Pak. j. life soc. Sci. (2024), 22(2):15425-15433 E-ISSN: 2221-7630;P-ISSN: 1727-4915

Pakistan Journal of Life and Social Sciences

www.pjlss.edu.pk

https://doi.org/10.57239/PJLSS-2024-22.2.001118

RESEARCH ARTICLE

Sustainable Aviation Fuel in Indonesia: A Comprehensive Overview

Adya Paramita Prabandari[1], Efrema Ardratya Prakasita Puteri[2]

[1,2] Faculty of Law, Universitas Diponegoro, Jalan dr. Antonius Suroyo, Tembalang, Semarang City, Central Java 50275, Indonesia.

ARTICLE INFO

Received: Sep 13, 2024

Accepted: Nov 15, 2024

Keywords

Sustainable Aviation Fuel

Indonesia

***Corresponding Author:**

adyaparamitaprabanda@lecturer.undip.ac.id

ABSTRACT

The release of gas emissions from transportation is one of the leading causes of the globe's air pollution. In the aviation sector, air travel has been continuously on the rise throughout the years. As a result, with the increase of flights flown each day, an increase in gas emissions is released into the earth's atmosphere. The rise of air pollution has further led to numerous global issues, hence becoming a concern within the international community. The ICAO has made it a great concern for States to begin finding a solution to this issue. Today, sustainable aviation fuel has been one of the leading solutions in combating air pollution in aviation. ICAO has made numerous recommendations for States to transition to sustainable aviation fuel. In Indonesia, there have been numerous attempts and challenges in the implementation of sustainable aviation fuel, creating an urgency for the government to make changes to increase the use and effectiveness of sustainable aviation fuel.

INTRODUCTION

Energy fuels the economic engine of the world. It acts as an essential constituent that drives the global community. The continuous reliance on energy in everyone's lives has created a compulsion in the earth's system resulting in being one of the main culprits on climate change. Therefore, the goal of decarbonization of global energy is of the utmost importance to the international community. The target of achieving a sustainable future, a global take on renewable energy plays a key role in achieving this approach.[1]

As continuous research has shown that there exists a linkage between energy and poverty eradication. The United Nations has made it a concern that led to the inclusion of Sustainable Development Goal 7 or SDG 7 in Agenda 2030 to ensure access to affordable, reliable, sustainable, and modern energy for all.[2] In SDG 7, the goal is to expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all, and further enhancing access to clean and

[1] Sanderink, L. Renewable Energy. In Governing the Climate-Energy Nexus. *Cambridge University Press*. 2022, p. 101. https://doi.org/10.1017/9781108676397.006

[2] United Nations, "*Goal 7 Department of Economic and Social Affairs*" United Nations.org, Accessed on August 31, 2023, https://sdgs.un.org/goals/goal7

renewable energy, as well as cleaner fossil fuel technology. All States are encouraged to further implement solutions to fulfill the targets of SDG by 2020.[3]

The concerns set forth within SDG 7, have increased the advancement of research and usage of sustainable fuel toward all forms of transportation. From the perspective of the Republic of Indonesia, the increased mobility from globalization and the continuous population growth simultaneously results in the high demand for goods and services to meet the needs and mobility of the Indonesian population. The high levels of mobility in the community make transportation an important aspect of their daily activities. However, in the viewpoint of the most carbon-intensive form of travel, aviation falls as the leading contributor. The most used form of transportation by the community in mobilizing is through air travel. According to the data released by *Badan Pusat Statistik* (BPS) or the Central Bureau of Statistics, there are a total of 30.07 million passengers in a domestic aircraft in 2021, meanwhile on international flights, a total of 630 thousand passengers were recorded.[4] The number of passengers on an aircraft reflects the high dependency of the Indonesian people on using air travel for their activities. However, the high levels of usage of air travel results in the high production of pollution.

