landing Fees

Landing fees and taxes can stimulate demand by incentivizing airlines to use cleaner fuels. The reduction or complete waiver of airport landing fees for an aircraft flying on an SAF blend constitutes an alternative option to charging fees and taxes on pollution that airlines generate.[99] Reduced landing fees reward airlines operating cleaner flights and thus create an economic incentive for them to choose SAF, thereby stimulating demand on the SAF market.

Although reduced landing fees have not yet been implemented in any jurisdiction, discussions concerning these incentives are ongoing. The

---

95 *See* Worldwide Air Transport Conference Sixth Meeting, *Economics of Airports*, ¶ 4, ICAO Working Paper ATConf/6-WP/88 (2013).

96 *Airport charges*, EURO. UNION MOBILITY & TRANSP., https://ec.europa.eu/transport/modes/air/airports/airport-charges_en (last updated Feb. 15, 2019).

97 *ICAO State Action Plan for Emissions Reduction, Germany*, FED. MIN. OF TRANSPO. & DIGITAL INFRA. (June 2016), https://www.icao.int/environmental-protection/Lists/States_Action_Plans/Attachments/33/ICAO_State_Action_Plan_Germany_ 2016.pdf.

98 *Taxing Energy Use Norway*, ORG. FOR ECON. CO-OP & DEV. (2018), https://www.oecd.org/tax/tax-policy/taxing-energy-use-2018-norway.pdf; *Taxes and Emissions Trading*, ENERGY FACTS NORW. (2017), https://energifaktanorge.no/en/et-baerekraftig-og-sikkert-energisystem/avgifter-og-kvoteplikt.

99 Email Interview Number 4, Norwegian civil servant – airport expert. (May 4, 2018).

Norwegian Parliament debated this policy instrument in 2016 and the legislature suggested that Avinor—Norway's state-owned airport operator—offer reduced fees for flights with SAF blends landing at certain Norwegian airports.[100] The proposal from Parliament in the state budget suggested a twenty-five percent discount in landing fees for flights using a twenty-five percent biojet blend.[101] Nevertheless, the plans for such a measure were not implemented, since they might have been inconsistent with the 1944 Chicago Convention and related policies,[102] whose provisions could be interpreted as indirectly prohibiting the modulation of airport landing charges for environmental reasons. This interpretation would render it legally impossible to provide a discount on airport charges for airlines using SAF.[103] The Norwegian Ministry of Transport and Communications concluded that reductions in landing fees would risk violating international law on airport or aviation charges.[104] Particularly, International Civil Aviation Organization ("ICAO") Document 9082 indicates that the cost basis of airport charges should be the cost of providing the "airport and essential ancillary services."[105] As an overarching principle, ICAO Document 9082 prescribes that charges should be imposed "only for services and functions that are directly related to, or ultimately beneficial for, civil aviation operations."[106] Apparently, it follows that the level and modulation of charges should not be derived from costs (or phenomena in general) that are unrelated to airport operations. The interpretation by the Ministry of Transport and Communications is that climate costs can be related to airport operations only to a negligible extent.[107] The aviation sector stands to benefit from ICAO's clarification of the normative contents of this article, particularly on whether it can be interpreted so as to permit modulation of landing fees aimed at making aviation more sustainable.

---

100 Wormslev et al., *supra* note 39; Telephone Interview Number 15, Norwegian environmental NGO – sustainable mobility expert (Apr. 15, 2016).

101 Telephone Interview with Norwegian environmental NGO – sustainabile mobility expert, *supra* note 100.

102 Email Interview Number 4, Norwegian civil servant – airport expert. (May 4, 2018); Email Interview Number 8, Norwegian civil servant – legal expert (July 2, 2018). The most relevant policies are those set out in ICAO Document 9082 on ICAO's Policies on Charges for Airports and Air Navigation Services.

103 *See* Email Interview Number 4-2, Norwegian civil servant – airport expert. (May 4, 2018).

104 Email Interview Number 8, Norwegian civil servant – legal expert (July 2, 2018).

105 ICAO, POLICIES ON CHARGES FOR AIRPORTS ND AIR NAVIGATION SERVICES § II ¶ 2 (9th ed. 2012).

106 *Id.* at § I ¶ 1.

107 Email Interview Number 8, Norwegian civil servant – legal expert (July 2, 2018).

C. Tackling the Political Economy and International Law through Positive Measures

Globally, only limited policy instruments are available that focus on supporting the demand side of the nascent SAF market. The most prominent example is ICAO's Carbon Offsetting and Reduction Scheme for International Aviation ("CORSIA"). CORSIA only promotes SAF use indirectly; it allows airlines to offset their own reductions by purchasing credits on a carbon market that represent reductions in other, more efficient projects.[108] There is a risk that the continuing lack of standards and the low cost of the offsets will create factors that systematically work against, and not for, the development and purchase of SAF.

Reduced landing fees is one of the first tentative steps to promote biofuels through airlines. By targeting airlines as the purchasers of fuel, landing fee reductions seek to offer direct incentives to shift the use from fossil-based kerosene toward more sustainable alternatives. Plenty of room remains for development; however, and it may well be that the political economy of the air transport industry is keeping regulatory developments at bay. Stakeholders are keen to avoid unnecessary obligations and supplementary charges on their operation, and many airlines' close ties to national governments give them considerable leverage for doing so. Yet the example of reduced landing fees shows that there is a potential way to approach the situation positively, with incentives rather than obligations. This requires active interventions from policy makers, including adjustments to the relevant international legal frameworks and policy documents, such as the Chicago Convention, ICAO Document 9082, and their interpretations. The fact that the cost-relatedness principle is in fact not enshrined in the Chicago Convention itself, but in the ICAO Document that has been adopted and updated on the basis of the recommendations and decisions of the ICAO Council, leaves more room for maneuvering.[109] Moreover, ICAO has recognized that airport operators need to be able to impose differential charges that promote behavioral responses for non-economic objectives such as environmental protection (e.g., air quality and airport noise).[110] These rules and practices need to be further updated and adapted to respond to

---

[108] First Edition of Annex 16, Volume IV, of the Convention on International Civil Aviation (Chicago Convention), Chapter 4, adopted by the ICAO Council at its 214th Session (June 11–29, 2018).

[109] *See* ICAO, CONVENTION ON INTERNATIONAL CIVIL AVIATION 26 (9th ed. 2006).

