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REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL

The ReFuelEU Aviation SAF flexibility mechanism

Contents

1 Introduction

The Communication from the Commission on the European Green Deal [1] sets out the targets of reducing greenhouse gas (GHG) emissions in transport by at least 90% by 2050 compared with 1990, and ramping up the production and deployment of sustainable alternative transport fuels. Sustainable aviation fuels (SAF) are recognised as the biggest contributor to any short- to long-term approach to reducing global aviation CO_2 emissions. This is also reflected in the discussions and measures taken internationally by the International Civil Aviation Organisation (ICAO). In this context, the European Union has adopted Regulation (EU) 2023/2405 [2] (ReFuelEU Aviation). ReFuelEU Aviation aims to decarbonise the aviation sector by mandating the supply of aviation fuels containing an increasing minimum share of SAF [3] – blended SAF – in all Union airports falling within the scope of the ReFuelEU Aviation [4], while avoiding potential distortions in the aviation internal market. The EU is leading the way globally in the deployment of SAF. ReFuelEU Aviation exploits the EU's greatest strength: its internal market – particularly regarding the provision of air services – which is one of the most integrated and most efficient markets in the world and key to the EU's global competitiveness. It sets out harmonised obligations, definitions and penalties throughout the EU preserving the level playing field. It is also consistent with the long-term global aspirational goal (LTAG) for international aviation of net-zero carbon emissions by 2050, which was adopted in 2022 by the 41st ICAO Assembly and with the ICAO aspirational goal of 5% GHG international aviation emissions reduction by 2030 agreed during the CAAF/3 [5] in 2023.

ReFuelEU Aviation contributes to achieving the EU's climate goal, which was set by the European Climate Law, of becoming climate-neutral by 2050. In this vein, it is expected that ReFuelEU Aviation alone will help reduce aviation's CO_2 emissions in the EU by at least 60% by 2050, with additional potential spillovers such as improving local air quality (notably around airports) and profiting from the lower non-CO_2 emissions the use of blended SAF entails, notably to reduce the impact of contrails. The SAF market is still in the early creation stage. However, ReFuelEU Aviation's entry into force has already boosted the current momentum of investment in SAF production in the EU[6] and significantly contributed to solving the 'chicken and egg' situation regarding SAF supply and demand. ReFuelEU Aviation will be the key element in overcoming the EU's challenge in widely deploying SAF, since: it allows for the free movement of these new aviation fuels in the internal market; opens new markets and opportunities; and introduces digital reporting tools and targeted flexibility to make life easier and faster for companies and investors. The aviation sector's transition to blended SAF benefits not only the climate but also the EU's economy. The regulatory certainty provided by ReFuelEU Aviation will unlock investment in new SAF production plants and increase the EU's strategic energy supply autonomy due to the variety

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1588580774040&uri=CELEX%3A52019DC0640
[2] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32023R2405
[3] 'SAF' here refers to the synthetic blend component (SBC). This is a synthetic product manufactured and certified according to ASTM D7566. SBC is equivalent to SAF that is not blended with conventional aviation fuel.
[4] See Article 3(1) of ReFuelEU Aviation.
[5] https://www.icao.int/Meetings/CAAF3/Pages/default.aspx
[6] European Union Aviation Safety Agency (EASA), *State of the EU SAF market in 2023*, 2024 - https://www.easa.europa.eu/en/domains/environment/refueleu-aviation/eu-saf-market-report.

of SAF feedstock and production pathways that can be produced in the EU. This objective is supported by the Clean Industrial Deal announced by President von der Leyen and the future Sustainable Transport Investment Plan referred in the mission letter [7] to the Commissioner for Sustainable Transport and Tourism, Apostolos Tzitzikostas. ReFuelEU Aviation sets uniform minimum levels for the supply share of blended SAF at EU level, thus creating a level playing field between aviation economic operators. It also sets out a path for the EU to seize the opportunity created by the aviation sustainable transition to strengthen its energy security and reinforce the industry in all Member States.

It is worth noting that ReFuelEU Aviation's obligatory minimum supply requirements only cover blended SAF. The existing aviation fuel quality standards do not allow SAF to be supplied and used in an aircraft without them first being blended with conventional aviation fuel [8]. Equally, ReFuelEU Aviation does not set a minimum obligatory level of uptake of blended SAF by aircraft operators. Aircraft operators and aviation fuel suppliers are free to decide on the amount of blended SAF they wish to trade in the market – provided that aviation fuel suppliers comply with the minimum obligatory supply shares of blended SAF and that aircraft operators comply with the refuelling obligation set in ReFuelEU Aviation, each year and at each Union airport.

By way of exception, the SAF flexibility mechanism, for the period 2025-2034, allows aviation fuel suppliers to supply the minimum shares of SAF as a weighted average over all the aviation fuel it supplied across all Union airports in a given year. From 2035 onward, however, all aviation fuel supplied in Union airports must be blended SAF. Conventional aviation fuel will therefore no longer be available at Union airports. The SAF flexibility mechanism is intended to give the SAF industry, and in particular aviation fuel suppliers, sufficient time to scale up its production and supply capacities. It will also allow aviation fuel suppliers to meet their obligations cost-effectively and without having to reduce the overall environmental ambition of ReFuelEU Aviation.

This report maps the developments in SAF production and supply on the EU's aviation fuel market. It also presents the findings of the Commission services' monitoring of the implementation of the SAF flexibility mechanism during these very early stages of ReFuelEU Aviation's application, as required by Article 15(2) of ReFuelEU Aviation. For this purpose, an external support study [9] has also been carried out.

Chapter 2 provides an overview of the current EU market for conventional as well as sustainable aviation fuels. Chapter 3 covers the functioning of the SAF flexibility mechanism in more detail and analyses its expected consequences for the relevant stakeholders impacted by ReFuelEU Aviation. Chapters 4 and 5 explore potential improvements and additional measures to the SAF flexibility mechanism, with a view to further facilitating the supply and uptake of SAF at Union airports, as required by Article 15(2) of ReFuelEU Aviation. This analysis includes assessing the implementation or recognition of a SAF accounting mechanism. It addresses both the traceability and the tradability of SAF under the EU legislative framework that could enable aviation fuel

[7] https://commission.europa.eu/document/de676935-f28c-41c1-bbd2-e54646c82941_en
[8] Such standardisation work is ongoing to allow 100% SAF in the future. See Annex 1 for the current blending limits.
[9] Guidehouse, *Assessment of the production and supply of SAF in Union airports and study on the feasibility of the creation of a system of tradability of SAF in the EU*, 2024.

supply in the EU without it being physically connected to a supply site. Chapter 6 summarises the findings and sets out some recommendations from the Commission on the way forward.

2 Overview of the EU's aviation fuel market

Article 3(6) of ReFuelEU Aviation defines 'aviation fuel' as a drop-in fuel manufactured for direct use by aircraft. In the EU, Jet A-1 is produced and delivered according to the fuel quality standard used for aviation turbine fuels set by DefStan 91-091 [10]. This standard covers almost 100% of total aviation turbine fuel consumption in the EU.

The fuel quality standards for the various production pathways of SAF are set by ASTM International under ASTM D7566 [11] and are adopted in DefStan 91-091. Eight SAF pathways (ASTM D7566) and three SAF co-processing pathways (ASTM D1655 [12]) have already been qualified and approved. Both standards (DefStan 91-091 and ASTM D1655) describe the quality specifications for the aviation turbine fuels to be used in commercial aviation. ASTM D7566 sets out different quality specifications for each of the SAF production pathways as well as the requirements for blended SAF. Once both the SAF and the conventional aviation fuels are certified, the blend of both may take place while taking into consideration the blending requirements for each type of SAF pathway [13]. Once blended, the blended SAF must undergo another fuel quality check to prove conformity with the ASTM D7566 blending requirements. If this check is passed, then the SAF blend is declared as DefStan 91-091 fuel and it can then be used in an aircraft.

Article 3(7) of ReFuelEU Aviation defines SAF as 'aviation fuels that are either synthetic aviation fuels, aviation biofuels or recycled carbon aviation fuels. These types of fuels are further defined in Article 3(12), 3(8) and 3(9) of ReFuelEU Aviation respectively. They all stem from Directive (EU) 2018/2001 [14] (the RED). Aviation fuel suppliers can also decide to comply with the minimum shares of SAF and synthetic aviation fuels using renewable hydrogen for aviation and low-carbon aviation fuels as defined in Article 3(16) and 3(18) of ReFuelEU Aviation respectively. Regarding ReFuelEU Aviation, hydrogen for aviation is not defined as an aviation fuel because it is not a drop-in fuel manufactured for direct use by aircraft. Hydrogen for aviation is to be used in next-generation aircraft that leverage innovative propulsion technologies. This report only addresses fuels defined as SAF in the Regulation.

2.1 Conventional aviation fuel in the EU

The EU currently has 77 refineries in 21 Member States that refine crude oil. Conventional aviation fuel typically represented around 9% of their total production output in 2022. In that same year, the EU relied on net imports for more than 97% of its crude oil consumption [15], which illustrates the high dependence on non-EU countries for aviation fuels supply.

[10] Defense Standard 91-091: Turbine Fuel, Kerosene Type, Jet A-1; NATO Code: F-35; Joint Service Designation: AVTUR - https://www.dstan.mod.uk/StanMIS/DefStan/Edit/8707.
[11] Standard Specification for Aviation Turbine Fuel Containing Synthesized Hydrocarbons – https://www.astm.org/d7566-22.html. See also Annexes 1 and 2.
[12] Standard Specification for Aviation Turbine Fuels – https://www.astm.org/d1655-22a.html.
[13] See Annex 2.
[14] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02018L2001-20231120
[15] Eurostat (2024) – https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Oil_and_petroleum_products_-_a_statistical_overview&oldid=315177.

Most of the refineries in the EU are located on the coast or close to waterways [16]. A refinery's location, the distance to the airports for which it produces conventional aviation fuel and the mode of transport used to deliver the fuels have an impact on the supply chain. This can ultimately have an impact on the price of aviation fuel at airports in the EU.

The price of aviation fuel also depends greatly on the fuel procurement arrangement made by aircraft operators. The most common commercial arrangement is for an aircraft operator and an aviation fuel supplier to sign a fuel supply agreement (FSA). This may for example be based on IATA's Aviation Fuel Supply Model Agreement [17], which sets out the general framework and terms and conditions for the sale and purchase of fuel. The parties must also agree specific terms for each location (i.e. airport) where fuel is supplied. Each location agreement (annexed to the FSA) specifies the fuel quality, quantity, price and other key terms. The price of conventional aviation fuel in the EU can vary significantly (as demonstrated by EUROCONTROL in 2019) [18].

Some aircraft operators have established a self-supply entity which procures aviation fuel from aviation fuel producers or other traders and then sells it to the aircraft operating entity. In some specific cases, the self-supply entity is the same legal entity as the aircraft operating entity. ReFuelEU Aviation allows for a given legal entity to bear several obligations.