The release of gas emissions from vehicles is one of the causes of air pollution. The sector of transportation donates around one-fifth of carbon dioxide emissions (CO2) globally. Each mode of transportation releases different levels of carbon footprint. According to the data collected by *Our World in Data* in 2020, aircraft become the highest producers of carbon footprint, especially short-distance flights (<1,500 km).[5] The pollution produced by an aircraft originates from the fuel of the aircraft, in-flight air conditioners (AC), and in-flight air fresheners. Avtur and kerosene as aircraft fuel produce emissions such as carbon dioxide, methane, and contrails, which are pollutant materials that effectively absorb heat and have an impact on global warming.[6]

One of the efforts made to reduce the impact of global warming caused by aircraft is to use Sustainable Aviation Fuel (SAF). SAF is an aviation fuel that uses non-conventional (non-fossil) basic materials, for example, plants, algae, cooking oil, and other non-conventional materials. The use of SAF as an aircraft fuel has been proven to have a positive impact, as there is a significant reduction in carbon dioxide in the carbon cycle compared to the use of fossil fuels. The reduction may reach up to 80%.[7] This makes the use of SAF referred to as a solution that can solve the problem of pollution produced by aircraft, given the target set by The International Air Transport Association (IATA) is to halve carbon dioxide emissions in 2050 from the number of emissions found in 2005.[8]

However, SAF has not been used optimally by many airlines. Several factors influence airlines to continue to choose the use of fossil fuels over using SAF. First, the price of SAF is more expensive in comparison to the price of fossil fuels. The price of fossil fuels in 2020 is $0.5/liter, while the price of

---

[3] United Nations, "Transforming the world: The 2030 Agenda For Sustainable Development" sustainabledevelopment.un.org, A/RES/70/1.

[4] Kabarbusiness.com, " Jumlah Penumpang Pesawat Sepanjang 2021 Capai 30,07 Juta, Turun 7,18 Persen: Transportasi," Kabarbisnis.com, accessed on June 2 , 2022. https://www.kabarbisnis.com/read/28111615/nomor-penumpang-pesawat-sepanjang-2021-reach-30-07-juta-turun-7-18-persen

[5] Vika Azkiya Dihni, "Jejak Polusi dari Transportasi," katadata.co.id, accessed on June 2, 2022. https://katadata.co.id/ariayudhistira/infografik/6228054eee128/jejak-polusi-dari-transportasi

[6] Lilik Slamet S, "Potensi dan Dampak Polusi Udara Dari Sektor Penerbangan," LAPAN *Journal*, p. 1.

[7] The International Airport Association, "What is SAF?" iata.org, accessed on 24 June 2022. https://www.iata.org/contentassets/d13875e9ed784f75bac90f000760e998/saf-what-is-saf.pdf

[8] Brandon Graver, "Glass Half Full: An Invitation For IATA To Update Climate Goals," theicct.org, accessed on June 24 , 2022. https://theicct.org/glass-half-full-an-invitation-for-iata-to-update-climate-goals/

SAF in the same year is $1.1/liter.[9] This is because there are limited technologies capable of producing SAF. Resulting in the low demand for SAF and affecting production costs which continue to remain high. Additionally, the emergence of the COVID-19 pandemic in 2020 further contributed to the increase in oil prices around the world, including SAF. Continuously increases the reluctance of airline companies to use SAF, and as a consequence keeping the use of SAF at its minimum. The emergence of the COVID-19 pandemic has also reduced the number of parties investing in this fuel, and as a result, the price remains expensive. Furthermore, the number of SAFs which is still very limited makes airline companies less interested in using this fuel. SAF production is currently estimated at less than 0.1% of global jet fuel consumption.[10] By 2021, there will be 100 million liters of SAF in use worldwide. This amount is very small when compared to the total fuel needed in the aviation industry. This amount is also very small when compared to the number of requests for SAF by airlines, which is 14 billion liters of SAF.[11] As the limited number of SAF affects the high price of SAF it results in airlines still choosing to use fossil fuels. These two factors are the main factors that make the lack of use of SAF globally.