[110] ICAO, AIRPORT ECON. MANUAL ¶ 4.137 (3rd ed. 2013). *See* ICAO, *supra* note 105, at § II ¶ 9, for LAQ policies regarding Local Air Quality (LAQ)-related charges in Doc 9082, Section II, paragraph 9. ICAO allows airports with LAQ issues to impose emissions-related charges at airports as long as the charges correspond with the cost of mitigating or preventing the damage caused by the aircraft.

the current state of environmental crisis and the political commitments made toward increasing the share of renewable energy in the total energy mix and mainstreaming climate change measures.[111]

IV. PUBLIC PROCUREMENT: LEVERAGING THE PUBLIC SECTOR TO CREATE DEMAND FOR SAF

A. The Greening of Public Procurement in the EU

Public authorities are responsible for a significant amount of purchasing—in the EU, they spend around fourteen percent of GDP on the purchase of services, works, and supplies.[112] Public procurement and—more specifically—green or sustainable public procurement, is one method used to promote a market for green or sustainable products and services.[113] Considering that the public sector is also a consumer of air transport services, a public procurement policy that targets the purchase of SAF as part of the tendering process could help guarantee a market for the fuel. A consolidation of demand would provide producers and suppliers of biofuels with some safety and, potentially, economies of scale, making SAF more price competitive over time. Public procurement could, in other words, offer a way to push the SAF market by allowing public authorities to lead by example.

B. Public Procurement Leveraging the SAF Markets

Swedavia, established in Sweden in 2010, is a state-owned company for airport operations.[114] In 2016, Swedavia calculated the use of kerosene in the annual business flights of its personnel and consequently purchased the corresponding 450 tons of SAF through a tendering process.[115] The

111 *See* Sustainable Development Goals 7 and 13, G.A Res. 70/1, at 14 (Oct. 21, 2015).

112 *Public Procurement*, EURO. COMM'N (July 4, 2016), https://ec.europa.eu/growth/single-market/public-procurement_en.

113 In the EU, for example, green public procurement is one of the strategies for shaping sustainable production and consumption trends in the region. *Communication from the Commission to the European Parliament, the Council, the European Econoic and Social Committee and the Committee of the Regions*, COM (2008) 400 (July 16, 2008).

114 Annika Lindell, ICAO STATE ACTION PLAN ON CO2 EMISSIONS REDUCTION ACTIVITES, SWED. TRANSP. AGENCY (2015), http://www.icao.int/environmental-protection/Lists/ActionPlan/Attachments/47/Sweden_State%20Action%20Plan_30%20Jun%202015.pdf.

115 Telephone Interview Number 3, Swedish civil servant – airport & sustainability expert (Mar. 27, 2018).

purchase was valued at SEK 7.5 million (USD $825,000).[116] The transaction made Swedavia the first company in the world to procure SAF for such a purpose.[117] The Swedish Fly Green Fund ("Fund") was awarded the purchasing contract for 2016,[118] with the option of a two year extension. The fund was responsible for organizing the purchase and delivery of the fuel, which was to be blended and certified and finally brought to refuelling stations at the Arlanda airport in Stockholm.[119] The volume of SAF is equivalent to (and symbolically represents) the jet fuel consumption of all of the Swedavia staff's official business flights.[120] The SAF was not physically fueled into each airplane carrying a member of the Swedavia staff, but was mixed with the conventional fossil jet fuel at Arlanda.[121] The first flight using the blended SAF took off from Arlanda in May 2017;[122] Swedavia, using its option to renew the contract, purchased SAF for its employees' flights for 2017 and 2018.[123] Swedavia plans to continue the public procurement of SAF for 2019 and is in the process of attracting other companies as well as public entities to make a collective tender from 2020 onwards, thereby substantially increasing SAF demand.[124]

The embryonic state of the SAF market is illustrated by the fact that Swedavia has faced regulatory challenges, such as the appropriate registration of the fuel under the EU's Registration, Evaluation,

---

116 *Inaugural Fuelling with Swedavia's Aviation Biofuel at Stockholm Arlanda Airport Today*, SWEDAVIA AIRPORTS (Jan. 5, 2017), https://www.swedavia.com/about-swedavia/for-press/inaugural-fuelling-with-swedavias-aviation-biofuel-at-stockholm-arlanda-airport-today/#gref.

117 *Id*.

118 Swedish Energy Agency, *Marknaderna för bodrivemedel* [*Report on the Markets for Biofuels]*, ER 2015: 31 (Swed.); *Fly Green Fund Project*, ICAO ENV'T, https://www.icao.int/environmental-protection/GFAAF/Pages/Project.aspx?ProjectID=42.

119 Telephone Interview with Swedish civil servant – airport & sustainability expert, *supra* note 115; Stockholm Arlanda Airport takes first delivery of biojet, BIOENERGY INT'L (Jan. 3, 2017), https://bioenergyinternational.com/biofuels-oils/stockholm-arlanda-airport-takes-first-delivery-of-biojet.

120 Swedish Energy Agency, *supra* note 118; ICAO ENV'T, *supra* note 118.

121 Telephone Interview Number 24, Swedish civil servant – airport & sustainability expert (April 18, 2016).

122 *Inaugural Fuelling With Swedavia's Aviation Biofuel at Stockholm Arlanda Airport Today*, *Newsroom*, SWEDAVIA AIRPORTS (Jan. 5, 2017), https://www.swedavia.com/about-swedavia/for-press/inaugural-fuelling-with-swedavias-aviation-biofuel-at-stockholm-arlanda-airport-today/#gref.

123 Telephone Interview Number 2, Swedish civil servant – airport & sustainability expert (Mar. 30, 2018).

124 *Id*.

Authorization and Restriction of Chemicals ("REACH") regulation, and has struggled to secure a sufficient supply of SAF.[125] By the end of 2017, Swedavia had only managed to receive a small part of the SAF procured for that year.[126] A shortage of qualified suppliers complicates the tendering process. Swedavia, as a purchasing public authority, has taken a proactive role in creating the market through dialogues with fuel suppliers and producers to explore options. By doing so, Swedavia is leading the SAF field by example, demonstrating the possibilities of public procurement and testing, and simplifying the tendering processes in order to raise public authorities' interest and ability to engage in similar actions more broadly.[127]

The U.S. Department of Defense ("DoD") is another example of a public authority playing a leading role in procurement processes that promote SAF. The DoD is central in the testing, certification, promotion, and purchase of SAF.[128] Alternative fuels are obtained through the DoD's standard fuel procurement programs.[129] The DoD determines the ongoing bulk fuel purchases needed to meet operational requirements, which go beyond certification and demonstration.[130] The DoD commits to making purchases of alternative fuels for military purposes, if the product is equal or better than fossil fuels in terms of cost, compatibility, performance, and GHG emissions.[131] The substantial amount of biojet fuels that could be purchased for military aviation in the United States can be instrumental in the overall development of the global SAF sector.

Geneva Airport's planned introduction of SAF in its operations is a third example of innovative public procurement of SAF. In 2017, Geneva Airport announced a collaboration with the SAF producer Neste to supply biojet fuel to the Airport and to make it available from existing fuelling

---

125 *Id*.

126 *Id*.

127 *Id*; Telephone Interview with Swedish civil servant – airport & sustainability expert, *supra* note 121.

128 Katherine Blakeley, *DOD Alternative Fuels: Policy, Initiatives and Legislative Activity, CRS Report for Congress*, CONG. RES. SERV. (Dec. 14, 2012).