Findings from the Airport Survey [19] conducted by Guidehouse in the context of the support study show that most airports have between one and five aviation fuel suppliers operating on their premises. A significant number of airports have only one or two aviation fuel suppliers. Different airports have different aviation fuel-supply rights-granting procedures (e.g. a tender procedure or a stake in the ownership of the airport fuel storage facility). On average, airports where aviation fuel supply rights are granted through a tender typically have fewer aviation fuel suppliers because such tenders often award exclusive aviation fuel supply rights to one or just a few aviation fuel suppliers for a number of years.

2.2 Sustainable aviation fuels in the EU

2.2.1 Production and supply of SAF

SAF production capacity in the EU reached only 0.3 million tonnes (Mt) in 2023 [20]. This represents around 0.6% of the EU aviation sector's fuels consumption and demonstrates a market failure when it comes to acquiring SAF. The market on its own was unable to scale up the production and supply of SAF and blended SAF which are vital for the future of the sector. However, since the entry into force of ReFuelEU Aviation in November 2023, the forecasted EU production, blending and supply capacities for aviation biofuels have been quickly ramping up, reaching levels above the minimum SAF blending obligatory share for aviation biofuels to be supplied until 2030. This

[16] Energy and Industry Geography Lab - https://energy-industry-geolab.jrc.ec.europa.eu/
[17] IATA - https://www.iata.org/en/programs/ops-infra/fuel/
[18] EUROCONTROL, *Fuel Tankering: economic benefits and environmental impact*, 2019 - eurocontrol-think-paper-1-fuel-tankering.pdf.
[19] Guidehouse, *Assessment of the production and supply of SAF in Union airports and study on the feasibility of the creation of a system of tradability of SAF in the EU*, 2024.
[20] European Union Aviation Safety Agency (EASA), *State of the EU SAF market in 2023* - https://www.easa.europa.eu/en/domains/environment/refueleu-aviation/eu-saf-market-report.

permits a cautiously confident look regarding the achievement of the EU's uniform targets until 2034 for these fuels. As shown in a recent report published by the European Union Aviation Safety Agency (EASA) on the state of the EU SAF market, SAF production capacity in the EU reached around 1.2 Mt in 2024. For reference, 2% of the total aviation fuel consumption at Union airport in 2025 is expected to be equivalent to around 0.9 Mt. EASA's analysis of the existing and announced EU SAF production projects also shows that, in a realistic scenario, the EU SAF production capacity in 2030 should amount to 3.2 Mt. However, the production capacity of advanced biofuels in the EU remains limited. As shown in a recent report published by DG RTD [21], the feedstock base for lignocellulosic materials, used in advanced biofuels production, is substantially broader than that for used cooking oil. Thus, advancing technologies that process lignocellulosic materials to market maturity is critical for achieving high biofuel production volumes in the future.

Greater uncertainty remains about the level of investment of aviation fuel producers in synthetic aviation fuel production plants in the EU to ensure the achievement of their dedicated minimum share (0.7%) and dedicated average share (1.2%) between 2030 and 2032. The SAF market is quickly evolving, and aviation fuel producers based in the EU have announced projects that have sufficient planned capacity to allow them to meet their obligations regarding synthetic aviation fuels in ReFuelEU Aviation by 2034. However, at the time of this Communication, none of the announced projects have yet secured a final investment decision. There is nevertheless still enough time for those plants to become operational and many different economic operators are actively discussing the matter. It would be premature to conclude that there is possible scarcity regarding the synthetic aviation fuel sub-target for 2030-2032. This market segment requires close monitoring and possible further support in the context of the announced Clean Industrial Deal and Sustainable Transport Investment Plan.

EASA's report on the *State of the EU SAF market in 2023* highlights a notable geographic concentration of EU SAF production facilities in specific regions and Member States at this early stage. This contrasts with the more dispersed nature of conventional refineries. The Netherlands has the largest announced production capacity by 2030 with an estimated 1.6 Mt of SAF produced each year. Spain, France, Finland and Sweden have several planned and under-construction facilities that employ diverse production pathways. Conversely, many central and eastern European Member States (e.g. Bulgaria, Latvia and Hungary) currently lack any SAF production capacity, whether already operational or merely announced. 12 Member States currently have operational or announced SAF production capacity. They are all among the 21 Member States that have conventional aviation fuel refining capacity. This disparity between western and eastern Member States is even more pronounced for synthetic aviation fuel production initiatives [22]. The announced synthetic aviation fuel production projects are all located in Denmark, France, Germany, the Netherlands, Portugal, Spain and Sweden. Further developments in the EU SAF

[21] DG RTD, *Development of outlook for the necessary means to build industrial capacity for drop-in advanced biofuels*, 2024 - https://op.europa.eu/en/publication-detail/-/publication/b1c97235-c4c3-11ee-95d9-01aa75ed71a1.
[22] Transport & Environment (T&E), *E-fuels for planes : with 45 projects, is the EU on track to meet its targets*, 2024 - https://www.transportenvironment.org/articles/e-fuels-for-planes-with-45-projects-is-the-eu-on-track-to-meet-its-targets.

production capacity will be reflected in the yearly technical reports of EASA required under Article 13 of ReFuelEU Aviation.

The variation in the Member States' existing SAF production capacities can be attributed to a range of factors, including the current availability of certain feedstock (e.g. used cooking oil, forestry residues and renewable electricity) and their price competitiveness as well as the investment environment in each Member State. Consequently, and based on the announcements made so far, the SAF production landscape in the early stages of ReFuelEU Aviation implementation and up to the date of this report varies considerably across the EU and differs from the production landscape of conventional aviation fuel. However, the fact that the SAF production landscape seems even more concentrated than the production of conventional aviation fuels in the EU is not a cause for concern *per se*. All 27 Member States are supplied with conventional aviation fuels today, even those with no refining capacity, and the SAF market is still in its early stages.

Despite the geographic concentration of SAF production facilities in some Member States, findings from the Airport Survey conducted by Guidehouse indicate that blended SAF are already being supplied to a broader geographic area. Furthermore, a substantial proportion of the surveyed airports that do not currently have a blended SAF offering are planning to make it available soon. This trend points towards an expected significant expansion of the geographic scope of blended SAF supply in the coming years, in line with the geographic scope of ReFuelEU Aviation. This also demonstrates the readiness of the industry and particularly the involvement of airport managing bodies in decarbonising aviation.

Blended SAF and conventional aviation fuel have different feedstock procurement and production pathways, but they have the same supply chains. As mentioned above, SAF must be blended with conventional aviation fuel in order to meet ASTM D7566 blend requirements and must be declared as Jet A-1. Because of safety reasons [23] and except for small volumes, DefStan 91-091 [24] currently recommends that the blending takes place upstream of the airport fuel storage depot. As the SAF industry grows, blending infrastructure will probably develop in synergy with the existing highly complex infrastructure network for conventional aviation fuel. This could be a subject for further research.

Once blended and certified, the blended SAF can use the same distribution infrastructure as conventional aviation fuel. This includes not only shipping and trucking but also interconnected infrastructure as defined by Implementing Regulation (EU) 2022/996 [25], which allows liquid fuels to be transported through pipeline networks (e.g. NATO-CEPS [26] and the Exolum Pipeline System [27]) using a mass-balance distribution approach [28]. Interconnected infrastructure will play a crucial role in the distribution of blended SAF. The fact that a large share of the aviation internal market is currently supplied through a network of pipelines makes the mass-balance approach a

[23] Blending SAF with fossil kerosene requires trained personnel and dedicated facilities. Having the blending step outside the airport limits the risk of off-spec fuels entering an aircraft.
[24] DEF STAN 91-091 - https://www.jig.org/documents/defstan-91-091-issue-15/
[25] https://eur-lex.europa.eu/eli/reg_impl/2022/996/oj
[26] https://www.nato.int/cps/en/natohq/topics_49151.htm
[27] https://exolum.com/en/
[28] Article 30 of the RED.

very efficient and cost-effective way of ensuring that blended SAF can reach many airports that are currently beyond the bigger hubs and fuel infrastructure managers should not raise administrative, procedural or any other kind of barriers to entry to render more difficult or prevent the supply of blended SAF through their interconnected infrastructure (e.g. fuel pipeline). Both the obligation to physically supply all Union airports with blended SAF by 2035 and the clear possibility for other airports and aircraft operators to opt into the scope of ReFuelEU Aviation provide aviation fuel producers and suppliers with the necessary legal certainty and time to ensure the provision of blended SAF instead of conventional aviation fuels throughout all their current networks.

2.2.2 Supporting measures

On top of the regulatory certainty provided by the adoption of ReFuelEU Aviation, the Commission has put in place several supporting measures (described below) to help increase the availability of SAF inside and outside the EU; de-risk investments in SAF production in the EU; and narrow the price gap between SAF and conventional aviation fuel.

Regulation (EU) 2024/1735 (The Net-Zero Industry Act) [29] lists sustainable alternative fuels (which include both sustainable aviation and maritime fuels) among the net-zero technologies. NZIA creates a regulatory framework to boost the competitiveness of EU industry and to advance technologies crucial for decarbonisation while ensuring strategic resilience. Moreover, the Renewable and Low-Carbon Fuels Value Chain Industrial (RLCF) Alliance [30] was created by the Commission together with industry partners to advance the production and supply of renewable and low-carbon fuels in the aviation and waterborne transport sectors. In 2024, the Alliance launched its project pipeline [31] to help the industry in matchmaking with partners up-stream and down-stream, as well as connecting with potential finance providers.

Both Horizon Europe and the Innovation Fund have provided grants to support SAF technology maturity. So far, 73 projects related to sustainable aviation fuels were funded under Horizon Europe with a budget of about EUR 400 million. Of these, 37 projects and EUR 210 million are directly related to the aviation end fuel product. The Innovation Fund has already awarded more than EUR 206 million to two projects producing sustainable aviation fuels, one focusing on synthetic aviation fuel production.

The EU further supports SAF deployment through blended finance. The European Investment Bank (EIB) is providing a EUR 120 million loan to Repsol to support the construction and operation of an advanced biofuels production plant in Spain [32]. The bank also signed, with the support of the InvestEU programme, a EUR 285 million loan with Moeve for the construction of

[29] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L_202401735
[30] https://transport.ec.europa.eu/transport-themes/clean-transport/alternative-fuels-sustainable-mobility-europe/renewable-and-low-carbon-fuels-value-chain-industrial-alliance_en
[31] https://rlcf-alliance-platform.converve.io/pipeline_front.html
[32] https://www.eib.org/en/press/all/2022-551-repsol-and-the-eib-sign-a-eur-120m-loan-agreement-to-finance-the-first-advanced-biofuels-plant-in-spain

another advanced biofuels plant in Spain [33]. Moreover, SAF is eligible under the EU–Catalyst partnership. This public-private partnership, bringing together the Commission, the European Investment Bank (EIB) and Breakthrough Energy Catalyst, plans to mobilise up to EUR 840 million between 2023 – 2026 to accelerate the deployment of and rapidly commercialise innovative technologies that will help deliver on the European Green Deal ambitions[34].