In addition to these two main factors, another factor that is also said to have contributed to the minimum use of SAF worldwide is the absence of a national policy from the local government to use SAF as aviation fuel.[12] With the "support of the right government policies", IATA estimates SAF production will reach 7.9 billion liters by 2025, which will only meet 2% of the overall fuel demand. Halfway through this century, the IATA says that production will jump to 449 billion liters or 65% of the sector's needs.[13] Currently, the only country in the world that has mandated the use of SAF is Norway. In Norway, since January 2020 all jet fuel supplied domestically must contain at least 0.5% SAF.[14] Other European Union (EU) member countries are also intensifying the use of SAF, one of which is by updating their aviation industry policies. Therefore, the support of the local government in carrying out policy reforms is an equally important factor in increasing the use of SAF in the country.

Several studies regarding SAF have been carried out before this research, among others: (1) An article entitled "Supporting Clean Energy in the ASEAN: Policy Opportunities from Sustainable Aviation Fuels Initiatives in Indonesia and Malaysia" studies the policy opportunities for drop-in sustainable aviation fuel (SAF) deployment in the ASEAN by considering the initiatives undertaken by Indonesia and Malaysia[15]; and (2) Article entitled "Proposed Marketing Strategy of Green Jet Fuel

---

[9] Sumit Singh, "How SAF Can Become Cost Competitive Against Conventional Fuel," simpleflying.com, accessed on June 24 , 2022. https://simpleflying.com/saf-cost-competitive-jet-fuel/

[10] Siddharth Vikram Philip and Ben Elgin, "Airlines Rush Toward Sustainable Fuel But Supplies Are Limited," Bloomberg.com, accessed on June 24 , 2022. https://www.bloomberg.com/news/articles/2021-11-10/airlines-rush-toward-sustainable-fuel-but-supplies-are-limited

[11] Anmar Frangoul , "Sustainable Aviation Fuel Costs More but Consumers Will Be Willing to Pay, IATA Chief Says," cnbc.com, accessed on June 24 , 2022. https://www.cnbc.com/2022/02/11/sustainable-aviation-fuel-costs-more-but-consumers-willing-to-pay-iata.html

[12] Pavlenko N, " *An assessment of the policy options for driving sustainable aviation fuels in the European Union"* in *Supporting Clean Energy in the ASEAN: Policy Opportunities from Sustainable Aviation Fuels Initiatives in Indonesia and Malaysia* , p . 1.

[13] Anmar Frangoul , "Sustainable Aviation Fuel Costs More but Consumers Will Be Willing to Pay, IATA Chief Says," cnbc.com, accessed on June 24 , 2022. https://www.cnbc.com/2022/02/11/sustainable-aviation-fuel-costs-more-but-consumers-willing-to-pay-iata.html

[14] Norway's Ministry of Climate and Environment, "More Advanced Biofuels in Aviation," regjeringen.no, accessed on 24 June 2022. https://www.regjeringen.no/en/historical-archive/solbergs-government/Ministries/kld/news/2019-nyheter/mer-avansert-biodrivstoff-i-luftfarten/id2643700/

[15] A. Atmowidjojo et. al., """Supporting Clean Energy in the ASEAN: Policy Opportunities from Sustainable Aviation Fuels Initiatives in Indonesia and Malaysia", IOP Conference Series: Earth and Environmental Science 940 (2021), accessed on August 17, 2023. https://iopscience.iop.org/article/10.1088/1755-1315/940/1/012031/pdf

or Sustainable Aviation Fuel (SAF) for Pertamina Post Development of Biorefinery Plant" that discuss on how to develop marketing strategy for SAF product of Pertamina[16].

Meanwhile, seeing the importance of using SAF in aircraft, this article will discuss the use of SAF and its current developments in Indonesia, as well as the constraints and policies that have been made to intensify the use of SAF in Indonesia as a means of fulfilling the United Nations' SDG 7. This article will also contain comparisons regarding policies on the use of SAF in Indonesia with international regulations so that it can be used as a recommendation to increase the use of SAF in Indonesia.

RESEARCH METHOD

The research method used in this paper is a normative juridical method, using a statute approach and a conceptual approach. The data used are secondary data obtained through library research. The data is processed and analyzed using qualitative analysis methods.[17]

RESULTS AND DISCUSSION

International Regulations on SAF

The rising concerns climate change has created towards all sectors of transportation are continuously increasing. As a solution to the goals of decarbonization, states have been called upon to find alternatives for the sources of energy, one of which includes alternative fuels. However, there are numerous challenges in creating a sustainable alternative fuel within transportation.