129 *Id.*; *Bulk Petroleum Products: Military Specification Fuels, DLA Energy*, DEF. LOGISTICS AGENCY, http://www.dla.mil/Energy/Offers/Products/BulkPetroleum (last visited Mar. 29, 2019).

130 Blakeley, *supra* note 128.

131 *Id.*; Isaac Emery, *Department of Defense Alternative Fuels Policy, Initiatives, and Opportunities* (Dec. 5, 2017), https://www.iscc-system.org/wp-content/uploads/2017/ 08/ Isaac-Emery_Department-of-Defense-Alternative-Fuels-Policy-Initiatives-and-Opportunities_TC-Las-Vegas-2017.pdf; Bret Strogen, *Drop-in Alternative Jet Fuels: Status of DoD's RDT&E, Interagency Initiatives, and Policies, NDIA Joint Service Power Exposition, Session 5, Talk #18003*, DEP'T OF DEF. (Aug. 25, 2015), https://ndiastorage.blob.core.usgovcloudapi.net/ndia/2015/power/18003Strogen.pdf.

infrastructure to all airlines operating at the Airport.[132] This collaboration under this Renewable Jet Fuel project would have been the first to utilize an "Airport Approach" model to SAF procurement.[133] The implementation of the procurement project was initiated by the environmental non-governmental organization Carbon War Room and SkyNRG.[134] Geneva Airport and the fuel producer[135] established, in collaboration with the airlines, a target SAF blend of 1% of the annual jet fuel consumption at Geneva Airport.[136] The collaborating group applied for project facilitation funding from the Swiss authorities.[137] The authorities, after several months of consultation, decided to withdraw their support for the project in August 2018, resulting in the cancellation of the initiative.[138] Neste is nevertheless preparing agreements with other airports based on this experience.[139] This Swiss initiative illustrates how a public authority that takes the initiative to use public procurement for the purchase of SAF often cannot rely on a classical public procurement approach. They may need to mix the procurement with network collaboration mechanisms—the topic of the final section of this Article—such as financial support and improved supply.

C. From Innovative Voluntary Schemes Toward Specific, Transparent Procurement Requirements

Currently, there are no specific mandates, with the exception of those planned by the U.S. DoD, requiring public authorities to meet particular sustainability criteria and biofuel blending requirements to procure SAF. Procurement remains a completely voluntary instrument for engaged

---

132 *See Geneva Airport is First to Advance Carbon War Room-SkyNRG 'Airport Approach'*, SKYNRG (Sept. 18, 2017), http://skynrg.com/wpcontent/uploads/2017/09/20170918_Press-Release-Geneva-Airport-is-first-to-advance-Carbon-War-Room-SkyNRG-Airport-Approach.pdf.

133 *Id*.

134 SkyNRG is a SAF supplier. *Id.*

135 Neste.

136 Jim Lane, *Geneva Aéroport: We're Going With Aviation Biofuels, So There*, BIOFUELS DIG. (Sept. 18, 2017), http://www.biofuelsdigest.com/bdigest/2017/09/18/geneva-aeroport-were-going-with-aviation-biofuels-so-there.

137 *Lack of Funding Grounds GVA's Renewable Jet Fuel Project*, BIOENERGY INT'L (Aug. 22, 2018), https://bioenergyinternational.com/biofuels-oils/lack-of-funding-grounds-gvas-renewable-jet-fuel-project.

138 Kaisa Lipponen, *Swiss Authorities' Decisions Leads to the Cancellation of the Renewable Jet Fuel Project in Geneva Airport*, NESTE (Aug. 21, 2018), https://www.neste.com/releases-and-news/swiss-authorities-decision-leads-cancellation-renewable-jet-fuel-project-geneva-airport.

139 BIOENERGY INT'L, *supra* note 137.

public authorities interested in developing the market and creating a level playing field for SAF in the long-term. As evidenced by the innovative approaches of Swedavia and the Geneva Airport, support from third-party networks[140] can be essential in the complex SAF markets in facilitating the identification and creation of opportunities and the required supply chains.

The call for tender in terms of SAF can be a call for a sustainable provision of services, or a call to purchase the physical product itself. In the former case, the public authorities will not be acquiring the SAF itself, but rather the service that leads to the sustainable jet fuel being purchased, blended, and put on the market.[141] In military aviation, however, such as the case of the U.S. DoD, the authority purchases the fuel for its own operations.[142] There is thus potential for the defense sector around the world to become more involved in the SAF supply chains through SAF-specific tenders, even if their involvement was less prominent in the production processes and specific fuel requirements than that of the U.S. DoD.

In general, regardless of whether a procuring institution uses the fuel directly or is more interested in ensuring demand for the product, it needs specific knowledge on the technology, market, and applicable laws (especially when imports or subsidies are involved). The experimental roles of Swedavia, Geneva Airport, and the U.S. DoD offer useful benchmarks for future procurers to avoid main barriers to the purchasing activities. The demand for special institutions to facilitate the complicated tendering processes on SAF emphasizes the importance of transparency in the preparation and award of the tenders.

V. SOFT INSTRUMENTS: THE VARIOUS WAYS OF COLLABORATION

A. Collaboration as a Policy Instrument

The discussion above analyzed four innovative types of policy instruments to promote the development, production, marketing, and use of SAFs. Many of these instruments are "hard" in the sense that they are

140 In the cases studied for this article, Fly Green Fund, SkyNRG, and Carbon War room, respectively.

141 Telephone Interview with Swedish civil servant – airport & sustainability expert, *supra* note 123.

142 DEP'T OF DEF., MANAGEMENT POLICY FOR ENERGY COMMODITIES AND RELATED SERVICES, INSTRUCTION NO. 4140.25 § 3(d) (Aug. 31, 2018), http://www.esd.whs.mil/Portals/54/Documents/DD/issuances/dodi/414025p.pdf?ver=2018-10-23-090903-757.

crafted by state parties[143] and are formally enacted as law with legally binding and enforceable character.[144] Various types of "softer" alternatives to such public legal instruments exist, however, particularly in the area of environmental and energy policy and law. The main groups are public *non-legal* instruments and private instruments. For public non-legal instruments, the parties are state actors but the instrument in question is not a formal source of law. Private instruments are enacted between parties that are (predominantly) not state actors or state-centric international organizations; as such, these instruments cannot constitute formal sources of law either.

Common to these alternative forms of instruments is that, in the complex field of renewable energy, they usually involve some form of collaboration between multiple interested parties.[145] Further, the forms of multi-stakeholder collaboration that were observed in this article regarding the promotion of SAFs can be roughly divided into two groups based on the nature and objectives of the collaboration: initiative-driven and process-driven. Initiative-driven collaboration focuses on concrete actions or tests, concrete solutions, and specific economic models. Conversely, process-driven collaborative networks prioritize the process of cooperation and emphasize broader and longer-term objectives over specific or narrow outcomes. They tend to primarily foster a relationship and dialogues between stakeholders. They may also take the role of representing their common interests toward governments, industry actors, and supranational bodies, for example. Research and development collaboration, raising public awareness, and exerting political pressure are further examples of the objectives of process-driven collaborative networks.

