Annex

Improvement opportunities for policies and certification schemes promoting sustainable biofuels with low GHG emissions

Part 2: Robustness of GHG emission verification and certification of biofuels – a case study of selected supply chains and policies

IEA Bioenergy: Task 39

December 2024

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Reader's guide to the annex

This annex has been compiled alongside the report ***"Improvement opportunities for policies and certification schemes promoting sustainable biofuels with low GHG emissions Part 2: Robustness of GHG emission verification and certification of biofuels – a case study of selected supply chains and policies"***. **The report (slide deck) can be found here** Publications | Task 39 (ieabioenergy.com).

The annex consists of a more detailed elaboration per work package, raw input and analysis of the work package's output. Please use the table of content below to navigate through the annex. The structure of the annex is similar to the structure of the report. Specific references to the annex can be found on the individual slides.

Index

Annex 1: Work package 1 Setting the framework

This annex contains the sustainability policy frameworks* that are included in our analysis. Data for completing the factsheets are obtained from different resources, including best available expert knowledge, publicly available reports, and websites. Relevant literature sources are mentioned at the end of each factsheet. The factsheets were initially filled in the period from September 2021-January 2022 (Part 1) and updated and peer reviewed from October 2023-May 2024.

While in Part 1, the policy frameworks were reviewed on a broad range of requirements, Part 2 focuses on the requirements of GHG-related features with special attention to sustainable aviation fuel (SAF). The aim of the factsheets is to present the key characteristics of the policy framework, it does not pretend to be fully complete, nor does it pretend to capture all the details and insights.

For Part 2, the following policy frameworks are analyzed:

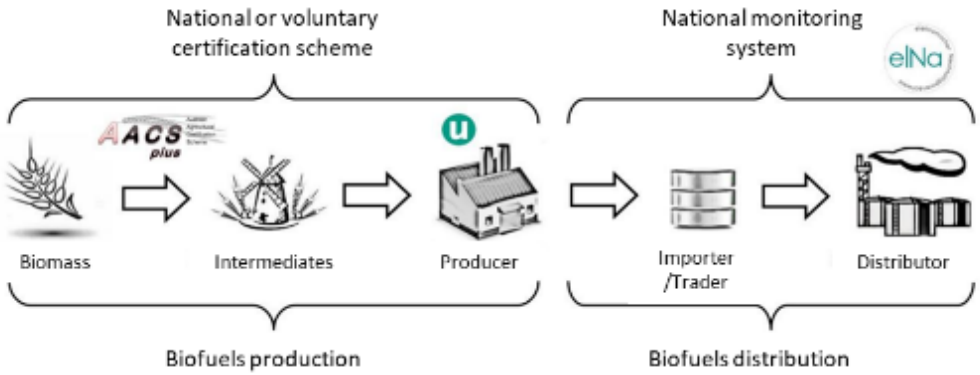
- Austria - Kraftstoffverordnung
- Brazil - RenovaBio
- Germany – Policy Framework related to SAFs
- ICAO - CORSIA framework
- U.S. - Inflation Reduction Act (IRA)
- U.S. - Californian LCFS
- The EU Renewable Energy Directive (EU RED II/III)
- The Netherlands – Policy on Energy for Transport

* In the context of this report, the policy frameworks also include the regulatory framework of ICAO - CORSIA

1.1. AUSTRIA - KRAFTSTOFFVERORDNUNG

A1. General information	
1. Existence of a policy on the sustainability of (advanced) biofuels in the country, plus description	Austria has a policy on the sustainability of (advanced) biofuels called the Fuel Ordinance ("Kraftstoffverordnung") from 2012. This Fuel Ordinance was amended in 2014, 2017, 2018, 2020 and latest in 2022 to implement RED-II. Additionally, there are the Sustainability Ordinance from 2014 and the Ordinance on Agricultural Feedstocks for Biofuels from 2010. There is no specific policy on the sustainability of sustainable aviation fuels so far.
2. Definition for 'advanced biofuels' under this policy	In the Fuel Ordinance ("Kraftstoffverordnung") advanced biofuels mean biofuels produced from feedstocks or fuels listed in Part A of Annex XIII of the Fuel Ordinance ("Kraftstoffverordnung") (see answer to question 3) In the Austrian legislation there is no definition of SAF, but it is referred to as "biofuels for aviation".
3. Feedstock categories under the scope of 'advanced biofuels'	• Algae, if cultivated on land in tanks or photobioreactors • Biomass fraction of mixed municipal waste, but not separated household waste, to which recycling targets apply • Bio-waste from private households which is subject to separate collection • Biomass fraction of industrial waste unsuitable for use in the food or feed chain, including material from wholesale and retail trade, agro-food industry and fisheries and aquaculture industry, excluding used cooking oil and animal fats • Straw • Manure/Slurry and sewage sludge • Wastewater from palm oil mills and empty palm fruit bunches • Tall oil pitch • Crude glycerine • Bagasse • Grape marc and wine lees • Nut shells • Pods • De-husked corn cobs • Biomass fractions of waste and residues from forestry and forest-based industries, i.e. bark, twigs, pre-commercial thinnings, leaves, needles, tree tops, sawdust, sawdust, black liquor, brown liquor, fibre sludge, lignin and tall oil; • Other non-food cellulosic materials • Other lignocellulosic materials with the exception of sawn timber and veneer logs

A2. Requirements on GHG emission reduction and sustainability	
4. GHG emission reduction and sustainability requirements included in the policy, and applicability to feedstock-to-biofuel chains, in particular requirements for: • Forest: forest residues to ethanol via gasification • Agriculture: ethanol production from cereal straw	For biofuels (incl. biofuels for aviation) produced in installations that started operation after 5 October 2015, a life cycle greenhouse gas emission reduction rate of at least 60% compared to the reference value shall apply. For biofuels produced in installations that were operational on or before 5 October 2015, a life-cycle greenhouse gas emission reduction rate of at least 50% compared to the reference value shall be met. For biofuels produced in installations that started operation after 1 January 2021, a life cycle greenhouse gas emission reduction rate of at least 65% compared to the reference value shall apply. Forest: According to the Sustainable Agricultural Inputs Ordinance, feedstocks for the production of biofuels may not originate from the following areas (status as of 2008): • Primary forest and other forested areas where there is no clearly visible sign of human activity and ecological processes are not significantly disturbed. • Highly biodiverse forest or other forested land that is species-rich and not degraded. • Areas with legal provisions or areas designated by the competent authority for nature conservation purposes • Areas for the protection of rare, threatened or endangered ecosystems or species • Grassland of more than one hectare with high biodiversity • Areas with high carbon stock (wetlands, continuously forested areas, areas of more than one hectare with trees over five metres high and a canopy cover of 10 to 30 %) Agriculture: If agricultural feedstocks used for the production of biofuels are produced domestically and designated as "sustainable", they have to originate from land which is cultivated by farmers and were already in agricultural use before 1st January 2008. They mustn't originate from areas which are protected under the nature conservation provisions. (Legislation on agricultural feedstocks for biofuels and bioliquids) **Ethanol production from cereal straw:** Typical value for GHG emissions 13.7 g/MJ CO2-equ., standard value 15.7 g/MJ CO2-equ. Typical value for GHG emissions reduction 85%, standard value 83%



B. Proofing compliance: Information required	
5. Obligated party and interval for reporting and proof of compliance of the sustainability and GHG emission of (advanced) biofuels	Companies, which bring the biofuels to the market (paying tax) are those, having obligations against the fuel ordinance for fuels used for road transport. All economic operators dealing with sustainable biofuels before the point of taxation have to be registered in the elNa database. Among those are producers, traders, importers etc. According to the Fuel Ordinance, the following economic operators must register with the Federal Environment Agency tool elNa – the electronic sustainability system for biofuels: • Sustainable biofuels producer • (Energy) traders and importers of sustainable biofuels • Storage operators • Distributors of sustainable biofuels Companies subject to the obligation to register are companies that put fuels or other energy sources for use in the transport sector into free circulation under excise law for the first time in the territory of Austria or use them except in the fuel tank of the vehicle. This includes, in particular, companies subject to fulfilling the relevant targets of the fuel ordinance (reduction of GHG values, substation requirement, fulfilling of the target for advanced biofuels). A report is generated out of the data input of the companies once a year from the elNa system for the companies, subject to the fulfilment of the targets and proofs of sustainability for the used biofuels (§20 notification, see answer to question E20). The deadline for preparation is 1 May of the year following the reporting year. The report covers both the sustainably biogenic fuel quantities and renewable energy sources that can be counted towards the targets of the Fuel Ordinance, as well as the fossil and non-sustainably biogenic fuels that were placed on the market by your company in the reporting year.

6.	Information requirements for reporting sustainability and GHG emission (reduction) by the obligated party	Information required depends on whether it is a trader, producer etc. The Federal Environment Agency knows which certificate is used; The voluntary schemes publish the certificates on their respective websites. This information is checked, when known companies register at elNa. Sustainability certificates shall contain at least the following information (see below). • The name and address of the issuing company producing biofuels • An indication of whether the installation in question was commissioned up to and including 5 October 2015 or thereafter • The date of issue • A number clearly identifying the certificate • The registration number issued by the Umweltbundesamt GmbH (Federal Environment Agency) or details of the inspection body which has confirmed the sustainability certificate and/or details of a voluntary scheme • Feedstock category • The quantity and type of biofuels to which the sustainability certificate relates • A confirmation of compliance with the provisions of this Regulation • The type, quantity, year of harvest and countries of cultivation or origin of the raw materials used • The life-cycle greenhouse gas emissions in grams of CO2 equivalent per megajoule of biofuel (g CO2eq/MJ) in the form of a default value or an actual value (disaggregated values for transport, conversion etc.) • For biofuels not listed in RED Annex IX, the energy content in megajoules • The name and address of the purchaser of the biofuels • Emissions from carbon stock changes due to land-use change • Information on whether a credit has been claimed in the calculation of greenhouse gas emissions • Information on whether the above credit has been claimed for emission savings due to accumulation of carbon in the soil as a result of better agricultural management practices • In the case of biofuel creditability: information on the type, quantity and countries of origin of the feedstocks used; and confirmation of registration with the Federal Environment Agency (Umweltbundesamt GmbH) Producer of biofuels must calculate and check GHG emissions according to the standards of the chosen voluntary scheme. The Federal Environment Agency is checking the published voluntary schemes on the respective websites. These voluntary schemes are mandatory to be used for proofs of sustainability by the economic operators producing, trading or bringing biofuels into the market in order to register at the elNa system.
7.	Information requirements on origin	The type, quantity, year of harvest and countries of cultivation or origin of the raw materials used.

8. Criteria for the categorisation and definitions of feedstocks	Categories are based on RED-II. The decisions if an application for a specific raw material is in line with the category “Industrial waste unsuitable for use in food or feed” is taken by case-to-case verifications. If a feedstock was declared as advanced feedstock or residue than only for a specific origin and possibly with certain restrictions for the total amount and for a certain time to minimize fraudulent use. Most important criteria for categorization as waste, residue or co-product are market price and intended use. **Definitions according to the Kraftstoffverordnung:** "Residual substance from processing" means a substance that is not a final product and the production of which is directly sought by the production process; it is not the primary objective of the production process, and the process has not been intentionally modified to produce it; "Residues from agriculture, aquaculture, fisheries and forestry" means residues directly generated by agriculture, aquaculture, fisheries and forestry; it does not include residues from related industries or processing;
9. Information requirements on feedstock type	elNa provides a drop-down list with about 80 feedstocks. When a company is registered, only listed feedstocks can be chosen. If a company want to add another feedstock, they have to make a request. Classification whether advanced or not is a matter for each country.

C. Proofing compliance: Verification methods required/ allowed	
10. Possibility to use certification systems to proof compliance and recognised schemes	In general all Voluntary Schemes approved by the European Commission can be used. Actually, the following Voluntary Schemes are active in Austria: 2BSvs, AACS (AMA), BLE, ISCC DE, ISCC EU, Red Cert DE, Red Cert EU, Bonsucro EU, Slovakian National System (certification systems of the quantities placed on the market in 2021) Regardless of which certification system/voluntary scheme biofuel producers are certified with, the companies must enter certain data into the elNa web application. A voluntary scheme is mandatory for using elNa. The elNa system generates so-called sustainability certificates (proof of sustainability) from this data, which are linked to the sustainable biofuels. Each trade needs a proof of sustainability POS from the elNa system – therefore a voluntary scheme and a registration at the elNa system is required by each party beginning at the first gathering point. The sale of sustainable biofuels must always be accompanied by a transaction of the corresponding proof from the seller to the buyer. Therefore, all biofuel traders and stockholders must also use the elNa system.

11. Possibility to use a national standard to prove compliance	For the production of biofuels there is no national system available. For proofing the sustainability for agricultural raw materials there is a semi national system available - the Austrian Agricultural Certification Scheme (AACS) - a national system which is approved by the European Commission, which is very similar to the existing Voluntary Schemes. Agrarmarkt Austria (AMA) is the competent certification body for businesses in the chain from the cultivation of agricultural raw materials to their processing into semi-finished or intermediate products. The Federal Environment Agency is responsible from the biofuel production sites to the marketing of the fuels. With the AACS, AMA offers a voluntary certification system for the certification of raw materials and feedstocks in accordance with the RED. As of 1 July 2021, the implementation of RED II for the promotion of the use of energy from renewable sources is in force. By Implementing Decision (EU) 2022/1656 of September 26, 2022, the national sustainability scheme AACS (Austrian Agricultural Certification Scheme) was again recognized by the European Commission as a certification scheme according to Directive (EU) 2018/2001
C1. The approval and monitoring procedures for certification standards *(only relevant when they can be used to proof compliance)*	
12. Authority deciding on usable certification systems and/or national standards	For the use of biofuels all certificates of Voluntary Schemes approved by the European Commission have to be accepted by the member states. The Federal Environment Agency (Umweltbundesamt) lists all these voluntary schemes which can be used.
13. Criteria used to approve a certification system and/or national standard	The voluntary schemes are approved at EU level. National standards are not replacing voluntary schemes, but represent an additional control, in other form. A voluntary scheme is required for a registration at elNa, that mean the minimum requirements must be met. AACS is a voluntary scheme approved by the Commission and only used and controlled in Austria, but it is not a national standard. ACCS only covers agricultural feedstocks.
14. Minimum requirements around 3rd party auditing, intervals of verification or accreditation	Certification bodies need approval by the voluntary schemes. There are no specific requirements from Austria. The database elNa extends independent control with state control. The Federal Environment Agency in Austria is in charge of e.g. emission trading system, waste registration, national monitoring, external environmental control for the Federal Minister, and it also acts as 3rd party auditor. Due to the Commission implementing regulation (EU) 2022/996 Austria is working on a procedure for the auditing of CBs
15. Possibility and conditions of cross-compliance	Voluntary schemes are mutually recognised - rejection by Federal Environment Agency only in case of non-compliance.

D. Traceability and transfer of information	
16. Allowed chain of custody systems (e.g., mass balance, book and claim) to link information to the biomass feedstock	Companies producing or trading in biofuels to be counted towards the targets shall be required to ensure full verification of compliance with the sustainability criteria through the use of a mass balance system based on the Renewable Energy Directive. The mass balance system shall contain the following information in particular: • Clear information on the allocation of purchased feedstocks or traded and sold biofuels to sellers and buyers, respectively, which allows for a clear identification of buyers and sellers • Date of purchase and sale of biofuels or feedstocks for biofuel production • Data on the type and quantity, the year of harvest and the countries of cultivation of the feedstocks • Information on the sustainability of the biomass used • A value for the greenhouse gas reduction potential of the biofuel produced, traded or used In the case of the use of default values, a clear description of the feedstock used
17. For mixing of different consignments of biomass, if allowed: Rules on allocation (e.g., based on energy content, mass)	Biofuels produced with different sustainability characteristics, and which are to count towards the targets may only be blended if the records by means of a mass balance system ensure in a traceable manner that the sum of all biofuels taken out of the blend has the same sustainability characteristics in the same quantities as the sum of all biofuels added to the blend. The GHG reduction rate of a blend of biofuels shall be calculated as the weighted average of the respective greenhouse gas reduction rates of the individual biofuels. Mass balance in means of a concept also covers energy balance, conversion factors, etc.
18. First point in supply chain to trace back the information to: • Forestry: forest residues • Agriculture: straw from cereals	The first point of the supply chain is always the first gathering point. Farmers do not need a certification from a voluntary scheme.

E. Monitoring compliance: the governance structure	
19. (Controlling) Authority to receive the required sustainability and GHG information from the economic operator (see A)	For biofuels used in road transport the Federal Environment Agency

20. Method of registering required information by the (controlling) authority, existence of database	elNa – the electronic sustainability system for biofuels used in road transport The Federal Environment Agency carries out checks on the sustainability of biofuels. Starting from the biofuel production site or the import, up to the point of marketing or export of the goods. Sustainability certificates, which are issued by means of the IT application elNa, certify compliance with the sustainability criteria for the quantity of biofuel produced and/or sold in Austria. Furthermore, in the course of the control, the data of the §20 notification is checked, which serves as the basis for the substitution target calculation, the GHG reduction target (2020) and as confirmation for the Federal Ministry. §20 notification Businesses that have issued or passed on sustainability certificates in the current calendar year shall submit an annual report to the Federal Ministry, which shall contain the following information in particular: • Proof of the quantities of all liquid and gaseous fossil fuels or biofuels and energy sources for use in the transport sector that were released for free circulation, used or traded for the first time in the territory of Austria, stating the origin and place of purchase; broken down by o the quantities that meet the sustainability criteria and the quantities that do not meet the sustainability criteria o the quantities produced from the raw materials listed. If different raw materials are used, the notifiers shall indicate the quantity of the final product for each input material produced in the reporting year in the corresponding processing plants. o A record of the quantities of all other renewable fuels for use in motor vehicles released for consumption or used, indicating the type and quantity of fuels; o A record of all quantities of fuel processed together, with details of the nature and quantity of each raw material and the place and time of manufacture of the final product; o Proof that the renewable energy to be credited towards the target meets the sustainability criteria, as well as a tabular list of the individual sustainability certificates and the data contained therein for the biofuels first released for free circulation under excise duty law in the Federal territory or released for free circulation under excise duty law in the Federal territory or used; and the level of the life cycle greenhouse gas emissions of biofuels calculated in accordance with the guidelines of the Austrian Fuel Ordinance and the greenhouse gas intensity of each individual fuel and energy carrier placed on the market or used for free circulation under excise duty law for use in the transport sector per unit of energy and the specific total value, in accordance with the respective shares of the total quantity in the respective reporting year. The calculation results shall be reported including the provisional mean values of the estimated emissions due to indirect land use changes from biofuels.

21. Method of correctness check on required information by the (controlling) authority	The elNA system has internal verification mechanisms that automatically verify the plausibility of the data entered before it generates a sustainability certificate. A check of the data entered by the market participants is also carried out by on-site inspections (only in Austria), which are carried out by experts from the Federal Environment Agency. In addition, ongoing checks of the database are carried out in order to be able to identify incorrect entries at an early stage. Generally, the Federal Environment Agency checks back until the first gathering point (traders, producers, distributors). There are on-site controls (only in Austria) at least every three years at each distributor. Big biofuel producers and importers are checked every year. There are also annual checks at companies with issues in the past. There are about 60 to 80 companies supplying fuel for road transport in total in Austria. Checked are certificates, trades, GHG emission calculations, requests regarding feedstocks, storage, etc. Sample inspections can be done also by farmers in the case of cross-compliance checks from AACS. A registration at elNa is only possible with a voluntary scheme certificate. These certificates are public and are checked from the Federal Environment Agency. The elNa database is providing the data for verifying the fulfilment of the targets of the fuel ordinance with sustainable biofuels. For each trade with biofuels a proof of sustainability from the elNa system is required. Biofuels without proof of sustainability cannot be counted to the target. There are reporting obligations for distributors. Incorrect or missing data can be detected if the mass balance is not correct.
22. Public availability of information and extent thereof	The Federal Environment Agency publishes the registered companies with company name, contact details of the company and registration number. The aggregated results of fuel quantities used, biofuel production and sustainability characteristics of the biofuels brought on to the market are published annually in a report on the website of the Federal Ministry for climate action: Erneuerbare Kraftstoffe und Energieträger im Verkehrssektor in Österreich (bmk.gv.at) The scheme AACS is publishing registered companies, with registration number, company name and address, date of registration, type of registration and date until the registration is valid on their website (such as the other voluntary schemes).
23. Authority of the controlling authority (or other governance organisation) to check correctness of information passed throughout the supply chain; • First applicable point in the value chain • Type of information	The Federal Minister for Climate Protection, Environment, Energy, Mobility, Innovation and Technology is entitled to monitor compliance with the provisions of the Fuel Ordinance. In doing so, it may, with due regard to the principles of economy, efficiency and expediency, avail itself of the services of the Federal Environment Agency, which shall act within the framework of the Environmental Control Act, its assigned tasks. On-site controls are only done in Austria. First point is the first gathering point. The substitution and reporting officers to be inspected shall provide the information necessary for the inspection activity, allow inspection of the records, provide printouts, copies or data records free of charge upon request and allow access to the premises. The monitoring activities shall be carried out in an appropriate manner during operating hours.

24. Consequences of non-compliance in case of incomplete and/or incorrect information submitted by the economic operator	If information is missing the elNa system is not generating a proof of sustainability. If there are issues at an on-site control the companies can be blocked for some time or completely. In the worst case the proof of sustainability is retroactively devaluated, which can lead to compensation payments if the targets are not fulfilled. Sanction from AACS: If a registered farmer who has sold agricultural raw materials as sustainable receives a sanction for non-compliance with a relevant provision, he shall immediately notify the buyer of the goods. The reason for this notification obligation of the registered farmer is the possibility of immediate reallocation of the goods concerned for the buyer.
E1. Monitoring compliance of certification standards *(Only relevant when they can be used to proof compliance)*	
25. Authority of the controlling authority (or other governance organisation) to monitor the competency of the auditors and if yes; • First applicable point in the value chain • Scope of the monitoring	The Federal Environment Agency is not providing certificates, but proof of sustainability. It is mainly collecting data regarding mass balance, achieving the target, check correctness of data (including sustainability compliance). If the Federal Environment Agency is noticing incorrect data or issues during on-site controls, there is consultation with the voluntary scheme. Actually, due to the Commission implementing regulation (EU) 2022/996 Austria is working on a procedure for the auditing of CBs
26. Consequences of insufficient verification by the auditor	If the Federal Environment Agency is noticing incorrect data or issues during on-site controls the voluntary scheme is consulted. There may be a time limit for solving issues. If issues continue the company can be blocked. Repeated severe deficiencies may result in changes to the system. There is exchange between parties implementing RED-II and voluntary schemes on EU-level (e.g., REFUREC).
27. Authority of the controlling authority (or other governance organisation) to monitor the competency of certification schemes, and way thereof	According to RED, a collaboration with voluntary schemes is required, but there is no controlling authority. According to the implementing regulation (EU) 2022/996 Member States have to supervise certification bodies of voluntary Schemes Austria is actually working on a framework to do so.

28. Insight of the controlling authority (or other governance organisation) into the number of certification schemes being used throughout the full supply chain	The Federal Environment Agency primarily checks certificates for biofuels, but it can also check certificates for feedstocks. Voluntary schemes can be regional or dedicated to specific feedstocks – it is usual to have different voluntary schemes throughout the whole supply chain.
29. Consequences of insufficient verification and monitoring by the certification scheme	Whereas voluntary schemes check single companies, the Federal Environment Agency is checking the whole supply chain (biofuels). With RED-II came the opportunity to report to the commission if a certification is insufficient.

F. Other (optional)	
30. Highest risks in information transfer (completeness, correctness) between economic operators in the supply chain for advanced biofuel supply chains	[No input received]
31. Highest risks in information transfer and monitoring of the sustainability and GHG emission requirements in advanced biofuel supply chains between countries	[No input received]

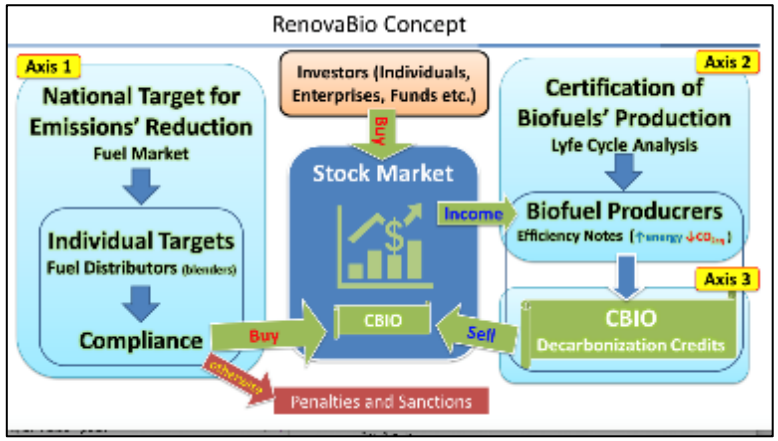
32. Opportunities for improvement to harmonize and strengthen policy frameworks to monitor the sustainability and GHG emission requirements of advanced biofuel supply chains	[No input received]

33. Other remarks	Issues: • Different classification regarding advanced feedstocks in different Member States leads to difficulties. • If a feedstock is considered as waste and resulting as advanced, the value is increasing, and the feedstock is not a waste anymore à misleading definition • Before classifying a waste/advanced feedstock, the historic application and the historic amount in comparison to the current amount must be monitored to avoid fraud. à A feedstock should only be considered as waste/advanced when it was really not used in the past. • A modern integrated biofuels production plant has disadvantages compared to older plants, which have on-site by-products/waste which can be considered as waste and therefore advanced. An incentive is created to generate more waste à Same dynamic as for UCO • Waste Management Act - So far companies have to report all generated waste, which they wanted to avoid. There was no mechanism to check if waste is really waste. Until now there was no advantage to declare a raw material as waste. This has now changed. The Federal Environment Agency can judge if a waste is really a waste (historic application and amount), whereas a voluntary scheme cannot. SAF related issues: • Although there are no specific policies promoting aviation and marine biofuels there is the intention to promote aviation biofuels. Initiatives, projects and strategy papers have been established in the recent years concerning the use of SAF. • BMK_Luftfahrtstrategie_2040_EN_UA.pdf (cicwp.nl): this Aviation Strategy, published by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), is a strategy and not legally binding. It is focusing on four thematic areas, namely: environmental protection and introduction of SAF, integration into the overall transport system, development of a level-playing field and innovation and technological change. • Internationality is a constitutive element in air traffic. Therefore, the objectives and measures of a national aviation strategy must also be geared towards the international context. National scope for action is largely determined by the the EU and international standards of ICAO. • CORSIA as part of the aviation strategy 2040+: Austria is committed to the use and further development of CORSIA, e.g. with regard to implementation, transparency, applicability and the quality of the offsets used. The BMK will examine whether and how aspects such as the quality of the offsets used can be communicated to passengers, e.g. as part of the EASA Eco-Label initiative. On EU level: • ReFuelEU Aviation aims at promoting SAF through a blending mandate for fossil suppliers to reach an increasingly high level of SAF into jet fuel (6% of by 2030 and 63% by 2050) and promoting the uptake of synthetic fuels (0.7% by 2030 and 28% by 2050 (pdf (europa.eu))

Relevant sources
Fuel Ordinance (Kraftstoffverordnung): https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20008075 Federal Environment Agency: https://www.umweltbundesamt.at/en/ Biokraftstoffbericht https://www.bmk.gv.at/themen/energie/energieversorgung/biomasse/alternative-kraftstoffe/biokraftstoffbericht.html BMK_Luftfahrtstrategie_2040_EN_UA.pdf (cicwp.nl) (German) Strategy for research, Technology and Innovation for Austrian aviation 2040+: https://www.bmk.gv.at/themen/innovation/aktivitaeten/luftfahrttechnologie/FTI-Strategien-Luftfahrt.html (German)

1.2. BRAZIL RENOVABIO

A1. General information	
1. Existence of a policy on the sustainability of (advanced) biofuels in the country, plus description	Brazil's current standards require a 27% blend of ethanol in gasoline, and gradually require an increase in biodiesel blends. In July 2021, The Brazilian government raised the mandatory blend of biodiesel into diesel to 12%. In Brazil, different regulations address the sustainability of biofuels production. Biofuel production plants and agricultural producers must comply with a comprehensive and detailed set of regulations (at federal, state and municipal level) covering aspects of environmental impacts, land use, social, economic, working conditions among others. For this project, we focus on the **RenovaBio program**, which contains national requirements for certifying biofuel production, and complements national regulation with a focus on GHG emissions. The RenovaBio program traces the production from farms to final use of fuel. RenovaBio includes ethanol, biodiesel, biomethane, biokerosene, second-generation ethanol, among others. The policy also serves to improve the country's energy security [1]. RenovaBio is composed of three strategic axes [2]: (i) annually the Government establishes national decarbonization targets for ten years, which are unfolded into mandatory individual targets for fuel distributors, proportional to their shares in the fossil fuel market. (ii) biofuel producers voluntarily certify their production and receive, as a result, energy-environmental sufficiency scores. (iii) These scores are multiplied by the volume of biofuel traded, resulting in the decarbonization credit (CBIO) that a biofuel producer can commercialize. These CBIOs are attested by certification agencies, and traded, in an over-the-counter (OTC) market, at trading platform B3. In December 2019, the program came into effect and it was possible to purchase CBIOs as of April 2020.