The challenges that arise specifically within air travel occur mainly due to the fact that the aviation sector contains large technical barriers to making a transition towards hydrogen or electricity-powered airframes, so the industry of air travel will most likely have to rely on liquid fuels through 2050.[18] The airframes and infrastructure of an aircraft have been designed to last for decades, as a result, any new alternative fuels must be compatible with the current basic structure of an aircraft. The term used for this matter is referred to as drop-in fuels. An alternative fuel for an aircraft must be drop-in fuel which refers to a substitute fuel that is functionally equivalent to the former fuel used. In the matter of sustainable fuel, it must be drop-in biofuels. Drop-in biofuel is a fuel produced in biomass sources to create a sustainable fuel that is chemically identical to petroleum or the current fuel that is used. The existence of drop-in bio-jet fuels commonly referred to as "sustainable aviation fuel" is the most effective method and has the largest opportunity for States to meet and exceed the goals of decarbonization as it plays a significant role in the long run.[19]

While reducing petroleum consumption in aviation is an important objective for decarbonization, the specific types of alternative fuels used to substitute petroleum will determine the net climate impact of any alternative fuels policy.[20] In the ICAO, the methodology that is recognized in determining the minimum requirement for a fuel to be considered as an SAF is seen through the amount of emission

[16] Wahyu Gunawan and Atik Aprianingsih, "Proposed Marketing Strategy of Green Jet Fuel or Sustainable Aviation Fuel (SAF) for Pertamina Post Development of Biorefinery Plant", *European Journal of Business and Management Research*, Vol. 8, Issue 3, June 2023, accessed on August 17, 2023. DOI: http://dx.doi.org/10.24018/ejbmr.2023.8.3.2010

[17] Mukti Fajar ND and Yulianto Achmad, Dualisme Penelitian Hukum Normatif dan Empiris, Yogyakarta: Pustaka Pelajar, 2010.

[18] Nikita Pavlenko and Stephanie Searle, *Assessing the sustainability implications of alternative aviation fuels* (ICCT, 2021), https://theicct.org/wp-content/uploads/2021/06/Alt-aviation-fuel-sustainability-mar2021.pdf

[19] Gonca Seber, Neus Escobar, Hugo Valin, and Robert Malina, "*Renewable and Sustainable Energy Reviews, Uncertainty in life cycle greenhouse gas emissions of sustainable aviation fuels from vegetable oils*", Elsevier Ltd, vol 170, 2022, p. 2. https://doi.org/10.1016/j.rser.2022.112945

[20] Nikita Pavlenko and Stephanie Searle, *Assessing the sustainability implications of alternative aviation fuels* (ICCT, 2021), https://theicct.org/wp-content/uploads/2021/06/Alt-aviation-fuel-sustainability-mar2021.pdf

reduction generated by the use of SAF through the calculation of its life cycle emission value.[21] Within ICAO's CORSIA scheme, they have provided a framework for tracking and crediting emission reductions or offsets from international aviation toward ICAO's goal of carbon-neutral growth for aviation after 2020.[22]

The fuels that are accepted by ICAO as SAF are biofuel or bio avtur that have passed the life cycle assessment (LCA). The LCA is a threshold and system that is used to estimate greenhouse gas (GHG) emissions from SAF in comparison to fossil kerosene.[23] The assessment takes into consideration the fuel's feedstock and its conversion process, referred to together as the fuel pathway, which determines the fuel's life-cycle GHG emissions.[24]

The core life cycle GHG emissions of the SAF pathways have been calculated using an LCA attributional or process-based approach. The attributional LCA implies accounting mass and energy flows, along the whole value chain. This refers to the calculation of greenhouse gas emissions throughout the entire process of creating the SAF as well as the ongoing operational activities. Additionally calculating emissions embedded in all the streams and utilities used, such as processing chemicals, electricity, and natural gas. However, emissions generated during one-time construction or manufacturing activities, for example, fuel production facility construction, and equipment manufacturing are not included.