Hydrogen can be used directly as a sustainable fuel in zero-emission aircraft or as feedstock in the production of SAF, notably of synthetic aviation fuels but is also an elementary component of the transition of the energy system. R&I investment in hydrogen is therefore correspondingly higher. The EU has, through the three most recent R&I programmes, initiated 776 projects related to hydrogen technology since 2007 with more than EUR 2.9 billion allocated. A strong increase in the amount of support provided was observed in 2023 [35].

The financial support provided under Directive 2003/87/EC (EU ETS) [36] through the zero-rating[37] of SAF and the additional support for uplift of eligible fuels [38] helps to narrow the price difference between conventional aviation fuels and SAF for aircraft operators. 20 million allowances (EUR 1.6 bn at an allowance price of EUR 80) have been reserved to cover some, or all, of the price gap between conventional fossil fuels and eligible alternative aviation fuels uplifted from January 2024. It is important to note that only fuels used on flights covered by ETS compliance obligation will be supported [39].

The Commission also provides technical support on SAF production to Member States through the Technical Support Instrument (TSI). For example, on their request, Estonia and Latvia will receive technical support to enhance SAF industrial capabilities, including through a SAF feasibility study, policy recommendations and awareness building. The Commission stands ready to provide further technical support to Member States for the conception, development and implementation of reforms towards safe, smart and sustainable mobility.

Moreover, the EU supports global production of SAF. To this end, the EU is providing EUR 4 million in financial support for feasibility studies and capacity-building in 14 African states and India, under the ACT-SAF programme implemented with ICAO and EASA. The EU has designated SAF as a 2024 Global Gateway Flagship to support the development, production, and use of sustainable aviation fuels. The ACT-SAF project is the starting point for this flagship, with work ongoing to further operationalise the SAF Flagship with new activities and projects.

[33] https://www.eib.org/en/press/all/2024-227-eib-and-cepsa-sign-eur285-million-loan-to-finance-the-construction-of-a-second-generation-biofuels-plant-in-spain
[34] https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_5647
[35] More information: https://op.europa.eu/en/publication-detail/-/publication/b82ce4e0-d215-11ee-b9d9-01aa75ed71a1/language-en/format-PDF/source-324740593.
[36] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02003L0087-20240301
[37] Incentive of approximately EUR 250 per tonne of SAF.
[38] This support is introduced under Article 3c(6) of Directive 2003/87/EC (EU ETS). The aim is to narrow the price difference between conventional aviation fuels and SAF.
[39] More information: https://climate.ec.europa.eu/document/download/9a82627a-8a5c-4419-93de-e5ed2d6248eb_en?filename=policy_ets_allowances_for_saf_en.pdf

2.2.3 Traceability of SAF

Due to the nature of aviation fuels' infrastructure (e.g. pipelines and shared airport tanks), it is difficult to trace the specific molecules of a specific supply from the moment of production and until it reaches the aircraft. This issue of traceability is not unique to SAF blends but it is a common challenge across all blended transport fuels. To address this challenge, the EU has developed the Union Database for Biofuels [40] (UDB), which is an IT system established under Article 31a of the RED. It enables the tracing of liquid and gaseous renewable fuels and recycled carbon fuels even when they become part of a blended fuel. The UDB enables the affected economic operators to decide and verify how sustainable molecules are accounted for and where they are being supplied and used. This will ensure transparency, accountability, and safety throughout the supply chain until the product is released onto the market as either fully sustainable fuels or blended fuels. In accordance with Article 10 of ReFuelEU Aviation, all volumes of SAF supplied to the Union airports must be registered in the UDB by aviation fuel suppliers. Further possible extensions of the scope of the UDB to provide complete traceability on SAF transactions beyond the point of supply are discussed in later chapters of this report.

[40] https://wikis.ec.europa.eu/display/UDBBIS/Union+Database+for+Biofuels+-+Public+wiki

3 The ReFuelEU Aviation SAF flexibility mechanism

To ensure the successful supply of minimum shares of SAF to the aviation market at the EU level while also avoiding local blended SAF supply shortages, ReFuelEU Aviation has introduced a SAF flexibility mechanism for 2025-2034. This mechanism allows aviation fuel suppliers to reach the obligated minimum share of SAF as a weighted average over all the Union airports where they supply aviation fuel. In practice, this means that aviation fuel suppliers may supply aviation fuels containing higher shares of SAF in certain Union airports (provided those are compliant with ASTM 7566 blending requirements) to compensate for aviation fuels containing zero or lower shares of SAF in other Union airports – provided that they supply the minimum total quantity of required SAF blend at the EU level. This flexibility is an option but not an obligation for aviation fuel suppliers. The range of their discretion includes the contractual agreements they may reach with aircraft operators to decide how to best use the provided flexibility. This mechanism is intended to provide the SAF industry, and especially aviation fuel suppliers, with sufficient time to scale up production and supply capacity, while also allowing aviation fuel suppliers to meet their obligations in a cost-effective manner, without reducing the overall environmental ambition of ReFuelEU Aviation. However, it may deprive some airports not supplied with blended SAF of the positive effects of its use on local air quality. The mechanism also makes it easier for Union airports' managing bodies, aviation fuel suppliers and aircraft operators to make the technological and logistical investments in the supply chain that are needed to ensure compliance with the minimum shares by 2035 in each Union airport – especially given that all aviation fuel supplied to Union airports must by then be blended aviation fuels with a significant minimum obligatory share of SAF.

The level of flexibility provided to aviation fuel suppliers under the SAF flexibility mechanism also depends on the interpretation of the definition of 'fuel supplier' in the national legislation transposing the RED, on which ReFuelEU Aviation's definition of aviation fuel supplier relies. Each Member State is responsible for identifying the aviation fuel suppliers whose compliance with the RED and ReFuelEU Aviation requirements they are responsible for ensuring. The Commission services have carried out extensive consultations with Member States on this matter within the framework of the implementation of ReFuelEU Aviation. These consultations have revealed that aviation fuel suppliers are primarily defined at Member State level and that they predominantly operate within their respective jurisdictions (although a few operate in two or more Member States). The Commission services have been informed that fiscal rules may sometimes even require aviation fuel suppliers to have a fiscal residence in a given Member State in order to operate in its territory. This would oblige them to operate through a separate national subsidiary in that Member State. The Commission services will closely look into this and make sure any fiscal requirements comply with the freedom of establishment. ReFuelEU Aviation allows aviation fuel suppliers to operate in multiple Member States under the same legal entity.

ReFuelEU Aviation does not prevent aviation fuel suppliers with difficulties to fulfil their obligations from coordinating with other aviation fuel suppliers that may exceed their obligations. Such coordination could allow those benefiting from surplus of blended SAF at given Union airports to supply blended SAF on behalf of those facing difficulties. This would, however, require

a restructuring of the EU market of aviation fuel suppliers and such coordination might currently be prevented by national legislation or by long-term agreements between aviation fuel suppliers and Union airport managing bodies.

Despite the possibility offered by the transitional flexibility mechanism, aviation fuel suppliers have not expressed any intention of concentrating the supply of blended SAF at a limited number of Union airports. To the contrary, the rules and conditions laid down for aircraft operators when claiming the use of SAF in the EU ETS mean that there is greater incentive on the demand side for most if not all Union airports to be supplied with blended SAF as soon as possible. This interest in supplying as many airports as possible is increased by the fact that the infrastructure for the supply chains of both blended and non-blended aviation fuels is shared, especially during the last stage of the supply chain to the EU's airports. Moreover, and as mentioned in the previous chapter, the use of the mass-balance approach to distributing blended SAF through interconnected infrastructure allows aviation fuel suppliers to reach a large share of Union airports efficiently, cost-effectively and without any additional infrastructure cost.

All these market features considerably restrict opportunities to geographically concentrate the supply of blended SAF in a reduced number of Union airports and it is expected that blended SAF will be supplied in at least one Union airport in each Member State by the beginning of the supply obligations in 2025. They also point towards a quicker spread of the blended SAF in line with the minimum shares of SAF required in ReFuelEU Aviation. The 10-year flexibility period is much longer than the 5-year period initially proposed by the Commission. This factor – combined with the features of the market and the willingness shown by all stakeholders to facilitate the supply of blended SAF – suggest that the flexibility mechanism of ReFuelEU Aviation currently provides aviation fuel suppliers with enough flexibility to meet their obligations. The commitment of public and private investors and aviation fuel producers to speeding up the production of synthetic aviation fuels in the EU remains crucial to achieving this aim.

4 Objectives and industry positions on possible improvements and additional measures to the SAF flexibility mechanism

Article 15(2) of ReFuelEU Aviation requires the Commission to assess and report on possible improvements or additional measures to the existing SAF flexibility mechanism with a view to further facilitating the supply and uptake of SAF during the 10-year flexibility period.

The article differs from the scope of ReFuelEU Aviation in at least three aspects:

- Firstly, it requires the Commission to reflect and report on the tradability of SAF but not on the tradability of aviation fuel that contains shares of SAF (i.e. blended SAF) – as is the case for the supply obligations.
- Secondly, this reflection process must cover the option of 'setting up or recognising a system of tradability of SAF to enable fuel supply in the EU without it being physically connected to a supply site'. In other words, this would be a tradability system for SAF sustainability certificates that could be decoupled from the traceability of their related SAF physical molecules.
- Thirdly, it requires the Commission to reflect on how such a system 'could enable aircraft operators or fuel suppliers, or both, to purchase SAF through contractual arrangements with aviation fuel suppliers and to claim the use of SAF at Union airports'. The Commission is required to take into account the ability of aircraft operators to claim the use of SAF, even though they are not obliged to use minimum shares of SAF under this Regulation.

It is worth noting that, under EU law, each quantity of SAF can be claimed for different purposes by different economic operators. Aviation fuel suppliers can claim the supply of SAF for the purposes of complying with their ReFuelEU Aviation obligations and contributing to the national RED targets. EU law does not prevent a batch of SAF to be certified under more than one certification scheme (e.g. RED, CORSIA certified fuels). Aircraft operators can claim the use of a given quantity of SAF under one greenhouse gas reduction scheme, including the EU ETS and ICAO's CORSIA. They can claim the same quantity of SAF also under the EU Taxonomy or the Flight Emissions Label [41]. However, it is of paramount importance for the robustness, stringency and accuracy of the market that only one aviation fuel supplier and only one aircraft operator can claim any given quantity of SAF respectively.