GHG emissions and allows for the sale and trade of decarbonization credits (CBIOs). Each CBIO represents one metric ton of carbon saved through the utilization of biofuels versus fossil fuels [3].

In addition to RenovaBio, Brazil already has a bill that addresses the incentives to produce aviation biokerosene (Law nº 14.248/2021). However, additional incentives were deemed necessary to broaden the spectrum of feedstocks to produce Sustainable Aviation Fuel (SAF) and better foster national production. In this sense, the Technical Committee Fuels for the Future (https://www.gov.br/mme/pt-br/programa-combustivel-do-futuro) was assembled to discuss not only SAF, but also road and marine fuels. The result was the Executive Bill nº 4516/23 (later attached to Bill no. 4196/2023), which was presented to Congress and is expected to be converted into Law soon.

Among other provisions, the Bill implements the National Sustainable Aviation Fuel Program (ProBioQAV), which sets emission reduction targets for airlines starting in 2027 through the use of SAFs. Airlines would be required to reduce GHG emissions in their domestic operations by using SAFs by at least 1% between 2027 and 2028. From then on, this percentage would increase by 1 percentage point each year until reaching a commitment to cut emissions by 10% by 2037. The National Agency of Petroleum, Gas and Biofuels (ANP) would be responsible for setting the values of total equivalent well-to-wake emissions per unit of energy for each production pathway for the purpose of accounting decarbonization against the fossil aviation kerosene.

2. Definition for 'advanced biofuels' under this policy	RenovaBio recognizes that different biofuels contribute differently to GHG emissions reduction, and those produced with lower carbon intensity (relative to liquid fossil fuel) will generate more CBIO per volume unit. Therefore, the more efficient and sustainable the individual production, the more CBIOs can be issued (2). For this reason, RenovaBio does not include a separate definition on advanced biofuels. RenovaBio certificates biofuels production mills that can prove to reduce GHG emissions related to fossil fuels counterparts and comply with eligibility criteria (beyond national regulation for other sustainability characteristics). Other criteria for the definition of advanced biofuels have been examined (i.e., non-food/feed crops) and our understanding is that such definition goes beyond scientific defensibility. The following biofuel pathways are considered in the policy: • Ethanol: sugarcane juice, 2G, corn (or combination of feedstock); • Biodiesel • Biomethane • Synthetic Alternative fuels (alternative KAV, gasoline, and diesel) from the soy-HEFA process. There is a process to include new pathways upon demonstration of economic and environmental potential.
3. Feedstock categories under the scope of 'advanced biofuels'	There is no definition of Advanced Biofuels. It works through a Life Cycle Analysis (see question 2). RenovaBio certifies biofuels that: (1) Reduce well-to-wheels GHG emissions (LCA analysis). (2) Comply with eligibility criteria (natural land conversion not allowed, compliance with forest code and agroecological zoning) So far, the detailed GHG accountability already plays the role to distinguish advanced and non-advanced biofuels.

A2. Requirements on GHG emission reduction and sustainability

4. GHG emission reduction and sustainability requirements included in the policy, and applicability to feedstock-to-biofuel chains, in particular requirements for:
   - Forest: forest residues to ethanol via gasification
   - Agriculture: ethanol production from cereal straw

GHG emission reduction requirements

Annual national emission reduction targets are set by the Brazilian National Council for Energy Policy (CNPE) for a 10-year period, which is then translated, by the National Agency of Petroleum, Gas and Biofuels (ANP), into individual targets applied to all fuel distributors, proportional to the amount of fossil fuel traded in the previous year. CNPE Resolution No. 6/2023 establishes the following annual targets:

Year	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Projected Carbon Intensity (gCO2/MJ)	72,77	71,70	69,97	68,74	67,67	66,68	66,02	65,56	65,44	65,22
Intended CI reduction (ref. 2018)	-0,8%	-2,2%	-4,6%	-6,3%	-7,7%	-9,1%	-10,0%	-10,6%	-10,8%	-11,1%
Annual CBIO target (Million CBIOs)	38,78	42,56	48,09	52,37	56,41	61,24	64,08	67,13	68,81	71,29
Tolerance range	-	48,94	55,30	60,23	64,87	70,43	73,70	77,20	79,14	81,98
	-	36,17	40,88	44,51	47,95	52,05	54,47	57,06	58,49	60,59

	Non-compliance with the individual targets results in fines proportional to the quantity of decarbonisation credits not acquired and may vary from R$ 100,000.00 to R$ 50,000,000.00.[1] Emissions reduction by using biofuels instead of fossil counterparts are the basis of the RenovaBio program. All biofuels' emissions from cradle to grave are considered and the program is technology "agnostic". The calculator "RenovaCalc", a tool based on the life cycle analysis, measures the carbon intensity of biofuels (in g CO2 eq./MJ) and compares it to its fossil fuel equivalent, generating the "Energy & Environment Efficiency Score" [2]. Emissions/reductions on land use change are <u>not accounted</u> due to scientific uncertainty. Eligibility criteria compliance assure that land use emissions are small or negative. Emissions of residues are zero at the point of collection. All emissions after collection are considered. <u>*Other sustainability requirements*</u> RenovaBio still establishes that, to be eligible, the biomass processed in the plants cannot be sourced from areas where there has been suppression of native vegetation and must comply with agroecological zoning. Additionally, biofuels producers must also demonstrate that biomass was produced in accordance with Brazilian environmental legislation, as demonstrated by the regularity in the Rural Environmental Registry (CAR) [(2)]. For biofuels produced in Brazil, RenovaBio requires therefore the following eligibility criteria at the farm level: • Traceability of feedstock and supporting information • Demonstration of compliance with the Brazilian Forest Code • Demonstration of protection of natural vegetation • In the case of palm oil, it must also demonstration of compliance with the agroecological zooning. National authority is working with interested parties to work on a definition for the same protection level in other countries.

[1] Lei No 13,576, de dezembro de 2017. Brasília, DF: Presidência da República.

B. Proofing compliance: Information required	
5. Obligated party and interval for reporting and proof of compliance of the sustainability and GHG emission of (advanced) biofuels	Fuel distributors are the obligated party to retire CBIOs. For 2023, the individual targets were calculated based on the compulsory annual target of 37.47 million CBIOs set by Resolution CNPE No. 13/2022. The market share of each fuel distributor in the commercialization of fossil fuels was calculated according to the methodology described in Article 6 of ANP Resolution No. 791/2019. The targets are achieved by distributors through the retirement (removal from circulation) of CBIOs in an amount corresponding to their targets. According to Decree 11,141/2022, the deadline for proving compliance with the 2023 targets is March 31 of the next year. Biofuel producers generate the CBIOs. The biofuel producer is responsible for providing all information and supporting evidence for the certification. A full certification process (including 3rd part inspection) is required every three years. Annual verification (without 3rd part inspection) is also required. Additional checks are adopted to verify volumes of biofuels *(see also question 6)*. Emissions reductions certificated (CBIOs) must be placed by banks and traded using the national banking system.
6. Information requirements for reporting sustainability and GHG emission (reduction) by the obligated party	Only authorized biofuel producers (and importers) are allowed to apply for a certification to be able to issue CBIOs. They all must provide individual information that allows to calculate the carbon footprint and the energy-environmental efficiency score using RenovaCalc and share of eligible volumes of: • Feedstock input levels • Processing input level efficiencies • Fuel transport modal • Final use emissions are built in the calculator *(See also "question 7")*
7. Information requirements on origin	For crop based feedstocks produced in Brazil: • GIS limits of the farm • Identification of feedstock producer • Evidence of no conversion of natural vegetation with cut-off date of 2018 (natural vegetation includes forests and other natural lands). In case of residue-based feedstocks, the origin of residues must also be provided. Propose grown biomass need to comply with eligibility criteria, as any other biomass. Additional definition of forest residues (based on local regulation) is available in the regulation. So far, no mill has requested to convert forest residues into liquid biofuels.

8. Criteria for the categorisation and definitions of feedstocks	The only categorization is whether feedstock is residue or not. The list includes residues from agricultural, forestry, industrial, processing, and “other”. A list of residues is provided in the official regulation (art. 3.2 of resolution 758/2018) [1].
9. Information requirements on feedstock type	The only categorization is whether feedstock is residue or not. All feedstocks used must be reported by the biofuel producer in the certification process.

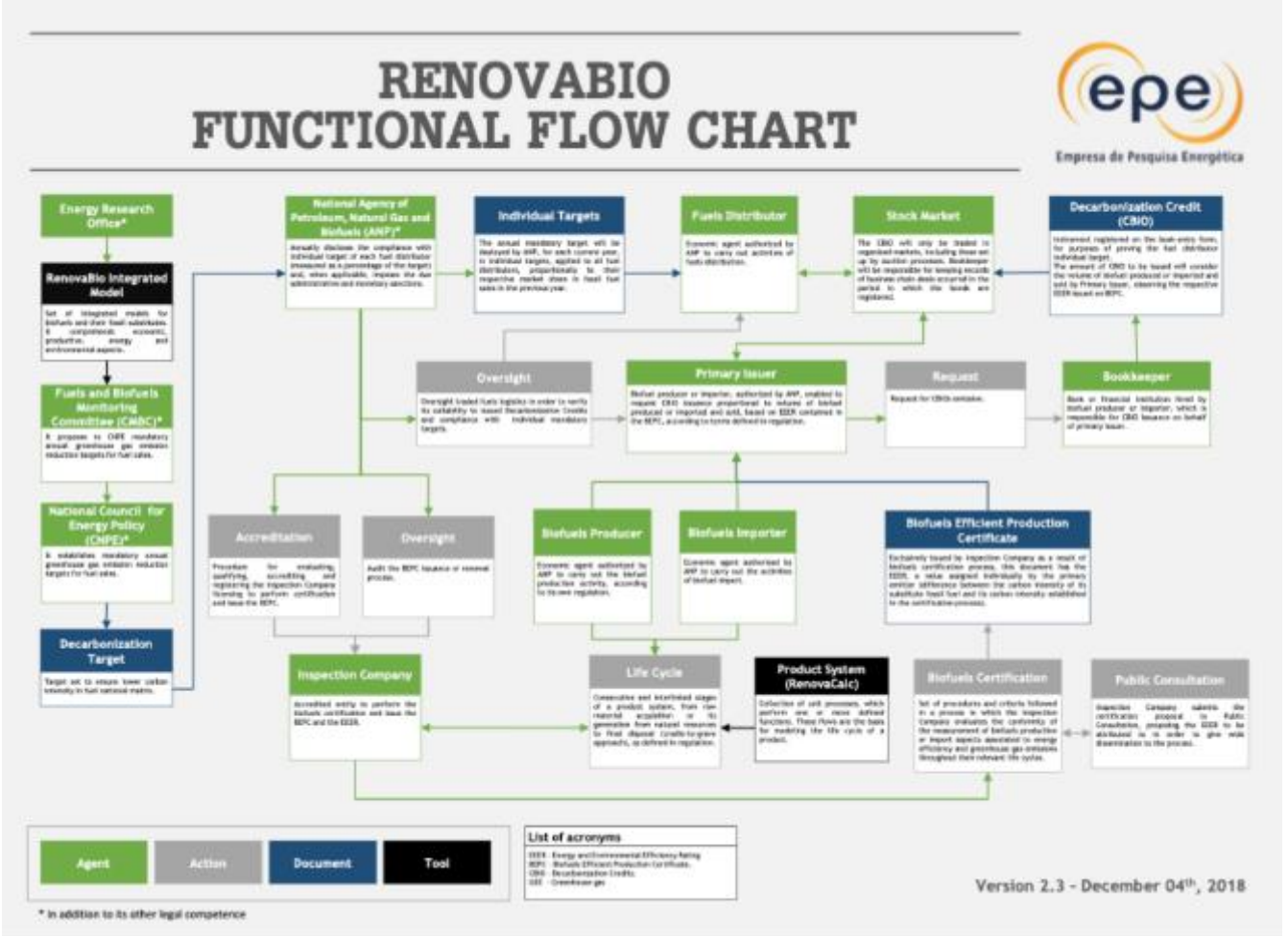
C. Proofing compliance: Verification methods required/ allowed	
10. Possibility to use certification systems to proof compliance and recognised schemes	RenovaBio does not make use of voluntary certification schemes (so far).
11. Possibility to use a national standard to prove compliance	RenovaBio has its own certification. No other certification is currently recognized.
C1. The approval and monitoring procedures for certification standards *(only relevant when they can be used to proof compliance)*	
12. Authority deciding on usable certification systems and/or national standards	The National Agency of Petroleum, Gas and Biofuels (ANP) is responsible for the specific regulation. ANP could recognize other certification schemes as part of the RenovaBio certification process if sufficient information regarding compatibility is presented by the certification owner. However, recognition has not been required yet.
13. Criteria used to approve a certification system and/or national standard	There is no specific regulation on this topic.

14. Minimum requirements around 3rd party auditing, intervals of verification or accreditation	The program requires 3rd part independent inspection and provides minimum requirements for auditors. Then the auditing results are made available for public consultation, and final revision from the national authority before a certificate is issued. There are detailed requirements and restrictions for a certification company to be recognized by RenovaBio. The firm that conducts the inspection must be accredited as a Greenhouse Gas Validation and Verification Body (OVV). There are also mandatory requirements on how to conduct the inspection, see [3])). As of December of 2023, the following certification companies are recognized by RenovaBio: Green Domus Desenvolvimento Sustentável LTDA EPP; SGS ICS Certificadora LTDA; Instituto Totum de Desenvolvimento e Gestão Empresarial LTDA; Fundação Carlos Alberto Vanzolini; Benri Classificação da Produção de Açúcar e Etanol LTDA; Verifit LTDA; Intertek do Brasil Inspeções LTDA; Associação Brasileira de Normas Técnicas; Pricewaterhousecoopers Auditores Independentes LTDA; KPMG Assessores LTDA; BVQI do Brasil Sociedade Certificadora LTDA; Ecogest - Projetos e Inovações Sustentáveis LTDA; Luiz Mattos e Engenheiros Associados LTDA. A full certification (including 3rd part audit) is required every 3 years. Annual evaluations (at least self-assessment) is also necessary, and reports can be requested by national authority at any time. A new full certification is required if carbon footprint or eligibility changes more than 10%.
15. Possibility and conditions of cross-compliance	Currently no possibility of cross-compliance. A single certification must be conducted for the entire value chain.

D. Traceability and transfer of information	
16. Allowed chain of custody systems (e.g., mass balance, book and claim) to link information to the biomass feedstock	Currently, certifiable feedstock needs to be segregated from non-certifiable feedstock along the value chain; only transfers without mixing is allowed along the chain of custody. Mass balance is allowed within the biofuel facilities in the biofuel production process and only when a (mass based) proportionality calculation is applied. The traceability of grains and vegetable oils has been particularly challenging within RenovaBio. After a research effort on this matter, ANP released in 2022 the Technical Report nº 06/SBQ v.0 providing operational details, supplementary to the procedures established in Resolution no. 758, for the implementation of a chain of custody. The models of “physical segregation” and “mass balance”, according to ISO 22095:2020, are accepted for the purpose of demonstrating the eligibility criteria for biofuel certification.
17. For mixing of different consignments of biomass, if allowed: Rules on allocation (e.g., based on energy content, mass)	The mixing is only allowed at the production of biofuel at the biofuel plant. Observed conversion factors are also applied. When only one feedstock type is used to produce biofuels (but only part of this feedstock is certified), the share of certified/noncertified biofuels is directly proportional to the share of certified feedstock in total feedstock that has been processed.

18. First point in supply chain to trace back the information to: • Forestry: forest residues • Agriculture: straw from cereals	Primary forest residues: Forest Management Unit (FMU) Primary agricultural residues: Field level: first collection point

E. Monitoring compliance: the governance structure	
19. (Controlling) Authority to receive the required sustainability and GHG information from the economic operator (see A)	The National Agency of Petroleum, Gas and Biofuels (ANP) is the controlling authority that oversees the certification process.



Source: [RenovaBio Functional Flowchart (epe.gov.br)]

20. Method of registering required information by the (controlling) authority, existence of database	ANP issues a certificate informing GHG savings per litre of biofuels by biofuel type and by economic operator. The abovementioned information, as well as information of the certification process is disclosed to public in a database hosted in the ANP website.
21. Method of correctness check on required information by the (controlling) authority	The economic operator must prepare the data and supporting evidence and request for a 3rd part inspection. This is communicated to the ANP. If the inspection firm considers that the economic operator (e.g., the biofuel producer) has provided sufficient and correct information based on credible evidence, the certification proposal is posted for public comments for a period no shorter than 30 days. Once all comments from the public comment period are addressed, the VB elaborates its final report and submit it to ANP. Once the company is certified, it will use the "CBIO emission factor" (gCO2 avoided per litre) for the biofuel production. ANP performs a final complete checking before a certification is issued. ANP staff also performs checks during the inspection process. ANP also verifies the quality of services of the inspection firms, including on-site visits during audit.
22. Public availability of information and extent thereof	All information of the certification process is available to the general public. However, some restrictions are applied for specific information, e.g. those treated as confidential business information. For example, the general public has access to aggregate agricultural inputs and all industrial efficiencies. However, the mill reserves the right to restrict the disaggregated information at farm level.
23. Authority of the controlling authority (or other governance organisation) to check correctness of information passed throughout the supply chain; • First applicable point in the value chain • Type of information	ANP can check correctness of all information in any step along the supply chain. Note that most feedstocks and biofuels are domestically produced.

24. Consequences of non-compliance in case of incomplete and/or incorrect information submitted by the economic operator	If incorrect information from OE is identified before the certificate is issued (i.e. by the VB), the VB must inform that the certification is in non-compliance and the product is not certified.

E1. Monitoring compliance of certification standards *(Only relevant when they can be used to proof compliance)*	
25. Authority of the controlling authority (or other governance organisation) to monitor the competency of the auditors and if yes; • First applicable point in the value chain • Scope of the monitoring	ANP has the obligation to oversee at any part of the production chain the correctness of the process, including the competence of auditors.
26. Consequences of insufficient verification by the auditor	ANP can apply sanctions according to Brazilian law. Sanctions include (but are not limited to) loosing recognition.
27. Authority of the controlling authority (or other governance organisation) to monitor the competency of certification schemes, and way thereof	No other certification scheme is recognized by RenovaBio, and ANP is the single controlling authority of the certification process.

28. Insight of the controlling authority (or other governance organisation) into the number of certification schemes being used throughout the full supply chain	No other certification scheme is recognized by RenovaBio.
29. Consequences of insufficient verification and monitoring by the certification scheme	No other certification scheme is recognized by RenovaBio.

F. Other (optional)	
30. Highest risks in information transfer (completeness, correctness) between economic operators in the supply chain for advanced biofuel supply chains	The "advanced biofuel" characterization is not used in RenovaBio. Regardless of this aspect, the risks in information transfer between economic operators under RenovaBio are essentially the same for other sustainability certification schemes. Therefore, the same common challenges and concerns are applicable: - Data accuracy and reliability (e.g., accurate assessment of the utilization of diesel and fertilizers by individual farmers); - Verification of compliance with the eligibility criteria (especially with respect to deforestation and forest code requirements); - The traceability of grains and vegetable oils has been particularly challenging within RenovaBio. In 2022, ANP released the Technical Report nº 06/SBQ v.0 providing operational details, supplementary to the procedures established in Resolution no. 758, for the implementation of a chain of custody; - Standardization of data formats. There is often a mismatch between the formats used by farmers (some provide the absolute figures for the calendar year, while others communicate values on a per hectare basis), which can eventually lead to errors associated with input parameters in RenovaCalc; - Ineffective communication and collaboration between economic operators due to, for example, lack of knowledge about the certification requirements or sectorial disputes between farmers and biofuel producers. It should be noted that RenovaBio came into effect in December 2019, and during its early stages the above-mentioned risks were naturally higher, as a relatively limited number of farmers and biofuel producers were familiar with sustainability certification schemes. But the industry has experienced a significant learning effect, and by 2022 there were already 11 accredited certification firms and more than 300 certified biofuel producers.

31. Highest risks in information transfer and monitoring of the sustainability and GHG emission requirements in advanced biofuel supply chains between countries	RenovaBio is a domestic policy which establishes annual decarbonization targets for the fuel sector in Brazil, aiming to encourage increased production and the participation of biofuels in the country's transportation energy matrix. Therefore, RenovaBio and CORSIA share common goals in addressing carbon emissions, albeit in different sectors. The alignment may involve ensuring that biofuels used in the aviation sector meet the sustainability criteria set forth by both RenovaBio and CORSIA, including factors such as life cycle GHG emission reductions and land use considerations. However, relevant differences exist in terms of other sustainability criteria and certification requirements. While focusing on GHG emissions, differently from CORSIA, RenovaBio does not set a minimum threshold for GHG mitigation. In terms of land use, RenovaBio does not include an LUC/ILUC factor, but relies on eligibility criteria to avoid deforestation and assure sustainable land use patterns within the country (with similar/equivalent requirements for imported fuels). In this sense, RenovaBio is more restrictive than other international policies that allow expansion over secondary vegetation types, if the associated emissions are below the policy threshold (as in the case of CORSIA). Further, the three eligibility criteria used in RenovaBio also contribute to water and biodiversity conservation, as all types of native vegetation are equally protected as well as sensitive habitats.[2] Apart from RenovaBio, it is important to remark that the ProBioQAV Program (established in the currently under discussion Bill no. 4196/2023) determines that ANP should seek alignment with the CORSIA eligibility criteria and certification requirements for SAF.
32. Opportunities for improvement to harmonize and strengthen policy frameworks to monitor the sustainability and GHG emission requirements of advanced biofuel supply chains	Even though the current sustainability criteria set forth by RenovaBio can be considered effective to avoid direct deforestation as well as contribute to water and biodiversity conservation2, opportunities to harmonize and strengthen the policy framework exist. In fact, these are considered necessary (by some stakeholders) as a strategy to expand the CBIO market. Particularly for SAF, the harmonization towards CORSIA would require the incorporation of direct LUC emissions into the carbon intensity score of the biofuel pathways. Protocols and assessment tools are already available for that purpose, but addressing the large uncertainties associated with these estimates remains a challenge.
33. Other remarks	[No input received]

[2] Renan M.L. Novaes et al., Resources, Conservation & Recycling, https://doi.org/10.1016/j.resconrec.2023.107207

Relevant sources

See also link to footnotes in text:

1. See: https://www.sugarcane.org/sustainability-the-brazilian-experience/renovabio/
2. Source: https://www.gov.br/mme/pt-br/assuntos/secretarias/petroleo-gas-natural-e-biocombustiveis/renovabio-1/renovabio-ingles
3. USDA (2021), Implementation of RenovaBio - Brazil's National Biofuels Policy, GAIN Agricultural Information Network, February 25,2021

1.3. GERMANY - POLICY FRAMEWORK RELATED TO SAFS

A1. General information	
1. Existence of a policy on the sustainability of (advanced) biofuels in the country, plus description	A general overview can be found here https://www.dbfz.de/en/Monitoring-renewables-transport/framework (last access: 01/2024) or here https://www.dbfz.de/en/Monitoring-renewables-transport/framework [Schröder 2023] at https://www.dbfz.de/fileadmin/user_upload/Referenzen/DBFZ_Reports/DBFZ_Report_44_EN.pdf as well as the update of the Implementation agendas of IEA Bioenergy Task 39. Within the Federal Climate Change Act, which has been amended again in 2021 the annual permissible emission in transport in Germany have to be reduced to 85 million metric tons by 2030 from the 1990 GHG emission levels. In Germany the RED and FQD for transport are implemented through the Greenhouse Gas Quota (GHG quota); specifically, Section 37a-d of the Federal Immission Control Act (BImSchG) and subsequent ordinances). This GHG quota is increasing from minimum 7% in 2022 to about 25% in 2030 (details in [Schröder 2023] Table 1-4). The fulfilment of the specified quotas is linked to further framework conditions in terms of the limiting or multiple counting of individual options. These are summarized in [Schröder 2023] Table 1-5. Biofuels can be used as one potential compliance options for reaching the GHG quota. Furthermore, there is a specific sub-target for the contribution of advanced biofuels towards the overall quota target. In addition, there is a specific quota for a minimum share of PTL or e-fuels in the aviation sector of 1% in 2028 and 2% in 2030. It is important to note, that this target can be fulfilled only with renewable fuels of non-biologic origin (RFNBOs). In theory, the aviation industry can use a higher share of alternative fuel, including biofuels, for example to achieve internal GHG reduction targets and trade this contribution to the overall quota target with other obliged parties. For 2024/25 the national transposition of RED II revision including aspects of RefuelAviation with a revision of the GHG quota. In that regard it is expected that also the National biomass strategy of Germany (NABIS) will be considered as well. Details or proposals are not known yet.
2. Definition for 'advanced biofuels' under this policy	The definition for advanced biofuels follows Annex IX, Part A of the RED II.
3. Feedstock categories under the scope of 'advanced biofuels'	See above, Annex IX Part A

A2. Requirements on GHG emission reduction and sustainability	
4. GHG emission reduction and sustainability requirements included in the policy, and applicability to feedstock-to-biofuel chains, in particular requirements for: • Forest: forest residues to ethanol via gasification • Agriculture: ethanol production from cereal straw	The German legislation for the implementation of the RED II follows the sustainability requirements for biofuels, as defined in the RED II. Precondition for the contribution of (advanced) biofuels towards the quota targets is that the production and use of these energy carriers is in compliance with the sustainability criteria of the RED II. These requirements are operationalised and implemented into national law with a specific ordinance on the sustainability of biofuels (Biofuels Sustainability Ordinance [Bio-NachAnpV); details can be seen in [Schröder 2023] section 7. The process of verifying that market actors fulfil these requirements is organised in a co-regulation approach, by recognised private certification schemes. Since Germany is not specifically promoting the use of biogenic SAF, no specific sustainability requirements do exist here. If SAF are being accounted as advanced biofuels under the Quota system (given that they are produced from qualified feedstock), the respective sustainability requirements included in the RED II have to be respected.

B. Proofing compliance: Information required	
5. Obligated party and interval for reporting and proof of compliance of the sustainability and GHG emission of (advanced) biofuels	The economic operator who wishes to bring certified biofuels on the German market. In most cases, these are biofuel producers which then sell their product to traders or those companies that are obliged to fulfil the GHG quota in the transport sector (e.g., mineral oil companies). However, those companies would only buy the biofuels in case they have the respective certificates. The certification period is usually one year. Sustainability declarations in Nabisy (the national German biofuel registry) are issued for each consignment traded.
6. Information requirements for reporting sustainability and GHG emission (reduction) by the obligated party	As for GHG emissions, a calculation according the RED II methodology has to be provided, usually in advance to the audit appointment, to the certification body. During the audit, the auditor will check the correctness of the actual values used for the calculations (e.g., electricity consumed, amount of harvested biomass, amount of produced products, etc.) The last interface in the biofuel supply chain (i.e. the market operator which is bringing the biofuel into the quota) needs to provide information to the national authority BLE by creating a “proof of sustainability” (database entry) in NABISY. This includes mass, energy content, GHG emissions, country of biomass cultivation and biomass-code of the biofuel supply chain (see 8.)

7. Information requirements on origin	Information about the country of origin is passed through the supply chain. The last interface reports about the country of origin to the national authority BLE via NABISY. For biofuels produced from agricultural biomass, the respective biomass producers have to be certified. This means that the Chain of Custody for such a biofuel will start at the level of the biomass producer, providing information from the audit and the verification of the sustainability requirements on a farm level, which are then traced throughout the supply chain. That downstream processors will buy sustainable material with related certificates. The origin of the biomass used for the production of certified biofuels has to be shown within a mass balance system.
8. Criteria for the categorisation and definitions of feedstocks	There is a list, published by BLE, in which 337 feedstocks are listed and related to a biomass code and further information. To issue a proof of sustainability in Nabisy (see 20), only feedstock from this list can be used (1). The list includes the following categories: type of biofuel, waste and residues from agriculture, RED II: Annex IX part a/b, advanced/conventional biofuel,
9. Information requirements on feedstock type	The biomass code (see 8)

C. Proofing compliance: Verification methods required/allowed	
10. Possibility to use certification systems to proof compliance and recognised schemes	The schemes that can be used are those that are approved and recognised by the EC. See: https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/voluntary-schemes_en
11. Possibility to use a national standard to prove compliance	There is no national certification scheme in Germany.
C1. The approval and monitoring procedures for certification standards *(only relevant when they can be used to proof compliance)*	
12. Authority deciding on usable certification systems and/or national standards	The EU Commission recognises voluntary schemes which are eligible for the certification process. In Germany, the Federal Office for Agriculture and Food (BLE) is responsible for the recognition and supervision of certification schemes. However, on a national level, the schemes that can be used are the same that are recognised on EU level.
13. Criteria used to approve a certification system and/or national standard	See 12. Those are the criteria used by the Commission.