In calculating the total emissions produced by creating an alternative fuel, the Committee on Aviation Environmental Protection or the CAEP, a technical committee of the ICAO, has established to use of attributional analysis for the core of LCA GHG emissions calculations. The core of LCA GHG emissions is the emissions associated with feedstock cultivation, feedstock harvesting, collection and recovery, feedstock processing and extraction, feedstock transportation to processing and fuel production facilities, feedstock to fuel conversion processes, fuel transportation and distribution, and fuel combustion in an aircraft engine.[25] In other words, it refers to the fact that there are no displacement effects related to co-products that are accounted for, as the emissions are allocated across the co-products based on energy content.

Furthermore, the calculation of emissions further extends towards induced land use change (ILUC) emissions. Eligible Fuel production may require some additional land to be used, and generating land may affect and change GHG emissions. These could occur where the new fuel production is taking place referred to as direct land use change, or also in other locations due to the displacement of crops or animals for which the land was previously used and in this referred to as indirect land use change. The ILUC emissions assessment takes into account these different effects, by evaluating greenhouse gas released from the conversion of natural vegetation such as forest, other natural land, soil organic carbon, oxidation of peatlands, and sequestered biomass. The approach taken in calculating the emissions in ILUC is consequential. Total life cycle GHG emissions values for a given SAF are given by

---

[21] ICAO, *Life Cycle of Sustainable Aviation Fuels* (Environmental Protection), accessed on 16 May 2023, https://www.icao.int/environmental-protection/pages/SAF_LifeCycle.aspx

[22] International Civil Aviation Organization (ICAO), "Consolidated statement of continuing ICAO policies and practices related to environmental protection – Global Market-based Measure (MBM) scheme," Assembly Resolution A39-3, https://www.icao.int/environmental-protection/documents/resolution_a39_3.pdf

[23] Gonca Seber, Neus Escobar, Hugo Valin, and Robert Malina, "*Renewable and Sustainable Energy Reviews*, *Uncertainty in life cycle greenhouse gas emissions of sustainable aviation fuels from vegetable oils*", Elsevier Ltd, vol 170, 2022, p. 2. https://doi.org/10.1016/j.rser.2022.112945

[24] Nikita Pavlenko and Stephanie Searle, *Assessing the sustainability implications of alternative aviation fuels* (ICCT, 2021), https://theicct.org/wp-content/uploads/2021/06/Alt-aviation-fuel-sustainability-mar2021.pdf

[24] ICAO, *Life Cycle of Sustainable Aviation Fuels* (Environmental Protection), accessed on 16 May 2023, https://www.icao.int/environmental-protection/pages/SAF_LifeCycle.aspx

[25] ICAO, *Life Cycle of Sustainable Aviation Fuels* (Environmental Protection), accessed on 16 May 2023, https://www.icao.int/environmental-protection/pages/SAF_LifeCycle.aspx

the sum of 'core LCA' emissions calculated with an attributional approach and ILUC emissions calculated with a consequential approach. The main calculation here is to find the default 'core LCA' values calculated by CAEP for several SAF pathways.[26]

Hence, the creation of a sustainable alternative fuel goes through an immense amount of calculation, putting into consideration the entirety of the emissions produced through the production. This shows the amount of research and expenses needed to create an alternative fuel. Once a fuel has passed all the tests, it may now be considered a sustainable fuel consistent with international regulations. This causes the high cost of production as well as the lack of support from governments domestically to fully change its energy source to sustainable fuel.

As a result, the ICAO has provided recommendations to push its Member States to use sustainable aviation fuel. ICAO has provided conditions for promoting SAF towards stakeholders and their responsibility. The state should put forward public policies as it plays a big role in fostering a national SAF industry. Governments should adopt diverse mechanisms, including but not limited to legislation (concerning environment and fuel quality specification), taxation, and support measures. Each State should have a definite goal and a clear target to further improve and develop SAF in the market, this should be conducted to evaluate the impacts, benefits, and implications, and coordinate the different public agencies and institutions needed to achieve them. States must also involve and take into consideration cooperation with the private sector in their country.