4.1 Objectives

As required by Article 15(2) of ReFuelEU Aviation, the Commission will assess possible improvements and additional measures to the SAF flexibility mechanism explored in this report with a view to further facilitating the supply and uptake of SAF during the flexibility period. The assessment must include the potential set up or recognition of a system of tradability of SAF to enable fuel supply in the Union without it being physically connected to a supply site.

[41] Established under Regulation (EU) 2024/3170 - https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32024R3170.

The assessment must also consider and preserve the different objectives of ReFuelEU Aviation and of the SAF flexibility mechanism, namely:

- preserving the air transport market's level playing field between economic operators globally and across the EU (e.g. recital 3);
- ramping up the production, supply and uptake of SAF and blended SAF in the EU in line with the regulatory framework and commercial freedom (e.g. recital 2);
- promote industrial opportunities for all EU regions (e.g. recital 47);
- strengthening the EU's energy security of supply and decreasing reliance on non-EU countries (e.g. recital 52);
- allowing Union airports' managing bodies, aviation fuel suppliers and aircraft operators to make the technological and logistical investments needed in order to comply with the physical supply obligations at all Union airports as from 2035 (e.g. recital 45);
- mitigating any risk of double-counting, misuse or fraud of any kind of sustainable certificates that accredit the production and use of a given batch of SAF in the EU (e.g. recital 48).

4.2 Industry positions

An extensive stakeholder consultation process conducted by Guidehouse and the Commission services has allowed the industry to share its concerns and expectations regarding the upcoming obligations under ReFuelEU Aviation and, more particularly, regarding the SAF flexibility mechanism. This consultation made it possible to capture a clear understanding of the various industry positions on key issues. Two stakeholder workshops were organised and many bilateral meetings were held. Moreover, many industry associations and organisations have shared their position papers and technical papers on the potential implementation of a SAF accounting mechanism that could enable virtual trading of SAF certificates between relevant operators. As highlighted in the Guidehouse support study, different parts of the industry (including within the same stakeholder groups) have expressed different and sometimes opposing concerns and expectations, notably regarding the possibility of enabling virtual trading of SAF sustainability certificates. The consultation revealed that there is no unified industry-wide position neither on the design or the necessity of implementing such an accounting mechanism system for the purposes of complying with current blended SAF obligations and of claiming their use under other pieces of EU law, such as the EU ETS.

It is worth noting, however, that there is a broad consensus across the industry regarding two parameters already imposed by ReFuelEU Aviation: (i) any further flexibility through any sort of SAF accounting mechanism would only be relevant while the blended obligatory shares of SAF remain low until 2035; and (ii) a SAF accounting mechanism could only ensure the necessary stringency, robustness and trust if it were to be kept within the boundaries of the EU's territory, in line with the scope of ReFuelEU Aviation.

The main issues captured during the consultation are summarised below in four categories:

- issues related to blended SAF availability at Union airports;
- issues related to SAF price;

- issues related to the transparency and robustness of sustainability claims;
- and issues related to the possibility of trading SAF certificates virtually (either on the supply side or on both the supply and demand sides).

4.2.1 Availability of blended SAF at Union airports

As described in the previous chapter, the introduction of the SAF flexibility mechanism allows aviation fuel suppliers to supply aviation fuel containing higher shares of SAF in certain Union airports to compensate for the supply of aviation fuel with none or lower shares of SAF in other Union airports. Associations of aircraft operators have expressed their concerns regarding the geographic concentration of blended SAF in just few Union airports, arguing that this could potentially create distortions of competition between aircraft operators, notably due to the impact of such geographic concentration on their ability to decarbonise their operations and on the price of aviation fuel.

The Commission finds that the risk of a significant geographic concentration of blended SAF in few Union airports is limited. Firstly (as highlighted in the previous chapter), it appears that most aviation fuel suppliers operate only within the borders of their respective Member State, so the possibility of significant geographic concentration is already largely limited to national markets. Secondly, many Union airport managing bodies have clearly communicated their intention to make blended SAF available in the coming years on their premises. Thirdly, projects for new SAF capacities are appearing in various locations across the EU and can be expected to feed into the existing regional supply chains of blended SAF.

Some aircraft operators have nevertheless expressed concern that enabling virtual trading of SAF certificates through a SAF accounting mechanism could increase their willingness to sign long-term offtake agreements with aviation fuel producers or suppliers, especially for synthetic aviation fuels. Aircraft operators argue that this could enable fuel producers to make a final investment decision regarding the first generation of projects. However, the factors that prevent aircraft operators from signing long-term offtake agreements are multiple and complex. Depending on the circumstances, aircraft operators' appetite to conclude long-term offtake agreements with aviation fuel suppliers may be more related to their own financial situation or to their commercial and business plans for their global and regional networks than to the availability of the fuel itself. It might also depend on their current commercial agreements with their aviation fuel suppliers for the supply of blended SAF at their network of Union airports in order to reduce their carbon-footprint-related costs under the EU ETS and CORSIA.

There is no guarantee that long-term offtake agreements would contain binding commitments from aircraft operators that would be sufficient to make the synthetic aviation fuel projects more bankable. There is also no guarantee that aircraft operators would sign long-term offtake agreements just because they could virtually purchase SAF certificates – given that many other economic and operational considerations are central to such decisions, such as those related to the high costs of SAF and the uncertainty around the evolution of their price, the cyclical aviation market fluctuations and even the level of experience of the procurement teams with those types of new fuels. A mechanism for the aggregation of demand and supply for hydrogen and its derivates

[42] could facilitate conclusion of offtake agreements for synthetic aviation fuels covering the entire investment and commercial maturity of projects. Moreover, as examined in the EIB study on the sustainable liquid fuels [43], the early movers face challenges related to the higher production costs related to the first-of-a kind industrial scale plants. Targeted actions and public support are therefore required to increase the bankability of SAF projects and de-risk investments (particularly for synthetic aviation fuels).

Aircraft operators are not obliged to refuel blended SAF under ReFuelEU Aviation, so the unavailability of blended SAF in some Union airports cannot distort competition. Aircraft operators can secure their access to SAF and demonstrate their willingness to decarbonise their operations through contractual commitments with aviation fuel producers for physical blended SAF deliveries. This would greatly support the development of the EU's SAF market.

4.2.2 Prices of SAF

4.2.2.1 Production and transportation costs of SAF

The price of SAF can have a significant impact on the willingness of aircraft operators to uptake blended SAF – given that fuel costs currently represent between 25% and 30% of their operational costs. In 2023, Price Reporting Agencies (PRA) reported an average price of conventional aviation fuel in north-western European hubs of 816 EUR/tonne. Also in 2023, the average price of aviation biofuels (e.g. hydrotreated esters and fatty acids (HEFA)) in the EU was reported to be equal to 2 768 EUR/tonne. Considering the current unavailability of synthetic aviation fuels on the market, EASA has developed and applied a bottom-up levelized cost of production estimation-based methodology to determine the minimum fuel selling price of such fuels [44]. Depending on the source of CO_2 used in the production process, the production cost of synthetic aviation fuels is currently estimated to range between 6 600 EUR/tonne to 8 700 EUR/tonne. The high price range is explained by the many challenges faced by the production of such fuels, such as the cost and availability of renewable electricity as well as the cost and availability of eligible CO_2.

When translated into the average blends required in 2030, the impact assessment [45] for ReFuelEU Aviation estimated a fuel cost increase for aircraft operators of 3.3% and a consequent increase in the ticket price of less than 1%. However, due to the SAF flexibility mechanism, the actual blends (e.g. level of blended SAF) may be much higher in some locations and much lower (or even zero) in other locations. In addition, aviation fuel suppliers' pricing policies may differ, between suppliers and between airports. It has been observed in past SAF mandates (e.g. in France), before ReFuelEU Aviation entered into force, that aviation fuel suppliers sometimes charge the same average SAF premium fee to all aircraft operators, regardless of where the blended SAF is physically supplied and of which aircraft operator will actually receive it. Such a pricing strategy

[42] https://energy.ec.europa.eu/topics/energy-systems-integration/hydrogen/european-hydrogen-bank/pilot-mechanism-support-market-development-hydrogen_en
[43] EIB, *Financing sustainable liquid fuel projects in Europe: Identifying barriers and overcoming them*, 2024 – https://www.eib.org/attachments/lucalli/20240101_financing_sustainable_liquid_fuel_projects_in_europe_en.pdf
[44] EASA, *State of the EU SAF market in 2023*, 2024.
[45] Study supporting the impact assessment of the ReFuelEU Aviation initiative – https://op.europa.eu/en/publication-detail/-/publication/46892bd0-0b95-11ec-adb1-01aa75ed71a1.

could result from the scarcity of SAF on the market and the absence of a centralised traceability tool, such as the UDB. Such a distribution of additional SAF costs between all aircraft operators is expected to create competitive distortions among aircraft operators – especially when one considers that the benefits of using SAF (e.g. the EU ETS benefits or the Flight Emissions Label) can only be claimed by those to whom SAF is physically delivered. Similar consequences are expected to be observed if aviation fuel suppliers decide to artificially increase the price of conventional aviation fuel for all aircraft operators to reduce the price gap for those aircraft operators supplied with the blended SAF. Commercial practices intended to artificially increase the price of conventional aviation fuel for all aircraft operators in order to reduce the burden on those getting the physical SAF – and claiming the economic benefits linked to its use – would distort the level playing field and therefore would amount to unfair commercial practices. The Commission services will pay particularly close attention to any complaints in this regard and take them into account in any possible future evaluation and impact assessment of ReFuelEU Aviation. The ramping-up of SAF production in the EU coupled with the implementation of the UDB, which will trace eligible fuels under ReFuelEU Aviation, should prevent aviation fuel suppliers from applying unfair or distortive pricing strategies.

Aircraft operators have often expressed concerns about the high prices of SAF and the impact of ReFuelEU Aviation on their costs of operation. The scarcity of SAF on the market and their high prices were precisely singled out as drivers that justified the regulatory intervention of ReFuelEU Aviation. The goal of ReFuelEU Aviation is to scale up the supply and uptake of SAF through increased shares of SAF in aviation fuel. As shown in Chapter 2, the supply obligations provide the market certainty needed to trigger new SAF production and supply capacities and allow the creation of a more liquid market for SAF. The increase in scale will lead to economies of scale, production efficiencies and industrial maturity that are expected to reduce the prices of SAF and consequently the relative price of blended SAF throughout the EU market. ReFuelEU Aviation will ensure a level playing field where both aircraft operators and Union airports can compete to maintain the right level of connectivity at affordable prices for all EU regions. Moreover, on top of benefiting from the zero CO_2-rating under the EU ETS, the use of SAF will also benefit until 2030 of the 20 million allowances reserved for the uplift of eligible aviation fuels that will help to kick-start the market.