The distinction between initiative- and process-driven collaboration is ambiguous at times, and many overlapping characteristics can be identified. The categories are useful, however, in further analyzing policy tools other than formal public legal instruments. Moreover, this type of grouping seems to resonate with inter-organizational theories.[146]

---

143 Including state-centric institutions as well as sometimes looser gatherings of public officials.

144 On "hardness" and "softness" in international law, *see, e.g.*, Harri Kalimo & Tim Staal, *"Softness" in International Instruments: The Case of Transnational Corporations*, 42 SYRACUSE J. OF INT'L LAW & COMM. 365 (2015).

145 *See* Rafael Leal-Arcas & Stephen Minas, *Mapping the International and European Governance of Renewable Energy*, 35 Y.B. OF EURO. L. 621, 637 (2016).

146 From the viewpoint of inter-organizational theories, *see, e.g.* Robin Keast & Kerry Brown, who have categorized inter-organizational arrangements into "cooperation," "coordination," and "collaboration," with cooperation being the loosest form of integration, and collaboration as the most integrated. Keast and Brown view these categories of arrangements as differentiated according to, among other factors, the level of

B. Collaboration in the Development of Aviation Biofuels

Biofuel for aviation is a new and emerging market, with the first ASTM International (originally founded as the American Society for Testing and Materials) approval for fuel in 2009 and the first commercial flight in 2011.[147] The supply chain as well as the infrastructure for a functioning market is in many ways under development; actual distribution at the airports are a notable exception. Evolution of the sector has been held back by a paradoxical situation where policy makers are hesitant in the absence of a major commercial interest to create a market,[148] while economic actors blame the uncertainty of the regulatory landscape for their unwillingness to invest.[149] While both policy makers and private actors at national and international levels have been largely passive, certain stakeholders from the private sector have taken the initiative and created collaborative networks amongst themselves, and at times with authorities, research and development agencies, and non-governmental actors.[150] The collaboration on SAF has been both initiative- and process-driven. The objectives of the collaboration range from ensuring the viability of the supply chains and the creation of a market for SAF with affordable prices to fostering a policy dialogue and a stable regulatory environment.

integration of goals/missions and activities, level of risks and rewards assumed by the members, autonomy, and formality of governance structures. According to these authors, "cooperation'' mainly involves sharing of information with minimal exchange of resources, and with members remaining autonomous. In "coordination" arrangements, parties remain autonomous, but there is joint planning involved, and possibly joint funding in order to align activities to achieve or realize an agreed plan of actions. Finally, "collaborations" involve long-term arrangements requiring a high level of trust, with members assuming greater risks and being more interdependent as they work toward "systems change"' or tackle a common problem. *See* Robin Keast et al., *Getting the Right Mix: Unpacking Integration Meanings and Strategies*, 10 INT'L PUB. MGMT. J. 9 (2007). In this article, however, the term "collaboration" is used loosely, without reference to the level of integration of the members involved. The inter-organizational relationships are differentiated according to the nature and purpose of their objectives, rather than the level of their integration.

147 Philippe Novelli, *Sustainable Alternative Fuels for Aviation*, ICAO (2014), https://www.icao.int/Meetings/EnvironmentalWorkshops/Documents/Env-Seminars-Lima-Mexico/Lima/14_ICAO_AlternativeFuels.pdf.

148 Telephone Interview Number 9, Swedish civil society – biofuels expert (Mar. 4, 2016).

149 Per Gegg et al., *The Market Development of Aviation Biofuel: Drivers and Constraints*, 39 J. OF AIR TRANSP. MGMT. 34, 39 (2014).

150 Telephone Interview Number 20, Swedish network – aviation biofuels expert (May 5, 2016).

1. Initiative-driven Collaborations

The most prominent examples of innovative, initiative-driven collaboration are the Swedish Fly Green Fund,[151] Gardermoen Biohub in Norway,[152] and the Bioport project in the Netherlands.[153]

a. Fly Green Fund

The Fund was established in 2015 in Sweden on the initiative of a combination of state-centric institutions and private parties: Karlstad Airport, SkyNRG Nordic, and the Nordic Initiative on Sustainable Alternative Fuels ("NISA").[154] Since then, membership has grown through a mixture of additional public and private parties, and it remains open for expansion.[155] The corporate partners cover the Fund's administrative costs and, when the Fund is in possession of SAF, it offers the fuel to these partners in priority.[156] Corporate and private travelers pay a premium for SAF when they fly.[157] The premium goes into the Fund, where seventy-five percent is used to cover the cost differential for the purchase of SAF and twenty-five percent goes to projects that strive to achieve SAF production in the Nordic countries.[158] Indeed, the organization wants to kick-start the market by increasing demand for biojet fuel through co-funding. The focus is not on fuel producers, although the Fund collaborates with them intensively and helps in securing the entire supply chain. [159] The increase in volume resulting from

151 *Energimyndigheten rapporterar om hållbara flygbränslen* [*The Swedish Energy Agency Reports on Sustainable Aviation Fuels*], FLY GREEN FUND, http://www.flygreenfund.se/en (last visited Jan. 24, 2019).

152 Erik C. Wormslev et al., *Sustainable Jet Fuel for Aviation: Nordic Perspectives on the Use of Advanced Sustainable Jet Fuel for Aviation*, 40 TEMANORD 224, 538 (2016), http://norden.diva-portal.org/smash/record.jsf?pid=diva2%3A956135&dswid=-8482.

153 Letter of Intent, "Bioport for Jet Fuels in the Netherlands," Stcrt. 2014, 3543 (Neth.), https://zoek.officielebekendmakingen.nl/stcrt-2014-3543.html.

154 *Fly Green Fund*, SKYNRG NORDIC, http://skynrg.com/nordic/fly-green-fund (last visited Jan. 24, 2019).

155 *Energimyndigheten rapporterar om hållbara flygbränslen*, *supra* note 151.

156 Telephone Interview with Swedish network – aviation biofuels expert, *supra* note 150; *Vad är Fly Green Fund?*, FLY GREEN FUND, http://www.flygreenfund.se/en/tjanster (last visited Jan. 24, 2019).

157 Telephone Interview with Swedish network – aviation biofuels expert, *supra* note 150; *Vad är Fly Green Fund?*, *supra* note 156.

158 Telephone Interview with Swedish network – aviation biofuels expert, *supra* note 150; *Vad är Fly Green Fund?*, *supra* note 156.