14. Minimum requirements around 3rd party auditing, intervals of verification or accreditation	The requirements given in the REDII are valid also on the national level.
15. Possibility and conditions of cross-compliance	Cross-compliance is possible but depends on the specifications of the systems (cross-compliance has to be defined by the systems).

D. Traceability and transfer of information	
16. Allowed chain of custody systems (e.g., mass balance, book and claim) to link information to the biomass feedstock	Usually, everything is based on mass balancing (as mentioned in the RED II); physical segregation is also allowed. According to §10 of the German Biofuels Sustainability Regulation, the mass balancing system used by biofuel suppliers and the different interfaces in the chain of custody have to show the following characteristics: • allows mixing supplies of raw materials or fuels with different sustainability characteristics and different greenhouse gas saving characteristics, • allows blending deliveries of raw materials with different energy content for further processing, provided that the volume of deliveries is adjusted according to their energy content, • prescribes that information on the sustainability properties and on the greenhouse gas saving properties and on the respective scope of the consignments shall continue to be assigned to the mixture, • provides that the sum of all consignments withdrawn from the mixture has the same sustainability characteristics in the same quantities as the sum of all consignments added to the mixture and that this balance is achieved within a reasonable period of time, • Provides that when a consignment is processed, the information on the sustainability and greenhouse gas saving characteristics of the consignment is adjusted and allocated to the output in accordance with the following provisions: a. where the processing of the feedstock supply results only in an output intended for the production of biofuels, bioliquids, biomass fuels, renewable liquid and gaseous transport fuels of non-biogenic origin or recycled carbonaceous fuels, the volume of the supply and the corresponding values of the characteristics related to sustainability and greenhouse gas savings shall be adjusted by applying a conversion factor expressing the ratio between the mass of the output intended for that production and the mass of feedstock at the start of the process, b. where the processing of the feedstock supply results in multiple outputs to be used for the production of biofuels, bioliquids, biomass fuels, renewable liquid and gaseous transport fuels of non-biogenic origin or recycled carbonaceous fuels, a separate conversion factor shall be applied for each output and a separate mass balance shall be used.

	As for residues, the first supply chain element that has to be certified is the one collecting the residues and bringing it to the market. They have to show, where this biomass is coming from and, that the that respective sustainability requirements for forestry and agricultural residues are being met, A big topic right now is the potential future development of biomethane trade. GOOs are being managed by the national Biogas registry. Currently, and for the two value chain examples in this project, eligible mass balance systems are defined by the criteria mentioned under point 7.
17. For mixing of different consignments of biomass, if allowed: Rules on allocation (e.g., based on energy content, mass)	Allocation of sustainability characteristics to a consignment can be done based on mass. "the sum of all consignments withdrawn from the mixture has the same sustainability characteristics in the same quantities as the sum of all consignments added to the mixture and that this balance is achieved within a reasonable period of time"
18. First point in supply chain to trace back the information to: • Forestry: forest residues • Agriculture: straw from cereals	The point of collection of the biomass, the operator producing the residue.

E. Monitoring compliance: the governance structure	
19. (Controlling) Authority to receive the required sustainability and GHG information from the economic operator (see A)	The BLE (our national authority, supervising the whole certification processes) operates a database system or registry (Nabisy) in which information is inserted by economic operators which put biofuels on the market (last interfaces). Traders after the last interface can receive (and also split) proofs of sustainability.
20. Method of registering required information by the (controlling) authority, existence of database	The national registry for biofuels: the Nabisy system.

21. Method of correctness check on required information by the (controlling) authority	In case of GHG emissions reported, there is a “traffic light system” which informs about “unusual” results (e.g. GHG mitigation values). If reported emissions exceed the threshold, the GHG calculation might be re-assessed.
22. Public availability of information and extent thereof	The database is not publicly available. BLE publishes a yearly report in which amounts of biofuels, GHG-emissions, countries of origins etc. are reported. For 2022 the report can be found here: https://www.ble.de/SharedDocs/Downloads/DE/Klima-Energie/Nachhaltige-Biomasseherstellung/Evaluationsbericht_2022.pdf?__blob=publicationFile&v=2
23. Authority of the controlling authority (or other governance organisation) to check correctness of information passed throughout the supply chain • First applicable point in the value chain • Type of information	BLE is monitoring the recognized certification bodies. Yearly surveillance audits are conducted in which certification projects are evaluated including the review of all required information. Moreover, auditors working for BLE are attending audits of recognized certification bodies in Germany and other countries. Operators are indirectly checked in the annual CB audit. As part of the sample of certification projects to be reviewed, BLE could choose a specific operator (e.g., when fraudulence is supposed for some reasons).
24. Consequences of non-compliance in case of incomplete and/or incorrect information submitted by the economic operator	National authority might inform the respective certification body. Consequently, missing information can be collected in a re-audit, if possible (see #30). Also, the certificate might be withdrawn in case inconsistencies are being recognised in this process (if possible, see #30).
E1. Monitoring compliance of certification standards *(Only relevant when they can be used to proof compliance)*	
25. Authority of the controlling authority (or other governance organisation) to monitor the competency of the auditors and if yes; • First applicable point in the value chain • Scope of the monitoring	To our knowledge a monitoring of the competency of auditors by the BLE is done in the following two ways: - Within the surveillance audits of recognized certification bodies, samples of certification projects are assessed. This includes a review of the audit report. Moreover, the CB should have a process to authorize auditors. This includes evidence of relevant qualification and experiences. Audits of recognized certification bodies are accompanied by BLE-auditors. There is no limitation of certain points in the value chain: it can be inside and outside Germany

26. Consequences of insufficient verification by the auditor	Potential consequences are: Certification scheme is informed and might take measures to investigate the case and potentially file restrictions against the involved parties. The respective certificates will become invalid. In cases of fraud, there might be additional investigations from the local authorities, leading to the withdraw of approval or recognition of certification schemes and bodies.
27. Authority of the controlling authority (or other governance organisation) to monitor the competency of certification schemes, and way thereof	Certification schemes are monitored by the EU-Commission. Schemes are required to report on their activities annually. If the BLE identifies non-compliances, they might inform the commission.
28. Insight of the controlling authority (or other governance organisation) into the number of certification schemes being used throughout the full supply chain	The controlling authority has no insight in this. Based on the information available in NABISY, the national authority BLE is only aware of the certification scheme applied by the last interface.
29. Consequences of insufficient verification and monitoring by the certification scheme	see 25. BLE would inform EC in case of sever shortcomings of the certification schemes.

F. Other (optional)	
30. Highest risks in information transfer (completeness, correctness) between economic operators in the supply chain for	The weakest point might be the human factor, i.e. the auditor and the question whether there are always enough well trained and experienced auditors around. Regarding #24: - collected missing information in a re-audit can be impossible to realise (e.g. in the case of biodiesel imports from Asia);

advanced biofuel supply chains	- the inability to revoke a certificate in the case of suspected fraud that cannot be clarified and therefore the recognition once granted remains valid and consequently large amounts of GHG savings, which also have an impact in the following year.
31. Highest risks in information transfer and monitoring of the sustainability and GHG emission requirements in advanced biofuel supply chains between countries	The Commission aims to set up a Union wide database. This is a good and necessary development. Furthermore, approaches for the collection of information and the general assessment of sustainability criteria might differ between certification schemes, hindering the general comparability of data collected across the EU. Another risk appears, where necessary controls along the supply chain are not allowed by national authorities in the country of origin (non EU MS). Regarding #23: Suspected cases of fraud have given rise to sobering experiences with regard to controllability. There is a corresponding need for improvement.
32. Opportunities for improvement to harmonize and strengthen policy frameworks to monitor the sustainability and GHG emission requirements of advanced biofuel supply chains	More harmonised sustainability criteria, and the national implementation of them, in all EU MS would not only ease the trade between countries, but also enable a harmonized monitoring. Harmonisation of minimum requirements regarding the qualification of auditors and also the auditor support by certification schemes.
33. Other remarks	[No input received]

Relevant sources
The German regulation: https://www.buzer.de/Biokraft-NachV.htm The list of feedstock that can be included in Nabisy: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjt17P7voj0AhWWR_EDHTsMCbkQFnoECBMQAw&url=https%3A%2F%2Fwww.ble.de%2FSharedDocs%2FDownloads%2FDE%2FKlima-Energie%2FNachhaltige-Biomasseherstellung%2FNabisy%2FBiomassecodeliste.xlsx%3F__blob%3DpublicationFile%26v%3D7&usg=AOvVaw0r5GEt2rec2JeUq4L4zOXu

1.4. ICAO – CORSIA FRAMEWORK

A1. General information	
1. Existence of a policy on the sustainability of (advanced) biofuels in the country, plus description	ICAO has agreed on four aspirational goals for the international aviation sector: • 2% annual fuel efficiency improvement through 2050 • Carbon neutral growth from 2020 onwards (CNG 2020) • a long-term aspirational goal of net-zero carbon emissions by 2050: https://www.icao.int/environmental-protection/Pages/LTAG.aspx • a mid-term global aspirational Vision to reduce CO_2 emissions in international aviation by 5% by 2030 through the use of SAF, LCAF, and other aviation cleaner energies ICAO has identified the following areas that can contribute to the attainment of the global aspirational goals: • Aircraft related technology and standards • Improved air traffic management and operational improvements • Development and deployment of sustainable aviation fuel • CORSIA CORSIA is a global market-based measure designed to offset international aviation CO2 emissions to stabilize the levels of such emissions from 2020 onwards (CNG2020). Offsetting of CO2 emissions will be achieved through the acquisition and cancelation of emissions units from the global carbon market by aeroplane operators. CORSIA Eligible Fuels (SAF and LCAF) can be used to reduce this offsetting obligation. There is no direct financial support from ICAO to States/operators for CORSIA. The approved Sustainability Certification Schemes that are permitted to certify CORSIA Eligible fuels are listed in the CORSIA Approved Sustainability Certification Schemes document as found in the CORSIA Eligible Fuels ICAO documents webpage. The third ICAO Conference on Aviation and Alternative Fuels (CAAF/3) emphasized the role of SAF, LCAF, and other aviation cleaner energies in achieving the sector's aspiration for 2050 with an agreement on a vision of 5% reduction in CO_2 emissions for international aviation sector's emission in 2030. CAAF/3 delivered a Global Framework that encompasses a common understanding of the needed policies, regulatory framework, implementation support, and financing that will aid in building towards the 2030 vision.

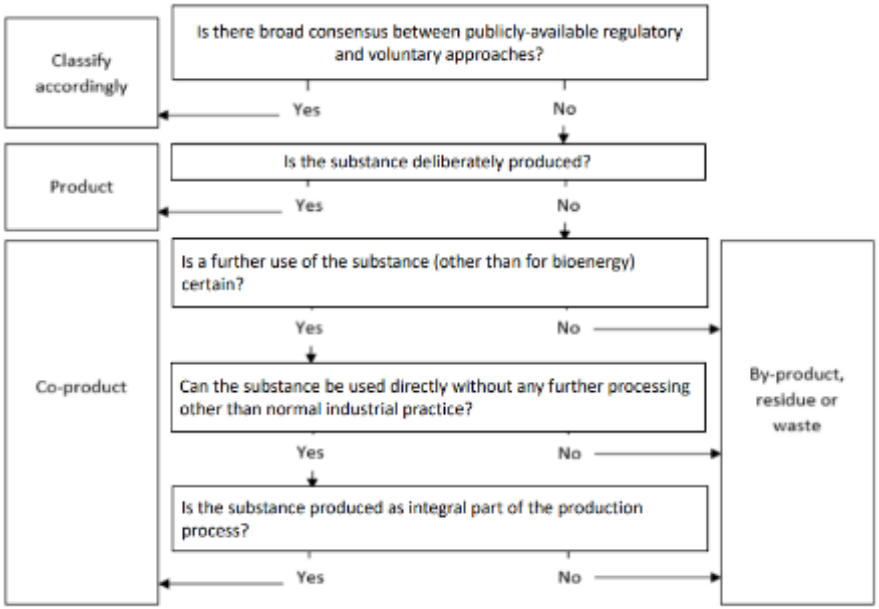
2. Definition for 'advanced biofuels' under this policy	CORSIA Eligible Fuels are not categorised distinctly as conventional or advanced biofuel because CORSIA was developed to be feedstock and technology neutral. Qualifying under the CORSIA Eligible Fuel Sustainability Criteria and in particular the minimum required life cycle GHG emissions reduction permit the alternative fuel to become CORSIA eligible. The number of CEF pathways qualified under ICAO CORSIA can deliver a spectrum of life cycle GHG emissions reduction as long as the CEF pathway meets the CORSIA Eligible Fuel Sustainability Criteria. There are two types of CORSIA Eligible Fuels (CEF) – (i) Sustainable Aviation Fuels (SAF) and (ii) fossil-based Lower Carbon Aviation Fuels (LCAF). SAF is defined as: "CORSIA sustainable aviation fuel. A renewable or waste-derived aviation fuel that meets the CORSIA Sustainability Criteria under this Volume." ("This Volume" refers to Standards and Recommended Practices (SARP) Annex 16 (Environmental Protection), Vol IV (CORSIA))
3. Feedstock categories under the scope of 'advanced biofuels'	Renewable or waste feedstocks (evolving list) – default LCA values (so currently allowable feedstocks) are here (June 2022 edition). Default values are specified by the fuel conversion process (e.g., alcohol/ ethanol to jet fuel or Fisher-Tropsch) and by the fuel feedstock and region. This includes for example forestry and agricultural residues, UCO, miscanthus, poplar. Also, sugar beet (from EU) or sugar cane (from Brazil) or corn grain (from the US) are on this list, among others. For waste-derived feedstocks, a positive list of allowable materials is provided in the Feedstock Categories section in the CORSIA Methodology for Calculating Actual Life Cycle Emissions Values. Such feedstocks are assessed critically for their economic value and any existing uses that might induce land use change if it is diverted for use in fuels production. A feedstock receiving "waste" or "by-product" classification is not penalized with an induced land use change GHG emission value that would otherwise be applied to a feedstock that is classified as a "primary" product or "co-product".
A2. Requirements on GHG emission reduction and sustainability	
4. GHG emission reduction and sustainability requirements included in the policy, and applicability to feedstock-to-biofuel chains, in particular requirements for: • Forest: forest residues to ethanol via gasification	The current sustainability requirements for all CEF for the pilot phase (2021-2023) of CORSIA are in Chapter 1 of the CORSIA Sustainability Criteria for CORSIA Eligible Fuels while the CEF sustainability requirements after the pilot phase (from 2024) are in Chapter 2 (SAF) and Chapter 3 (LCAF)of requirements related to GHG emissions reduction includes: 1) A 10% reduction in GHG emissions compared to petroleum-based jet fuel. 2) Restrictions on conversion (after 1 Jan 2008) or degradation of carbon stock of primary forest, wetlands, peatlands > CORSIA eligible fuel shall not be made from biomass obtained from land converted after 1 January 2008 that was primary forest, wetlands, or peat lands and/or contributes to degradation of the carbon stock in primary forests, wetlands, or peat lands as these lands all have high carbon stocks. 3) In the event of land use conversion after 1 January 2008, as defined based on IPCC land categories, direct land use change (DLUC) emissions shall be calculated. If DLUC greenhouse gas emissions exceed the default induced land use change (ILUC) value, the DLUC value shall replace the default ILUC value (e.g., if there is a conversion between IPCC land use categories after the cut-off date, then DLUC is addressed). A set of expanded sustainability criteria addressing water quality/use, soil, air quality, conservation, wastes and chemicals, and

• Agriculture: ethanol production from cereal straw	social and economic themes were approved in November of 2022 to be implemented in the Voluntary Phase (2024-2026) and thereafter, as found in Chapter 2 and 3 of the Sustainability Criteria document. There are no separate requirements for the two pathways listed in the question. The system boundary of the core LCA value calculation shall include the full supply chain of CEF production and use. As such, emissions associated with the following life cycle stages of the CEF supply chain must be accounted for: (1) production at source (e.g., feedstock cultivation); (2) conditioning at source (e.g., feedstock harvesting, collection, and recovery); (3) feedstock processing and extraction; (4) feedstock transportation to processing and fuel production facilities; (5) feedstock-to-fuel conversion processes; (6) fuel transportation and distribution to the blend point; (7) fuel transportation from the blending point to the aircraft uplift location; and (8) fuel combustion in an aircraft engine. CORSIA is applicable only to international aviation. For the purposes of CORSIA, an international flight is defined as the operation of an aircraft from take-off at an aerodrome of a State or its territories, and landing at an aerodrome of another State or its territories.[3]

B. Proofing compliance: Information required	
5. Obligated party and interval for reporting and proof of compliance of the sustainability and GHG emission of (advanced) biofuels	States (countries) are the obligated party reporting CORSIA eligible fuel use to ICAO. The States receive information from the aeroplane operators (airlines) that are assigned to their State. States submit this information to ICAO annually. However, fuels that are purchased in one year do not need to be claimed for emissions reductions in that year – the airlines have up to three years to claim the emissions reductions. (ICAO MEMBER STATES participating IN CORSIA need to ensure that their aeroplane operators comply with the CORSIA offsetting requirements every three years, in addition to annual CO2 MRV). So far, 192 States agreed to it originally, and the current commitments to be engaged in the pilot phase are posted here: https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-News.aspx As of October 2023, a total of 126 Member States have agreed to voluntarily participate in the post-pilot phase of CORSIA, which begins on 1 January 2024.
6. Information requirements for reporting sustainability and GHG emission	All CORSIA Eligible Fuels (CEF) need to be certified by a Sustainability Certification Scheme (SCS). Annually as part of the submission to the CORSIA Central Registry, the State must submit information on: • Production year of the CEF • Producer of the CEF

[3] https://www.icao.int/environmental-protection/CORSIA/Documents/CORSIA_FAQs_Dec2022.pdf

	(reduction) by the obligated party	• Batch numbers • Total mass of each batch • Type of fuel, feedstock and conversion process of CEF batch production • Total mass of neat CEF being claimed by all airlines to the State • Total emissions reduction claimed from CEF There is a separate annual reporting process specified in the CORSIA Eligibility Framework and Requirements for SCS that requires the SCS to supply information as well – which gives information about the certification scheme used. This way, Batch #'s can be compared and associated life cycle GHG emission reduction claims can be traced to a CORSIA certified production pathway and the constituent economic operators in the supply chain. SCSs also publish on their website the economic operators who are certified by them.
7.	Information requirements on origin	Certification by an SCS is required and goes to the point of initial collection. For crops/forestry products this would be at the field, whereas for wastes it would be at the first collection point after waste is produced. Thus: • Primary forest residues: on forest level (Forest management unit) • Secondary (sawmill residues): First collection point • UCO: First collection point • Straw (primary agricultural residues): Farm level
8.	Criteria for the categorisation and definitions of feedstocks	The CORSIA decision-tree:

	
9. Information requirements on feedstock type	General requirements: Feedstocks must be provided for each batch of fuel and are certified per answer to #7. For fuel claims based on a CORSIA Eligible Fuel default life cycle emissions value, the feedstock, region of production of the feedstock, and associated feedstock to fuel conversion process must match the default value table specifications in the ICAO Document "CORSIA Default Life Cycle Emissions Values for CORSIA Eligible Fuels." Relevant requirements for feedstock certification are specified by ICAO in Table 2 (General requirements set by SCS on Economic Operators) of the ICAO Document "CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes." More actual certification/auditing requirements in the operational procedures of SCS for certification bodies are publicized on the ICAO CORSIA website (see #10).

C. Proofing compliance: Verification methods required/ allowed	
10. Possibility to use certification systems to proof compliance	This is possible. Thus far RSB and ISCC are approved/recognized. The current list can always be found here.

and recognised schemes	Both RSB and ISCC have two "tiers" of CORSIA certification – one that only applies the currently approved sustainability criteria, and one that is more comprehensive/has more criteria. Their materials are public at: RSB: https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-SCS-evaluation-RSB.aspx ISCC: https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-SCS-evaluation-ISCC.aspx For example: ISCC CORSIA and ISCC CORSIA PLUS For RSB: CORSIA eligibility only (non-RSB) and RSB CORSIA
11. Possibility to use a national standard to prove compliance	No national standards are currently approved; they are not precluded from being approved if they apply through the ICAO SCS application process.
C1. The approval and monitoring procedures for certification standards *(only relevant when they can be used to proof compliance)*	
12. Authority deciding on usable certification systems and/or national standards	ICAO has a task group called the Sustainability Certification Scheme Evaluation Group (SCSEG) that screens applicant SCSs for compliance with the ICAO Document "CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes" and recommends their inclusion to ICAO Council. There is a requirement to review the ICAO-approved SCSs at a minimum once every five years according to the SCSEG terms of reference. Next to that, the SCSs will need to be reapproved for the Voluntary Phase of CORSIA (which starts in 2024) as the sustainability criteria will change. If criteria change again for the Mandatory Phase (or requirements change at any time in between), a re-approval would be needed as well.
13. Criteria used to approve a certification system and/or national standard	See the CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes. The requirements are organized in tables and include the following themes (further outlines in criteria): Table 1: Requirements for SCS: • Documentation management • Audit competencies • SCS Group auditing requirements (where applicable) • Non-compliance with certification requirements • Monitoring and system review • Transparency • Annual reports • Risk management plan • Accreditation of certification bodies • Stakeholder engagement (SCS has a process for incorporating stakeholder input relevant to the CORSIA sustainability criteria and adequate to the scope and scale of the operation) • Complaint procedure • Transparency on Greenhouse Gas (GHG) reporting and accounting

	• Application of sustainability criteria Table 2. General requirements set by SCS on Economic Operators • Documentation management • Transparency on other SCS participation by economic operators • CORSIA certification requirements: SCS requires the economic operator to demonstrate and document that it satisfies all CORSIA requirements specific to the economic operator stated herein (further specified) Table 3. Traceability requirements set by SCS on Economic Operators • Traceability: mass balance • Traceability: Mass balance system documentation • Traceability: Mass balance level of operation • Traceability: Mass balance timeframe Table 4. Information Transmission requirements set by SCS on Economic Operators • Transmission of information in the supply chain Table 5. Requirements set by SCS on Certification Bodies • Accreditation and auditing standards • Audits • Transfer from one SCS to another • Certificate issuance • Group auditing (where applicable) • Auditor competencies • Establishment of a level of assurance Referenced ISO standards: • ISO/IEC 17065 Conformity assessment — Requirements for bodies certifying products, processes and services • ISO 19011 Guidelines for auditing management systems • ISO 14064-3 Specification with guidance for the validation and verification of greenhouse gas assertions ISO/IEC 17011 Conformity assessment — Requirements for accreditation bodies accrediting conformity assessment bodies

14. Possibility to use certification systems to proof compliance and recognised schemes	See the CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes
	• See Table 1: Requirements for SCS
	  ○ Requirement 2. Audit competencies e.g., SCS must reflect specific audit competencies requirements and ensure auditors meet such requirements
	  ○ Requirement 9. Accreditation of certification bodies e.g., accreditation body compliance with ISO 17011; accreditation body competencies
	• See Table 5. Requirements set by SCS on Certification Bodies

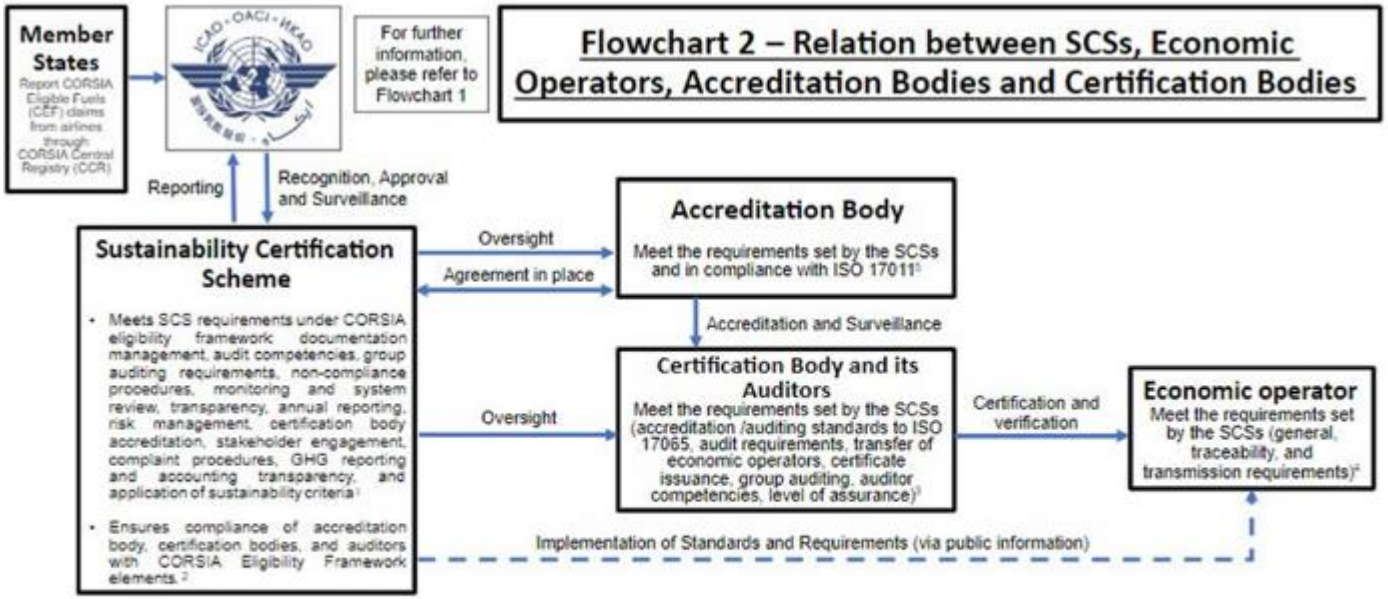
	○ Requirement 1: Accreditation and Auditing Standards e.g, compliance with ISO 17011, 17065, and 19011 as appropriate; GHG LCA in line with ISO 14064-3 ○ Requirement 2: Audits ○ Requirement 6. Auditor competencies e.g., auditor appointment in accordance with ISO 19011, auditor knowledge base and competencies with respect to CORSIA eligible fuels framework For example: • Initial audits should be performed on-site. • SCS may permit remote audits by the certification body under conditions such as when the certification body assesses the audit risk to be low; the level of assurance can be ensured; and traceability of records and GHG data are sufficiently available
15. Possibility to use a national standard to prove compliance	ICAO-approved SCSs are not required to recognize each other. No formal requirements have been outlined regarding cross-compliance. The following requirements for SCS, economic operators, and certification bodies, as appropriate, references cross-compliance: Table 1.6: SCS ensures that the following information is made publicly available on a website: the names of any other eligible SCS that the subject SCS recognizes within its CORSIA certification programme. Table 2.2: Transparency on other SCS participation by economic operators: SCS requires all economic operators to declare the names of all SCS under which they are and/or were certified and make available to the auditors all information relevant to those certifications. Table 5.3: Transfer from one SCS to another: Prior to re-certification of an economic operator that was previously found to be in major non-conformity with any other SCS, the certification body will be required to bring this to the attention of the SCS.

D. Traceability and transfer of information	
16. Allowed chain of custody systems (e.g., mass balance, book and claim) to link information to the biomass feedstock	Mass balance requirements and information transmission requirements are specified for biomass feedstocks (See Table 3 and Table 4 in the CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes). It should be noted that CORSIA is a type of book and claim system whereby certification (based on mass balance C-o-C) up to the fuel blend point is required. Thereafter, SAF is not required to be physically completely traceable to the aircraft that uses it in operation. Instead, proof of claim to the SAF that was blended is required from the aircraft operator claiming the use of SAF. Section 2.4.3 in Chapter 2 of ICAO Annex 16, Volume IV (CORSIA) details requirements for such proof which can include fuel purchases, transaction reports, fuel blending records, and sustainability credentials. While fuel usage is the focus, the biomass feedstock used to produce the fuel is part of sustainability certification of the CORSIA eligible fuel.
17. For mixing of different consignments of biomass, if allowed: Rules on allocation	Mass balance is required (See Traceability requirements in Table 3, Requirement 1.1 in the CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes) SCS requires economic operators to use a mass balance system that:

(e.g., based on energy content, mass)	a) Allows batches of sustainable materials with differing sustainability characteristics to be mixed. b) Requires information about the sustainability characteristics and sizes of the physical quantity (batches) referred to in point (a) to remain assigned to the mixture. c) Provides for the sum of all consignments withdrawn from the mixture to be described as having the same sustainability characteristics, in the same quantities, as the sum of all consignments added to the mixture. d) Demonstrates that the product claims are linked correctly to the feedstock quantities claimed. Overall management of feedstocks/fuels is required via mass balance. When talking specifically about allocation of greenhouse gases within an LCA for a given fuel, that's allocated by energy content.
18. First point in supply chain to trace back the information to: • Forestry: forest residues • Agriculture: straw from cereals	For forest or agricultural residues, the first collection point would be the point of production itself (field or forest), and therefore sustainability information would be traced back to this point. Group auditing is allowed for smallholder landowners in some circumstances (see the Eligibility Framework for details) but without group auditing it would be the individual forestry unit.