Many aircraft operators have nevertheless claimed that enabling virtual trading of SAF certificates could further decrease the prices of SAF by concentrating even further the supply in a small number of Union airports and could thus reduce logistics costs. The geographical concentration of SAF supply could potentially reduce transportation costs in a few Union airports that are located far from any SAF blending or production facility and are not linked to any interconnected infrastructure, but it is likely that the current conventional aviation fuel prices at such airports are already higher due to similar supply-chain challenges. A further analysis of concrete cases is needed to demonstrate the alleged added difficulties and increases in costs that a blended SAF supply could entail. Neither external consultants nor the Commission services themselves have been able to gather any data substantiating a significant increase of the fuel price attributable to the transport of SAF. In addition, and as mentioned in Chapter 3, ReFuelEU Aviation does not prevent aviation fuel suppliers experiencing difficulties in accessing blended SAF from

coordinating (as far as is legally permissible) with aviation fuel suppliers that have easier access to blended SAF, in order to benefit from their supply rights at given Union airports and supply blended SAF in their place. Lastly, the geographic concentration of blended SAF at just a few Union airports might slow down necessary investment (for instance, in the development of new SAF production and blending facilities throughout the EU) that would ensure the fulfilment of the uniform blended shares requirement at all Union airports as from 2035.

Virtual trading of SAF sustainability certificates may bring new dynamics to the market on the demand side, but it is not clear whether this would have any real impact on the production side at this early stage. The possibility that prices may fall quicker than expected during the first years of the supply obligations may discourage aircraft operators -very sensitive to fuel-related operational costs- into entering long-term offtake agreements today, for fear of finding themselves at a competitive disadvantage compared to late movers. Uncertainty regarding SAF production costs and SAF prices, notably for synthetic aviation fuels, seem to carry a greater risk of leading to a lack of commitment from the demand side to engage into long-term offtake agreements than the availability of the fuels themselves by 2030. In a virtual market, aircraft operators with higher financial capacity to sign long-term offtake agreements may secure larger amounts of SAF at better prices – while other aircraft operators may struggle with paying higher prices for the remaining SAF in the market or may be obliged to buy it through intermediaries, in the current context of SAF and synthetic aviation fuel scarcity.

From the supply side – particularly but not only for synthetic aviation fuels – the biggest challenge faced by the industry seems to be the delay of final investment decisions (FIDs) for the fuel production projects related to the offtake challenge rather than technical or technological challenge. Fossil fuel producers still seem to keep prioritising investments in the less risky area of current fossil fuel technologies. At the same time, small synthetic aviation fuel producers are struggling to scale up their operations because they cannot find investors ready to assume the higher first-mover risks in a market where the range of price uncertainty is too large to make long-term offtake agreements attractive on the demand side. Moreover, some fossil fuel producers have recently halted or delayed their publicly announced investment in aviation biofuels. The fact that the expected price of HEFA-based fuels may only be double – instead of triple – the current price of conventional aviation fuel (as some projections may have wrongly assumed) may have impacted their decisions. Other possible reasons mentioned by the industry for the delay in first final investment decisions (FIDs) for synthetic aviation fuel production facilities may be related to the lack of clarity regarding any possible public support to help de-risk early movers' decisions on the demand and/or supply sides, and the uncertainty regarding the scale of the national penalty schemes not yet adopted by the Member States [46].

Stakeholders have not been able to demonstrate how a virtual market could help solve these financial and commercial obstacles and how it could stimulate the production of SAF more than

[46] In the absence of a synthetic aviation fuel market, the hypothetical price and level of penalties are to be calculated on the basis of a bottom-up production cost estimation. These costs can be up to four times greater depending on the assumptions. This means that investors do not yet know what would be the impact that penalties may really have on financial decisions.

the policy framework already in place. Close monitoring of the market and the effectiveness of the support measures is necessary. Further public support to de-risk first movers' investments (on either or both demand and supply sides) may be considered to unlock the current impasse on investments.

4.2.2.2 Market position of aviation fuel suppliers

Several aircraft operators have expressed concerns about the market position of aviation fuel suppliers at Union airports and their capacity to impose higher shares of blended SAF than required by ReFuelEU Aviation or to impose significantly higher prices for aviation fuels (with or without supplying SAF blends). These aircraft operators argue that the high level of concentration (and in some cases the monopolistic nature of the aviation fuel market) combined with the legal obligation to refuel [47] force them into unequal commercial relationships with aviation fuel suppliers, resulting in higher prices of blended SAF. Some of these aircraft operators see the implementation of a virtual market for SAF sustainability certificates as an opportunity to decrease their current reliance on local aviation fuel suppliers and thus improve the balance in negotiating power between the two sets of economic operators.

The Commission could only gather indirect information on a small number of airports in two Member States, where only one or two aviation fuel suppliers are operating and where agreements between airport managing bodies and aviation fuel suppliers might have led to such a situation. It is, however, unclear how a SAF accounting mechanism could mitigate these concerns – given that aircraft operators are in any case required by Article 5 of ReFuelEU Aviation to uplift a minimum amount of aviation fuel when departing from a Union airport and are therefore already required to source physical aviation fuels from such an airport. In any event, all market participants (including aircraft operators) are entitled to inform the authorities (e.g. the Commission and national competition and regulatory authorities) of any market behaviour by other participants that they believe to be in breach of EU or national competition law, including in relation to the obligation to refuel minimum quantities under Article 5.

Union airport managing bodies must comply with their obligation under Article 6(1) of ReFuelEU Aviation to facilitate to aircraft operators the access to aviation fuels containing the minimum shares of SAF. If a Union airport managing body fails to comply with that obligation (either by blocking the supply of blended SAF or by imposing the supply of blend levels higher than the legal obligation), aircraft operators may, as provided for in Article 6(2) of ReFuelEU Aviation, report to the competent authorities their difficulties in accessing aviation fuels that contain the minimum shares of SAF required by ReFuelEU Aviation.

4.2.3 Increased transparency and robustness of claims, including for the voluntary market

Aircraft operators and Union airport managing bodies have highlighted a lack of transparency regarding the supply of blended SAF in the EU market. They state that they have difficulties in collecting the relevant documentation needed to claim the benefits associated with the use of SAF

[47] Article 5 of ReFuelEU Aviation.

and even in collecting documentation to prove that they are being supplied with blended SAF. They argue that such a lack of transparency may reduce the efficiency of the incentives provided for the use of SAF under current EU law.

Article 9(2) of ReFuelEU Aviation requires aviation fuel suppliers to provide, free of charge, the information that aircraft operators need in order to meet their reporting obligations under ReFuelEU Aviation or under a greenhouse gas scheme (e.g. the EU ETS, ICAO's CORSIA). This information includes the amount of SAF and the type of SAF supplied. The UDB, which was set up under Article 31a of RED, could facilitate transparency and traceability for SAF transactions and consumption on the market. Moreover, in a context where the industry is shifting from mainly using a single product (conventional aviation fuel) to using a variety of products (SAF), traceability of such products along the entire value chain also ensures safe use.

Several aircraft operators have requested that the sustainable fuel traceability requirement should be extended to the voluntary market. They argue that a centralised EU system that registers both obligated and voluntary supply of SAF would increase economic operators' and citizens' confidence in the SAF market. They also argue that it could promote not only the fulfilment of the obligatory shares but also the supply of blended SAF above the minimum shares of ReFuelEU Aviation. The voluntary market for blended SAF is closely linked to the Scope 3 emissions [48] of companies that use aviation services. Their readiness to pay a premium for the use of blended SAF may depend heavily on the transparency and robustness of the voluntary SAF market.

4.2.4 Enabling virtual trading of SAF sustainability certificates through a SAF accounting mechanism

Many aircraft operators (particularly in the cargo and the general aviation sectors and long-haul aviation operators [49]) are willing to take advantage of the momentum created by the early stages of developments in the SAF market to set up a system of tradability of SAF - or a SAF accounting mechanism - to enable a virtual market for SAF sustainability certificates which could share some similar features with the markets allowed under the RED in some Member States for land biofuels or green electricity (e.g. the Hernieuwbare brandstofeenheden [50] (HBE) system in the Netherlands). However, stakeholders have highlighted the point that such a virtual market for SAF sustainability certificates should not only be set up for the supply side (e.g. aviation fuel suppliers) but should also cover the demand side (e.g. aircraft operators). Aircraft operators would thus be able to claim, under relevant EU legislation, the benefits of using SAF based strictly on the purchase of SAF sustainability certificates and regardless of where the blended SAF are physically delivered.

The stakeholders mentioned in the previous paragraph argue that a virtual market for SAF sustainability certificates would create a larger market for SAF than the current one. Any volume of SAF supplied in the EU could be purchased by any aircraft operator, regardless of where it operates from in the EU. They argue that such a market would increase competition and could

[48] https://ghgprotocol.org/sites/default/files/2022-12/FAQ.pdf
[49] Air carriers with a large number of routes flying outside EEA and EU ETS scope.
[50] https://www.emissionsauthority.nl/topics/general---energy-for-transport/renewable-energy-units

therefore reduce the prices of SAF and upscale their production. The mass balance system which provides flexibility for the supply and uptake of blended SAF at Union airports is already improving the situation in much of the EU's aviation market. However, aircraft operators argue that they often depend on only a few aviation fuel suppliers (or even just one) at each airport. This greatly restricts aircraft operators' market power and ability to scale up purchases of blended SAF at lower prices. The Guidehouse Airport Survey showed that 43% of the airports surveyed have reported two or less aviation fuel suppliers operating at their facility.

In general, airport managing bodies tend to support the idea of setting up a virtual market for SAF sustainability certificates. However, they have very different views on the scope and features of such a virtual market. They make two main points.

- A large majority of Union airport managing bodies and those intending to opt in are fully committed to the decarbonisation of the sector. They are therefore working to secure a permanent supply of blended SAF on their premises – even if it is only virtual.
- Smaller and regional airports are concerned that allowing virtual trading may prompt aviation fuel suppliers to decide, while SAF remains scarce, to concentrate all their supply in the bigger hubs. They argue that such a virtual market could put secondary airports at a competitive disadvantage compared with the bigger hubs – as regards ability to attract aircraft operators interested in using high shares of blended SAF.

Aviation fuel suppliers are generally less vocal regarding the potential virtual market for SAF sustainability certificates, but they generally do not express opposition. Some shared their concerns regarding the potentially complex implementation of a regulated virtual market for SAF and requested more simple and straightforward solutions.

There is a large spectrum of possible features, requirements and technical tools necessary for the implementation of such a regulated virtual market, especially if the intention is to cover both the supply and demand sides. It is worth noting that a regulated virtual market for sustainability certificates for the demand side does not exist anywhere in the world for any kind of energy use. Even if the private sector has already started reflecting on similar systems for the voluntary volumes, none of them encompasses the scale and complexity required to cover both the supply and demand sides for a market as large as the EU's aviation market – and on a regulated rather than merely voluntary basis.