159 Main collaborators from the production side are Neste and Altair who supply their fuel via a third party stakeholder SkyNRG with whom the Fly Green Fund has a service level agreement. Telephone Interview with Swedish network – aviation biofuels expert, *supra* note 150.

increased demand for SAF should lead to a decrease in cost, making the price of SAF more comparable to fossil fuel in the long term. In other words, the vision is to give organizations and individuals the opportunity to fly more sustainably using SAF in the Nordic countries at a reasonable cost.[160]

Overarching the Fly Green Fund's economic objective is its goal "to develop the Nordics into a pioneering biojet fuel region."[161] To achieve that goal, the Fund aims to have biofuels represent twenty-five percent of the total fuel for domestic aviation in Sweden by 2025, extending to the whole Nordic region on the long term.[162] This entails secondary objectives of broader, process-type goals to raise awareness and bring Nordic stakeholders together.[163] The Fly Green Fund is a prominent example of a voluntary, grassroots network. This approach gives the network a sense of inclusiveness and solidarity, which are key elements in pushing for political engagement and commitment.[164]

b. Gardermoen Biohub

The Gardermoen Biohub is a multi-stakeholder collaboration that extends across the entire SAF supply chain. It was founded in 2016 under the lead partner Avinor, a state-owned operator of most of the civil airports in Norway.[165] Other partners in the experimental collaboration are predominantly from the private sector, albeit some of them with close links

160 *Id*.

161 *Swedavia, Fly Green Fund, World Energy, Shell and SkyNRG enable sustainable aviation fuel flights from five airports in Sweden*, SKYNRG (Dec. 19, 2018), http://skynrg.com/wp-content/uploads/2018/12/20181219_Swedavia-Fly-Green-Fund-World-Energy-Shell-and-SkyNRG-enable-sustainable-aviation-fuel-flights-from-five-airports-in-Sweden.pdf

162 ANNIKA LINDELL, SWEDISH TRANSPORT AGENCY, ICAO STATE ACTION PLAN ON CO2 EMISSIONS REDUCTION ACTIVITIES 57 (June 30, 2015) http://www.icao.int/environmental-protection/Lists/ActionPlan/Attachments/47/Sweden_State%20Action%20Plan_30%20Jun%202015.pdf; Telephone Interview with Swedish network – aviation biofuels expert, *supra* note 150.

163 The Fund is open for partnership to corporate clients interested in becoming frontrunners in flying with SAF. Through such partnerships, the Fund brings greater visibility on the sustainability issues of the aviation sector to end consumers. The Fund also invests in technology and supply chain development in the Nordic countries, and offers a platform for stakeholders to collaborate and work together to accelerate the commercial availability of SAF. *See Fly Green Fund*, *supra* note 154.

164 Telephone Interview with Swedish network – aviation biofuels expert, *supra* note 150.

165 Erik C. Wormslev et al., *supra* note 152.

to the public sector.[166] The concrete aim of the collaborative effort is to explore the possibility of a fully functioning supply chain for SAF at Oslo Gardermoen Airport to demonstrate the feasibility of dropping biojet into an airport's main fuel system. The initiative is the first in the world to deliver SAF through existing airport infrastructure.[167] The project used Camelina Oil from the Initiative Towards Sustainable Kerosene for Aviation project[168] and used cooking oil as its initial feedstocks.[169] EU ETS taxes and domestic Norwegian CO_2 taxes are waived for aircraft using the fuel, while the cost premiums on SAF are shared by the project partners.[170] The fuel is now offered to all airlines at Oslo Airport on a commercial basis. So far, three airlines have started using the fuel, with around half of all flights leaving Oslo airport flying on SAF blend.[171]

Avinor has set an indicative target of thirty percent share of SAF from 2030 in Norway (ca. 400 million liters).[172] Thus, the project illustrates how an initial collaborative project that started with a test period of one year and a modest amount of 700 liters of SAF can be expanded and extended. A collaborative initiative like this can provide an impetus for the supply and demand of SAF on a national level. The long-term goal of the Biohub is to create a proper market for locally (or regionally) produced SAF in Norway. The initiative's broader objectives are to overcome administrative and legal hurdles to the deployment of SAF and to enhance communication between relevant actors. For example, the initiative was

166 The other partners are SkyNRG Nordic, Statoil, SAS, KLM, Lufthansa, Neste, and Air BP. *Id.*

167 *See Oslo Initiative – Avinor Bioport*, ICAO ENVTL. PROJECT, https://www.icao.int/environmental-protection/GFAAF/Pages/Project.aspx?ProjectID=41 (last visited Jan. 24, 2019).

168 Kent Harrington, *Norway's Oslo Airport Now Offers Jet Biofuel to All Airlines*, AICHE.ORG (Jan. 27, 2016), https://www.aiche.org/chenected/2016/01/norways-oslo-airport-now-offers-jet-biofuel-all-airlines; Olav Mosvold Larsen, ATM Conference – Green Aviation: Jet Biofuel for Aviation in Norway 7 (May 24, 2016), https://slideplayer.no/slide/12852676.

169 Feedstocks refer to the raw materials converted into jet fuel. This was the first ever batch of jet biofuel that was imported to Europe. Larsen, *supra* note 27.

170 *Id*.

171 Press Release, SkyNRG, SkyNRG, Avinor and Air BP Make First Volumes of Sustainable Jet Fuel a Reality for Lufthansa, KLM and SAS at Oslo Gardermoen Airport (Jan. 22, 2016), http://skynrg.com/wp-content/uploads/2016/01/20160122_Press-Release_SkyNRG-Avinor-and-Air-BP-make-first-volumes-of-sustainable-jet-fuel-a-reality-for-Lufthansa-KLM-and-SAS-at-Oslo-Gardermoen-Airport.pdf; Telephone Interview with Norwegian civil servant – airport expert, *supra* note 14.

172 Airports Council Int'l, *Controbutions from Airports to the Supply of Sustainable Aviation Fuels (SAfs)* 1-4 (Int'l Civil Aviation Org., Working Paper No. CAAF/2-WP/22, 2017), https://www.icao.int/Meetings/CAAF2/Documents/CAAF.2.WP.022.2.en.pdf.

faced with the legal requirements of the EU's REACH regulation[173] when importing the fuel.[174] Other issues, such as the business rationale for running an initiative on public funding and financial support mechanisms, were also brought forth and need to be analyzed before offering SAF as a more permanent part of airport services.[175]

c. BioPort Holland

The third example, the BioPort Holland initiative, started in 2013 when a group of stakeholders in the Netherlands decided that it was important and possible to develop regional sustainable jet fuel supply chains.[176] They eventually signed a Letter of Intent with Dutch public authorities.[177] The objective of this collaboration was to move from project-based funding for test flights to a continuous production and supply of SAF in the Netherlands and Europe more broadly.[178] In practical terms, the initiative led to the creation of BioPort Holland. This initiative-driven collaboration has a larger variety of practical and process-related objectives than the Fly Green Fund and Gardermoen Biohub above. It has various working groups on topics such as the sourcing of sustainable and price-competitive biofuel feedstocks, conversion technology analysis, as well as production, blending, logistics, transport, and certification.[179] Additionally, BioPort Holland offers a network that facilitates participation in pilot projects and experiments across the entire supply chain, and promotes communications.[180] BioPort Holland thus drives the development of the SAF sector on multiple fronts, and the involvement of policy makers provides the initiative with concrete opportunities to consider the introduction of complementary instruments.