An important factor national governments should have to develop and implement measures that may help and improve the economic feasibility of SAF projects to minimize any risks generally associated with innovation, such as a tax regime and special financing lines can be used to reduce operational costs and investment in projects for SAF production and use. Other actions to reduce risk perception is providing an understanding and promotion of SAF, for example as developed in Mexico by the *Aeropuertos y Servicios Auxiliares* (ASA), a decentralized federal agency in charge of management and operation of Mexican airports, which provides aviation-related services, offers technical assistance and consultancy, as well as instruction and research in aeronautical and airport matters, including aviation fuel supply.

States are also recommended to conduct Research and development institutions, under government control or supported by governmental funds. In the field of SAF, there is a wide scope of subjects that must be studied, ranging from basic research to more specific and applied themes. Hence, without the help and funds directly from the government, the use of SAF would be a challenge to achieve. Furthermore, studies should also be done to cover research on feedstock production, processing, and final use. In that sense, research and development institutions can provide valuable assistance in studying processes and systems, and developing and implementing evaluation methodologies.[27]

Once the State government has implemented regulations and policies, the regulation would start expanding toward private entities including airlines and aviation equipment manufacturers. The system of drop-in fuels is crucial for the production of SAF, hence if airlines and aviation

[26] ICAO. (2022). CORSIA eligible fuels, Life cycle assessment methodology (CORSIA Supporting Document). Version 5, June 2022, https://www.icao.int/environmental-protection/CORSIA/Documents/CORSIA_Eligible_Fuels/CORSIA_Supporting_Document_CORSIA%20Eligible%20Fuels_LCA_Methodology_V5.pdf

[27] ICAO, Sustainable Aviation Fuel Guide, Transforming Global Aviation Collection, accessed on 11 May 2023, p. 12, https://www.icao.int/environmental-protection/knowledge-sharing/Docs/Sustainable%20Aviation%20Fuels%20Guide_vf.pdf

manufacturers are involved in the research and production of SAF, it would drastically increase the utilization of SAF.[28]

Within the International community, there have only been a few countries that have attempted and shown positive results in the implementation of SAF. The first has been practiced in the UK's Renewable Transport Fuel Obligation in the form of a buyout penalty per liter of fuel. The Renewable Transport Fuel Obligation (RTFO) supports the goal and policy of decarbonizing transport by encouraging the production and use of renewable fuels that do not damage the environment. Under the RTFO, suppliers of relevant transport fuel in the UK must be able to show that a percentage of the fuel they supply comes from renewable and sustainable sources.[29]

Furthermore, there is also the US EPA's civil penalty. The US EPA or Environmental Protection Agency, puts forward a penalty for every use of non-sustainable fuel. This creates an incentive for the usage of sustainable fuel. The form of compliance can take the form of tradable certificates or credits for unit compliance.[30]

As SAFs play a major role, SAFs make up a minuscule share of current global jet fuel consumption despite a variety of conversion technologies and fuels that could be used in commercial aircraft. On an international scale, the enacted measures by the International Civil Aviation Organization (ICAO) are only limited to emissions for international flights, as it has been established that it is under the responsibility of States to regulate and deploy SAF within their domestic laws and domestic flights.[31]

INDONESIA ON SUSTAINABLE AVIATION FUEL

Indonesia, as part of the international community and the United Nations, has not fallen short of the goals outlined in the sustainable development goal for 2023. Indonesia has been one of the countries with the fastest growing economy in Southeast Asia, with an air market growth of up to 3.6% yearly and 310 million passengers have been predicted to travel via Indonesia alone by 2035.[32] The continuous number of passengers simultaneously increases the production of emissions within aviation. As a result, it has been of great concern to the Indonesian government to reduce greenhouse gas emissions. It became Indonesia's commitment as expressed in the Nationally Determined Contribution (NDC) to reduce greenhouse gas emissions by up to 29% independently, and an additional 41% with the help of the international community according to SDG 7 for 2030. The percentage has further increased throughout the years. It was then further enshrined within the decree of the Minister of Transportation No. KP.201 of 2013 concerning the provision of the national action plan for reducing greenhouse gas emissions in the transportation sector to use renewable energy has begun with the development of sustainable aviation fuel. The commitment is to reach net zero emissions in the year 2060. This goal requires major changes and collaborations from