Many concerns shared by stakeholders (particularly aircraft operators) – which they expect the implementation of a SAF accounting mechanism in the EU to address and mitigate – appear to be linked to traceability issues rather than to tradability as such. The Commission has not yet obtained any evidence that the virtual trading of SAF sustainability certificates would be a decisive factor to really increase production in the EU, improve the physical availability of blended SAF across the EU or reduce their prices. Moreover, the impact of such a virtual market (particularly on the demand side) would require further assessment of several pieces of EU legislation and their related national transpositions (e.g. the RED, EU ETS, ReFuelEU Aviation and Directive (EU)

2024/1788 [51] (the Gas Directive)). For instance, the EU ETS does not allow aircraft operators to claim the use of blended SAF if these are not physically delivered to them.

As already explained in Chapter 3, aviation fuel suppliers have not expressed any intention or shown any sign of actively seeking to supply blended SAF to only a limited number of airports at this stage, and they are obliged to supply to all as of 2035. Moreover, most airport managing bodies are actively working to facilitate access to blended SAF on their premises. Possible bottlenecks due to a lack of blending facilities near refineries and fuel transportation networks may be better and more efficiently cleared through administrative and financial help rather than by setting up a virtual market for SAF sustainability certificates. The potential negative effects of anticompetitive behaviour by market participants can be mitigated by enhancing market transparency and through the intervention of relevant competition authorities.

The positive impacts on price of a virtual market remain uncertain in this new and low volume market. Such a virtual market might have a detrimental impact on smaller airlines and regional airports that would not be able to compete for the currently limited supply of blended SAF. Moreover, a virtual market could attract new intermediaries and the emergence of a secondary market dominated by a few investors that could exploit the benefits of economies of scale without necessarily passing them on to the aircraft operators. Those intermediaries could make it more difficult for aviation fuel suppliers to purchase the SAF shares they need to fulfil their obligations under ReFuelEU Aviation. They could also establish themselves in a strong position during the early stages of the new market and exclude future entrants to the market, leaving no space for new aviation fuel suppliers at airports and without achieving the goal of broader competition in blended SAF supply at airports that is demanded by aircraft operators.

[51] https://eur-lex.europa.eu/eli/dir/2024/1788

5 Possible improvements and additional measures to the SAF flexibility mechanism.

The flexibility options explored in this chapter are intended to address the risks and concerns identified in Chapter 4 for all stakeholders, while also respecting the objectives of ReFuelEU Aviation. The aim is not only to facilitate the supply and uptake of SAF during the flexibility period (2025-2034) – but also to preserve the environmental benefits of EU regulations and the level playing field for operators across the EU and globally, and to support the aviation fuel supply industry in preparing its supply chain to comply with the mandatory physical supply of blended SAF at all Union airports from 2035 onward. To this end, this chapter focuses on (i) possible improvements related to the traceability of SAF and their sustainability certificates; and (ii) the impact of the possible virtual tradability of such certificates.

5.1 Potential improvements through changes in the Union Database for Biofuels (UDB)

The UDB, which has been established under Article 31a of the RED, ensures market transparency, traceability, and safety in the supply chain for renewable and low-carbon fuels – mitigating the risks of irregularities, fraud and double-counting related to such fuels and thereby supporting efforts to meet the EU's ambitious decarbonisation targets. The system globally traces, on a transaction basis, fuels that are supplied on the EU market from the point of origin of the raw materials to the point that they are released on the EU market for final consumption. Since 15 January 2024, the UDB has been open for online registration by the relevant economic operators of transactions of biofuels in the EU. It will be extended to other types of fuels eligible under the RED and the Gas Directive, effectively covering all types of eligible fuels under ReFuelEU Aviation. Notably, Article 31a of the RED obliges the Commission to set up the UDB by 21 November 2024 to enable tracing of all renewable fuels and recycled carbon fuels. Moreover, Article 9(11) of the Gas Directive requires tracing of low-carbon fuels through the UDB.

Article 10(d) of ReFuelEU Aviation requires aviation fuel suppliers to report the content of aromatics and naphthalene by percentage volume and of sulphur by percentage mass in aviation fuel supplied by batch, by Union airport and at EU level. This requirement implies that aviation fuel suppliers must, as part of their UDB reporting, provide a reference to and a copy of the certificates of quality received at the conventional aviation fuel production or blending point (or equivalent certificate), so that they can prove the authenticity of the information reported for both the fossil and the blended SAF batches. This requirement also helps to ensure the safety of using such fuels, but the reporting obligation equally implies that there is no requirement to re-test the blended batches at the delivery sites – because the information encoded in the UDB with the certificates should be enough to demonstrate the quality of the fuel supplied in line with recital 30 of ReFuelEU Aviation.

The current design of the UDB already provides valuable traceability to all relevant stakeholders, but additional improvements to the database could further address and mitigate their concerns.

5.1.1 Extend traceability of SAF to aircraft operators

SAF traceability in the UDB currently ends when aviation fuel suppliers release the SAF for consumption at Union airports. The system does not trace the identity of the buyers (in this case, the aircraft operators). Under Article 9(2) and (3) of ReFuelEU Aviation, aviation fuel suppliers are required to provide, free of charge, relevant and accurate information about all aviation fuels supplied to aircraft operators. This improves aircraft operators' ability to view the volumes of SAF they are supplied with. However, the information-sharing process could be made more efficient and further streamlined to easily provide accurate real-time information on SAF transactions between aviation fuel suppliers and aircraft operators regarding the provided sustainability and fuel quality certificates that prove the authenticity of the reported information.

Aircraft operators' lack of real time visibility of blended SAF deliveries is a significant barrier to the ramping-up of SAF uptake. It also makes it more difficult to properly implement and enforce the Regulation. Enlarging the scope of the UDB to extend SAF traceability to the final consumers (i.e. the aircraft operators) could provide stakeholders with accurate information. This would improve their ability to report and account for the fuels supplied – thus avoiding the risk of double-claiming, irregularities and fraud as well as facilitating compliance and enforcement. This could also facilitate the transfer of relevant documents for claiming benefits for the use of SAF under GHG reduction schemes such as the EU ETS, in line with Article 9 of ReFuelEU Aviation. This extended traceability would also support the reporting and verification of SAF volumes purchased and claimed under the EU Taxonomy or the Flight Emissions Label.

5.1.2 Extend coverage of the UDB to voluntary volumes of SAF supply

Voluntary supply of SAF refers to volumes of SAF supplied to Union airports that are not claimed by aviation fuel suppliers for the purpose of legal compliance with SAF supply obligations under ReFuelEU Aviation. Some aircraft operators, typically cargo and business aviation airlines, have expressed the importance of differentiating voluntary from mandatory SAF supply for their clients that wish to reduce their indirect emissions when using aircraft operator's flying services (i.e. their scope 3 emissions). Aircraft operators claim that such clients are interested and willing to pay the SAF premium cost provided that the SAF volumes are supplied above the minimum shares required under ReFuelEU Aviation. It is expected that the SAF production capacity will exceed the minimum required volumes in the first years of application of the Regulation, so the voluntary market may have an important role to play in the market's development.

The UDB does not currently differentiate between voluntary and mandatory blended SAF volumes, leaving aircraft operators unable to verify from the UDB if specific SAF volumes were used to meet the supplier's obligations. However, in some cases, aircraft operators need this information in order to fulfil the requests of their customers who would be willing to pay additional premium fees for volumes of blended SAF [52]. Aircraft operators currently have to rely on the willingness of aviation fuel suppliers to provide them with this information, which is most probably not verified by any authority. Aircraft operators' customers are therefore entirely reliant on the integrity of the aircraft operators and aviation fuel suppliers with whom they are dealing.

[52] Often in order to reduce their Scope 3 emissions – https://www.wri.org/initiatives/greenhouse-gas-protocol.

Aircraft operators explain that this current lack of monitoring and certification is reducing customers' readiness to buy extra blended SAF volumes.

Enabling aviation fuel suppliers to differentiate between voluntary and mandatory volumes of blended SAF in the UDB could increase the industry's and customers' trust in the voluntary market and could potentially increase uptake as it would facilitate the reduction of Scope 3 emissions by third economic operators [53]. Such an improvement to the UDB would address one of the most common requests from stakeholders. It could (i) centralise the identification and reporting of all volumes of SAF within a single system through the UDB; (ii) potentially increase the blended SAF supplied and purchased on the EU market; and (iii) support the reporting and verification by national competent authorities.

It is important to note that this information should always be used by aircraft operators and their customers in compliance with other relevant GHG reporting standards and Union law, including with rules on avoiding double-counting.

5.1.3 Extend UDB traceability to CORSIA [54] eligible fuels (CEF) under the EU ETS

The UDB is set to cover the traceability of all eligible fuels under ReFuelEU Aviation. However, the UDB does not currently cover CORSIA eligible fuels (CEF) that can be claimed by aircraft operators under the scheme for their international extra-EEA flights. CORSIA requests aircraft operators to prove the GHG emission reduction of the CEF they claim by supplying copies of the CEF purchase bills accompanied by their CEF certificates. Without a proper IT tool to trace CEF supplies to aircraft operators, it may be administratively complex for them to substantiate their claims once CEF volumes increase. This could create risks of fraud and double-counting for the same batch of fuel under more than one GHG scheme (e.g. EU ETS, CORSIA).

CORSIA is implemented in EU law through the EU ETS. Aircraft operators with an air operator certificate or equivalent provided by the EU or any of its Member States must already report their yearly amount of emissions on international routes (inside and outside EEA) to their national competent authorities. They must also demonstrate the use of CEF certified under CORSIA's Standards and Recommended Practices and related implementing acts. An option to extend the traceability of these fuels in the UDB when they are supplied in the EU could facilitate both the reporting of EU aircraft operators and the broad uptake of higher-quality SAF, because it will be easier to demonstrate the higher level of GHG emission reductions in each batch of CEF purchased. Extending the traceability of the UDB to CEF would also ensure the safe use of such fuels.

5.2 Potential improvements through the implementation of a SAF accounting mechanism

As described earlier, a SAF accounting mechanism can involve different possible designs options and parameters. The Commission therefore hired Guidehouse to assess the different possible options. This section relies on the analysis described in detail in Section 8.2 of the Guidehouse support study. The following assumptions apply for each of the possible options for a SAF accounting mechanism.

[53] In accordance with the GHG Protocol for Project Accounting - https://ghgprotocol.org/project-protocol.
[54] https://www.icao.int/environmental-protection/CORSIA/Pages/default.aspx

- The scope of the mechanism is the same as ReFuelEU Aviation (e.g. legal, geographic, eligible fuels, stakeholder definitions, etc.).
- The physical volumes linked to the virtually traded SAF sustainability certificates must be physically supplied to a Union airport as blended SAF.
- The SAF sustainability certificates can only be claimed once by aviation fuel suppliers for the purpose of complying with the ReFuelEU Aviation and RED obligations. Similarly, the SAF sustainability certificates can only be claimed once by aircraft operators under GHG or financial support schemes.
- The UDB can accommodate a SAF accounting mechanism that enables virtual trading of SAF sustainability certificates.