E. Monitoring compliance: the governance structure	
19. (Controlling) Authority to receive the required sustainability and GHG information from the economic operator (see A)	The SCS certification body and its auditors are the ones who receive information directly from the economic operator and certify the fuel under the SCS's scheme. Economic operators include feedstock producers, processing facilities, and traders. • The aeroplane operators have the right to audit the certification and access detailed data from the economic operator[4]. • The aeroplane operators report this information to the States, who report the information to ICAO. • The SCS must also provide information/data relevant to GHG reductions to the national authority if requested. ICAO also receives an annual report from the SCSs regarding the economic operators who have been certified. This annual report includes information on batches of fuels that have been certified, including the sustainability and GHG information of the CORSIA eligible fuel pathway. See SCS annual reports to ICAO in the CORSIA SCS evaluation page of the ICAO website.

[4] The aeroplane operators' right to audit the detailed data is in ICAO Annex 16, Vol IV. In particular, see section 2.4.3 on Verification of CORSIA eligible fuels in Part II, Chapter 2 of Annex 16, Vol IV. The CORSIA Eligibility Framework for SCSs states in definitions that: Economic operator. Economic operators include feedstock producers, processing facilities, and traders.


Member States
Report CORSIA Eligible Fuels (CEF) claims from airlines through CORSIA Central Registry (CCR)
For further information, please refer to Flowchart 1
Flowchart 2 – Relation between SCSs, Economic Operators, Accreditation Bodies and Certification Bodies
Reporting
Recognition, Approval and Surveillance
Sustainability Certification Scheme
Meets SCS requirements under CORSIA eligibility framework documentation management, audit competencies, group auditing requirements, non-compliance procedures, monitoring and system review, transparency, annual reporting, risk management, certification body accreditation, stakeholder engagement, complaint procedures, GHG reporting and accounting transparency, and application of sustainability criteria[1]
Ensures compliance of accreditation body, certification bodies, and auditors with CORSIA Eligibility Framework elements.[2]
Oversight
Agreement in place
Accreditation Body
Meet the requirements set by the SCSs and in compliance with ISO 17011[5]
Accreditation and Surveillance
Oversight
Certification Body and its Auditors
Meet the requirements set by the SCSs (accreditation /auditing standards to ISO 17065, audit requirements, transfer of economic operators, certificate issuance, group auditing, auditor competencies, level of assurance)[3]
Certification and verification
Economic operator
Meet the requirements set by the SCSs (general, traceability, and transmission requirements)[4]
Implementation of Standards and Requirements (via public information)
References to the ICAO document "CORSIA eligibility framework and requirements for Sustainability Certification Schemes"
1: Table 1.
2: Tables 1-5.
3: Table 5.
4: Tables 2, 3 and 4.
5: Table 1, Item 9.1.
Legend:
Bi-directional information exchange
Assurance system coordination
Indirect information exchange

20. Method of registering required information by the (controlling) authority, existence of database	The SCSs all have public websites on which certifications are posted This is also a requirement: SCS ensures that the following information is made publicly available on a website: • The list of economic operators that are certified under its CORSIA certification programme...[...].... • The latest version of SCS CORSIA certification programme requirements. • The list of certification bodies that are permitted to conduct audits within the CORSIA certification programme, as well as any certification bodies that are no longer permitted to conduct audits ..[..]... • Publication of contact details for the SCS CORSIA certification programme ..[...]... • The names of any other eligible SCS that the subject SCS recognizes within its CORSIA certification programme The CORSIA Central Registry (CCR) is used for States to submit information related to CORSIA and for ICAO To perform calculations and compile information related to CORSIA implementation and transparency.
21. Method of correctness check on required information by the (controlling) authority	The CCR data will be cross checked with information submitted by the SCSs (and as published in SCS annual reports to ICAO, see #19) to ensure that appropriate batches and GHG values are claimed.
22. Public availability of information and extent thereof	Consolidated information from CCR will be published on the ICAO CORSIA website and can be found here. SCS annual reports to ICAO are published in the CORSIA SCS evaluation page of the ICAO website.
23. Authority of the controlling authority (or other governance organisation) to check correctness of information passed throughout the supply chain • First applicable point in the value chain • Type of information	* Limited to States in which the fuel is being claimed: “Purchasers and States may elect to independently audit the production records of the CORSIA eligible fuel producer in order to provide further assurance. * Possible to go back in the supply chain: States and purchasers (aeroplane operators or their designated representative) have audit rights to production records for CORSIA Eligible Fuels (CEF) they purchase to verify the CEF. Annex 16 Vol IV says: Note.— The quality control assurances of CORSIA eligible fuel producers include declarations and/or process certifications, with periodic audits by verifiers, purchasers, or trusted entities. The process certifications, including the sustainability credentials, provide assurance that the CORSIA eligible fuel producer has established business processes to prevent double counting, and the periodic audits verify that the producer is following their established procedures.

24. Consequences of non-compliance in case of incomplete and/or incorrect information submitted by the economic operator	This is addressed by the SCS. Each SCS that is approved must have measures in place to address non-compliance (See the CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes) SCS has documented procedures for addressing when a certified economic operator is found to not comply with the certification requirements. This includes: • Procedures for withdrawing or suspending certificates and the circumstances under which this occurs. • Procedures to ensure that any non-conformities that do not lead to immediate withdrawal or suspension of the certificate are corrected. ○ SCS makes these procedures available to economic operators. • For eligibility as ICAO-approved SCS for CORSIA, SCS are required to have a documented complaints procedure to respond to complaints from clients, the public, and other stakeholders about its CORSIA certification programme and fraud or potential fraud.
E1. Monitoring compliance of certification standards *(Only relevant when they can be used to proof compliance)*	

25. Authority of the controlling authority (or other governance organisation) to monitor the competency of the auditors and if yes;
• First applicable point in the value chain
• Scope of the monitoring
	The SCS is responsible for monitoring the competency of auditors to execute CEF certification throughout the supply chain (See the CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes). To illustrate:
	• Table 1: Requirements for SCS
	  ○ Requirement 2. Audit competencies e.g., SCS must reflect specific audit competencies requirements and ensure auditors meet such requirements
	  ○ Requirement 9. Accreditation of certification bodies e.g., accreditation body compliance with ISO 17011; accreditation body competencies
	• Table 5. Requirements set by SCS on Certification Bodies
	  ○ Requirement 1: Accreditation and Auditing Standards e.g, compliance with ISO 17011, 17065, and 19011 as appropriate; GHG LCA in line with ISO 14064-3
	  ○ Requirement 6. Auditor competencies e.g., auditor appointment in accordance with ISO 19011; and auditor knowledge base and competencies with respect to CORSIA eligible fuels framework

26. Consequences of insufficient verification by the auditor	This is addressed by the SCS. Each SCS that is approved must have measures in place to address non-compliance. See CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes with in Table 1: Requirements for SCS, that indicate:
	• Theme 4. Non-compliance with certification requirements
	  ○ SCS must have a documented procedures for non-compliance of certified economic operators with certification requirements. Non-compliance can lead to withdrawal or suspension of certificates.
	• Theme 11. Complaint procedure
	  ○ SCS are required to have procedures in place for investigating and responding to relevant complaints, including reporting relevant information, to the oversight body or certification body
	  ○ Reviewing the assurance system and taking corrective actions where necessary
	  ○ Documenting all complaints received and actions taken for consideration in the system review

27. Authority of the controlling authority (or other governance organisation) to monitor the competency of certification schemes, and way thereof	States and purchasers (aeroplane operators or their designated representative) have audit rights to production records for CEF they purchase to verify the CEF. ICAO's SCS Evaluation Group recommends to the ICAO Council whether an applicant SCS meet ICAO's requirements for CORSIA eligible fuel certification. One of its primary tasks is to also monitor SCS compliance to ICAO's SCS requirements. ICAO can also request additional information from the SCSs. Note that the CORSIA requirements also require from certification schemes to have a complaint procedure in place so to be able to handle complaints. E.g.: "SCS has procedures in place for responding to requests for information from the Committee on Aviation Environmental Protection (CAEP) Sustainability Certification Schemes Evaluation Group (SCSEG)" (See Table 1 Requirement 11.3 on responding to requests for information in the CORSIA Eligibility Framework and Requirements for Sustainability Certification Schemes).
28. Insight of the controlling authority (or other governance organisation) into the number of certification schemes being used throughout the full supply chain	This would be evident from the reporting of batches certified by individual SCSs which will be reported annually. SCS annual reports to ICAO are published in the CORSIA SCS evaluation page of the ICAO website.
29. Consequences of insufficient verification and monitoring by the certification scheme	CORSIA approved SCSs are monitored on an ongoing basis and will need to be re-approved for each phase of CORSIA (i.e., the Pilot Phase (2021-23), the Voluntary Phase (2024-26), and the Mandatory Phase (2027-35)). ICAO's SCS Evaluation Group can make recommendations to the ICAO Council as regards the competency of an SCS that is questioned on its verification and monitoring sufficiency.

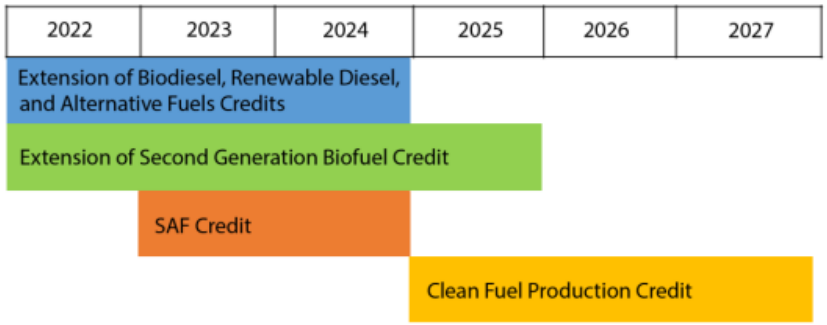
F. Other (optional)	
30. Highest risks in information transfer (completeness, correctness) between economic operators in the supply chain for advanced biofuel supply chains	The biggest challenges are likely to be related to the use of commodity crops (e.g., corn) in which rarely is the raw material/crop tracked from the field through collection point to downstream destinations. Other SAF pathways possess their own kinds of risks. For example, low life cycle GHG intensity pathways such as used cooking oil to SAF have been on the radar for potentially being misused as a carrier for palm oil, which itself carries a high life cycle GHG intensity as a feedstock. Proper assessments that respect mass balance, full traceability, and SCS & CB risk assessments are useful mechanisms to guard against such risks from becoming problems.

31. Highest risks in information transfer and monitoring of the sustainability and GHG emission requirements in advanced biofuel supply chains between countries	Some stakeholders have expressed concern that there will be confusion about the counting of CEF toward State obligations under CORSIA versus under the Nationally Determined Contribution to emissions reductions under UNFCCC (e.g., soil carbon benefits induced by a SAF crop feedstock that is claimed in the life cycle GHG emissions reduction of SAF in another country's airline operator that purchased the SAF). There is ongoing work to better understand and minimize this risk. SCSs are required under the CORSIA Eligibility Framework to provide information to national authorities as requested, and much of the information related to GHG emissions reductions related to CEF will be publicly available and can be cross-checked. CORSIA is implemented in three phases: a pilot phase (2021-2023), a first phase (2024-2026), and a second phase (2027-2035). For the first two phases (2021-2026), participation is voluntary. From 2027 onwards, participation will be determined based on 2018 RTK data. The CORSIA Central Registry (CCR) is a database that is used by States to submit CORSIA-specific information and data to ICAO in accordance with the provisions of Annex 16, Volume IV and the timeline in its Appendix 1. The State is required to take necessary action to ensure that the necessary national policies and regulatory framework be established for the compliance and enforcement of CORSIA. For additional information, see FAQ at: https://www.icao.int/environmental-protection/CORSIA/Documents/CORSIA_FAQs_Dec2022.pdf
32. Opportunities for improvement to harmonize and strengthen policy frameworks to monitor the sustainability and GHG emission requirements of advanced biofuel supply chains	[No input received]
33. Other remarks	[No input received]

Relevant sources

The ICAO CORSIA Implementation Element "CORSIA eligible fuels" is reflected in five ICAO documents referenced in Annex 16, Volume IV, see: https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-Eligible-Fuels.aspx

1.5. U.S. INFLATION REDUCTION ACT (IRA)

A1. General information	
1. Existence of a policy on the sustainability of (advanced) biofuels in the country, plus description	Within the Inflation Reduction Act ("IRA") [1] there are several different sections that develop policy with respect to the sustainability of biofuels. The key sections ("Sec.") of the IRA regarding the sustainability of both clean fuels generally and Sustainable Aviation Fuels ("SAFs") specifically are: • Sec. 13203: Sustainable Aviation Fuel Credit (current) • Sec. 13704: Clean Fuel Production Credit (upcoming) Other key sections regarding the sustainability of non-SAF biofuels are: • Sec. 13201: Extension of incentives for Biodiesel and Renewable Diesel and for Alternative Fuels (current) • Sec. 13202: Extension of Second-Generation Biofuel Incentives (current)  . Timeline of incentives in Inflation Reduction Act of 2022 (HR5376 Inflation Reduction Act, 2022). Key aspects of U.S. policies supportive of biofuels (particularly SAF) include the increased adoption of state policies, the ability to combine (stack) federal and state tax credits, and the use of performance-based incentives. • State policies such as clean fuel standards and SAF-specific tax credits provide multiple benefits. • Biofuel producers can take advantage of various credits, which depend on factors like biofuel types, feedstocks, and pathways. RIN credits, SAF Credit (in 2024), Clean Fuel Production Credit (in 2025), and state LCFS incentives are all used by a SAF producer under the RFS program.

	• Performance-based incentives are becoming common in U.S. policies. The adoption of performance-based incentives incentivizes the production and utilization of fuels with lower emissions, while also fostering innovation in feedstocks, pathways, and technologies to achieve even greater improvements in emissions reductions. Notably, advanced biofuels include biojet fuels (SAF), included as a RIN-eligible fuel since 2010 if meeting the requirements of a minimum 50% reduction in GHG emissions. The 2022 IRA established a SAF Fuel Credit (Sec. 13203, 40B) of $1.25 per gallon of a qualifying SAF mixture, requiring a minimum 50% reduction in lifecycle GHG emissions compared to traditional aviation fuels, with supplemental credits of $0.01 per gallon for each additional percentage point of reduction in GHG emissions (Congress 2022). The policy not only defines SAF in terms of a 50% lifecycle GHG emission reduction, qualifying SAF mixtures are further required to meet the requirements of ASTM International Standards D7566 or D1655 and exclude palm fatty acid materials.
2. Definition for 'advanced biofuels' under this policy	Under the IRA, there is no specific definition for advanced biofuels; however the incentive is increased as the carbon intensity of the fuels decreased; In the U.S. Renewable Fuels Standard (RFS) "Advanced biofuel is: renewable fuel, other than corn starch ethanol, with lifecycle greenhouse gas emissions of at least 50% less than lifecycle greenhouse gas emissions from its gasoline or diesel counterpart" [1, 6]

3. Feedstock categories under the scope of 'advanced biofuels'	Sec. 13203: Sustainable Aviation Fuel Credit [1] • Regarding Internal Revenue Service ("IRS") guidance on the Sec. 13203 SAF Credit, to qualify as an SAF the liquid fuel meet the requirements of ASTM International Standard D7566 or the Fischer Tropsch provisions of ASTM International Standard D1655, Annex A1, but "must not be derived from co-processing an 'applicable material' (or materials derived from an applicable material) **with a feedstock that is not biomass** (within the meaning of § 45K(c)(3) of the Code). Section40B(d)(2)(A) defines the term applicable material for this purpose to mean (i) monoglycerides, diglycerides, and triglycerides, (ii) free fatty acids, and (iii) fatty acid esters. Section 45K(c)(3) defines the term biomass to mean any organic material other than (A) oil and natural gas (or any product thereof), and (B) coal (including lignite) or any production thereof." Additionally, to qualify as SAF, "the liquid fuel must **not** be derived from palm fatty acid distillate or petroleum." and must have a minimum 50% reduction in lifecycle greenhouse gas emission reduction compared to the fossil jet baseline. Sec. 13704: Clean Fuel Production Credit [1] • While additional guidance has not been released on this subsection, existing 26 U.S. code section 45Z(d)(5) states that with regard to feedstocks, an applicable material is: o Transportation fuel (A) In general The term "transportation fuel" means a fuel which— (i) is suitable for use as a fuel in a highway vehicle or aircraft, (ii) has an emissions rate which is not greater than 50 kilograms of CO_2e per mmBTU, and (iii) is not derived from coprocessing an applicable material (or materials derived from an applicable material) with a feedstock which is not biomass. (B) Definitions In this paragraph— (i) Applicable material The term "applicable material" means— (I) monoglycerides, diglycerides, and triglycerides, (II) free fatty acids, and (III) fatty acid esters. (ii) Biomass The term "biomass" has the same meaning given such term in section 45K(c)(3)" [3]
A2. Requirements on GHG emission reduction and sustainability	
4. GHG emission reduction and sustainability requirements included in the policy, and applicability to feedstock-to-biofuel chains, in particular requirements for:	Sec. 13203: Sustainable Aviation Fuel Credit To qualify as an SAF under this section, the liquid fuel must have a certified lifecycle greenhouse gas emissions reduction percentage of **at least 50 percent**. The definition of the lifecycle greenhouse gas emissions reduction percentage is, "with respect to sustainable aviation fuel, the percentage reduction in lifecycle greenhouse gas emissions achieved by such fuel as compared with petroleum-based jet fuel, as defined in accordance with the '(1) the most recent Carbon Offsetting and Reduction Scheme for International Aviation which has been adopted by the International Civil Aviation Organization with the agreement of the United States, or ''(2) any similar methodology which satisfies the criteria under section 211(o)(1)(H) of the Clean Air Act (42 U.S.C. 7545(o)(1)(H)), as in effect on the date of enactment of this section.

• Forest: forest residues to ethanol via gasification • Agriculture: ethanol production from cereal straw	By requiring lifecycle GHG emission reductions in SAF, this policy demonstrates a shift from volumetric-based standards towards accounting for GHG emissions from the production to utilization of a fuel, making these policies more effective in realizing progress on decarbonization (Pavlenko 2022.).The exclusion of palm-based materials is aligned with recommendations to ensure the sustainability of fuels by minimizing adverse land-use impacts (Mirolo 2020, Ng 2021, World Economic Forum 2021, Pavlenko 2022.). These SAF-specific advancements may potentially inform future changes in federal biofuel policies more broadly to allow for increased sustainability measures and the adoption of a federal standard for biofuels aligned with GHG emission reductions to replace volumetric RFS. Sec. 13704: Clean Fuel Production Credit (added new section 45Z) [1] • In order to qualify for the clean fuel production credit, the lifecycle greenhouse gas emissions from the fuel must be **less than 50kg of CO** • **E/MMBtu (CO2e =** with respect to any greenhouse gas, the equivalent carbon dioxide (as determined based on relative global warming potential**; mmBTU = 1,000,000 british thermal units)**; • for SAF, the **jet baseline is 94kg CO_2e/MMBtu** [4] *N.B. 89 kgCO2e/MJ based on CORSIA*

B. Proofing compliance: Information required	
5. Obligated party and interval for reporting and proof of compliance of the sustainability and GHG emission of (advanced) biofuels	Sec. 13203: Sustainable Aviation Fuel Credit [1] To be able to receive the credit, the producer or importer of the qualified fuel must be registered with the IRS Secretary and provide information including certification "from an unrelated party demonstrating compliance with… (i) any general requirements, supply chain traceability requirements, and information transmissions requirements established under the Carbon Offsetting and Reduction Scheme for International Aviation described in paragraph (1) of subsection (e), or ''(ii) in the case of any methodology established under paragraph (2) of such subsection, requirements similar to the requirements described in clause (i), ... Sec. 13704: Clean Fuel Production Credit [1] • **Additional guidance not yet made available by the IRS**; however the taxpayer must be "registered as a producer of clean fuel under section 4101 at the time of production"[3]
6. Information requirements for reporting sustainability and GHG emission	Sec. 13203: Sustainable Aviation Fuel Credit [1] • When submitting a claim to the IRS for a tax credit, the claimant must declare that the following obligations have been met for an SAF Qualified Mixture:

(reduction) by the obligated party	○ "The SAF synthetic blending component used to create the mixture meets the requirements of an ASTM (American Society for Testing and Materials) D7566 Annex" ○ "The kerosene used to create the mixture meets the requirements of ASTM D1655" • When submitting a claim for an SAF Synthetic Blending Component, the following obligations must be met: ○ "Name and address of the unrelated party certifying compliance with the general requirements, supply chain traceability requirements, and information transmission requirements established under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) or similar requirements for methodologies established under section 211(o)(1)(H) of the Clean Air Act (42 U.S.C. 7545(o)(1)(H))." ○ "Meets the requirements of an ASTM D7566 Annex" ○ "Is not derived from co-processing an applicable material (monoglycerides, diglycerides, triglycerides, free fatty acids, or fatty acid esters) or materials derived from an applicable material with a feedstock that is not biomass (as defined in section 45K(c)(3))" ○ "Is not derived from palm fatty acid distillates or petroleum" ○ "Has been certified in accordance with section 40B(e) as having a lifecycle greenhouse gas emissions reduction percentage of at least 50 percent." • IRS Notice 2023-6 section 7. Certificates and statements states a.o : ..The certificate identification number is determined by the producer or importer and must be unique to each certificate.... ...A reseller cannot make multiple copies of a Certificate for SAF Synthetic Blending Component in order to use it for multiple buyers. If a single certificate applies to a SAF synthetic blending component that a reseller expects to sell to multiple buyers, then the reseller should return the certificate (together with any statements provided by intervening resellers) to the producer or importer. The producer or importer may reissue multiple Certificates for SAF Synthetic Blending Component to the reseller that reflect the appropriate volumes. The reissued certificates must include the certificate identification number from the certificate that was returned.... [2] Note: EPA has issued several facility-specific renewable fuel pathway assessments for jet fuel derived from sugarcane ethanol, soybean oil, Brassica carinata oil, renewable diesel, distillers sorghum oil, distillers corn oil, energy cane and napier gas, and Camelina sativa oil. The completed pathway assessments are accessible at [7] Sec. 13704: Clean Fuel Production Credit • Additional guidance not yet made available by the IRS

7. Information requirements on origin	IRS Notice 2023-6 states: Procedure of registration (SAF producer/importer) ... providing the following: (c) The feedstocks and sources of feedstocks used to produce the sustainable aviation fuel; See also #6
8. Criteria for the categorisation and definitions of feedstocks	N/A See #3, #6
9. Information requirements on feedstock type	Sec. 13203: Sustainable Aviation Fuel Credit • "Section 45K(c)(3) defines the term biomass to mean any organic material other than (A) oil and natural gas (or 6 any product thereof), and (B) coal (including lignite) or any product thereof" [2] Sec. 13704: Clean Fuel Production Credit • "Applicable material: The term "applicable material" means— (I) monoglycerides, diglycerides, and triglycerides, (II) free fatty acids, and (III) fatty acid esters. (ii) Biomass The term "biomass" has the same meaning given such term in section 45K(c)(3)." [3]

C. Proofing compliance: Verification methods required/ allowed	
10. Possibility to use certification systems to proof compliance and recognised schemes	Sec. 13203: Sustainable Aviation Fuel Credit • Third-party verification is used: "A COA (Certificate of Analysis) is a document from an unrelated party used to verify the type and quality of fuel used as jet fuel. Separate COAs are generated for each synthetic blending component, for the kerosene used to mix with the synthetic blending component, and for the SAF qualified mixture" [2] Sec. 13704: Clean Fuel Production Credit • For non-aviation fuels, "the lifecycle greenhouse gas emissions of such fuel shall be based on the most recent determinations under the Greenhouse gases, Regulated Emissions, and Energy use in Transportation model developed by Argonne National Laboratory, or a successor model (as determined by the Secretary)." [3]
11. Possibility to use a national standard to prove compliance	Unclear – information has either not been defined or remains something that has not/will not be addressed by the IRA or future guidance published by various federal government agencies tasked with implementing the IRA

C1. The approval and monitoring procedures for certification standards *(only relevant when they can be used to proof compliance)*	
12. Authority deciding on usable certification systems and/or national standards	The IRS/Treasury Department oversees tax credit-related programs such as these incentive-based programs
13. Criteria used to approve a certification system and/or national standard	Sec. 13203: Sustainable Aviation Fuel Credit • "Certification from the International Sustainability and Carbon Certification ("ISCC"), Roundtable on Sustainable Biomaterials ("RSB"), or other unrelated party demonstrating compliance with— (i) any general requirements, supply chain traceability requirements, and information transmission requirements established under CORSIA, which has been adopted by the ICAO with the agreement of the United States, or (ii) any similar methodology that satisfies the criteria under section 211(o)(1)(H) of the Clean Air Act (42 U.S.C. 7545(o)(1)(H)), as in effect on August 16, 2022" [2] Sec. 13704: Clean Fuel Production Credit • Criteria established for non-aviation fuels by "the Greenhouse gases, Regulated Emissions, and Energy use in Transportation model developed by Argonne National Laboratory" [3]
14. Minimum requirements around 3rd party auditing, intervals of verification or accreditation	Unclear – information has either not been defined or remains something that has not/will not be addressed by the IRA or future guidance published by various federal government agencies tasked with implementing the IRA
15. Possibility and conditions of cross-compliance	Unclear – information has either not been defined or remains something that has not/will not be addressed by the IRA or future guidance published by various federal government agencies tasked with implementing the IRA

D. Traceability and transfer of information	
16. Allowed chain of custody systems (e.g., mass balance, book and claim) to link information to the biomass feedstock	Sec. 13203: Sustainable Aviation Fuel Credit • IRS published guidance relies on CORSIA standards for all matters related to traceability of transfer of information, and per CORSIA requirements, traceability must follow a mass balance system Sec. 13704: Clean Fuel Production Credit • Additional guidance not yet made available by the IRS

17. For mixing of different consignments of biomass, if allowed: Rules on allocation (e.g., based on energy content, mass)	Sec. 13203: Sustainable Aviation Fuel Credit • Reference CORSIA standards Sec. 13704: Clean Fuel Production Credit • Additional guidance not yet made available by the IRS
18. First point in supply chain to trace back the information to: • Forestry: forest residues • Agriculture: straw from cereals	Sec. 13203: Sustainable Aviation Fuel Credit • Reference CORSIA standards Sec. 13704: Clean Fuel Production Credit • Additional guidance not yet made available by the IRS

E. Monitoring compliance: the governance structure	
19. (Controlling) Authority to receive the required sustainability and GHG information from the economic operator (see A)	The IRS (Treasury Department)
20. Method of registering required information by the (controlling) authority, existence of database	Sec. 13203: Sustainable Aviation Fuel Credit • Must register with and submit all claims to the IRS Sec. 13704: Clean Fuel Production Credit • Must register with and submit all claims to the IRS
21. Method of correctness check on required information by the (controlling) authority	Sec. 13203: Sustainable Aviation Fuel Credit • Claims sent to the IRS must include a Certificate of Analysis from an unrelated third-party verifying the type and quality of the SAF fuel Sec. 13704: Clean Fuel Production Credit • Additional guidance not yet made available by the IRS

22. Public availability of information and extent thereof	Unclear – information has either not been defined or remains something that has not/will not be addressed by the IRA or future guidance published by various federal government agencies tasked with implementing the IRA
23. Authority of the controlling authority (or other governance organisation) to check correctness of information passed throughout the supply chain • First applicable point in the value chain • Type of information	Unclear – information has either not been defined or remains something that has not/will not be addressed by the IRA or future guidance published by various federal government agencies tasked with implementing the IRA
24. Consequences of non-compliance in case of incomplete and/or incorrect information submitted by the economic operator	The entity pursuing the claim will not be eligible for the tax credit
E1. Monitoring compliance of certification standards *(Only relevant when they can be used to proof compliance)*	
25. Authority of the controlling authority (or other governance organisation) to monitor the competency of the auditors and if yes; • First applicable point in the value chain • Scope of the monitoring	Unclear – information has either not been defined or remains something that has not/will not be addressed by the IRA or future guidance published by various federal government agencies tasked with implementing the IRA
26. Consequences of insufficient verification by the auditor	Unclear – information has either not been defined or remains something that has not/will not be addressed by the IRA or future guidance published by various federal government agencies tasked with implementing the IRA

27. Authority of the controlling authority (or other governance organisation) to monitor the competency of certification schemes, and way thereof	Sec. 13203: Sustainable Aviation Fuel Credit • Guidance published by the IRS is deferential to the monitoring/certification schemes outlined by CORSIA, so the IRS would not appear to have authority in that regard Sec. 13704: Clean Fuel Production Credit • Additional guidance not yet made available by the IRS
28. Insight of the controlling authority (or other governance organisation) into the number of certification schemes being used throughout the full supply chain	Sec. 13203: Sustainable Aviation Fuel Credit • Reference CORSIA standards Sec. 13704: Clean Fuel Production Credit • Additional guidance not yet made available by the IRS
29. Consequences of insufficient verification and monitoring by the certification scheme	The entity will not be eligible for the tax credit

F. Other (optional)	
30. Highest risks in information transfer (completeness, correctness) between economic operators in the supply chain for advanced biofuel supply chains	[No input received]
31. Highest risks in information transfer and monitoring of the sustainability and GHG emission requirements in advanced biofuel	[No input received]

supply chains between countries	
32. Opportunities for improvement to harmonize and strengthen policy frameworks to monitor the sustainability and GHG emission requirements of advanced biofuel supply chains	[No input received]
33. Other remarks	[No input received]

Relevant sources

1. BILLS-117hr5376enr.pdf (congress.gov)
2. https://sgp.fas.org/crs/misc/R43325.pdfNotice 2023-06, Sustainable Aviation Fuel Credit; Registration; Certificates; Request for Public Comments (irs.gov)
3. 26 U.S. Code § 45Z - Clean fuel production credit | U.S. Code | US Law | LII / Legal Information Institute (cornell.edu)
4. 3_ISCC_TC-SAF_Anna-Oldani_Updates-on-recent-SAF-policydevelopments-in-the-US.pdf (iscc-system.org)
5. Notice 2024-6 (irs.gov)
6. The Renewable Fuel Standard (RFS): An Overview - Congressional Research Service
7. https://www.epa.gov/renewable-fuel-standard-program/approved-pathways-renewable-fuel.