---

[28] ICAO, Sustainable Aviation Fuel Guide, Transforming Global Aviation Collection, accessed on 11 May 2023, p. 14, https://www.icao.int/environmental-protection/knowledge-sharing/Docs/Sustainable%20Aviation%20Fuels%20Guide_vf.pdf

[29] Department for transport, "Renewable Fuel Obligation", accessed on 15 May 2023, https://www.gov.uk/guidance/renewable-transport-fuels-obligation

[30] Pavlenko N, " *An assessment of the policy options for driving sustainable aviation fuels in the European Union"* in *Supporting Clean Energy in the ASEAN: Policy Opportunities from Sustainable Aviation Fuels Initiatives in Indonesia and Malaysia* , p . 4.

[31] Nikita Pavlenko, *An assessment of the policy options for driving sustainable aviation fuels in the European Union* (ICCT, 2021), https://theicct.org/wp-content/uploads/2021/06/Sustainable-aviation-fuel-policy-eu-apr2021.pdf

[32] Badan Kebijakan Transportasi Kementrian Perhubungan, *Dukungan Implementasi SAF di Indonesia*, accessed on 17 May 2023, https://baketrans.dephub.go.id/berita/dukungan-implementasi-saf-di-indonesia

different sectors through innovative and massive solutions. One major solution includes substituting fossil fuel with a renewable energy source.[33]

It has been established that the benefits of using SAF are in its similarity in characteristics with conventional fuel, which can be used for aviation through a process of conversion that has been standardized and recognized globally. In Indonesia, there are multiple challenges in fully utilizing SAF within the aviation sector. Despite the lagging progress, studies related to SAF development studies scarce, with more focus placed on the technical aspects although the lack of regulation has been spotted as one of the prominent challenges.

At the start of 2016, Indonesia attempted to pursue a strategy to use aviation biofuels by mandating national rules to incorporate the use of bio-jet fuel. It was planned to be enacted from 2% bio-jet fuel in 2016 and 5% in 2025 based on the Ministry of Energy and Mineral Resources (MEMR) Decree No. 25 Year 2013. To fulfill this goal, the Indonesian government has established the Indonesian Aviation Biofuels and Renewable Energy Task Force (ABRETF). This task force was created to further enhance Indonesia's role and ability in substituting energy towards sustainable energy. However, upon its formation, the task force missed the initial deadline and failed to implement the SAF target by 2016. This failure of Indonesia's inability to achieve its 2016 SAF target reflects the fact that its ambitious mandate may be insufficient. Along with the mandate, the Indonesian government should also pursue measures to ensure compliance through incentives or penalties.[34]

In Indonesia, there is a broad range of possible feedstock for producing SAF, including palm, coconut, microalgae, and lastly, the most feasible and abundant feedstock is palm oil. Palm oil has been used as a conversion to create SAF. However, despite Indonesia being one of the highest-producing palm oils in the world, at present, has not created a single flight that uses bio-jet fuels in daily operations and flights. There have only been a few airlines set firm that have plans to substitute their fuel in the future. There has also been no regulation put forward that mandates flight firms to use SAF.[35]

Indonesia has begun implementing tests and research on SAF. However, bio-jet fuel development in Indonesia is still in the pilot phase by the national airline, Garuda Indonesia, while Pertamina Indonesia's state-owned oil company is still currently demonstrating the feasibility of using biofuel on regular flights.[36] Pertamina has initiated a collaboration with the *Institut Teknologi Bandung* (ITB) by producing a 2.4% biofuel mixture composition in the form of J2.4 fuel. The fuel, which is made from palm kernel oil and red and white catalyst, has been flight-tested using a CN-235 aircraft.[37]

After being tested, the results did not meet the target set in *Permen* on *Energi dan Sumber Daya Manusia* or ESDM Number 12 of 2015 concerning the third Amendment to the Regulation of the Minister of Energy and Mineral Resources Number 32 of 2008 concerning the Provision, Utilization and Trade Administration of Biofuels as Other Fuels. The target that was set was a percentage of mixture for biofuels to reach 5% in 2025 was not achieved. Additionally, biofuel J2.4 has not yet achieved the SAF criteria certification recognized by ICAO. Hence, may not be considered as SAF.