5.2.1 Impact on ReFuelEU Aviation

A virtual market for SAF sustainability certificates implemented within the legal boundaries of ReFuelEU Aviation could enable aviation fuel suppliers with insufficient access to SAF to comply with their obligations by purchasing virtual SAF sustainability certificates from other aviation fuel suppliers with more supply than they need. Aircraft operators could therefore also be able to purchase virtual SAF sustainability certificates from aviation fuel suppliers on the virtual market. However (as highlighted in the next section on impacts on the EU ETS), aircraft operators might have very limited ability to use virtual SAF sustainability certificates under EU law. Several design options for such a SAF accounting mechanism are presented in Section 8.2 of the Guidehouse support study.

With a SAF accounting mechanism**,** the obligation on all aviation fuel suppliers to supply physical volumes of blended SAF to Union airports would be removed during the flexibility period, because they could use virtual SAF sustainability certificates instead. This approach is similar to the flexibility allowed under the RED for fuel suppliers and sustainable road transport fuels (as mentioned in Chapter 4). Aviation fuel suppliers that face difficulties in the production or procurement of SAF and blended SAF would have 10 years to upgrade their supply chain and physically comply with the minimum share requirements as from 2035.

A virtual market for SAF sustainability certificates implemented under ReFuelEU Aviation could allow aircraft operators to claim the purchased virtual certificates under the Flight Emissions Label. Aircraft operators could also leverage virtual certificates to purchase voluntary volumes of SAF on the market and sell them to customers willing to reduce their Scope 3 emissions. It nevertheless appears that the use of such virtual certificates is limited to aircraft operators and might therefore decrease their willingness to purchase such certificates.

However, such a virtual market could geographically concentrate the physical stocks of SAF in a few airports located close to the production and blending facilities which are, as seen in Chapter 2, mainly located in western and northern Member States. The Guidehouse support study also concludes that such a SAF accounting mechanism could delay investment in the development of the EU SAF supply chain because there would be no incentive for aviation fuel suppliers to transport or produce SAF across the EU during the flexibility period. This could send the wrong signal to the industry, which must prepare its supply chain to be ready to supply a minimum share of 20% of SAF to all Union airports by 2035. This concern is also shared by some Union airport

managing bodies, which are keen to see SAF production and supply developing everywhere in the EU to preserve a level playing field for industry stakeholders and Member States in the EU. The geographic concentration of blended SAF supplied only to airports near production facilities would deprive a significant share of EU territory of the non-CO_2 benefits that the use of SAF can offer, in terms of air quality around airports and reduction of contrails in given air routes.

The beneficial impact of a SAF accounting mechanism on blended SAF prices for all aircraft operators and across all regions in the EU remains unclear. The argument that a virtual market for certificates would lead to reduced SAF transportation costs and emissions has not been substantiated. Extra transportation costs depend only on the distance between the place where SAF is produced or imported into the EU and the blending facility. The Guidehouse support study demonstrates that this concern should lessen over time due to the development of the SAF industry. From the blending point onward, transportation is identical to that for conventional aviation fuels and should not result in a significant logistical cost increase.

Furthermore, facilitating the virtual trading of SAF could de-motivate developing domestic industrial capacity in particular for emerging SAF, such as advanced biofuels and synthetic fuels, while using the flexibility period for safeguarding industry's profit. This period is however of critical importance to develop industrial capacity in the EU for SAF production. Once they are produced at scale and sufficient quantities, trading them in the EU would not be a barrier.

Regarding voluntary volumes, nothing in ReFuelEU Aviation prevents aviation fuel suppliers from virtually selling their excess SAF above the mandatory minimum to interested customers for any use that is not legally required and that respects the current legal framework. Some private initiatives are underway. The Commission will monitor the developments of these initiatives and assess their compliance with EU legislation. A robust and transparent virtual market for voluntary volumes of blended SAF that could help customers to reduce their Scope 3 emissions (particularly if they are fully traceable through the UDB) could bolster the general public's confidence in the decarbonisation of aviation and could reduce greenwashing risks without the need for further regulatory intervention.

Aviation fuel suppliers have not expressed concerns regarding their supply obligations that would justify the implementation of such a virtual market by law during the flexibility period. Aviation fuel suppliers are already free under the current regulatory framework to trade physical volumes of SAF and blended SAF with each other before supplying it to the market.

5.2.2 Impact on other relevant pieces of legislation

5.2.2.1 Directive (EU) 2018/2001 (the RED)

The RED allows Member States to grant some flexibility to their fuel suppliers when complying with their obligations through the purchase of compliance tickets. However, virtual SAF sustainability certificates that are traded internationally would not be recognised by Member States' competent authorities because the supply must happen within the borders of a given Member State. This means that aviation fuel suppliers that decide to comply with their obligations under ReFuelEU Aviation in a virtual manner would not be able to count those virtual certificates for the purpose of helping to meet the national RED targets.

5.2.2.2 Directive 2003/87/EC (EU ETS)

Aviation has been part of the EU ETS since 2012. Under the EU ETS, aircraft operators monitor, report and verify (MRV) emissions from flights performed within the geographical scope of the EU ETS. Aircraft operators must therefore surrender EU allowances to cover all of these emissions. The MRV system relies on physical uplift and actual fuel burn of all fuel types – SAF included – and on a mass-balance system (including the proportionality principle) if the physical uplift of certain fuels cannot be determined (e.g. in the case of interconnected infrastructure such as pipeline systems). This means that aircraft operators cannot currently claim virtual SAF sustainability certificates under the scheme.

Enabling virtual supply of SAF under ReFuelEU Aviation without allowing aircraft operators to claim virtual certificates under the EU ETS could lead to further significant distortions of competition in the EU market. On the one hand, aircraft operators operating from Union airports where only virtual certificates are available would not be able to claim any benefits under the EU ETS while on the other hand, aircraft operators operating from Union airports where blended SAF is physically supplied will have the opportunity to claim the benefits of using SAF under the EU ETS and will incur reduced costs linked to the surrender of EU allowances and the additional support for uplift of eligible fuels. Without a robust mechanism for tracing SAF sustainability certificates to the final consumer, it would also greatly increase the risks of fraud with aviation fuel suppliers potentially selling SAF sustainability certificates twice to different aircraft operators – once at the place of virtual supply and once at the airport of physical supply.

The stakeholder consultation revealed that most economic operators from both the demand side (e.g. aircraft operators) and the supply side (e.g. aviation fuel suppliers) consider the ability of aircraft operators to claim the use of virtual SAF sustainability certificates as a primary requirement for the implementation and well-functioning of a SAF accounting mechanism that enables virtual trading in such certificates in the EU. Implementing such a mechanism within ReFuelEU Aviation alone would limit the benefits of the virtual market strictly to the supply side and might create inconsistencies within EU law.

6 Conclusions and recommendations

6.1 Assessment of the developments on SAF production and supply on the EU's aviation fuel market

The recent developments in the EU SAF market allow to conclude, at this early stage, that the current SAF flexibility mechanism of 10 years, paired with the recent increase in SAF production capacity in the EU, is adequate for ensuring the availability and supply of the minimum shares of blended SAF in a significant number of Union airports from 2025 until 2035, certainly for aviation biofuels. It also allows the industry to make the necessary technological and logistical investments to upgrade the supply chain and ensure compliance with the supply of minimum shares by 2035 to all Union airports.

The Commission will nevertheless continue to support and create the right conditions for aviation fuel producers' investments in SAF in three ways.

- It will maintain the legal certainty regarding the ReFuelEU Aviation supply obligations of minimum shares of SAF in 2030 and beyond. The Commission considers that both the SAF target and the synthetic aviation fuels subtargets for 2030 and 2035 set by the Regulation are realistic, proportionate, and crucial to achieving the objectives of the Fit for 55 package and the recently published Climate Target Plan for 2040 [55].
- It will implement the supporting measures mentioned in Chapter 2 of this report in the simplest, fairest, and most cost-efficient way.
- It will continue to urge Member States to adopt national legislation defining the rules related to penalties in the Regulation as soon as possible [56] and will not hesitate to take action should this be necessary. EASA recently published its report on the *State of the EU SAF market in 2023*. The report describes the methodology to determine aviation fuels prices. The level of penalties set in Article 12 of ReFuelEU Aviation is clear, proportionate and dissuasive enough to facilitate a coherent and harmonised level of penalties throughout the internal market.

The Commission will monitor developments in the sustainable aviation fuel sector and particularly the development of advanced aviation biofuels and synthetic aviation fuels production projects across the EU. The Commission is aware that aviation fuel producers (particularly aviation fossil fuel producers) have not yet launched the required investments for the upscaling of synthetic aviation fuel production plants. The Commission notes that – given the constrains on the availability of biomass feedstock such as used cooking oil (UCO) – developing and scaling up advanced aviation biofuels and synthetic aviation fuels production and supply in the EU as from 2030 will be necessary so that the aviation sector can significantly reduce its emissions and achieve its own decarbonisation goals and roadmaps by 2050. R&I and early movers support to new SAF technologies is thus necessary to increase EU competitiveness and security of the domestic production by mitigating the SAF supply chain risks. Moreover, demand and supply aggregation

[55] Impact assessment on a 2040 Climate Target – https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2040-climate-target_en#documents.
[56] Article 12(1) of ReFuelEU Aviation.

mechanism could further facilitate market development for synthetic aviation fuels. If necessary, the Commission will intervene to support the scaling-up of such fuels and address the risk profile of these projects by mitigating regulatory, market and technology risks and making them more attractive to investors with a view to enabling the timely development of industrial scale facilities in the EU before 2030. The Clean Industrial Deal and Sustainable Transport Investment Plan will foster investment in and scale up of clean energy technologies and prioritise investment in transport decarbonisation solutions that are crucial for the decarbonisation of 'hard-to-abate' modes like aviation and that are key to many EU regions and citizens' mobility. As announced in the Clean Industrial Deal, the Commission will come forward with a Sustainable Transport Investment Plan later in 2025, outlining a strategic approach to scale-up and prioritise investments in transport decarbonisation solutions, including SAF.

There are a number of ways to support these projects and contribute to the EU's sustainability ambitions in aviation: (i) improving market conditions and keeping regulatory certainty; (ii) reducing complexity and administrative burden; (iii) increasing awareness of the necessity and benefits of synthetic aviation fuels among stakeholders; and (iv) designing effective financial support mechanisms. Investment in SAF capacity-building must happen in the EU to reinforce reindustrialisation and strategic energy security of supply throughout the entire EU. The Commission will make sure that the right framework is in place to attract investment in SAF and particularly in synthetic aviation fuels. For this purpose, the Commission will work with public and private actors to unlock the financing needed for the transition. The Commission will also continue to support the development of the EU SAF market in the coming years through the Clean Industrial Deal, in which SAF are considered as a main contributor to the decarbonisation efforts in the EU.