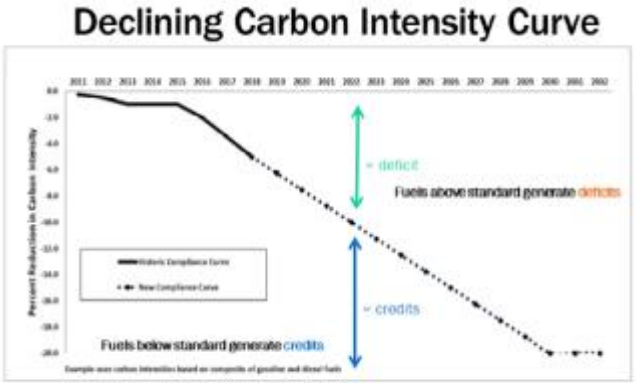
Sources of Additional Context:

- Sustainable Aviation Fuel Credit | Internal Revenue Service (irs.gov)
- IRA Section 13203 - Sustainable Aviation Fuel Tax Credit - Inflation Reduction Act Tracker (iratracker.org)
- ICAO document 03 - Eligibility Framework and Requirements for SCSs - June 2022.pdf
- Inflation-Reduction-Act-Guidebook.pdf (whitehouse.gov)
- Inflation Reduction Act Summary: Energy and Climate Provisions | Bipartisan Policy Center
- ERN22335 (senate.gov)

1.6. CALIFORNIA LCFS

A1. General information	
1. Existence of a policy on the sustainability of (advanced) biofuels in the country, plus description	The main goal of the California Low Carbon Fuel Standard (LCFS) is to decarbonize the transportation sector by using low-carbon alternative fuels such as ethanol, biojet and bio-mass based diesel (both biodiesel and renewable diesel) as well as cleaner burning fossil fuels such as CNG and LNG. [1] California's LCFS is part of a portfolio of GHG policies. It is a key part of a comprehensive set of programs in California to reduce emissions from the transportation sector, including the Cap-and-Trade Program, Advanced Clean Cars Program, and SB 375. [2] Goal: Reduce carbon intensity (CI) associated with producing, distributing and consuming (complete life cycle analysis) of transportation fuel pool by at least 20% by 2030 (from a 2010 baseline) [2] The transportation fuels to which the LCFS applies are gasoline, diesel and the fuels that replace them (a.o. conventional jet fuel and aviation gasoline are exempted). Carbon savings are expected to come from increasing the use of alternative fuels, including bio-mass based fuels, compressed natural gas (CNG), hydrogen, and electricity, which all have lower carbon intensities than gasoline and diesel, in the California fuel mix. The LCFS covers both renewable and non-renewable fuels in California and relies on life cycle analysis to estimate the carbon intensity of transportation fuels [4]. Alternative aviation fuel is eligible for (tax) credits, both production and importation. The CO2 emitted during biofuel combustion is considered carbon neutral, in accordance with IPCC and U.S. EPA GHG inventory guidelines, as the carbon released was uptaken from the atmosphere within a short timeframe by the plant that produced the oil. A small amount of emissions, less than 1 g/MJ, result from the GHGs (methane and nitrous oxide) that form during biodiesel combustion [2] [1,2,4] Note: amendments to this program are currently under consideration. [7]. The CARB staff proposal includes a.o: - a 30% reduction in fuel CI by 2030 and a 90% reduction in fuel CI by 2045 from a 2010 baseline. - elimination of the exemption for intrastate fossil jet fuel from the LCFS regulation starting in 2028.

2.	Definition for 'advanced biofuels' under this policy	Within the California LCFS, there is no specific definition for 'advanced' biofuels. However, there is a separate application process designed for innovative, next-generation pathways (Tier 2), which may use unique feedstocks (e.g. cellulosic alcohols). See also #6 The types of alternative transportation fuels to satisfy the LCFS (§ 95482) include amongst others biomass-based fuels: • (4) Bio-CNG, bio-LNG, or bio-L-CNG. • (7) A fuel blend containing greater than 10 percent ethanol by volume. • (8) A fuel blend containing biomass-based diesel. • (11) **Alternative Jet Fuel** Opt-In Fuels (meaning they may voluntarily elect to participate in the program, while for others participation it is mandatory), amongst others biomass-based fuels: • (2) Bio-CNG; • (3) Bio-LNG; • (4) Bio-L-CNG; • (5) **Alternative Jet Fuel**: **Alternative (lower CI) jet fuel (AJF)** has become an eligible LCFS opt-in fuel in 2019, increasingly generating credits in the LCFS program, reducing effectively aviation carbon dioxide emissions [7] [2,3,7]
3.	Feedstock categories under the scope of 'advanced biofuels'	On US level, there is a definition for advanced biofuels under the Renewable Fuel Standard (RFS): Advanced biofuel is: renewable fuel, other than corn starch ethanol, with lifecycle greenhouse gas emissions of at least 50% less than lifecycle greenhouse gas emissions from its gasoline or diesel counterpart . Within the California LCFS, there is no specific definition for advanced biofuels (see #2) However, California LCFS distinguishes pathways utilizing a 'Specified Source Feedstock'. In order to be eligible for a reduced CI that reflects the lower emissions or credit associated with the use of a waste, residue, by-product or similar material as feedstock in a fuel pathway, fuel pathway applicants must meet the following requirements: Specified source feedstocks include: 1. Used cooking oil, animal fats, fish oil, yellow grease, distiller's corn oil, distiller's sorghum oil, brown grease, and other fats/oils/greases that are the non-primary products of commercial or industrial processes for food, fuel or other consumer products, which are used as feedstocks in pathways for biodiesel, renewable diesel, **alternative jet fuel**, and co-processed refinery products; 2. Biomethane supplied using book-and-claim accounting ..[..].. and is claimed as feedstock in pathways for bio-CNG, bio-LNG,

	bio-L-CNG, and hydrogen via steam methane reformation; 3. Any feedstock whose supplier applies for separate CARB recognition using site-specific CI data; and 4. Other feedstocks designated as specified source at the time of pathway review and prior to certification. See also #6 [3, 5]
A2. Requirements on GHG emission reduction and sustainability	
4. GHG emission reduction and sustainability requirements included in the policy, and applicability to feedstock-to-biofuel chains, in particular requirements for: • Forest: forest residues to ethanol via gasification • Agriculture: ethanol production from cereal straw	The LCFS **sets annual carbon intensity (CI) standards**, or benchmarks, which reduce over time, for gasoline, diesel, and the fuels that replace them. Carbon intensity is expressed in grams of carbon dioxide equivalent per megajoule of energy provided by that fuel. CI takes into account the GHG emissions associated with all of the steps of producing, transporting, and consuming a fuel—also known as a complete life cycle of that fuel. The LCFS lets the market determine which mix of fuels will be used to reach the program targets [2] Fuels and fuel blend stocks introduced into the California fuel system that have a CI higher than the benchmark generate deficits. Similarly, fuels and fuel blend stocks with CIs below the benchmark generate credits. Annual compliance is achieved when a regulated party uses credits to match its deficits. [2] 

Credits and deficits are calculated using the carbon intensity benchmarks for gasoline and diesel fuel in each calendar year. Since **conventional jet fue**l is not (yet) subject to the LCFS regulation and does not generate deficits, the carbon intensity benchmarks below are used specifically to calculate credits from alternative jet fuel. The jet fuel benchmarks remained fixed at the 2010 baseline CI for conventional jet fuel, with a zero percent reduction in each year, until the benchmark for diesel substitutes declined below the CI baseline for jet fuel, in 2023. The jet fuel benchmarks then mirror the benchmarks for diesel through 2030 [2]

Carbon Intensity Benchmarks for Fuels Used as a Substitute for Conventional Jet Fuel

Year	Average CI (gCO_2e/MJ)
2019	89.37
2020	89.37
2021	89.37
2022	89.37
2023	89.15
2024	87.89
2025	86.64
2026	85.38
2027	84.13
2028	82.87
2029	81.62
2030 onwards	80.36

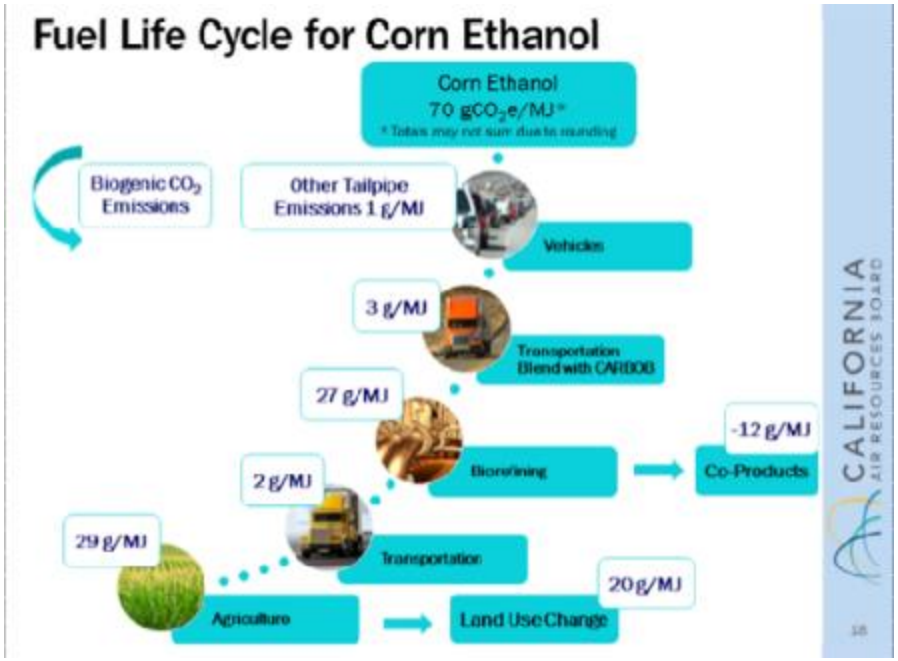
There are three ways to generate credits in the LCFS: fuel pathways, projects, and capacity- based crediting [2]

- Fuel pathway-based crediting, all transportation fuels need a carbon intensity score to participate in the LCFS, and the fuel type dictates which process is used to determine that certified CI; verification occurs post-credit generation
- Project-based crediting, projects include actions to reduce GHG emissions in the petroleum supply chain, and also CCS using Direct Air Capture; project operators generate credits by determining the GHG emission reductions (in metric tons); verification occurs before credits are issued
- Zero emission vehicle infrastructure (since 2018)(capacity-based) crediting: Hydrogen refuelling and direct current (DC) fast charging infrastructure. Credits for ZEV infrastructure are determined on the basis of the capacity of the station to

provide fuel when fully utilized or EV fast charging site, minus the actual fuel dispensed and credited through fuel pathways.

Life cycle analysis [2]

- The CI includes the **"direct" effects of producing and using the fuel, as well as "indirect" effects that are primarily associated with crop-based biofuels**.
- Two models are used to calculate the direct effects, which are the California GHGs, Regulated Emissions, and Energy Use in Transportation (CA-GREET) and Oil Production Greenhouse gas Emissions Estimator (OPGEE) models.
- To calculate the indirect effects, the Global Trade Analysis Project (GTAP) model was updated, and the Agro-Ecological Zone Emissions Factor (AEZ-EF) model was created to supplement GTAP's estimates of GHG emissions from various types of land conversions.
- Contributing substantially to the impacts associated with corn (and other crops) used to produce biofuels is the phenomenon called **land use change, or LUC**. The estimated amount of land conversion and associated GHG emissions are determined using the GTAP and AEZ-EF models and are added to the CI of corn ethanol. All crop-based feedstocks have LUC values. *See the example*.

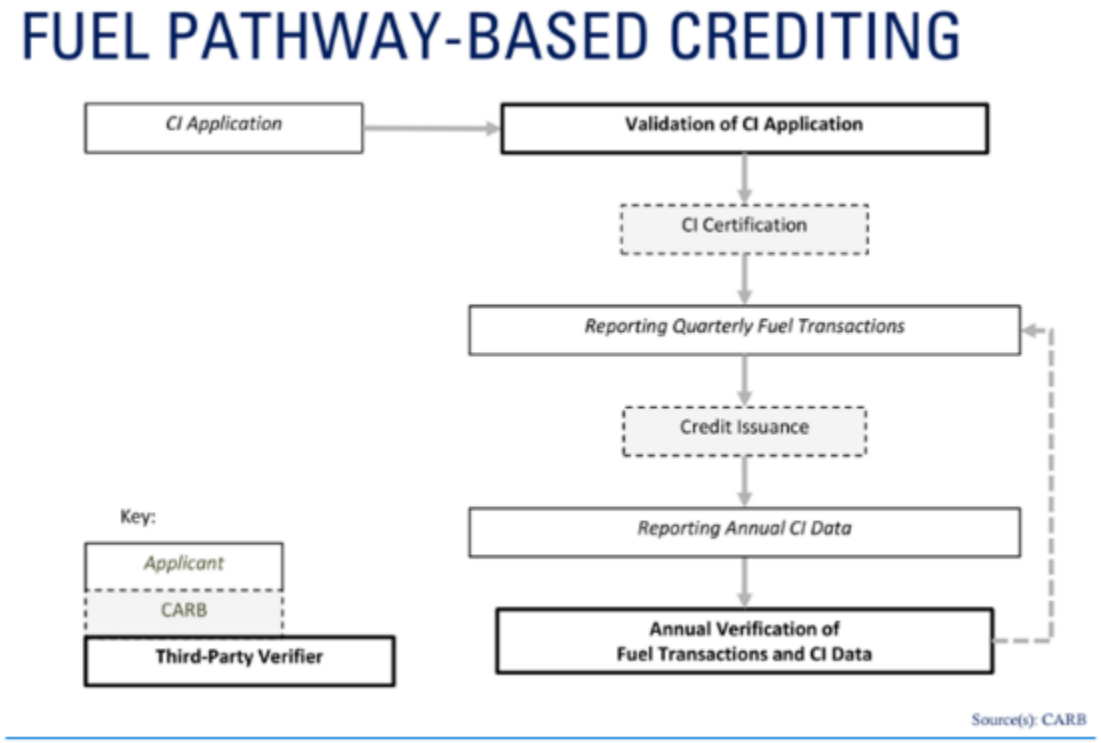


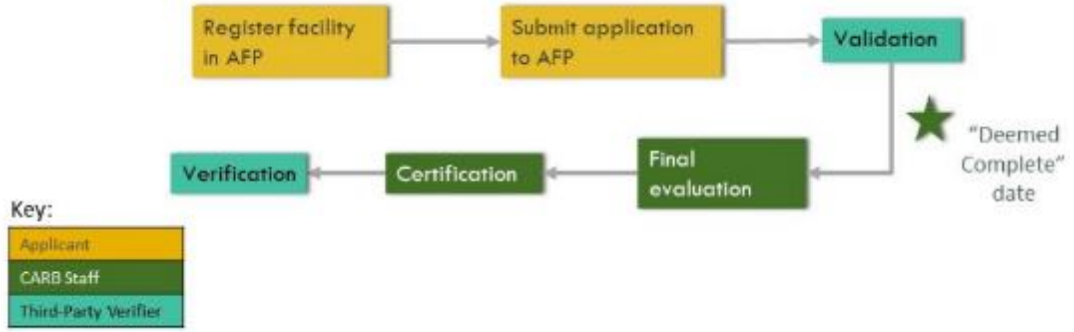
Note: amendments to this program are currently under consideration. [7].

The CARB staff proposal contains a.o. [10] :

- to remove palm-derived fuels from eligibility for credit generation. Palm-derived fuel transactions have not been reported under the program or received any credits to-date.
- Transition to Greet 4.0

B. Proofing compliance: Information required	
5. Obligated party and interval for reporting and proof of compliance of the	§ 95483: **Fuel reporting entities**: The first fuel reporting entity is responsible for initiating reporting within the LCFS Reporting Tool – Credit Bank and Transfer System (LRT-CBTS) for a given amount of fuel and, by default, also holds the status as initial credit or deficit generator for the reported fuel quantity [3].

sustainability and GHG emission of (advanced) biofuels	Entity requirements and responsibilities are defined by the role each entity plays. An entity may have multiple roles in the LCFS, such as an alternative liquid fuel producer may be a Fuel Pathway applicant, but because this entity also reports and generates credits, they are a fuel reporting entity as well [2]. All fuel pathway applicants become fuel pathway holders once their CI is certified; they must annually demonstrate that the pathway remains valid [2]. The diagram below shows the basic process for credit generation and verification 

6.	Information requirements for reporting sustainability and GHG emission (reduction) by the obligated party	Under fuel pathway-based crediting, providers of low carbon fuels used in California transportation generate credits by obtaining a certified CI and reporting transaction quantities on a quarterly basis [2] A regulated entity's annual compliance obligation is met when the regulated entity demonstrates via its annual report that it possessed and has retired a number of credits from its credit account that is equal to its compliance obligation [2]. **All transportation fuels need a carbon intensity score** to participate in the LCFS, and the fuel type dictates which process is used to determine that CI [2]. • Lookup Table pathways have CI scores that are predetermined by CARB using industry-wide average inputs, or conservative assumptions (not subject to verification since no site-specific CI) • The Tier 1 pathway application process is for the most common low carbon fuels, and applicants use a Simplified CI Calculator and a discrete set of inputs to determine their site-specific fuel production and transport emissions. Under Tier 1, most emissions from feedstock production are based on standard inputs, but the calculators have some flexibility to accommodate user-defined process energy inputs. Applicants must submit documentation to substantiate Simplified CI Calculator inputs to CARB. Applications require at least 3 months of fuel production data and corresponding feedstock procurement records. Applicants will provide these records to a CARB-accredited verifier as part of mandatory validation of verification. Tier 1 pathway  • The Tier 2 application process is designed for innovative, next-generation pathways, which may use unique feedstocks. Applicants use the full CA-GREET 3.0 model for CI calculations. Tier 2 fuels include **Alternative jet**

fuel, and any other pathway that is not eligible to use the Lookup Table or Tier 1 process (including pathways with carbon capture and sequestration). Tier 2 applications are based on CARB-approved modifications to Tier 1 calculators or the CA-GREET3.0 model. These modifications are designed to capture project-specific parameters that are not otherwise available in the Tier 1 framework (see LCFS section 95488.7(a) for all application requirements). Applicants will provide these records to a CARB-accredited verifier as part of mandatory validation or verification.

Tier 2 pathway

Credits for fuel pathways are calculated based on the CI score that is determined in the initial pathway application, the energy economy ratio or EER for the type of vehicle the fuel is used in, and the quantity of fuel reported. The LCFS Regulation also includes requirements for data accuracy and meter calibration

§ 95488.8. Fuel Pathway Application Requirements Applying to All Classifications.

(a) Requirements for Attestation Letter. Each fuel pathway application must include a fuel pathway applicant attestation letter. The attestation letter must attest to the veracity of the information in the application packet ...[...]... The fuel pathway applicant attestation letter must make the following specific attestations [3]:

(1) No products, co-products, by-products, or wastes undergo additional processing, such as drying, distillation, or clean-up, once they leave the production facility, except as explicitly included in the pathway life cycle analysis and pathway CI.

(2) All data and information supplied is true and accurate in all areas, including, but not limited to the following:

(A) Feedstocks used to produce the fuel
(B) Fuel and feedstock production technology
(C) Regions in which feedstocks and finished fuel are produced
(D) Modes used to transport feedstocks and finished fuel and the transport distances involved
(E) Types and amounts of thermal and electrical energy consumed in both feedstock and finished fuel production
(F) Full life cycle carbon intensity, which must be no higher than the carbon intensity specified in the Lookup Table, or Tier 1 or Tier 2 application; and
(G) Fuel production operations.

Additional Demonstrations. Upon request from the (CARB) Executive Officer, a fuel pathway application must meet the following requirements (a.o):

Demonstrate that the fuel that will be produced under the proposed pathway would comply with all applicable ASTM or other generally recognized national consensus standards

Note: amendments to this program are currently under consideration. [7].

The CARB staff proposed a.o the requirement that:

- all 'specified source feedstock' (corn oil, used cooking oil and animal fats) supply chain entities it is required to maintain **attestation letters** for CARB accredited verifier and CARB review

-The attestation letters will require each entity within the supply chain to attest that:

- The feedstock meets the definitions in 95481
- The feedstock has not undergone additional processing
- Deliveries consist only of the product documented on the feedstock transfer documents and have not been mixed with other materials
- The feedstock was not intentionally modified or contaminated to meet definitions

(Specified source feedstocks must provide chain-of-custody documentation, which traces feedstock to point-of-origin)

- Crop-based and forestry-based feedstocks must not be sourced on land that was forested after January 1, 2008. They must maintain continuous third-party sustainability certification under an Executive Officer approved certification system [10]

7.	Information requirements on origin	Depending on pathway – on aggregated level or on more detailed level § 95488.5. Lookup Table Fuel Pathway Application Requirements and Certification Process. (a) Applicability. A fuel reporting entity may use a Lookup Table pathway if the Lookup Table (Table 7-1 in section 95488.5(e)) contains a fuel pathway that closely corresponds to the actual physical fuel production pathways used to produce the fuel in question [3] - Feedstocks used to produce the fuel - Fuel and feedstock production technology - Regions in which feedstocks and finished fuel are produced. - The modes used to transport feedstocks and finished fuel and the transport distances involved - The types and amounts of thermal and electrical energy consumed in both feedstock and finished fuel production. The CI of the fuel pathway applicant's product must be lower than or equal to the Lookup Table pathway CI. Note: amendments to this program are currently under consideration. [7]. The CARB staff proposal contains a.o: All feedstocks at the point-of-origin must be certified by Jan. 1, 2028. The certification system must have been recognized by an international, national or state/provincial government for at least 24 months. [10] see #6
8.	Criteria for the categorisation and definitions of feedstocks	See #3, 6 above
9.	Information requirements on feedstock type	§ 95488.8 Feedstock Transfer Documents. A feedstock transfer document must prominently state the information specified below. 1. Transferor Company name, address and contact information; 2. Recipient Company name, address and contact information;

	3. Type and amount of feedstock, including units; 4. Transaction date. See also #3 above See #6

C. Proofing compliance: Verification methods required/ allowed	
10. Possibility to use certification systems to proof compliance and recognised schemes	There is a third-party verification program [2]. As of 2020 entities are required to retain the services of independent verifiers accredited by CARB at fuel pathway applications and to ensure accuracy of reported greenhouse gas data (see also #6). Credits are calculated relative to the annual CI benchmark and undergo verification post credit generation. In case of project-crediting verification occurs before credits are issued [2], see also #5 The verification program is based on ISO 14064-3 and 14065. It also provides a systematic, independent, and documented process for evaluation of reported data against the LCFS regulatory requirements and methods for calculation. Entities required to contract for LCFS verification are amongst others alternative liquid fuel producers ad importers and all fuel pathway holders with site-specific CI data [2] Note: amendments to this program are currently under consideration. [7]. The CARB staff proposal contains a.o: All feedstocks at the point-of-origin must be certified by Jan. 1, 2028. The certification system must have been recognized by an international, national or state/provincial government for at least 24 months. [10]
11. Possibility to use a national standard to prove compliance	NA There is a verification program [2] see #10
C1. The approval and monitoring procedures for certification standards *(only relevant when they can be used to proof compliance)*	
12. Authority deciding on usable certification systems and/or national standards	NA The California Air Resources Board (CARB) is the responsible organization in California to implement and monitor LCFS [2]
13. Criteria used to approve a certification	For the verification program (NOT certification!): The verification program is based on ISO 14064-3 and 14065 [2]

system and/or national standard	See #10
14. Minimum requirements around 3rd party auditing, intervals of verification or accreditation	For the verification program (NOT certification!): From 2019, verifiers apply for CARB accreditation and take required training and exam(s). CARB publishes on the LCFS website the list of verification bodies and verifiers accredited to perform LCFS verification services [2] (d) Verification Outcomes. Each entity responsible for obtaining a validation or verification statement under this sub-article must obtain third-party verification services from a verification body that meets the requirements specified in section 95502 [3]. § 95501. Requirements for Validation and Verification Services. Validation and verification services must be performed by verification bodies accredited by the Executive Officer; in addition, such services must meet the following requirements – includes e.g., sampling plan... [3] § 95502. Accreditation Requirements for Verification Bodies, Lead Verifiers, and Verifiers. Verification bodies, lead verifiers, and non-lead verifiers that will provide verification services (including validation services) under this sub-article must become accredited through fulfilling the accreditation requirements set forth in..... [3] § 95503. Conflict of Interest Requirements for Verification Bodies and Verifiers
15. Possibility and conditions of cross-compliance	Cross-compliance of certification schemes is N/A

D. Traceability and transfer of information	
16. Allowed chain of custody systems (e.g., mass balance, book and claim) to link information to the biomass feedstock	Mass balance is only allowed when specifications and physical characteristics of batches are the same. Pathways Utilizing a Specified Source Feedstock [3]. In order to be eligible for a reduced CI that reflects the lower emissions or credit associated with the use of a waste, residue, by-product or similar material as feedstock in a fuel pathway, fuel pathway applicants must meet the following requirements...[....]... (B) Chain-of-custody Evidence. Fuel pathway applicants using specified source feedstocks must maintain either (1) delivery records that show shipments of feedstock type and quantity directly from the point of origin to the fuel production facility, or (2) information from material balance or energy balance systems that control and record the assignment of input characteristics

	to output quantities at relevant points along the feedstock supply chain between the point of origin and the fuel production facility. Chain- of-custody evidence is used to demonstrate proper characterization and accurate quantity. Chain-of-custody evidence must be provided to the verifier and to CARB upon request. Joint Applicants may assume responsibility for different portions of the chain-of-custody evidence, but each such entity must meet the following requirements to be eligible for a pathway that utilizes a specified source feedstock: 1. Maintain records of the type and quantity of feedstock obtained from each supplier...[...]...; 2. Maintain records used for material balance and energy balance calculations. 3. Ensure CARB staff and verifier access to audit feedstock suppliers to demonstrate proper accounting of attributes and conformance with certified CI data. (C) Feedstock Transfer Documents.
17. For mixing of different consignments of biomass, if allowed: Rules on allocation (e.g., based on energy content, mass)	Beginning Q1 2019, fuel reporting entities and fuel producers must use fuel pathway allocation methods specified in the regulation: - MULTIPLE FEEDSTOCKS USING FEEDSTOCK INVENTORY ACCOUNTING - MULTIPLE FEEDSTOCKS USING CHEMICAL ANALYSIS OF CALCULATED YIELD - MULTIPLE CO-PRODUCTS Requirements on adjustment and mixing of consignments with different energy content are stated in LCFS Guidance 19-08 'Fuel Pathway Allocation for Produced Fuel and Quarterly Fuel Transactions Reporting': https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/lcfsguidance_19-08.pdf Low Carbon Fuel Standard (LCFS) Guidance 19-08 This guidance describes fuel pathway allocation methods for the production of a single fuel, and does not apply to the renewable portion of a diesel fuel derived from co-processing biomass with a petroleum feedstock, which is defined in the regulation as a separate fuel type (Section 95481(123)). In case of co-products energy based allocation is used as an accounting method.
18. First point in supply chain to trace back the information to: • Forestry: forest residues • Agriculture: straw from cereals	Typically verified at point of collection with use of professional judgement and risk assessment to select some CoC records to trace to point of origin (PoO). A fuel producer processing specified source feedstock(s) is required to demonstrate chain of custody back to the point of origin. "Feedstock First Collection Point" means the facility that aggregates and stores or treats feedstock materials collected from a point of origin. The first collection point may be upstream of the fuel production facility, or, if feedstocks are

	transported to the fuel production facility directly from the point of origin, the first collection point is the fuel production facility [3] Note: amendments to this program are currently under consideration. [7]. The CARB staff proposed a.o: All feedstocks at the point-of-origin must be certified by Jan. 1, 2028. The certification system must have been recognized by an international, national or state/provincial government for at least 24 months. [10] See also #6,7