173 Commission Regulation 1907/2006, art. 153, 2006 O.J. (L 396) 1 (EC).

174 Telephone Interview with Norwegian civil servant – airport expert, *supra* note 14.

175 *Id*.

176 ICAO Environment. Project, *supra* note 118.

177 The actors include the Ministry of Infrastructure and the Environment, the Ministry of Economic Affairs, KLM, Schiphol Airport, Port of Rotterdam, SkyNRG, and Neste's renewable aviation fuel production facility in Rotterdam. *Letter of Intent 'BioPort for Jet Fuels in the Netherlands*,' OVERHEID.NL (Feb. 14, 2014), https://zoek .officielebekendmakingen.nl/stcrt-2014-3543.html.

178 *Dutch Initiative – 'Bioport Holland'*, ICAO ENV'T, https://www.icao.int/ environmental-protection/GFAAF/Pages/Project.aspx?ProjectID=3 (last visited Feb. 19, 2019).

179 ICAO Environment. Project, *supra* note 118.

180 *See id*.

2. Process-driven Collaborative Networks

Innovative instances of broader, process-oriented collaborative networks at the national level include the Commercial Aviation Alternative Fuels Initiative ("CAAFI") in the United States[181] and Aireg in Germany.[182] At the regional level, an advanced example from Europe is the Nordic Initiative for Sustainable Aviation.[183] At the international level, the collaborative processes have so far been more modest.[184]

a. The Commercial Aviation Alternative Fuels Initiative

The United States' Commercial Aviation Alternative Fuels Initiative ("CAAFI") is likely the largest and best established network in the field of SAF. CAAFI aims to enhance energy security and environmental sustainability for aviation through the deployment of commercially viable SAF.[185] Since 2006, it has attracted more than 800 stakeholders and 450 organizations from across the SAF value chain.[186] This advanced network is a further example of the importance of collaboration between public and private entities, since it is sponsored by the U.S. Federal Aviation Administration ("FAA") and three trade associations: the Aerospace Industries Association, Airlines for America ("A4A"), and the Airports Council International – North America. The CAAFI network has been very active in promoting SAF on multiple fronts. Its main focus for the future is information creation and sharing on the one hand, and market creation on the other.[187]

Information creation and sharing activities are important for SAF as a technical, nascent sector. A public-private network is well-situated for this task, as is illustrated by CAAFI's prominent documentation work. CAAFI produces studies, information documentation, and guidelines not only for industry actors but also for authorities and policy makers.[188] The

---

181 *About CAAFI*, CAAFI, http://www.caafi.org/about/caafi.html#main (last visited Jan. 28, 2019).

182 *About Us*, AIREG, http://aireg.de/en/about-us (last visited Jan. 28, 2019).

183 *Nordic Initiative for Sustainable Aviation (NISA)*, ICAO, https://www.icao.int/environmental-protection/GFAAF/Pages/Project.aspx?ProjectID=25 (last visited Jan. 28, 2019); *At a Glance*, MASBI, http://www.masbi.org/at-a-glance (last visited Jan. 28, 2019).

184 *See, e.g.*, *See, e.g.*, Airports Council Int'l, *supra* note 27, at 1–4.

185 *About CAAFI*, CAAFI, http://www.caafi.org/about/caafi.html#main (last visited Jan. 28, 2019).

186 *CAAFI Frequently Asked Questions*, CAAFI, http://www.caafi.org/about/faq_test.html (last visited Feb. 18, 2019).

187 Written Questionnaire Interview Number 19-1, American aviation biofuels expert (May 4, 2018).

188 *CAAFI Brochure 2014*, CAAFI.COM, http://www.caafi.org/about/pdf/CAAFI_brochure_Jan_2014.pdf.

documents vary in content from user guides on the SAF certification process[189] and sales[190] for entrepreneurs to fuel readiness level ("FRL"),[191] feedstock readiness level ("FSRL"),[192] and sustainability evaluation frameworks.[193] The network is also an effective instrument in sharing and communicating positions[194] on research and development needs, which remain essential for the SAF sector where room for further improvement remains. For the broader public, a network can raise awareness on the existence, feasibility, and importance of SAF. [195]

The collaboration in the CAAFI network has also contributed to market creation. This example shows how broader networks can facilitate economic aspects alongside the more targeted initiative-based collaborations described in the preceding section.[196] CAAFI aims to improve and support a higher capacity process for the Fuel Qualification Approach and develop the supply of SAF in general.[197] More specifically, CAAFI has been instrumental in creating and validating the "drop-in jet fuel" concept through the collaboration with the FAA, ASTM, and aircraft manufacturers; this concept has preceeded five alternative jet fuel approvals by ASTM.[198] CAAFI has also been a party to the "Farm to Fly 2.0" agreement with the U.S. Department of Agriculture and Department of Energy, which has a goal of accelerating the development of feedstocks

189 ASTM D4054 Users Guide assists entrepreneurial firms with navigating the complex fuel qualification process. MARK RUMIZEN, SENIOR TECHNICAL SPECIALIST, FED. AVIATION ADMIN., ASTM D4054 USERS' GUIDE (2013), http://www.caafi.org/resources/pdf/d4054_users_guide_v6_2.pdf.

190 The Guidance for Selling Alternative Fuels to Airlines in cooperation with Airlines for America (A4A) assists producers prepare for airline offtake discussions.

191 The FRL evaluation framework aims at determining at what stage of development a specific biojet fuel pathway is situated.

192 The FSRL tool is intended to complement the FRL by providing a means to track the development and availability of raw materials for SAF production.

193 Sustainability Overview and Environmental Progression frameworks complement CAAFI/USDA Feedstock Readiness Level frameworks.

194 *See* CAAFI Research and Development Team, *Research and Development Investment Position Paper*, CAAFI.COM (May 8, 2013), http://www.caafi.org/information/rdchallenges.html.

195 *About CAAFI*, CAAFI.COM, http://www.caafi.org/about/caafi.html (last visited Jan. 27, 2019).

196 *See supra* Part V(B)(1).

197 Written Questionnaire Interview with American aviation biofuels expert, *supra* note 187; *See About CAAFI*, CAAFI.COM, http://www.caafi.org/about/caafi.html (last visited Jan. 27, 2019).

198 *See CAAFI and its 10-Year Journey to the Cutting Edge of Sustainable Jet Fuel Commercialization*, GREENAIRONLINE.COM (May 26, 2016), http://www.greenaironline.com/news.php?viewStory=2237.

and regional development activities in several states.[199] The strategic alliance between airlines (via A4A) and the Defence Logistics Agency has signalled a "single market" for SAF. The network has moreover facilitated airline and fuel producer offtake agreements[200] in cooperation with A4A.