[33] Badan Kebijakan Transportasi Kementrian Perhubungan, *Dukungan Implementasi SAF di Indonesia*, accessed on 17 May 2023, https://baketrans.dephub.go.id/berita/dukungan-implementasi-saf-di-indonesia

[34] Pavlenko N, " *An assessment of the policy options for driving sustainable aviation fuels in the European Union"* in *Supporting Clean Energy in the ASEAN: Policy Opportunities from Sustainable Aviation Fuels Initiatives in Indonesia and Malaysia* , p . 4.

[35] Badan Kebijakan Transportasi Kementrian Perhubungan, *Dukungan Implementasi SAF di Indonesia*, accessed on 17 May 2023, https://baketrans.dephub.go.id/berita/dukungan-implementasi-saf-di-indonesia

[36] Pavlenko N, " *An assessment of the policy options for driving sustainable aviation fuels in the European Union"* in *Supporting Clean Energy in the ASEAN: Policy Opportunities from Sustainable Aviation Fuels Initiatives in Indonesia and Malaysia* , p . 4.

[37] Badan Kebijakan Transportasi Kementerian Perhubungan, *Dukungan Implementasi SAF di Indonesia*, accessed on 17 May 2023, https://baketrans.dephub.go.id/berita/dukungan-implementasi-saf-di-indonesia

Starting from January 2021, Indonesia voluntarily participated in the Carbon Offsetting Reduction Scheme for International Aviation (CORSIA) offsetting requirements pilot phase that was adopted by ICAO to offset international aviation carbon emissions above baseline levels. There is also a domestic carbon market proposal announced in Indonesia called Archipelagic Carbon Scheme (Skema Karbon Nasional) that includes the commercial aviation industry as the market's participant in cutting greenhouse gases. However, this scheme operates on a wholly voluntary basis, meaning that there will be no legal consequences for those who are unwilling to report and certify their GHG emissions. Creating no binding force between aviation forms in using SAF.

The lack of regulation and proper implementation of SAF has been the biggest obstacle in maximizing and reaching the goals of decarbonization. Indonesia has taken the steps to further push forward a new alternative fuel but to no avail. Therefore, today SAF is still in the testing and pilot phase.

CONCLUSION

The concerns set forth within SDG 7, have pushed states to increase the advancement of research and usage of sustainable fuel in all forms of transportation, most particularly within aviation. In fulfilling the goals, aviation organizations, including the ICAO have made it a main priority to further enhance SAF. On an international scale, several international integrations have been made, partnership opportunities are still broadly unexplored. The ICAO has provided recommendations and thresholds on the minimum requirement of a drop-in fuel that may be considered an SAF. However, the ability of ICAO to implement and regulate SAF is limited. Domestic regulations fall solemnly on each sovereign State's right. It must be the commitment of each State to take the step of decarbonizing. Especially, in the field of finding and creating obligations on environmentally friendly alternative fuels.

Indonesia has attempted to implement and regulate a more sustainable alternative source of fuel. It may be seen in Indonesia's attempt to pursue a strategy to use aviation biofuels by mandating national rules to incorporate the use of bio-jet fuel. The attempt was planned to be enacted from 2% bio-jet fuel in 2016 and 5% in 2025. However, this attempt did not reach its goal and is still far behind from requirements of SAF in ICAO.

Here, Indonesia has a command-and-control approach by enacting SAF mandates. however, it is not accompanied by a comprehensive assessment to create an eligibility framework for reaching the targeted share. Hence, through recommendations from ICAO that are continuously progressing, as well as technology and research that is growing in the field of SAF, Indonesia has to further increase the implementation of SAF.

ACKNOWLEDGMENT

The writers thank the Faculty of Law, Universitas Diponegoro, Semarang - Indonesia for the financial support in doing the research and publication of this article.