E. Monitoring compliance: the governance structure

19. (Controlling) Authority to receive the required sustainability and GHG information from the economic operator (see A)

California Air Resources Board (CARB)

Diagram MRR Governance Structure:

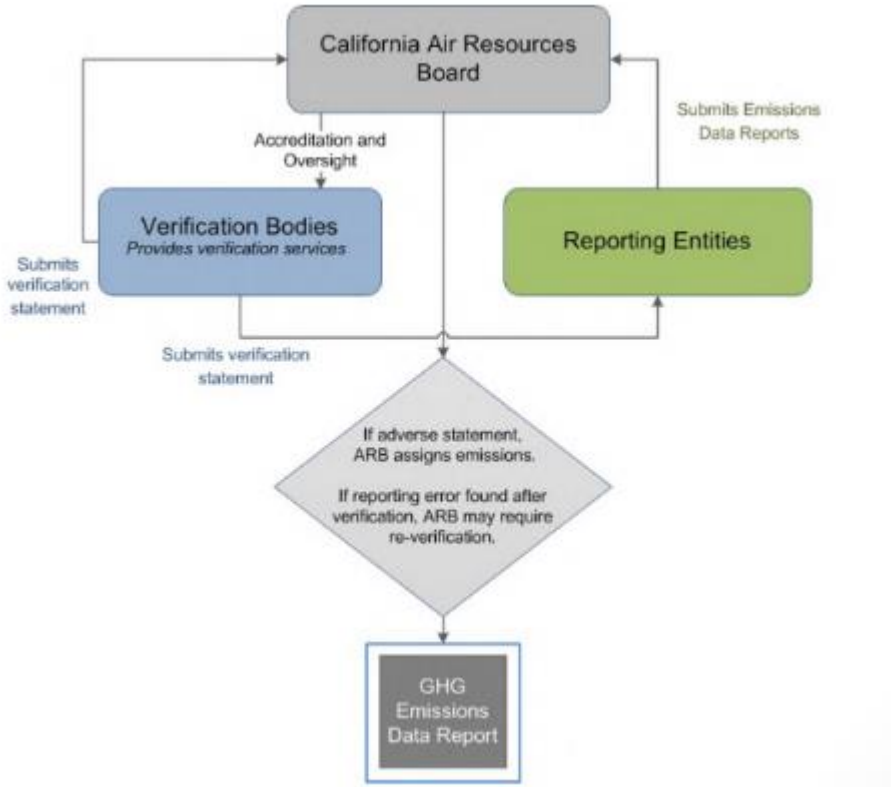
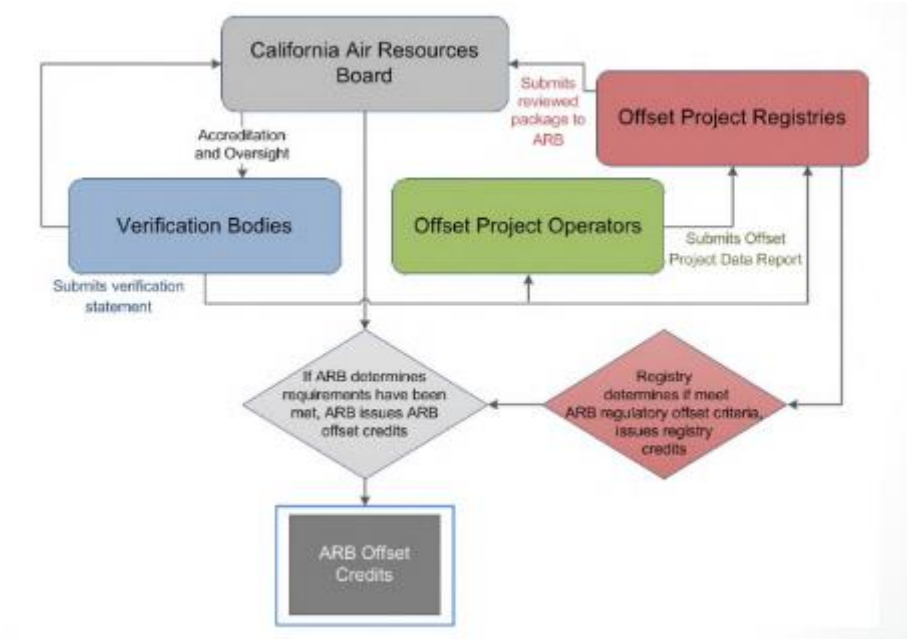
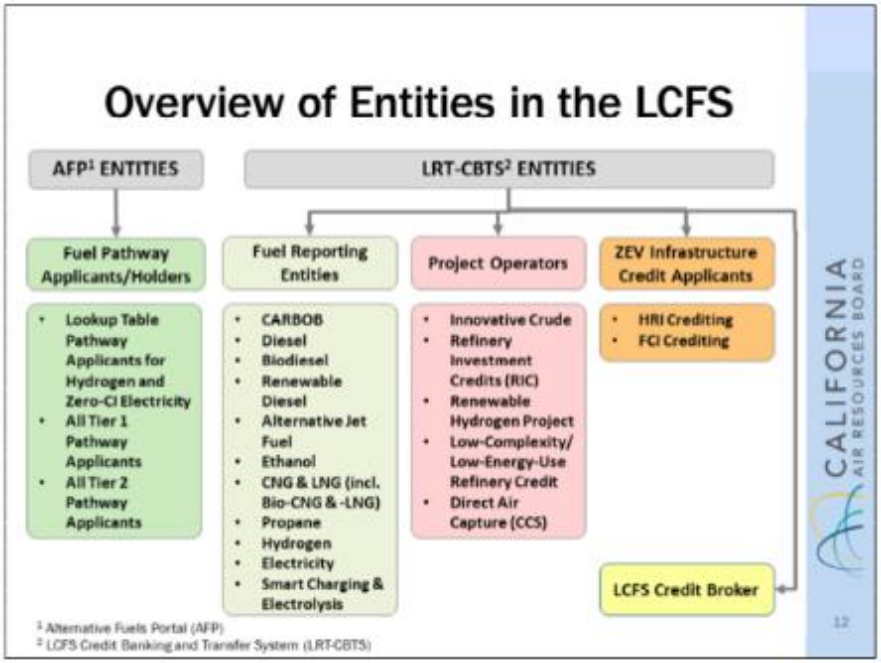


Diagram Compliance offset verification governance structure:



20. Method of registering required information by the (controlling) authority, existence of database	The Alternative Fuels Portal (AFP) and the LCFS Credit Banking and Transfer System (LRT-CBTS) are two of the modules that make up the LCFS database management system. The management system also includes a Verification module, which provides access to participant data for LCFS-accredited Verification Bodies [2]. § 95483.2. LCFS Data Management System: (a) Alternative Fuel Portal (AFP) supports fuel pathway applications, certifications, and verifications. It also handles the registration of fuel production facilities and opt-in projects [3]. The AFP facilitates the application process to obtain a certified CI score. Applicants for Tier 1 and Tier 2 pathways, which rely on site-specific data, use this portal to submit their CI calculator and supplemental information [2]. 

21. Method of correctness check on required information by the (controlling) authority	§ 95491.1. Recordkeeping and Auditing. .....(2) Record Retention for Fuel Pathway Holders and Applicants. Fuel pathway holders and applicants must maintain all records relied upon in producing fuel pathway applications and annual Fuel Pathway Reports. The retained documents, including CI input source data and supplemental documentation, must be sufficient to allow for verification of each CI calculation [3] § 95492. Enforcement Protocols. ... the Executive Officer may enter into an enforceable written protocol with any person to identify conditions under which the person may lawfully meet the recordkeeping, reporting, or demonstration of requirements under this sub-article. The Executive Officer may only enter into such a protocol if he or she reasonably determines that the provisions in the protocol are necessary ..... [3] Also on-site visits
22. Public availability of information and extent thereof	The LCFS Data Dashboard web page is created to display the current and historical LCFS program data. Some of the information found in the Data Dashboard are the following [2]: • Volume of fuels and credits generated under the LCFS • Compliance curve and the percent reduction in carbon intensity to date • Credit volumes transacted and the average credit prices per month under the LCFS. see http://www.arb.ca.gov/fuels/lcfs/dasboard/dashboard.htm
23. Authority of the controlling authority (or other governance organisation) to check correctness of information passed throughout the supply chain • First applicable point in the value chain • Type of information	If needed for further investigation, CARB can do (risk-based) checks back to the point of origin. § 95493. Jurisdiction. (a) The following persons are subject to the jurisdiction of the State of California, including the administrative authority of CARB and the jurisdiction of the Superior Courts of the State of California, irrespective of whether the person has registered as a fuel reporting entity in the LRT-CBTS: (1) any person who, pursuant to section 95483 or 95483.1, is the fuel reporting entity; (2) any person to whom the obligation to generate credits or deficits has been transferred directly or indirectly (including the reporting party); (3) any verifier; (4) any project operator; and (5) any fuel pathway or project applicant. (b) Any of the following actions shall conclusively establish a person's consent to be subject to the jurisdiction of the State of California, including the administrative authority of CARB and the jurisdiction of the Superior Courts of the State of California: ...[...].... [3]

24. Consequences of non-compliance in case of incomplete and/or incorrect information submitted by the economic operator	§ 95494. Violations. (a) CARB may seek penalties and injunctive relief for any violation of this subarticle pursuant to Health and Safety Code section 38580 and Chapter 1.5 of Part 5 of Division 26 [3] § 95495. Authority to Suspend, Revoke, Modify, or Invalidate. (a) If the Executive Officer determines that any basis for invalidation set forth in subsection (b)(1) below occurred, in addition to taking any enforcement action, he or she may: suspend, restrict, modify, or revoke an LRT-CBTS account; modify or delete a Certified CI; restrict, suspend, or invalidate credits; or recalculate the deficits in an LRT-CBTS account [3].
E1. Monitoring compliance of certification standards *(Only relevant when they can be used to proof compliance)*	
25. Authority of the controlling authority (or other governance organisation) to monitor the competency of the auditors and if yes; • First applicable point in the value chain • Scope of the monitoring	In this case the competency of the verifiers § 95491.1. Recordkeeping and Auditing. (3) Record Retention for Verification Bodies. The verification body providing verification services pursuant to this sub article must retain the following [3]: (A) The sampling plan ... for a period of no less than ten years following the submission of each validation or verification statement. The sampling plan must be made available to the Executive Officer upon request. (B) All material received, reviewed, or generated to render a validation or verification statement for an entity required to validate and verify under LCFS. The documentation must allow for a transparent review of how a verification reached its conclusion in the validation or verification statement, including independent review. Accreditation Only verifiers accredited by CARB can provide verification services for entities subject to the LCFS regulation. Accredited verifiers and verification bodies are issued an Executive Order recognizing accreditation by CARB for a period of three years, after which both verifiers and verification bodies must apply to be reaccredited [6].
26. Consequences of insufficient verification by the auditor	In this case the competency of the verifiers Accreditation can be lost
27. Authority of the controlling authority (or other governance organisation) to monitor the competency of certification schemes, and way thereof	NA CARB does monitor the performance of the verification scheme

28. Insight of the controlling authority (or other governance organisation) into the number of certification schemes being used throughout the full supply chain	NA
29. Consequences of insufficient verification and monitoring by the certification scheme	NA

F. Other (optional)	
30. Highest risks in information transfer (completeness, correctness) between economic operators in the supply chain for advanced biofuel supply chains	[No input received]
31. Highest risks in information transfer and monitoring of the sustainability and GHG emission requirements in advanced biofuel supply chains between countries	[No input received]

32. Opportunities for improvement to harmonize and strengthen policy frameworks to monitor the sustainability and GHG emission requirements of advanced biofuel supply chains	[No input received]
33. Other remarks	[No input received]

Relevant sources
1. IEA Bioenergy report (2023), Implementation Agendas: 2022-2023 Update Compare and Contrast Transport Biofuels Policies
2. LCFS Basics, see: https://ww2.arb.ca.gov/sites/default/files/2020-09/basics-notes.pdf
3. Unofficial electronic version of the Low Carbon Fuel Standard Regulation https://ww2.arb.ca.gov/sites/default/files/2020-07/2020_lcfs_fro_oal-approved_unofficial_06302020.pdf
4. https://www.transportpolicy.net/standard/california-fuels-low-carbon-fuel-standard/
5. The Renewable Fuel Standard (RFS): An Overview, Updated January 31, 2022. See: https://sgp.fas.org/crs/misc/R43325.pdf
6. https://ww2.arb.ca.gov/resources/fact-sheets/accreditation-requirements-third-party-verifiers-californias-low-carbon-fuel
7. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/isor.pdf
8. https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/lcfs_meetings/12192016presentation_vb.pdf
9. https://www.climatesolutionslaw.com/2024/01/carb-proposes-new-emissions-reduction-rule/
10. https://www.christiansoncpa.com/details-on-proposed-lcfs-amendments/

1.7. THE EU RENEWABLE ENERGY DIRECTIVE (EU RED)

The following note is included as part of the report:

Note: In the EU' Member States, the implementation of RED II Directive (EU) 2018/2001 at national level is very recent. Here we report a specific document for the EU, based on the updated REDIII targets, that differs from the specific regulation for each MS (still regarding the implementation of RED II at national level).

A1. General information	
1. Existence of a policy on the sustainability of (advanced) biofuels in the country, plus description	The EU binding targets for biofuels & advanced biofuels are set by the Renewable Energy Directive (EU) 2001/2018 (REDII) and the RED (EU) 2023/2413 (REDIII) amending RED II. In order to mainstream the use of renewable energy in the transport sector, each Member State shall set an obligation on fuel suppliers to ensure a share of renewable energy within the final consumption of energy in the transport sector of at least 29 % by 2030, or a greenhouse gas intensity reduction of at least 14,5 % compared to the baseline by 2030. (Art. 25) In the EU REDII/REDIII encourages the deployment of advanced biofuels, by setting a target for use of renewable energy in the transport sector and limiting the amount of biofuels and bioliquids produced from cereal and other starch-rich crops, sugars and oil crops. Therefore, biofuels from feed & food crops have a cap (7% of final consumptions of energy in the road and rail transport). RED III sets an obligation to require fuel suppliers to ensure a minimum share of advanced biofuels and biogas for transport, as a way to encourage continuous development of advanced biofuels technologies. The contribution of advanced biofuels and biogas for transport shall be at least 5.5% (including at least 1% RFNBOs).by 2030.For the purpose of demonstrating compliance with the minimum shares mentioned in art. 25, point 2 (REDIII): (c) the share of biofuels and biogas produced from the feedstock listed in Annex IX and renewable fuels of non- biological origin shall be considered to be twice its energy content; (d) the share of renewable electricity shall be considered to be four times its energy content when supplied to road vehicles and may be considered to be 1,5 times its energy content when supplied to rail transport; (e) the share of advanced biofuels and biogas produced from the feedstock listed in Part A of Annex IX supplied in the aviation and maritime transport modes shall be considered to be 1,2 times their energy content and the share of renewable fuels of non-biological origin supplied in the aviation and maritime transport modes shall be considered to be 1,5 times their energy content; (f) the share of biofuels and biogas produced from the feedstock listed in Part B of Annex IX in the energy content of fuels and electricity supplied to the transport sector shall, except in Cyprus and Malta, be limited to 1,7 %;". During 2023, the EC published specific regulation for the aviation and maritime sector.

		For aviation, the ReFuelEU Aviation set a target of 70% (energy basis) of Sustainable Aviation Fuels (SAFs) towards 2050 for both fuel suppliers to distribute SAF in increasing amounts over time, and to airlines companies to uplift (SAF-blended) aviation fuel at EU airports. Specifically, first targets are a minimum share of 2 % of SAF by 2025 and 6 % by 2030. After 2030, specific targets for RFNBO are introduced. According to the Regulation (EU) 2023/2405 (ReFuelEU Aviation), SAF are defined as drop-in aviation fuels that are either biofuels produced from feedstocks listed in Annex IX of the Renewable Energy Directive (RED II) or synthetic aviation fuels (as RFNBO, according to the REDII), and which comply with the sustainability and GHG emissions reductions criteria set Article 29 of the RED II. The Regulation (EU) 2023/1805 has set a target for the maritime sector of 80% GHGs reduction intensity of the energy used on board by a ship by 2050 expressed in Well-to-Wake (WTW) (6% by 2030) accounting for all the life-cycle emissions (CO_2, CH_4, N_2O) of the different fuels and relevant engine technologies. Maritime renewable fuels have no specific definitions as SAF, since they include all fuel categories eligible towards the REDII/REDIII targets. *(references of these regulations are available in the last section)* See the recent IEA T39 newsletter produced by JRC for further details: IEA BIOENERGY T39 BIOFUEL NEWS
2.	Definition for 'advanced biofuels' under this policy	'Advanced biofuels' are defined in RED II as 'biofuels that are produced from the feedstock listed in Part A of Annex IX'. RED II includes a list of feedstocks in Annex IX Part A that can be used for the production of advanced biofuels. The Commission shall review, every two years, the list of feedstock set out in Parts A and B of Annex IX with a view to adding feedstock. The Commission can adopt delegated acts to amend the list of feedstock set out in Parts A and B of Annex IX by adding, but not removing, feedstock. Feedstock that can be processed only with advanced technologies shall be added to Part A of Annex IX. Feedstock that can be processed into biofuels, or biogas for transport, with mature technologies shall be added to Part B of Annex IX. A delegated regulation updating the REDII' Annex IX is due in 2024 (see here below).
3.	Feedstock categories under the scope of 'advanced biofuels'	Feedstocks for the production of biogas for transport and advanced biofuels (RED II, Annex IX Part A): (a) algae; (b) biomass fraction of mixed municipal waste; (c) biowaste; (d) biomass fraction of industrial waste not fit for use in the food or feed chain; I straw; (f) animal manure and sewage sludge; (g) palm oil mill effluent and empty palm fruit bunches; (h) tall oil pitch; (i) crude glycerine; (j) bagasse; (k) grape marcs and wine lees; (l) nut shells; (m) husks; (n) cobs; (o) biomass fraction of wastes and residues from forestry and forest-based industries, (bark, branches, pre- commercial thinning, leaves, needles, tree tops, saw dust, cutter shavings, black liquor, brown liquor, fibre sludge, lignin and tall oil); (p) other non-food cellulosic material; (q) other ligno-cellulosic material except saw logs and veneer logs. Feedstocks for the production of biofuels and biogas for transport, the contribution of which towards the minimum share at 1.7% (Part B): Used cooking oil; Animal fats classified as categories 1 and 2 in accordance with Regulation (EC) No 1069/2009. Upcoming delegated act amending RED II Annex IX has been released for public consultation, and now the EC is taking the final decision Biofuels - updated list of sustainable biofuel feedstocks (europa.eu)

A2. Requirements on GHG emission reduction and sustainability	
4. GHG emission reduction and sustainability requirements included in the policy, and applicability to feedstock-to-biofuel chains, in particular requirements for: • Forest: forest residues to ethanol via gasification • Agriculture: ethanol production from cereal straw	The GHG calculation methodology for advanced biofuels (and other liquid biofuels) is specified in the Annex V of the REDII. Annex VI presents the methodology for solid and gaseous biomass fuels. Both annexes also include pre-calculated carbon intensity (default values) representing baseline scenario for a specific biofuels or biomass fuel category. REDII methodology is based on a well-to-tank LCA system (as system boundary) including emissions from the extraction or cultivation of raw materials, from land use change, emissions from processing, from transport and distribution and from the fuel in use and excluding the CAPEX emissions. The emissions from the biofuel in use (combustion) are considered to be zero for biofuels, due to the biogenic origin of the fuels. The methodology uses an energy allocation for the emissions of co-products, and the specific assumptions are presented in the following JRC reports Giuntoli et al (2017) and Edwards et al (2019) (see references). The **GHG emission savings** from the use of biofuels, bioliquids and biomass fuels (not only for advanced biofuels) (REDII/REDIII Art 29): (a) at least 50 % for biofuels, biogas consumed in the transport sector, and bioliquids produced in installations in operation on or before 5 October 2015 (b) at least 60 % for biofuels, biogas consumed in the transport sector, and bioliquids produced in installations starting operation from 6 October 2015 until 31 December 2020 (c) at least 65 % for biofuels, biogas consumed in the transport sector, and bioliquids produced in installations starting operation from 1 January 2021 (d) at least 70% for RCF and RFNBO The fossil fuel comparator of 94 gCO2e/MJ for all other transport fuels represents the GHG intensity of the average liquid fossil fuel mix in the EU, whereas 183 gCO2e/MJ represents the GHG intensity of fossil-derived electricity and 80 gCO2e/MJ for heating. Greenhouse gas emissions saving criteria apply to: • solid biomass fuels, in installations producing electricity, heating and cooling with a total rated thermal input equal to or exceeding 7,5 MW; • gaseous biomass fuels, in installations producing electricity, heating and cooling with a total rated thermal input equal to or exceeding 2 MW; • in the case of installations producing gaseous biomass fuels with the following average biomethane flow rate above 200 m3 methane equivalent/h measured at standard conditions of temperature and pressure, namely 0 °C and 1 bar atmospheric pressure. Member States may apply the sustainability and greenhouse gas emissions saving criteria to installations with lower total rated thermal input or biomethane flow rate. **Sustainability requirements (REDII Art 29, and REDIII Art 29' replacement)** Biofuels, bioliquids and biomass fuels produced **from waste and residues**, other than agricultural, aquaculture, fisheries and

forestry residues, are required to fulfil only the greenhouse gas emissions saving criteria.

Biofuels, bioliquids and biomass fuels produced from **forest biomass** shall meet the following criteria:

(a) the country has national or sub-national laws in place or (b) management systems are in place ensuring:

i. legality of harvesting operations
ii. forest regeneration of harvested areas
iii. areas designated for nature protection purposes
iv. harvesting is carried out with the aim of minimising negative impacts on soil quality and biodiversity; and
v. harvesting maintains the long-term production capacity of the forest

Biofuels, bioliquids and biomass fuels produced from **forest biomass** shall meet the following land-use, land-use change and forestry (LULUCF) criteria:

(a) the country

(i) is a Party to the Paris Agreement

(ii) has submitted a NDC to UNFCCC, covering emissions and removals from agriculture, forestry and land use; or

(iii) has national or sub-national laws in place to conserve and enhance carbon stocks and sinks, and providing evidence that reported LULUCF-sector emissions do not exceed removals

(b) management systems are in place to ensure that carbon stocks and sinks levels in the forest are maintained or strengthened over the long term.

Biofuels, bioliquids and biomass fuels produced from **agricultural biomass** shall not be made from raw material obtained from land with a high biodiversity value, (on January 2008):

(a) primary forest and other wooded land
(b) highly biodiverse forest and other wooded land
(c) areas designated: for nature protection purposes; or (ii) for the protection of rare, threatened or endangered ecosystems or species
(d) highly biodiverse grassland

Biofuels, bioliquids and biomass fuels produced from agricultural biomass shall not be made from raw material obtained from **land with high-carbon stock** (on January 2008):

(a) wetlands

(b) continuously forested areas

I land spanning more than one hectare and a canopy cover of between 10 % and 30 %.

Biofuels, bioliquids and biomass fuels produced from agricultural biomass shall not be made from raw material obtained from land that was **peatland** in January 2008

Sustainability criteria for RCF and RFNBO the rules are specified in the delegated regulations: a) Delegated Act on a methodology

	for renewable fuels of non-biological origin (EU) 2023/1184; b) Delegated Act establishing a minimum threshold for GHG emissions savings of recycled carbon fuels (EU) 2023/1185 The Renewable Energy Directive (EU) 2001/2018 (REDII) and its update, RED (EU) 2023/2413 (REDIII) establish sustainability and the greenhouse gas emissions saving criteria for the energy from biofuels, bioliquids and biomass fuels. Biofuels, bioliquids and biomass fuels produced from waste and residues, other than agricultural and forestry residues, are required to fulfil only the greenhouse gas emissions saving criteria. The RED II excludes several land categories with recognised high biodiversity value from being used for biofuels, bioliquids and biomass fuels production: a) primary forests and other wooded land; b) highly biodiverse forests and other wooded land; d) areas designated for nature protection or for the protection of rare, threatened or endangered ecosystems or species; c) highly biodiverse grassland, either natural or non-natural. Biofuels, bioliquids and biomass fuels shall not be made from material from peatland and land with high carbon stock, such as: a) wetlands; b) continuously forested areas; c) land covered by trees higher than 5 m and a canopy cover between 10% and 30%. Biofuels, bioliquids and biomass fuels produced from forest biomass shall meet the following criteria: (a) national or sub-national laws or (b) management systems are in place ensuring: (i) legality of harvesting operations; (ii) forest regeneration of harvested areas; (iii) protection of designated areas; (iv) maintenance of soil quality and biodiversity; and (v) maintenance or improvement of long-term production capacity of the forest. In order to mitigate Indirect Land Use Change (ILUC) impacts, the ILUC Directive 2015/1513 and then the RED II limited the share of high ILUC-risk biofuels produced from food and feed crops and reduced the share of high ILUC-risk biofuels, bioliquids or biomass fuels down to zero in 2030. Low ILUC-risk biofuels, bioliquids and biomass fuels are exempt from the specific and gradually decreasing limit.

B. Proofing compliance: Information required	
5. Obligated party and interval for reporting and proof of compliance of the sustainability and GHG emission of (advanced) biofuels	Economic operators are required to show that the sustainability and greenhouse gas emissions saving criteria of biofuels, bioliquids and biomass fuels, or other fuels (Article 29) have been fulfilled. The information about the geographic origin and feedstock type of biofuels, bioliquids and biomass fuels per fuel supplier shall be made available to consumers on the websites of operators, suppliers or the relevant competent authorities and shall be updated on an annual basis. Each voluntary scheme shall submit annually by 30 April a report to the Commission covering each of the points set out in Annex IX to Regulation (EU) 2018/1999 for the preceding calendar year (Article 30). Economic operators have to arrange for an adequate standard of independent auditing. The first-, or second-party auditing, may be used to verify that the systems used by economic operators are accurate, reliable and protected against fraud, enabling verification of the data. Operators uses EU-recognized voluntary schemes (VSs) and national certification schemes for proving compliance of the sustainability and GHG emission: they are control systems that certify sustainability of biofuels. Voluntary schemes must be recognised by the European Commission under the sustainability framework. The sustainability and GHG emission criteria apply regardless of whether the biofuels, bioliquids, biomass fuels are produced within the Union or are imported. EC does not run these schemes itself, but open the opportunity private companies and other institutions to cover this role. The approved voluntary schemes and national certification schemes are listed here Voluntary schemes (europa.eu). VSs check that: • Production of feedstock used for the production of biofuels, bioliquids and biomass fuels does not take place on land with high Biodiversity and that land with a high amount of carbon has not been converted for such feedstock production • Electricity used for the production of renewable hydrogen is of renewable origin • Production of renewable fuels and gases leads to sufficient greenhouse gas emissions savings • Other details of the value chains depending on the system Several schemes also take into account additional sustainability aspects such as soil, water, air protection and social criteria. For the certification process, an external auditor verifies the whole production chain from the origin of the raw material and energy to the fuel producer or trader. For a scheme to be recognised by the Commission, it must fulfil criteria such as • Feedstock producers comply with the sustainability criteria and the criteria for RFNBOs production set out in the RED and implementing legislation • Information on the sustainability characteristics can be traced to the origin of the feedstock • All information is well documented • Companies are audited before they start to participate in the scheme and retroactive audits take place regularly • The auditors have both the generic and specific auditing skills needed with regard to the scheme's criteria

6.	Information requirements for reporting sustainability and GHG emission (reduction) by the obligated party	Economic operators have to provide information on the sustainability characteristics of those fuels, including their life-cycle greenhouse gas emissions, starting from their point of production to the fuel supplier. Where an economic operator provides evidence or data obtained in accordance with a scheme (i.e., a certificate), a Member State shall not require the supplier to provide further evidence of compliance with the sustainability and greenhouse gas emissions saving criteria. The regulation that will allow to the current voluntary schemes to apply for their eligibility as "certified schemes" is reported in the implementing regulation (EU) 2022/996 Publications Office (europa.eu) The Commission Implementing Regulation (EU) 2022/996 set the rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land use change-risk criteria. Voluntary schemes have the role to provide the certification of the compliance of biomass fuels with sustainability and GHG emissions saving criteria. The mass balance system was set for demonstrating compliance with the sustainability and greenhouse gas saving criteria by allowing mixing of raw material and fuels with differing sustainability characteristic and reduce the administrative burden. Voluntary schemes shall set up a system to verify compliance of economic operators with the rules and procedures applied by the scheme and to ensure the quality of the work carried out by the auditors of the certification bodies. The Annex II of the implementing regulation (EU) 2022/996 provides the minimum content of the audit reports. Link: Publications Office (europa.eu)
7.	Information requirements on origin	Information about the geographic origin and feedstock type of biofuels, bioliquids and biomass fuels per fuel supplier shall be made available on annual basis. The obligations shall apply to all domestic or imported biofuels, bioliquids, biomass fuels, renewable liquid and gaseous transport fuels of non-biological origin, or recycled carbon fuels. Economic operators may provide the required evidence directly at sourcing area level. The whole supply chain shall be covered starting from its origin, where the feedstock (waste or residue) is produced. The collection points shall be required to submit a list of all points of origin that have signed a self-declaration to the auditor prior to the audit of the collection point. For biofuels and bioliquids, points of origin supplying five or more tonnes per month of waste or residue listed in part A and B of Annex IX to Directive (EU) 2018/2001 shall be subject to an on-site audit. Whether a feedstock is considered as a waste or residue shall be determined at the points of origin in the supply chain. In addition to the requirements reported in the RED II and the COMMISSION IMPLEMENTING REGULATION (EU) 2022/996, depending on the energy sources, it is required compliance with the rules reported in: • Delegated Act on a methodology for renewable fuels of non-biological origin (EU) 2023/1184 • Delegated Act establishing a minimum threshold for GHG emissions savings of recycled carbon fuels (EU) 2023/1185 • Commission Implementing Regulation establishing operational guidance on the evidence for demonstrating compliance with the sustainability criteria for forest biomass (EU) 2022/2448 In cascade, at MS level, additional requirements may be needed.