Looser public-private networks such as CAAFI often have an advantage compared to formal public legal instruments[201] at the international level between states and state-centric institutions. Driven by genuine interest and unrestricted by many formal requirements, the networks can expand rather speedily the cooperation with their international counterparts, as CAAFI has done in Australia, Brazil, Spain, Germany, and Indonesia. In a sector as international as aviation, this is essential. At the same time, this public-private network's close relationship with key government bodies remains important in designing funding schemes and in paving the way for more formal policies and regulations.

b. The Aviation Initiative for Renewable Energy in Germany

In Europe, SAF networks still function mostly on national or regional bases. The Aviation Initiative for Renewable Energy in Germany ("Aireg") is a prominent example. This network is comprised of partners from the entire biojet value chain, including research institutes, ministries, aviation companies, and bioenergy producers. There are currently twenty-eight members since the network's inception in 2011.[202] The members help fund the network.[203] Similar to the above-mentioned networks, Aireg's vision in general terms is to facilitate the development and deployment of SAF in Germany which, as with CAAFI, can be divided into informative and market creation related activities. The communication task of the network is to raise awareness and deepen the general understanding of the field in Germany. The network does this by organizing workshops, conferences, and research projects, and by

199 *Id*.

200 CAAFI works with potential producers to prepare them for potential offtake agreements with airlines. The latter are agreements to sell or purchase a part of the producer's future production. Written Questionnaire Interview with American aviation biofuels expert, *supra* note 187.

201 Such as the more "hard" legally binding instruments discussed above: blending mandates, tradeable certificate schemes, reduced landing fees at airports & public procurement, as well as other command and control instruments.

202 *Members*, AIREG.DE, http://aireg.de/en/politics/members (last visited Jan. 27, 2019).

203 FED. MINISTRY OF TRANSP. AND DIGITAL INFRASTRUCTURE, ICAO STATE ACTION PLAN FOR EMISSIONS REDUCTION-GERMANY 56 (June 2016), https://www.icao.int/environmental-protection/Lists/States_Action_Plans/Attachments/33/ICAO_State_Action_Plan_Germany_2016.pdf.

providing policy support.[204] It also focuses on the need to support the feedstock and biorefining capacity on an industrial scale through appropriate policies. Aireg's Working Group on Feedstock Provision and Conversion helps determine the most economically, environmentally, and technologically viable biojet feedstock and develop a roadmap for the SAF industry on this basis.[205] It has called on the German government to implement a "National Development Plan for Alternative Aviation fuels" focusing on the supply and refineries.[206] In terms of market creation, the network is deploying soft self-regulation instruments by setting a performance goal for the sector to reach a ten percent share in the total jet fuel consumed domestically by 2025.[207] Aireg's member organizations have also collaborated on a number of practical projects in order to reach this target, including research and development of Advanced Biomass Value using microalgae species.[208]

c. The Nordic Initiative for Sustainable Aviation

Finally, there is the Nordic Initiative for Sustainable Aviation ("NISA"), a European regional-level organization. NISA brings together the aviation sector in the five Nordic countries[209] in a structured way to collectively find sustainable solutions. The partners include the Nordic airlines, airports, transport authorities, and relevant governmental and non-governmental bodies, as well as producers including Boeing, Volvo, and Airbus. Yet, unlike Aireg, it does not include fuel producers or research and development organizations in the network. However, NISA consults with experts and producers regularly. Objectives of NISA echo those of CAAFI and Aireg, but with a more regional focus: to facilitate dialogue and collaboration between partners along the supply chain as well as between countries, to create new knowledge by conducting cross-country studies, and to raise awareness in the region on the opportunities offered by SAF as well as on the importance of accelerating their

---

204 *Id.* at 44.

205 *Working Groups*, AIREG.DE, http://aireg.de/en/politics/working-groups/ (last visited Jan. 27, 2019).

206 *National Development Plan for Alternative Aviation Fuels*, AIREG (2018), http://aireg.de/en/politics/national-development-plan-for-alternative-aviation-fuels; *Aviation Initiative for Renewable Energy in Germany (AIREG)*, ICAO, https://www.icao.int/environmental-protection/GFAAF/Pages/Project.aspx?ProjectID=3.

207 *Climate friendlier flying – 10% alternative aviation fuels by 2025*, AIREG, http://aireg.de/en/home-en/ (last visted Feb. 19, 2019).

208 INT'L AIR TRANSP. ASS'N, IATA 2015 REPORT ON ALTERNATIVE FUELS 23 (10th ed. 2015).

209 *Nordic Initiative for Sustainable Aviation (NISA)*, ICAO ENVIRONMENT, https://www.icao.int/environmental-protection/GFAAF/Pages/Project.aspx?ProjectID=25.

development and commercialization.[210] The regional perspective that a network approach allows can be quite important in creating political pressure to support SAF development. By combining five advanced and proactive Nordic countries and their stakeholders under the same initiative, NISA might be able to act as a policy entrepreneur with sufficient political clout. Its aim is to push policy makers into action and to create a framework and conditions for accessing new fuels by displaying a united front and proposing solutions that are based on the latest scientific knowledge.[211] Results of this strategy are visible, for example, in NISA's participation in the above described Fly Green Fund and Oslo's Gardermoen Biohub initiatives.

C. Initiatives and Networks as Vital Complements to SAF Regulation

The overview above highlighted six of the most innovative initiative-based and collaborative networks as soft instruments to develop the SAF market. The examples reflect the broad range of networks and their varied scope. At the same time, at the core of these networks tend to be the same main objectives: to create and communicate information, on the one hand, and to establish a functioning SAF market, on the other. There are also multiple other networks that share many of these objectives.[212] It is indeed

---

210 Telephone Interview Number 11-1, Denmark – Aviation Biofuels Expert (Oct. 3, 2016).

211 *Nordic Initiative for Sustainable Aviation (NISA)*, *supra* note 209; *Nordic aviation sector joins with Boeing and Airbus to launch a regional sustainable biofuels initiative*, Greenair, (Nov. 8, 2013), http://www.greenaironline.com/news.php?viewStory=1780; Erik C. Wormslev et al.,Sustainable Jet Fuel For Aviation: Nordic Perpectives On the Use of Advanced Sustainable Jet Fuel for Aviation 538 (2016).