In parallel, the Commission will remain especially vigilant in ensuring that aviation fuel suppliers do not pass the cost of penalties for underachieving the supply obligations onto airlines and ultimately onto passengers – as an alternative to investing in the necessary production of SAF and, more specifically, synthetic aviation fuels. The Regulation deters such behaviour by cumulatively carrying over any supply shortfall to subsequent years.

Through EU programmes for infrastructure (e.g. TEN-T), the Commission will support the development of blended SAF infrastructure to facilitate compliance in all Union airports with the minimum share requirements, before or at the latest at the end of the flexibility period in 2035.

6.2 Assessment of possible improvements or additional measures to the existing SAF flexibility mechanism with a view to further facilitate the supply and uptake of SAF for aviation during the flexibility period

In anticipation of the 2025 supply obligations, some industry stakeholders (mainly aircraft operators) have expressed concerns regarding the SAF market ramp-up and the associated premium costs. Issues such as SAF availability and traceability at Union airports, prices of SAF and the dominant position of certain aviation fuel suppliers were highlighted. The Commission has explored several options to address these concerns.

6.2.1 Improvements through the changes in the Union Database for Biofuels (UDB)

The Commission finds that enlarging the scope of the Union Database for Biofuels (UDB) to extend SAF traceability to the final consumers – the aircraft operators – could improve market transparency, safety, and the ability of aircraft operators to report and account for the SAF supplied and reduce the administrative burden. It is especially vital for the proper implementation of the Flight Emissions Label to allow aircraft operators to attribute the right fuel mix (and its related GHG emissions level) to any given flight. This could also facilitate the transfer of relevant documents for the purpose of claiming benefits for the use of SAF under GHG reduction schemes such as the EU ETS or the ICAO's CORSIA under Article 9 of ReFuelEU Aviation. It could also greatly facilitate compliance with and enforcement of all articles of ReFuelEU Aviation by stakeholders and competent authorities.

Enabling the economic operators to differentiate between mandatory and voluntary volumes of SAF in the UDB could increase the confidence of stakeholders and customers in the voluntary market and could potentially increase the supply of voluntary volumes. Such an improvement to the UDB could centralise all volumes of SAF within a single system and could facilitate reporting and verification by Member States' competent authorities.

The Commission considers that extending the scope of the UDB to include CORSIA certified fuels (CEF) could further incentivise the uptake of such fuels at Union airports. Such an improvement to the UDB is crucial for the success of the CORSIA initiative, which was recently implemented through the EU ETS and would contribute to ICAO's collective global aspirational vision of using SAF to reduce CO_2 emissions in international aviation by 5% by 2030.

As part of its support for facilitating and incentivising the supply and uptake of blended SAF at Union airports, the Commission will implement the necessary changes to the UDB to extend SAF traceability on a voluntary basis to aircraft operators by 2025. The Commission expects that these improvements will address most of the concerns and requests expressed by stakeholders in the context of a tradability system for SAF (as described in Chapter 4). The Commission will also, in cooperation with EASA, prepare the business and technical documents needed to prepare the implementation of the two other improvements. These changes will greatly improve SAF traceability in the EU, thus strengthening the competitiveness of the EU's sustainable fuels industry.

6.2.2 Relevance of a virtual market for SAF sustainability certificates under ReFuelEU Aviation

The virtual tradability of SAF sustainable certificates enabled through a SAF accounting mechanism could benefit the few aviation fuel suppliers that might face difficulties in accessing SAF during the flexibility period. However, a regulatory intervention that would require a revision of ReFuelEU Aviation and potentially other pieces of legislation at this early stage of the newly regulated market does not appear justified, especially considering that private initiatives are possible for any voluntary trade on both the supply side and the demand side. As Guidehouse has concluded, enabling aviation fuel suppliers to comply with their obligations in the short-term by trading virtual certificates increases the risk that they will not be ready to supply physical SAF to

every Union airport by 2035. This would imply concentrating the beneficial effects of SAF for local communities to just a handful of airports and Member States, jeopardising efforts to improve air quality around airports and to decrease non-CO_2 effects, namely contrails. It could also de-motivate the industry from building domestic industrial capacity of SAF and from optimally using the flexibility period. This ten-year period is however of critical importance to develop industrial capacity in the EU for SAF production. Moreover, stakeholders remain unclear regarding the preferred design and parameters that such a mechanism should have. It is also important to note that the scope of implementation of a SAF accounting mechanism would greatly impact its effectiveness and relevance for stakeholders. Implementing such a mechanism within ReFuelEU Aviation alone could create unwanted inconsistencies.

The initial mandatory amounts of SAF to be blended are relatively modest. This limits the adverse risks of unexpected market developments and provides an opportunity to observe actual market performance during the first years of the supply obligations. Continued market monitoring in the coming years will be crucial to determine whether regulatory intervention is necessary in order to achieve the EU's aims regarding the aviation sector's contribution to achieving the 2030 and 2050 climate goals.

6.2.3 Other mitigations

The Commission takes note of aircraft operators' concerns regarding perceived disproportionate differences in the price and availability of blended SAF at certain airports. The Commission services will in particular pay close attention to any unfair pricing practices of aviation fuels at Union airports by aviation fuel suppliers. If any infringements of EU law are observed, the Commission will take any measures needed to address the issues in line with its enforcement policy. The report reviewing of ReFuelEU Aviation in 2027 will allow the Commission to identify those Union airports where blended SAF is not yet available and where the market structure and the position of aviation fuel suppliers may have an impact on the price and availability of SAF. The Commission will gather information on current concession agreements and other kinds of commercial agreements that may clarify relations between airport managing bodies, aviation fuel suppliers and aviation fuel ground-handlers. This will help it understand their economic and legal relations and the impact they may have on the quality and price of blended SAF at Union airports. A better understanding of the different roles of each stakeholder and of the decision-making process regarding the volumes and the quality of aviation fuels made available at Union airports is required to address the concerns expressed by aircraft operators. It will also help the Commission to monitor commercial practices in this new market context, where multiple types of blended SAF will soon be available with substantial price differences.

The Commission will continue the technical and feasibility study on SAF accounting mechanisms within the EU regulated framework (including those that enable virtual trading of SAF sustainability certificates) through a preparatory action that has started in December 2024, in collaboration with EASA. The work under this preparatory action will also cover the assessment of the business and the technical requirements and related costs of the two above-mentioned improvements to the UDB. The outcome of the preparatory action with EASA may inform any

future evaluation or impact assessment for a possible revision (where justified) of relevant pieces of EU law, especially as regards the use of virtual SAF certificates under EU law.

Annex 1: Overview of sustainable aviation fuels (SAF) type (non-exhaustive)

SAF type	Feedstock	ASTM specification	Max. blend ratio	Producers in EU (including planned projects)	Offtakers (airlines)	Users (airports)
HEFA	Bio-oils, animal fat, recycled oils	D7566	50%	Neste (Finland, and Netherlands planned), ENI (Italy), Preem (Sweden), SkyNRG (Netherlands site), Shell (Netherlands), TotalEnergies (France)	Lufthansa, KLM, IAG, Finnair, UPS and Amazon Prime Air (Neste)	Rotterdam The Hague Airport (Shell production on site) Paris Charles de Gaulle (Total) Le Bourget Airport (Total) Rome Fiumicino (ENI)
CHJ	Triglycerides: soybean, jatropha, camelina oil, etc.	D7566	50%			
FT	Biomass	D7566	50%	Enerkem/Shell (Netherlands), Repsol (Spain),	British Airways (Velocys investor/offtake agreement)	
SIP	Biomass from sugar production	D7566	10%			
AtJ	Biomass from ethanol or isobutanol production	D7566	50%	LanzaJet (Sweden), SkyNRG (Netherlands)	Scandinavian Airlines, Iberia Airlines (Gevo offtake agreement), British Airways (LanzaJet investor/offtake agreement), Virgin Atlantic (LanzaJet offtake agreement)	
HC-HEFA	Algae	D7566	10%			
Co-processing	FT and HEFA feedstocks	D1655	5%	AirBP (Germany), Repsol (Spain)		
Synthetic aviation fuels	Renewable energy, water, carbon		50%	SkyNRG (NL)		

Annex 2: Sustainable aviation fuels (SAF) production routes

Hydrotreated esters and fatty acids (HEFA)	HEFA production includes the use of hydrogen for refining vegetable oils, waste oils or fats. The first step is to remove the oxygen from the fats. The straight paraffinic molecules are then thermally cracked and isomerised to jet-fuel chain length.
Fischer-Tropsch (FT)	The FT synthesis technology can be used to gasify any carbon-containing material to produce carbon monoxide and hydrogen – known as syngas. The syngas acts as a building block to be used in SAF production. The syngas is liquified via catalytic reaction with iron, cobalt, nickel and ruthenium. It is then thermally cracked into smaller molecules to produce a final kerosene product. There are two certified pathways for SAF production using FT technology: (i) synthetic paraffinic kerosene (SPK) produces a straight paraffinic jet fuel; and (ii) SKA produces synthetic kerosene from additional aromatic compounds.
Catalytic hydrothermolysis (CHJ)	CHJ converts fatty acid esters and free fatty acids into SAF via catalytic hydrothermolysis. The SAF are further processed by any combination of hydrotreatment, hydrocracking, or hydroisomerisation and fractionation.
Synthesised iso-paraffins (SIP)	SIP ferments and converts sugars into six closely-related chemical compounds called farnesene. The farnesene is then treated with hydrogen and can be used in SAF.
Alcohol to Jet (AtJ)	AtJ converts alcohols into SPK jet fuel by removing the oxygen and linking the molecules together to get the proper carbon chain length.
Hydroprocessed hydrocarbons, esters and fatty acids (HC-HEFA)	In the HC-HEFA process, which is similar to the HEFA process, free fatty acid esters and free fatty acids are upgraded for use in SAF. The hydrocarbon molecules are saturated and all oxygen is removed via hydroprocessing. One recognised bio source is the *Botryococcus braunii* species of alga.
Synthetic aviation fuels	Synthetic aviation fuel is derived from a power-to-liquid process. Water is broken down into hydrogen and oxygen via electrolysis using renewable energy. The hydrogen is then paired with carbon dioxide to form carbon monoxide and water. Using the FT synthesis process, the hydrogen and carbon monoxide are converted into a wax. This wax acts as a synthetic crude oil which is upgradeable to different fuels, including synthetic aviation fuel. Synthetic aviation fuel only emits the carbon input during its production process when it is burned. Using carbon from carbon capture means that the fuel is carbon-neutral.
Co-processing	Co-processing is not a dedicated SAF pathway but a co-process in conventional crude oil refining. FT or HEFA feedstocks are fed into existing jet-fuel refining processes. Co-processed FT uses FT wax, which is a by-product of the FT process. Co-processed HEFA is made using vegetable oil, waste oil and fat feedstocks.