8. Criteria for the categorisation and definitions of feedstocks	RED II' obligations are already reported. Categories are defined within Annex IX. An obligation on Member States to require fuel suppliers to ensure a minimum share of advanced biofuels and certain biogases, produced from feedstock listed in Annex IX of REDII. Definitions provided: • 'Agricultural biomass' means biomass produced from agriculture • 'Forest biomass' means biomass produced from forestry • 'Biowaste' means biowaste as defined in point (4) of Article 3 of Directive 2008/98/EC • 'Food and feed crops' means starch-rich crops, sugar crops or oil crops produced on agricultural land as a main crop excluding residues, waste or lignocellulosic material and intermediate crops, such as catch crops and cover crops, provided that the use of such intermediate crops does not trigger demand for additional land • 'Residue' means a substance that is not the end product(s) that a production process directly seeks to produce; it is not a primary aim of the production process, and the process has not been deliberately modified to produce it • 'Agricultural, aquaculture, fisheries and forestry residues' means residues that are directly generated by agriculture, aquaculture, fisheries and forestry and that do not include residues from related industries or processing The feedstock category used for the production of biofuels, bioliquids and biomass fuels which are subject to different rules concerning their contribution towards the targets for renewable energy should be defined separately, since differentiated treatment applies in some cases. The list of feedstock to produce advanced biofuels is set out in an Annex IX of RED II takes into account the principles of the waste hierarchy established in Directive 2008/98/EC, the sustainability criteria and the need to ensure it does not create additional demand for land.
9. Information requirements on feedstock type	Voluntary schemes must ensure that feedstock producers comply with the sustainability criteria, information on the sustainability characteristics can be traced to the origin of the feedstock and all information is well documented along the supply chain. Whether a feedstock is considered as a waste or residue shall be determined at the points of origin in the supply chain.

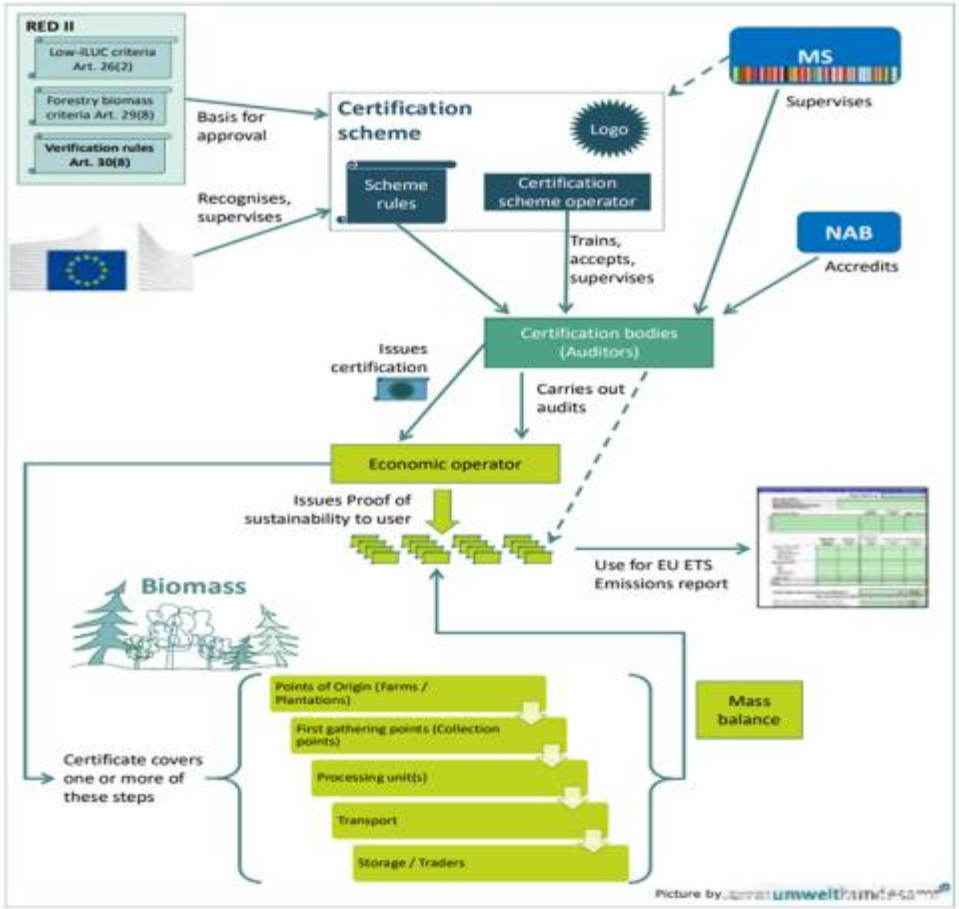
C. Proofing compliance: Verification methods required/ allowed	
10. Possibility to use certification systems to proof compliance and recognised schemes	The Commission may decide that voluntary national or international schemes setting standards for the production of biofuels, bioliquids or biomass fuels, or other fuels that are eligible. The Commission has so far not recognized voluntary schemes under the RED II, but The Commission has **received applications** for the recognition of voluntary schemes. Commission shall adopt implementing acts specifying detailed implementing rules, including adequate standards of reliability, transparency and independent auditing and require all voluntary schemes to apply those standards. A focus on the upcoming IA is reported in section E.1. EU recognised schemes under the RED are listed here Voluntary schemes (europa.eu).

11. Possibility to use a national standard to prove compliance	According to RED II, Member States may set up national schemes where compliance with the sustainability and greenhouse gas emissions saving criteria laid down is verified throughout the entire chain of custody. The Commission may decide whether such a national scheme complies with the conditions laid down in RED II.
C1. The approval and monitoring procedures for certification standards *(only relevant when they can be used to proof compliance)*	
12. Authority deciding on usable certification systems and/or national standards	According to RED II, Member States may set up national schemes where compliance with the sustainability and greenhouse gas emissions saving criteria laid down is verified throughout the entire chain of custody. The Commission may decide whether such a national scheme complies with the conditions laid down in RED. The Commission may decide that voluntary national or international schemes setting standards provide accurate data on greenhouse gas emission savings or demonstrate that consignments of biofuels, bioliquids or biomass fuels comply with the sustainability criteria.
13. Criteria used to approve a certification system and/or national standard	The Commission shall adopt implementing acts specifying detailed implementing rules, including adequate standards of reliability, transparency and independent auditing and require all voluntary schemes to apply those standards. This is the *Implementing Regulation on rules to verify sustainability and greenhouse gas emissions savings criteria and low indirect land-use change-risk criteria ()* The Commission assesses schemes for quality of their control system and their reliability. For a scheme to be recognised by the Commission, it must fulfil criteria such as • Feedstock producers comply with the sustainability criteria for biofuels described in the previous section and the criteria for RFNBOs production set out in the Renewable Energy Directive and its implementing/delegated legislations • Information on the sustainability characteristics can be traced to the origin of the feedstock • All information is well documented • Companies are audited before they start to participate in the scheme and retroactive audits take place regularly: a follow up audit of the companies in the supply chain takes place at least once a year • The auditors have both the generic and specific auditing skills needed with regard to the scheme's criteria • The administrative system is protected against fraud. The decision recognising a voluntary scheme has usually a legal period of validity of 5 years.

14. Minimum requirements around 3rd party auditing, intervals of verification or accreditation	Voluntary schemes must ensure that feedstock producers comply with the sustainability criteria, information on the sustainability characteristics can be traced to the origin of the feedstock and all information is well documented along the supply chain. The auditing shall verify that the systems used by economic operators are accurate, reliable and protected against fraud, including verification ensuring that materials are not intentionally modified or discarded so that the consignment or part thereof could become a waste or residue. It shall evaluate the frequency and methodology of sampling and the robustness of the data. The voluntary schemes shall publish (at least annually) a list of their certification bodies used for independent auditing, indicating for each certification body by which entity or national public authority it was recognized, and which entity or national public authority is monitoring it. Certification bodies shall submit, upon the request of competent authorities, all relevant information necessary to supervise the operation, including the exact date, time, and location of audits. For third countries, Member States shall to the extent possible establish cooperation frameworks with third countries for the supervision of certification bodies auditing in their territories, where relevant, in order to ensure the same level of information flow and the application of audit supervision standards to certification bodies operating in third countries. 3rd party auditing is also necessary the time that biofuels can also cover other scopes than complying the REDII targets (e.g. ICAO CORSIA eligibility, …)
15. Possibility and conditions of cross-compliance	The Commission assesses national schemes in order to facilitate mutual bilateral and multilateral recognition of schemes for verification of compliance with the sustainability and greenhouse gas emissions saving criteria. These schemes assessed by the Commissions cannot refuse mutual recognition with that Member State's scheme.

D. Traceability and transfer of information	
16. Allowed chain of custody systems (e.g., mass balance, book and claim) to link information to the biomass feedstock	Economic operators are required to use a mass balance system for reporting for each consignment, including data on the size of the consignment and related sustainability and greenhouse gas emissions saving characteristics. The sustainability and GHG emissions saving characteristics and other information about the raw material or fuel, together with transaction data shall be thoroughly documented and passed on from economic operator to economic operator through the supply chain. The economic operators shall apply a mass balance system which allows consignments of raw material or fuels with differing sustainability and greenhouse gas emissions saving characteristics to be mixed and the sustainability and greenhouse gas emissions saving characteristics of the consignment shall be adjusted and assigned to the output.

17. For mixing of different consignments of biomass, if allowed: Rules on allocation (e.g., based on energy content, mass)	Economic operators are to use a mass balance system which requires information about the sustainability and greenhouse gas emissions saving characteristics and sizes of the consignments. Economic operators must use a mass balance system which: (a) allows consignments of raw material or fuels with differing sustainability and greenhouse gas emissions saving characteristics to be mixed for instance in a container, processing or logistical facility, transmission and distribution infrastructure or site (b) allows consignments of raw material with differing energy content to be mixed for the purposes of further processing, provided that the size of consignments is adjusted according to their energy content (c) requires information about the sustainability and GHG emissions saving characteristics and sizes of the consignments referred to in point (a) to remain assigned to the mixture; and (d) provides for the sum of all consignments withdrawn from the mixture to be described as having the same sustainability characteristics, in the same quantities, as the sum of all consignments added to the mixture and requires that this balance be achieved over an appropriate period of time. Where a consignment is processed, information on the sustainability and greenhouse gas emissions saving characteristics of the consignment shall be adjusted and assigned to the output in accordance with the following rules: * when the processing of a consignment of raw material yields only one output that is intended for the production of biofuels, bioliquids or biomass fuels, renewable liquid and gaseous transport fuels of non-biological origin, or recycled carbon fuels, the size of the consignment and the related quantities of sustainability and greenhouse gas emissions saving characteristics shall be adjusted applying a conversion factor representing the ratio between the mass of the output that is intended for such production and the mass of the raw material entering the process; when the processing of a consignment of raw material yields more than one output that is intended for the production of biofuels, bioliquids or biomass fuels, renewable liquid and gaseous transport fuels of non-biological origin, or recycled carbon fuels, for each output a separate conversion factor shall be applied, and a separate mass balance shall be used.
18. First point in supply chain to trace back the information to: • Forestry: forest residues • Agriculture: straw from cereals	For forest residues: The first- or second-party auditing may be used up to the first gathering point of the forest biomass. The information is to be gathered on forest sourcing area level. '*sourcing area' means the geographically defined area from which the forest biomass feedstock is sourced, from which reliable and independent information is available and where conditions are sufficiently homogeneous to evaluate the risk of the sustainability and legality characteristics of the forest biomass* Compliance with REDII requirements, and LULUCF criteria for forestry biomass and low-ILUC for agricultural biomass.

E. Monitoring compliance: the governance structure	
19. (Controlling) Authority to receive the required sustainability and GHG information from the economic operator (see A)	As explained later (section E.1), the Commission receives the sustainability performances of biofuels/advanced biofuels/alternative fuels from the economic operators by means of a mechanism of voluntary schemes (regulation under development), or certified standards according to the national criteria set by RED II. Member States shall submit to the Commission, in aggregated form, the information they receive/ collect. 

20. Method of registering required information by the (controlling) authority, existence of database	Economic operators have to provide information on the sustainability characteristics of those fuels, including their life-cycle greenhouse gas emissions, starting from their point of production to the fuel supplier and on the transactions made. Where an economic operator provides evidence or data obtained in accordance with a scheme (i.e., a certificate), a Member State shall not require the supplier to provide further evidence of compliance with the sustainability and greenhouse gas emissions saving criteria. The information should be inserted into a national database that is linked to the Union database to enable the tracing of liquid and gaseous transport fuels. The Union Database (UDB) is a platform developed and managed by the European Commission Union Database for Biofuels_EO.pdf (europa.eu)
21. Method of correctness check on required information by the (controlling) authority	RED II reports the sustainability criteria which must be met by the advanced biofuels produced by the operators. The mechanism has been already explained. The Commission shall adopt implementing acts specifying detailed rules, including adequate standards of reliability, transparency and independent auditing and require all voluntary schemes to apply those standards. At the request of a Member State, which may be based on the request of an economic operator, the Commission shall, on the basis of all available evidence, examine whether the sustainability and GHG emissions saving criteria in relation to a source of biofuels, bioliquids and biomass fuels, and the GHG savings thresholds have been met. For schemes to be recognised by the Commission, they have to include rules about who checks that the rules of the scheme are applied correctly by companies and that these checks occur with sufficient frequency. The Commission requires that the auditors of the scheme are competent and independent. Schemes can show this by, for instance, laying down in their rules that only auditors who have relevant ISO (International Organization for Standardization) standards in place and who are accredited by an independent accreditation body who is a member of the International Accreditation Forum, may audit for that scheme.
22. Public availability of information and extent thereof	Annex V and VI report a list of default/typical values of the GHGs intensity calculated for different production pathways. The operators can use those values if they are operating the plants as the same way of the standard cases, otherwise, they must provide their own calculations. Information about the geographic origin and feedstock type per fuel supplier must be made available to consumers on the websites of operators, suppliers or the relevant competent authorities and shall be updated on an annual basis. The voluntary schemes shall publish a list of their certification bodies used for independent auditing, indicating for each certification body.

23. Authority of the controlling authority (or other governance organisation) to check correctness of information passed throughout the supply chain • First applicable point in the value chain Type of information	The mechanism is still under development. See next section. RED II mentions the following: At the request of a Member State, which may be based on the request of an economic operator, the Commission shall, on the basis of all available evidence, examine whether the sustainability and GHG emissions saving criteria in relation to a source of biofuels, bioliquids and biomass fuels, and the GHG savings thresholds have been met. In case of concerns that a voluntary scheme does not operate in accordance with the standards of reliability, transparency and independent auditing, the Commission can investigate the matter and take appropriate action.
24. Consequences of non-compliance in case of incomplete and/or incorrect information submitted by the economic operator	See point nr. 29 for the certification schemes. RED II also mentions the following: Within six months of receipt of a request (of further investigation) and in accordance with the examination procedure, the Commission shall, by means of implementing acts, decide whether the Member State concerned may either: take into account biofuels, bioliquids, biomass fuels and other fuels that are eligible for counting towards the numerator ...[...]...; or (a) by way of derogation from paragraph 9 of this Article, require suppliers of the source of biofuels, bioliquids, biomass fuels and other fuels that are eligible for counting towards the numerator ..[...]... to provide further evidence of compliance with those sustainability and greenhouse gas emissions saving criteria and those greenhouse gas emissions savings thresholds. See Chapter III Article 10 – Audit process and levels of assurance – Point 4 Publications Office (europa.eu)
E1. Monitoring compliance of certification standards *(Only relevant when they can be used to proof compliance)*	
25. Authority of the controlling authority (or other governance organisation) to monitor the competency of the auditors and if yes; • First applicable point in the value chain • Scope of the monitoring	In EU, an Implementing Act on rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land-use change-risk criteria have been published (see references). The document establishes a procedure to recognize whether biofuels, biomass fuels, bioliquids, renewable gaseous and liquid transport fuels of non-biological origin and recycled carbon fuels comply with the requirements of RED II Directive (EU) 2018/2001. The mechanism works with the use of voluntary schemes, which have to be first approved by EC. The recognition of the schemes by the Commission is not a pre-requisite for certification. EU countries may accept evidence from voluntary schemes that are not recognised if they provide the required assurances. According to the RED II: Competent authorities of the Member States shall supervise the operation of certification bodies that are conducting independent auditing under a voluntary scheme. Certification bodies shall submit, upon the request of competent authorities, all relevant information necessary to supervise the operation, including the exact date, time and location of audits. Where Member States find issues of non-conformity, they shall inform the voluntary scheme without delay. Update: VSs submit yearly reports to the EC or national authorities. Upon request, voluntary schemes shall provide access to

	actual GHG calculations certified under their voluntary scheme together with the respective audit reports to the Commission and the national authorities responsible for supervision of the certification bodies. Audit rules are reported in Chapter III "AUDIT PROCESS, AUDIT SCOPE, QUALIFICATIONS OF AUDITORS AND AUDIT SUPERVISION" Publications Office (europa.eu)
26. Consequences of insufficient verification by the auditor	See point nr. 29. According to the RED II: Where Member States find issues of non-conformity, they shall inform the voluntary scheme without delay. The Commission could request of additional information and clarifications. Then, the Commission can revoke its decision to recognize the certification schemes if it becomes clear that the scheme does not follow the agreed set of rules.
27. Authority of the controlling authority (or other governance organisation) to monitor the competency of certification schemes, and way thereof	As first, voluntary schemes must be first approved by EC, which is the controlling authority. Afterwards, they can operate and act together with certification bodies to provide certification services for raw materials or fuels, by carrying out audits of economic operators and issuing certificates. Voluntary scheme's certification system considers the certification bodies performing audits which are accredited to ISO 7065 or equivalent and to ISO 14065 or equivalent where it performs audits on actual GHG values. According to the RED II: In case of concerns that a voluntary scheme does not operate in accordance with the standards of reliability, transparency and independent auditing, the Commission can investigate the matter and take appropriate action. Verification schemes are checked by auditors and rules are reported in Article 17 " Publications Office (europa.eu)
28. Insight of the controlling authority (or other governance organisation) into the number of certification schemes being used throughout the full supply chain	Not at this moment, regulation is still under development.
29. Consequences of insufficient verification and monitoring by the certification scheme	In case of non-conformities of economic operators under a scheme, the certificates may be suspended. For each type of non-conformity, there shall be a transparent set of rules and procedures to ensure timely enforcement of corrective measures and sanctions, including suspensions, where appropriate. In case of concerns that a voluntary scheme does not operate in accordance with the standards of reliability, transparency and independent auditing, the Commission can investigate the matter and take appropriate action and request of additional information and clarifications. Then, the Commission can revoke its decision to recognize the certification schemes if it becomes clear that the scheme does not follow the agreed set of rules.

F. Other (optional)	
30. Highest risks in information transfer (completeness, correctness) between economic operators in the supply chain for advanced biofuel supply chains	There is a risk that the methodology for GHGi is not correctly applied and the GHGi calculations of advanced/conventional biofuels may not be correctly carried out. We recommend the Commission to check some of the GHG calculations companies submit for their biofuels, to check to see if the calculations of GHGi for biofuels are being done the proper way. The Commission leaves it to the Voluntary Schemes to check if the methodology proposed by the Commission is exactly followed when calculated the actual values. And as the RED moves towards a GHG emissions reduction from transport, this issue is going to be more and more important. In the EU' Member States, RED II had to be transposed to national level (deadline 30 June 2021) and the implementation of RED II at national level is very recent. Here we report a specific document for EU that differs from the specific regulation for each MS (regarding the reception of RED II at national level). There is a high risk that different MS can call different biofuel types advanced or not. Risks may occur when certification of feedstock and other input, traceability, use of standardized procedures are missing. DG ENERGY recently commissioned a study on the "Assessment of the potential for new feedstocks for the production of advanced biofuels" (see references). This project shortlisted 30 feedstocks set of fraud risk indicators to assess their potential eligibility for inclusion in Annex IX.
31. Highest risks in information transfer and monitoring of the sustainability and GHG emission requirements in advanced biofuel supply chains between countries	International fuel trade can trigger some fraud risks, which should be limited by strong standard and certification mechanisms. E,g, conventional biofuels may be sold as advanced biofuels. When international standards are missing (for example for UCO trade), potential frauds have been observed. In order to limit such problems, some international initiatives as ICAO-CORSIA (aviation) already set an International biofuel certification scheme, while IMO (maritime) and IPHE-IEA (hydrogen) are developing guidelines to develop new standards and certification mechanisms to ensure international common rules for biofuels and renewable fuels trade. **Focus on ICAO-CORSIA:** According to the Regulation (EU) 2023/2405 on ensuring a level playing field for sustainable air transport (ReFuelEU Aviation), the EU is aligned with ICAO as much as possible. • *From recital (3): "The Union's external air transport policy is governed by rules established at global level at ICAO, and in comprehensive multilateral or bilateral agreements between the Union or its Member States, and third countries. It is therefore important that the Union sustains the efforts made at international, multilateral and bilateral level to promote a high level of ambition and convergence in the uptake of SAF, while providing for an international level playing field."* • From recital (10): "*implementation by the Union and its Member States of ICAO's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) in accordance with Council Decision (EU) 2020/954 (4) and EU Emissions*

Trading System (EU ETS) established by Directive 2003/87/EC of the European Parliament and of the Council (5) as amended by Directive (EU) 2023/958 of the European Parliament and of the Council (6)"

In EU, the eligibility of aviation biofuels, synthetic aviation fuels and recycled carbon aviation fuels should be based on the sustainability criteria and thresholds established in Directive (EU) 2018/2001.

Recently, ICAO 3rd Conference on Aviation Alternative Fuels (CAAF/3) held in Dubai (20-24 November 2023) set the target at 5% CO2 emissions reduction by 2030 through a greater use of SAF and other cleaner energy. That corresponds to about 7% in SAF volume terms.

As regards the GHG emissions savings criteria, ICAO-CORSIA requires only a 10% GHG emissions reduction of the so-called CORSIA eligible fuels (CEF) compared to a fossil baseline set at 89 gCO2e/MJ on a lifecycle basis. CORSIA eligible fuels (CEF) include Sustainable Aviation Fuels (SAF) and Lower Carbon Aviation Fuels (LCF). In order to be used into commercial flights, a fuel, either eligible under CORSIA or not, has to comply with the ASTM D4054.

GHG emissions calculations

Total life cycle GHG Life Cycle Emissions (LSf) of the of the SAF are calculated by the sum of core LCA emissions calculated with an attributional approach and *Induced Land Use Change (ILUC)* emissions calculated with a consequential approach. Similar to RED, emissions are allocated across the co-products on the basis of energy content. CORSIA LCA methodology considers all emissions from feedstock cultivation, harvesting, collection and recovery; feedstock processing and extraction; feedstock transportation to processing and fuel production facilities; feedstock-to-fuel conversion processes; fuel transportation and distribution; and fuel combustion in an aircraft engine.

Emissions from operational activities as well as emissions embedded in all inputs, such as processing chemicals, electricity and natural gas are considered. However, emissions from the construction of construction or manufacturing activities are not included, just like RED. For waste, residue and by-product feedstocks have zero GHG emissions associated, but the emissions from their collection, recovery, extraction and processing are included.

Certification/Obligations

As regards EU International flights, aircraft operators are able to claim the use of SAF under greenhouse gas schemes such as the EU ETS or CORSIA, at their own discretion, without double claiming the reduction of emissions.

Two SAF certification bodies have been currently approved for CORSIA:

- International Sustainability and CarbonCertification (ISCC)
- Roundtable on Sustainable Biomaterials (RSB)

	More info on ICAO-CORSIA interactions/alignment: Commission welcomes new UN Aviation Agency global target for sustainable aviation fuels - European Commission (europa.eu) **Focus on binding vs non-binding targets, and Member States (MSs) that will not achieve such targets:** REDIII is a Governance Regulation at the center of ensuring EU "binding" targets achievement. The only non-binding target reported in this document is the one set by the RePowerEU on biomethane 35 bcm by 2030. Currently, the EC is obligated by the "RED" Regulation to aggregate and assess MSs' National Energy and Climate Plans and Progress Reports and the measures presented therein to monitor whether the EU is on track to meet the EU 2030 energy and climate targets. However, the Regulation set mandates for the EU, not specific targets for the MSs. The EC has the role to trigger actual changes in case MSs show insufficient progress. The regulation enables the EC "to recommend" guidelines, but it is up to the MSs to define the regulatory framework for national target achievement and what happens if targets are not met.
32. Opportunities for improvement to harmonize and strengthen policy frameworks to monitor the sustainability and GHG emission requirements of advanced biofuel supply chains	- Maybe random checks of biofuel certifications could help to ensure quality. In any case a continuous checking of the actual GHG calculations by the Commission is a key-issue. - Harmonized criteria for sustainability and GHG emission requirements at international level
33. Other remarks	[No input received]

Relevant sources

- Renewable Energy Directive (EU) 2001/2018 (RED II), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC
- Rewable Energy DIRECTIVE (EU) 2023/2413 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652 http://data.europa.eu/eli/dir/2023/2413/oj
- Commission Implementing Regulation (EU) 2022/996 of 14 June 2022 on rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect landuse change-risk criteria https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022R0996&qid=1696513069854
- Commission Delegated Regulation (EU) 2019/181 amending Delegated Regulation (EU) 2015/2446 as regards the declaration of certain low-value consignments https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R1143
- REGULATION (EU) 2023/1805 on the use of renewable and low-carbon fuels in maritime transport, and amending Directive 2009/16/EC
- Giuntoli, Jacopo, Alessandro Agostini, Robert Edwards, and Luisa Marelli. 2017. "Solid and Gaseous Bioenergy Pathways : Input Values and GHG Emissions. Calculated According to the Methodology Set in COM(2016) 767 (EUR 27215)." https://doi.org/10.2790/27486
- Edwards, Robert; O'Connell, Adrian; Padella, Monica; Giuntoli, Jacopo; Koeble, Renate; Bulgheroni, Claudia; Marelli, Luisa; Lonza, Laura (2019): Biofuels pathways. Input values and GHG emissions. Database (Directive 2018/2001). European Commission, Joint Research Centre (JRC) [Dataset] PID: http://data.europa.eu/89h/e51f4304-7023-4fca-8900-7d206f89b914
- European Commission, Directorate-General for Energy, Haye, S., Panchaksharam, Y., Raphael, E. et al., Assessment of the potential for new feedstocks for the production of advanced biofuels – Final report, Publications Office of the European Union, 2022, https://data.europa.eu/doi/10.2833/719121

1.8. THE NETHERLANDS – POLICY ON ENERGY FOR TRANSPORT

A1. General information	
1. Existence of a policy on the sustainability of (advanced) biofuels in the country, plus description	Transposition of EU REDII in national legislation: Policy on 'energy for transport' (*regelgeving energie vervoer*), introducing the system of annual obligation and reduction obligation in which a tradable unit (HBE) plays an essential role for compliance Objective: The share of renewable energy within the final consumption of energy in the transport sector: 28% by 2030 with a sub target of 7% for advanced biofuels[5]; SAF deployment can contribute on a voluntary basis Upcoming: Transposition of EU REDIII in national legislation (by 2026): Tradable unit will become an emission reduction unit (ERE) Objective: fuel deployment in aviation will become part of the obligation [6] Fit-for-55 package relevant legislation: ReFuel Aviation & EU-ETS
2. Definition for 'advanced biofuels' under this policy	Biofuels produced from RED Annex IXa feedstocks, recently updated with specific attention to SAF feedstock (see separate factsheet EU-RED). ReFuel Aviation refers to EU-RED Annex IXa

[5] See: Staatsblad 2021, 619 | Overheid.nl > Officiële bekendmakingen (officielebekendmakingen.nl)
[6] both ReFuel Aviation and EU-ETS refer to the EU-RED with respect to the sustainability and GHG requirements

3. Feedstock categories under the scope of 'advanced biofuels'	Annex IXa (RED). For the broad sub d category of this annex, a national list of underlying feedstocks is laid down in Annex 5 of the regulation energy transport (*regeling energie vervoer*): wetten.nl - Regeling - Regeling energie vervoer - BWBR0041050 (overheid.nl): • Waste/residues from processing of alcohol • Wastewater from the food industry • Wastewater from the paper and cardboard industry • Wastewater from slaughterhouses • Renewable component of end-of-life tyres • Cashew Nut Shell Liquid (CNSL) • Spent bleaching earth • Bio-waste from trade, services and companies • Starch slurry (low grade) • Brown grease/grease trap fat • Sugar beet residues • Velasse • Food and feed products unfit for human and animal consumption, i.e. food waste and feed waste Added in 2022/2023 regulation: • Ethanol used in the cleaning/extraction of blood plasma • Residue of FAME end distillation • Wastewater from ship transport
A2. Requirements on GHG emission reduction and sustainability	
4. GHG emission reduction and sustainability requirements included in the policy, and applicability to feedstock-to-biofuel chains, in particular requirements for: • Forest: forest residues to ethanol via gasification	General RED requirements, i.e., certification under one of the EU recognized voluntary schemes. No additional requirements. ReFuel Aviation: all aviation biofuels which comply with the sustainability and lifecycle emissions criteria laid down in Directive (EU) 2018-2001 and are certified in accordance with that Directive, with the exception of biofuels produced from "food and feed crops" and certain feedstock listed in Article 4(5) of this Regulation, synthetic aviation fuels and recycled carbon aviation fuels complying with the lifecycle emissions savings threshold referred to in that Directive should be eligible.