212 Examples of Further SAF Networks: Sustainable Bioenergy Research Consortium ("SBRC"), https://sbrc.masdar.ac.ae/index.php/about-us; International Civil Aviation Organization ("ICAO"), https://www.icao.int/about-icao/Pages/default.aspx;

European Advanced Biofuels Flightpath, https://www.biofuelsflightpath.eu/about; Sustainable Aviation Fuel Users Group, http://www.safug.org; International Air Transport Association ("IATA"), https://www.iata.org/about/Pages/index.aspx; Bioqueroseno, https://www.icao.int/environmental-protection/Pages/Bioqueroseno.aspx; Partnership for Air Transportation Noise and Emissions Reduction, http://partner.mit.edu; Aviation Sustainability Center ("ASCENT"), https://ascent.aero; Australian Initiative for Sustainable Aviation Fuels ("AISAF"), https://www.icao.int/environmental-protection/GFAAF/ Pages/Project.aspx?ProjectID=29; Midwest Aviation Sustainable Biofuels Initative, http://www.masbi.org/; Plan de Vuelo, https://seneam.gob.mx/scta/ planvuelo.asp; BioFuelNet, http://www.biofuelnet.ca/nce/about-us; Initiatives for Next Generation Aviation Fuels ("INAF"), https://www.icao.int/Meetings/Environmental Workshops/Documents/ 2014-Malaysia/7-2_AlternativeFuels_Japan-Satoshi.pdf. This is

striking: if the international development of "hard" public legal instruments on SAF is sluggish, there are active yet fragmented "softer" developments to complement them. These softer SAF initiatives tend to be combinations of public and private actors, so most of them are combinations of public non-legal instruments and private instruments. The core question for future development of the sector is whether and how the various softer initiatives and collaborative networks can act as complements and supplements to the emerging policy instruments in the field— not to exhaust nor to undermine them. The links that the collaborations create between industry actors, fuel producers, and governments offer vital opportunities for well-informed policymaking and effective initiatives.

CONCLUSIONS AND RECOMMENDATIONS: LESSONS LEARNED FROM INNOVATIVE POLICY INSTRUMENTS

The aviation biofuels sector remains largely underdeveloped due to technological, economic, and political constraints. These constraints will need to be overcome in the near future if aviation is to move away from fossil-based kerosene and achieve any significant emission reductions. Although policy instruments are finally emerging to stimulate the production, use, and market uptake of SAF, many uncertainties remain regarding this complex, novel policy field.

A. Collaborative Instruments as Precursors to Regulation

The scope of the SAF value chain and the complexities it encompasses in terms of sustainability and supply security make collaborative approaches, such as stakeholder networks and small-scale initiatives, essential as an initial step forward. Importantly, the networks enable the stakeholders within the field to communicate with a single voice. This raises awareness regarding the needs of the sector in public and political spheres. Further, many, if not all, actors currently active in this niche field have a common interest to develop the market. The networks allow for flexibility and enable the stakeholders to confidently experiment and find out what works as local-level initiatives. The successes of the test phase collaborations can then be built upon at a larger scale. The networks may also play an essential role in driving international developments in the sector, which is necessary considering the global

not an exhaustive list, but an illustration of the number and variety of networks available beyond those described in this article.

nature of the aviation industry. These collaboration activities may in fact be the only feasible approach currently available at the international level. They enable stakeholders to create and maximize opportunities, without compromising their competitiveness—a criticism often directed at the more rigorous command-and-control type approaches.

B. Regulation and Market-based Instruments at a Stage of Initialization

Policy instruments such as public procurement schemes, blending mandates, and tradable certificates also have an important role to play, particularly at subinternational levels in testing and scaling-up technologies and supply chains. The networks and research and development funding are essential to create small-scale success at the local level, and networks can extend globally. These larger regulation- and market-driven mechanisms need to come through in order to scale-up production capacity and generate sufficient supply and demand for SAF.[213]

Government-operated procurement schemes have the potential to create stable demand on the SAF market, assuming that sufficient quantities are procured. Considering the complexity of the tenders and the multiple safety, performance, and sustainability standards involved, the processes within procurement schemes need to be streamlined and kept transparent. These changes would facilitate the involvement of the interested government entities, as would the creation of one-stop shops to purchase SAF.

Instruments such as blending mandates have traditionally been used to stimulate the biofuels market in the road transport sector. The process of designing blending mandates in the aviation sector can benefit from the ample experience of regulating road transport. Implementation of blending mandates have been shown not to significantly affect the cost for obligated parties— at least if relatively low targets are set initially. Financial support schemes in the form of subsidies may also be called for as financial safeguards, while a strong political will and consumer (i.e., end-user) awareness will be required when engaging the affected industries in setting up the schemes. Further, international action on this front is desirable in order to mitigate the measures' effects on the airlines' relative competitiveness and to allow further increases in blending obligations.

Tradable certificate schemes operating in combination with blending mandates may be a good way of utilizing market efficiencies to stimulate supply and provide extra financing to SAF producers. Multiple such

213 *See also Mabee*, *supra* note 6.

mechanisms already exist at all jurisdictional levels (local, national and international), which offer useful insights into the practicalities and pitfalls of operating the mechanisms. Extending the schemes' obligations to cover SAF is an important first step. Currently, the incentives created by many of the tradable certificates are nonetheless insufficient. The incentives also need to turn biofuel producers away from the less costly and far less technically demanding road transport to shipping SAF for aviation.[214]

C. Collaborative Instruments and Regulatory Measures as Complements in Promoting SAF

SAF market uptake will undoubtedly rely on different variants and combinations of the abovementioned innovative instruments. We observed a chronology of instruments so far; the sluggish uptake of policies has contributed to the emergence of numerous pilot initiatives and voluntary networks, where proactive private and public actors have taken the lead, facilitated by funding and expert intermediaries. The finding corresponds with recent observations in the biofuels sector.[215] There are also similar trends in climate policies more broadly speaking;[216] states have failed both in their traditional role as regulators and in setting up robust markets to mitigate climate change, emphasizing the role of transnational, polycentric non-state actors. Yet, now more prominent regulatory instruments are emerging. They have potential to develop the SAF sector further, each with their particular means. It will be vital to ensure a complementary development of both voluntary and regulatory instruments. This will not be easy, considering that the biofuels sector has been depicted as governed by flexible networks of governmental and non-governmental actors that carry out actions in flexible yet unsystematic processes.[217] The further synchronous development of the policies will require focused, rapid attention in order to help launch the markets and deliver on the emissions reductions promised by SAF.

---

214 Shipping is increasingly subjected to environmental requirements. Biofuels for ships are in the plans of the European Commission. For example, subjected to the same "multipliers" as those that incentivize biofuel supplies for aviation, biofuels for ships have a clear cost advantage due to their far lower technical requirements. *See, e.g.*, Commission Proposal for Directive on the Promotion of the Use of Energy from Renewable Sources (Recast), COM (2016) 767, art. 25(1)(b)(2).

215 Paul Martin & Elodie Le Gal, *Unpacking the Complexities of Biofuel Policy*, *in* THE LAW AND POLICY OF BIOFUELS (Yves Le Bouthillier et al. eds., 2016).

216 Andrew Jordan et al., *Governing Climate Change Polycentrically*, *in* GOVERNING CLIMATE CHANGE: POLYCENTRICITY IN ACTION? 3 (Andrew Jordan et al. eds., Cambridge Univ. Press 2018).

217 Beer, *supra* note 6.