• Agriculture: ethanol production from cereal straw	

B. Proofing compliance: Information required	
5. Obligated party and interval for reporting and proof of compliance of the sustainability and GHG emission of (advanced) biofuels	The end fuel supplier is the obligated party. This is the company doing the end delivery to transport. The end fuel supplier must be certified under a recognized voluntary scheme and deliver its biofuel/blend from a certified location for which he holds/manages the mass balance for sustainability.
6. Information requirements for reporting sustainability and GHG emission (reduction) by the obligated party	The information on the proof of sustainability, as issued to NEa by the end fuel supplier. It regards the general RED sustainability characteristics: feedstock, country of origin of the feedstock, energy content, GHG value. Furthermore, the fuel supplier must demonstrate that he is certified and that he manages the mass balance for sustainable biofuels for the locations from which the delivery to Dutch transportation took place.
7. Information requirements on origin	Country of origin of the feedstock
8. Criteria for the categorisation and definitions of feedstocks	Feedstocks are not all necessarily categorized as waste, residue, co-product or product. Annex IX-a is considered to be advanced. For the national list, filling in sub d of Annex IXa (see Q A1.3), the discussion how to categorize the feedstock is relevant. This is not translated in legal criteria, case by case assessment is required. Whether a feedstock can be considered as a waste depends on several elements: is it produced intentionally or the process optimized to increase its yield, what is its market value compared to the main product, can it be used for other applications (food/feed, oleochemical industry, etc).
9. Information requirements on feedstock type	Name only. But for new feedstocks more information is needed on the questions under 8, before the feedstock is allowed to be booked. The type of feedstock is currently fully substantiated on the basis of the PoS and the double counting statement. The auditor and verifier ensure correct feedstock labelling; this may also soon be done by the inspectors within national borders. Non-modification is in itself checked under the voluntary scheme. Waste cannot be labelled a waste if it were produced on purpose.

C. Proofing compliance: Verification methods required/ allowed	
10. Possibility to use certification systems to proof compliance and recognised schemes	For sustainability, certification under a recognized voluntary scheme is mandatory. Only the EU recognized schemes can be applied (see separate factsheet on EU-RED), no national scheme for biofuels apply in the Netherlands.
11. Possibility to use a national standard to prove compliance	Not possible to use a national standard. For sustainability, an EU voluntary scheme must be applied
C1. The approval and monitoring procedures for certification standards *(only relevant when they can be used to proof compliance)*	
12. Authority deciding on usable certification systems and/or national standards	Refer to answer on C10: The European Commission decides
13. Criteria used to approve a certification system and/or national standard	Refer to answer on C10: RED2
14. Minimum requirements around 3rd party auditing, intervals of verification or accreditation	Refer to answer on C10: RED2
15. Possibility and conditions of cross-compliance	Refer to answer on C10: RED2

D. Traceability and transfer of information	
16. Allowed chain of custody systems (e.g., mass balance, book and claim) to	Mass balance for liquid biofuels. Mass balance is strictly limited to biofuels. Fossil fuels and fossil components of blends cannot be part of the mass balance and therefore never be accompanied by a proof of sustainability. Guarantees of origin for gaseous biofuels (CNG and from 2022 also intended for methanol and LNG under specific criteria)

link information to the biomass feedstock	ReFuel: The purpose of using the mass balance system referred to in Directive (EU) 2018/2001 is to ensure the traceability of aviation fuels. And aviation fuel suppliers may demonstrate compliance with this Regulation by using a mass balance system, including when a system is shared between two or more Member States
17. For mixing of different consignments of biomass, if allowed: Rules on allocation (e.g., based on energy content, mass)	No national rules for mixing of biomass. For biofuels, the rules as used by the voluntary schemes apply. It is allowed to allocate sustainability characteristics as allowed by the voluntary schemes. Sustainability characteristics may not be allocated to fossil fuels, as also applied by voluntary schemes.
18. First point in supply chain to trace back the information to: • Forestry: forest residues • Agriculture: straw from cereals	There are no national additional requirements on this item. The Netherlands follows the approach applied by the voluntary schemes. Note that for receiving national subsidy for advanced biofuels, the use of straw as feedstock is only allowed for bioLNG digestion § 3.4.10. Geavanceerde hernieuwbare brandstof, Artikel 81. https://wetten.overheid.nl/BWBR0045389/2021-10-01 For Forest residues: The first- or second-party auditing may be used up to the first gathering point of the forest biomass (RED2) 'Sourcing area' means the geographically defined area from which the forest biomass feedstock is sourced, from which reliable and independent information is available and where conditions are sufficiently homogeneous to evaluate the risk of the sustainability and legality characteristics of the forest biomass (RED2)

E. Monitoring compliance: the governance structure	
19. (Controlling) Authority to receive the required sustainability and GHG information from the economic operator (see A)	NEa, Dutch Emissions Authority EU-ETS aviation : NEa Upcoming: ReFuel: NEa
20. Method of registering required information by the (controlling) authority, existence of database	A national database called the Register Energie voor Vervoer (REV): In this register, the obligated party books its fuel delivery for transport in the Netherlands, referring to the so-called 'proof of sustainability' (PoS), which has information about the: (i) name of the feedstock(s), (ii) country of origin, (iii) GHG emission and (iv) sustainability certificate used at the delivery. The items are entered in the database.

	As of 2024: Union Dabase (UDB)
21. Method of correctness check on required information by the (controlling) authority	The information in the database is compared with the proofs of sustainability and mass balance documentation of the fuel supplier. Whether the delivered fuels contain biofuel with the registered specifications may be checked by more administrative checks (stock and pumping data, invoices etc) and sampling and analysis (e.g., C14: C14-kader | Hulpdocument | Nederlandse Emissieautoriteit) From 2022 onwards, checks will be performed also at companies in the upstream supply chain within the Netherlands. Upcoming: ReFuel:"Member states should ensure that aviation fuel suppliers enter timely and accurate information in the EU UDB and that that information is verified and audited".
22. Public availability of information and extent thereof	Companies that supply fuels for the Dutch transport market have an obligation to deliver an annually increasing share of renewable energy, currently rising to 28% in 2030 (including multipliers). These companies also need to reduce the greenhouse gas emissions of their delivered fuels yearly with at least 6%. The NEa publishes **an annual report on the progress of these two obligations** on a national level
23. Authority of the controlling authority (or other governance organisation) to check correctness of information passed throughout the supply chain • First applicable point in the value chain • Type of information	From 2022, further checks within the Dutch borders can be performed, any relevant information; this is a strategy currently in progress. Furthermore, more checks will be performed on the certification bodies, to be worked out.
24. Consequences of non-compliance in case of incomplete and/or incorrect information submitted by the economic operator	NEa may delete created HBEs from the companies account. If this leads to a negative HBE-balance on the economic operators REV account, it needs to be replenished. In addition may also impose further sanctions (fines). ReFuel: fines for the aircraft operator as well as the aviation fuel supplier, amount of fine not determined on yet.
E1. Monitoring compliance of certification standards *(Only relevant when they can be used to proof compliance)*	
25. Authority of the controlling authority	Currently not for certifying auditors, but auditors doing work on verification under the Dutch legislation (double counting,

(or other governance organisation) to monitor the competency of the auditors and if yes; • First applicable point in the value chain • Scope of the monitoring	booking) are under the scope of supervision. Note that the Netherlands has a separate verification protocol for the double counting of biofuels (Annex 7 Regeling energie Vervoer: wetten.nl - Regeling - Regeling energie vervoer - BWBR0041050 (overheid.nl)). The work performed by certification bodies is under supervision of NEa since 2022 onwards.
26. Consequences of insufficient verification by the auditor	Currently for auditors doing verification work any significant findings are passed on to the accreditation body. In case of serious findings, sanctions (fines) may be imposed. Findings regarding the work performed by certification bodies will be passed on to the sustainability schemes in line with RED2 since 2022 onwards.
27. Authority of the controlling authority (or other governance organisation) to monitor the competency of certification schemes, and way thereof	Not yet
28. Insight of the controlling authority (or other governance organisation) into the number of certification schemes being used throughout the full supply chain	There's no insight of the controlling authority (or other governance organisation) into number of certification schemes being used throughout the full s
29. Consequences of insufficient verification and	No actual experience so far, no regulation on what would be done by NEa.

monitoring by the certification scheme	

F. Other (optional)	
30. Highest risks in information transfer (completeness, correctness) between economic operators in the supply chain for advanced biofuel supply chains	Most risks are in incorrect passing on of sustainability information as no link exists between mass balances of economic operators in the supply chain. Advanced biofuels may be created on purpose. Auditors have limited mandate to cross check with information from other 'shackles' in the supply chain. Only in case operators acts at supplier and receiver in the supply chain, auditors are able to do some cross checks. Auditing is also more procedural by nature than focussing on truth finding. The known fraud cases have shown that it's rather easy to commit fraud while being subject to audits. Public supervision offers far more possibilities to (cross) check actual data. Even though this will also never fully prevent fraud of course.
31. Highest risks in information transfer and monitoring of the sustainability and GHG emission requirements in advanced biofuel supply chains between countries	In general: GHG emission information early in the supply chain might lay outside the jurisdiction (country) of the controlling authority. Countries with less regulation and less monitoring may be vulnerable to incorrect sustainability information which is then passed on further down the supply chain.
32. Opportunities for improvement to harmonize and strengthen policy frameworks to monitor the sustainability and GHG emission requirements of advanced biofuel supply chains	Harmonized feedstock definitions, database of biofuel characterises and volumes (e.g., based on block chain technology), easy access to data from the supply chain (tracing back the upstream supply chain)
33. Other remarks	Temporary solution 2024, pending a definitive approach via the Union database on parallel claiming EU RED & EU ETS (SAF) Rules on co-processed fuels: see Delegated regulation - 2023/1640 - EN - EUR-Lex (europa.eu)

Relevant sources
• Besluit energie Vervoer, https://wetten.overheid.nl/BWBR0040922/2023-02-16 • Regeling energie Vervoer, https://wetten.overheid.nl/BWBR0041050/2023-02-17 Sources of Additional Context: • ReFuelEU Aviation - European Commission (europa.eu) • EU-ETS: Reducing emissions from aviation - European Commission (europa.eu)

Annex 2: Work package 3 Robustness of the GHG assurance system ('on paper')

There are several sensitivities in the SAF supply chains and auditing process challenging the robustness of the system. Within this project we focused on sensitivities related to the carbon intensity (CI). Below you find the most relevant sensitivities identified by Task39 partners in WP3 of this project. These findings are based on the Task 39 part 1 report[7], the in-person workshop in Leipzig and in-depth interviews with committed countries to this project. Where necessary, findings were complemented with desk research. The sensitivities are focussed on the determination and verification of the carbon intensity (CI) of current SAF supply chains, based on a lifecycle GHG calculation methodology. Moreover, the list consists of sensitivities in the governance system of a selection of policies and their auditing processes focussing on the determination of the GHG reduction achievements in SAF supply chains. We focused in particular on sensitivities in (verification of) emissions sources and effects we considered to have the largest impact for SAF (based on a qualitative relevance and complexity score by the committed partners).

The sustainability of biofuels is largely determined by the carbon intensity (CI) of its supply chain. In order to achieve defined targets on GHG-emissions reduction for Sustainable Aviation Fuels (SAF), it is important to have robust policy frameworks and underlying verification processes[8]. Robust frameworks have a regulating system to ensure that its objectives are achieved and appropriate procedures have been followed. A robust regulating system contains elements like:

- Setting and achieving predefined reduction targets for SAF;
- Clear and transparent rules for the accounting of GHG emissions and GHG reduction potentials from the production and use of SAF;
- Clear sustainability criteria;
- In line with other policies, to avoid (un)intentional misuse like double valuation of GHG-emission reductions;
- A system that is considered reliable and implementable by the market and relevant governmental authorities;
- A robust audit process.

In the context of biofuel sustainability, verification governance plays a crucial role in shaping the robustness of biofuel policy frameworks, with audit quality being a key component. Verification governance refers to the systems, rules, and oversight mechanisms that guide how sustainability verification is conducted, in which verification of carbon intensity (CI) calculations are a critical component. Auditors are responsible for verifying whether economic operators in the biofuel supply chain comply with the rules set by the policy framework
The robustness of biofuel policy frameworks depends on the reliability[9] and uniformity of the data used to assess sustainability of the biofuel supply chain. When auditor requirements leave too much room for interpretation, the resulting variability in auditing can lead to

[7] IEA Bioenergy T39 (2022): Improvement opportunities for policies and certification schemes promoting sustainable biofuels with low GHG emissions – Part 1: A review of policy frameworks.
[8] Verification in this context refers both to certification and verification processes, both control processes to proof compliance with the Regulation.
[9] Reliable data in this context implies that the collected data matches the data required for the calculations in a specific policy framework and thus is "correct"

uncertainty and doubt about the true environmental impact of biofuels. This, in turn, can weaken trust in the policy framework and reduces its effectiveness in promoting sustainable biofuels

2.1. DATA QUALITY & TRANSPARENCY

Data verification is a key aspect of the assurance of GHG calculations. Auditors may look for discrepancies, data gaps or inconsistencies. Life cycle GHG calculations consider multiple emissions sources.
Clear accounting rules for supply chain data are important for the traceability of sustainability claims and the transparency of the certification/verification system overall. To calculate the GHG emissions performance of a fuel and its environmental impact, supply chain data must be passed through the supply chain. Key information for determining GHG emissions is for example: the origin of the feedstock, the feedstock type and its production method, the fuel production technologies used, transportation method. Also, a robust Chain of Custody (CoC) model is important to prevent misuse, e.g. to make sure that GHG emission reductions are not valued twice in cases where this is not permitted by legislation. When this data is not available or transparent, it is difficult to certify or verify supply chain components and (intermediate) products. For a robust system, key questions arise like: which data needs to be tracked, who needs access to this data, and how do we secure the data?

2.1.1. Data collection throughout the supply chain

Collection and registry of relevant data to ensure a sound carbon intensity (CI) determination is complex: a great variety of information needs to be collected from the entire supply chain. Gathering all necessary data is especially challenging for SAF because of the inherent international scope of the aviation sector and its fuel supply chains. In general, different types of input data (actual data, regional averages, default values) in combination with different GHG calculation tools and allocation steps result in differences in calculated GHG emission values (quantitative) at different steps of the supply chain. However, it could also lead to differences in sensitivities with respect to their verification (qualitative)[10].

Gathering correct feedstock data for SAF production was considered to be highly sensitive by project members. This usually involves crop cultivation related inputs like fertiliser application, and might also involve other complex factors like soil carbon and land use change (LUC) emissions related information. The Brazilian project partner emphasises the complexity when biomass is sourced from many different farmers. In these cases, the biorefinery process at a specific location is certified and the economic operator has to provide specific data from all the different farmers supplying feedstock to this location. There could be a risk of limited data availability for the certification/verification, depending on the size of the farm and experience of the farmer, or a risk on the correctness of the data provided. Both could potentially lead to incorrect GHG emissions and therefore incorrect claims on the sustainability of the feedstock used. The RenovaBio policy requires that each farmer must provide individual farm-level data to the government[11]. Some frameworks allow for the use of pre-assessed regional averages (e.g. EU RED) or prescribe the use of default values instead of actual values (Californian LCFS). These methods could possibly resolve these challenges in data collection. At the same time, the use of default values raises the discussion to which extent these values are a realistic representation of actual values and requires a certain

[10] IEA Bioenergy T39 (2022): Improvement opportunities for policies and certification schemes promoting sustainable biofuels with low GHG emissions – Part 1: A review of policy frameworks.
[11] See RenovaBio policy factsheet (Annex 1.2)

degree of flexibility. In the consultation process in the current preparation of an amendment of the Californian LCFS, parties requested to allow individual farm-level GHG emissions values rather than the current fixed average agriculture phase value. A topic that is still under discussion. This means farmers could generate incremental credits for enhanced agricultural practices, which may lead to an underestimation of actual emissions in cases where data verification is challenging.
Similar sensitivities with respect to data collection (actual data, regional averages or default values) may occur at other steps in the supply chain. For example, the share of renewable energy of the electricity mix and the hydrogen used in the production process were mentioned, as well as the tracking and correct allocation of intermediate products that can be used in multiple (internal and external) processes, such as methanol.

The reliability of the data submitted to the respective authority of intermediates and/or final products is largely determined by the quality and completeness of the input data transferred through the supply chain, from the point of origin to the final fuel supply and end use. Furthermore, depending on the ultimate target for which the data is required, reliable robust data (e.g. for a minimal GHG-emission reduction threshold) could be completely unreliable for calculations for another target (e.g. for actual value GHG-emission calculations).
In addition, the Brazilian project partner mentioned that farmers in Brazil, especially at the introduction of the RenovaBio system, didn't know how to collect the correct data. Clear guidelines for economic operators regarding the policy requirements for implementation, verification and certification are often lacking for new systems.

2.1.2. Monitoring and Chain of Custody model

The choice of Chain of Custody (CoC) approach determines to which extent the physical link between the GHG "claim" and the final product is maintained and can be controlled in situ. A book and claim approach, for example, offers no physical link between the SAF and the claimed GHG emissions reduction. This link is only provided on paper using trading documentation and registries to trace the GHG emissions and therefore, highly dependent on a solid administrative system. The CoC model with the strongest link between the GHG emissions "claim" and the final product is the physical segregation model. In this model, he claim is directly attached to the physical product and can't be administratively allocated to other batches of a production site.

To support monitoring and verification on the CoC used for SAF, a well-performing registry database is required. However, experience with overarching databases, covering international biofuel flows, is currently lacking. The development of supply chain registry databases (like the EU's Union Database which was launched at the start of 2024) is a complex process. These databases often start from a narrow scope, for example the Union Database focussing on EU renewable transport fuels only. However, extending the scope or linking different databases would increase the monitoring and transparency of the supply chain data. In the policies selected for this study, the most common CoC model used up to the fuel supplier is the mass balance model (in one of its underlying variations). In practice, stakeholders indicate that the international nature of the aviation sector makes a CoC model without a physical link to the SAF more attractive when extending the SAF supply chain to the aircraft operator. However, following a book and claim model increases sensitivities in the verification/certification processes and therefore the need for a solid administrative registry.

In the project team, co-processing was indicated as a production route that requires specific attention. Co-processing is currently one of the technologies used to produce SAF via the HEFA pathway. In co-processing, a mixture of biogenic and fossil feedstock is used to produce SAF. To determine which part of the fuel might be claimed as biogenic based, a consistent and

reliable way of tracing the biogenic parts of the output is needed for correct GHG 'claiming' of the sustainable part of the SAF. From a sustainability verification perspective, the sustainability claim of the SAF part after co-processing is the most challenging, as the feedstock supply chain traceability up to the co-processing site is the same as for all other biofuels.

The EU developed a Delegated Act on co-processing to establish a common understanding of the methodology to determine the sustainable biogenic part of the produced fuel using the co-processing technology. Several certification schemes have started to apply for the official recognition process by the Commission for the Delegated Act. However, co-processing remains a technical and challenging aspect of certification/verification which could challenge the robustness of SAF policy framework implementation.

2.2. GHG TARGET SETTING & CALCULATION METHODOLOGIES

Globally, there are differences in the national/international requirements and targets for e.g. overall biofuel mandates, sustainability criteria, GHG emission reduction thresholds of biofuels, and allowed feedstock (characteristics) These differences could eventually lead to impediments in the uptake of SAF since these different requirements influence the attractiveness/accessibility of the regional market. On the other hand, certification of parties along the biofuel supply chain can enable trade of feedstocks and/or biofuels between countries and qualify biofuels to contribute to objectives in other countries. The verification procedure of the EU RED and ICAO CORSIA relies mainly on certification by private schemes for the different actors in the SAF supply chain whereas Brazil and the US mainly rely on public regulatory rules for CI certification of individual production sites.

2.2.1. Contradicting GHG calculation rules between different policy frameworks

Sometimes national and international legislation are contradicting each other, leading to (international) trade barriers and inefficiencies. Both GHG calculation methodologies and the verification of their outcome often differ among (policy) frameworks (also see 'auditor qualifications'): A key example is how iLUC is handled. In systems where iLUC factors are part of the CI calculation (US, CORSIA) this could give those countries a disadvantage compared to systems without a contribution of an iLUC factor to the GHG emission value (Brazil, EU), especially in cases where high iLUC feedstocks like palm oil are used for SAF production.
A policy framework may also use system specific rewarding measures (bonuses) in its calculation methodology. These rewards may not be an exact reflection of the actual climate impact. For instance, frameworks differ in how avoided emissions (through changes in agricultural or process management) are rewarded in the GHG calculation. EU-RED allows the use of fixed emissions reduction values in case when manure is used as a feedstock or when crops are grown on degraded land, while ICAO CORSIA allows the use of fixed emissions reduction values in case of avoided emissions related to landfill or recycling. Such fixed values could in potential even lead to negative CI values of a fuel.
Such differences could increase the complexity of verifying whether all the requirements are finally met, especially in case of exchanges of biofuels and/or GHG fuel data among frameworks. Thus, the contradicting rules don't allow comparing GHG values between policy frameworks.

2.2.2. Diverging targets and definitions

Targets on SAF, and how these targets may be fulfilled differ internationally and depend on the policy framework used. Some policies, like RenovaBio place emphasis on blending mandates (volume, energy), other policies, like IRA or CORSIA focus more on GHG performance (reduction thresholds and/or carbon intensities) or combinations of both (e.g. EU REDIII). These targets are often combined with additional sustainability criteria (e.g. on biodiversity).

To fulfill these targets certain feedstocks may be excluded or limited for SAF production in one country or policy, while being accepted in another. For example, in Europe, crop-based fuels are excluded (ReFuelEU Aviation) or less incentivized (EU-RED). At the same time, multipliers are used to further stimulate the use of specific feedstocks for SAF production and for the deployment of SAF in general (EU-RED).
Another example is feedstocks with a high risk on indirect land-use change like palm oil. These type of feedstocks, unless certified as low-ILUC risk feedstocks, are for instance phased out in European policies but accepted in other policies.

Furthermore, policy frameworks diverge on important definitions. and use definitions open to multiple interpretations, e.g. 'advanced' biofuels[12], low carbon fuels. Moreover, diverging feedstock classifications (e.g. waste or residue vs crop based) could lead to diverging CI outcomes, challenging verification of the correct feedstock type (see 'feedstock categorization'). Furthermore, diverging definitions and classifications impede mutual recognition and comparability. It could also lead to preferred feedstocks or fuels under certain policy frameworks, since definitions may incentivize the use of specific feedstocks. Feedstocks will likely flow to countries with the least strict sustainability and auditing requirements, impacting the trade flow and effectiveness of policy frameworks worldwide.

Example
The US and Brazil mainly focus on SAF production based on crops intentionally cultivated for biofuel production. Generally, local waste streams are less under consideration for feedstocks for SAF production and are therefore "thrown away". On the other hand, in the EU, local waste streams are considered to be preferred feedstocks and stimulated to be used in SAF production. At the same time, European policies have stricter requirements on crop based feedstocks competing with the food industry. These discrepancies could potentially lead to trade flows of waste streams to the EU and trade flows of food and feed crops to the US and Brazil.

2.2.3. Methodological differences regarding the calculation of GHG emissions at different process steps of SAF supply chains

In the context of the frameworks for biofuels, the legislation generally defines requirements for the minimum of the sustainability level including the GHG reduction potential of a biofuel. Furthermore, it also contains a general methodological guideline on how to calculate the individual GHG emissions and GHG reduction potential. While this methodology defines several relevant aspects such as system boundaries, allocation procedures or the life cycle impact assessment methodology, it also leaves some flexibility in the execution, for example regarding aspects like input data requirements, eligible sources for emission factors, etc. The same applies to more complex factors impacting the GHG performance of a fuel, such as the N_2O emissions from fertilizer application, BECCS, BECCU or emission savings from improved agricultural practices. This could lead to an inconsistent interpretation of the data during certification and/or verification.

In frameworks like the EU RED and CORSIA, third party certification schemes recognized under these frameworks usually provide more specific guidance on how to fulfil the more flexible requirements. However, in practise this can lead to differences between the schemes, especially for the requirements for the sourcing of input data, eligible sources for emission factors and the guidance which is provided to system users and auditors for the quantification of these complex factors (e.g. BECCU and BECCS or savings from improved agricultural practices). Since mutual recognition of certification schemes is a requirement in

[12] https://task39.ieabioenergy.com/about/definitions/

the above mentioned frameworks, this could lead to an accumulation of variation among GHG emissions calculations as the data is passed along the chain (see 'Comparability and mutual recognition').

2.3. FEEDSTOCK CATEGORIZATION

As pointed out in the previous section, policies diverge on important definitions and classifications used in the SAF supply chain. Evidently, it is difficult to come to an objective, international accepted classification of feedstocks. One of the most stringent is the classification of waste streams.
Since feedstock categorization is linked to GHG performance of SAF, not having an universal classification could pose risk on actual climate impact SAF, depending on the related policy framework to which these fuels belong.

2.3.1. Diverging definitions

Because of the lack of harmonization in feedstock categorization, a given feedstock may have different sustainability criteria in different countries. Even within policies diverging interpretations of the definitions by states and/or certification schemes exist. This is currently a matter of discussion in the EU where Member States give a different meaning to the definition of REDII Annex IX A(d) 'biomass fraction of industrial waste not fit for use in the food or feed chain'.
An example of divergence between policies is the promotion of 'advanced biofuels' based on feedstocks listed on Annex IX A of EU-RED, while this definition is completely non-existent in Brazil's RenovaBio.

2.3.2 Diverging interpretations

According to the German project partners, in practice it is difficult to categorize feedstocks including (intermediate) products homogenously They found that certification and verification schemes have diverging interpretations of the definitions and categorizations cited in policy frameworks, especially on residues and waste streams. Specifically in the case of waste, we see that the definition of waste is closely linked to local circumstances (see cases of Austria and Brazil below). It was mentioned that categorization may even diverge between auditors working for the same certification body. In practice, guidelines for determining whether a feedstock may be classified as a co-product, residue, or waste is usually included in the regulatory framework (e.g. ICAO CORSIA) but its refinement has largely been left to the parties responsible for auditing (verification/certification schemes and underlying verifiers), with different interpretations possible across those entities in the industry.
Diverging interpretations on feedstock categorization could lead to trade barriers. In general, harmonization of feedstock categorization and further refinement or guidance`(e.g. technical specifications) could be potential solutions to overcome this risk.

2.3.3. Identifying the first link of the supply chain.

The classification of the feedstock determines the first link of the SAF supply chain, which is crucial since it marks the system boundaries of the GHG calculations.
When a feedstock is classified as waste or residue, the GHG emission calculation of the SAF supply chain starts at the collection point because the waste is not intentionally "cultivated" for SAF. Thus, the GHG emissions in the process before the collection point are not included in the GHG calculation.
When the feedstock is not a waste (i.e. crop), the producer of the feedstock (e.g., the farm) would be the starting point of the SAF supply chain.
Furthermore, determination of the exact origin of a feedstock by auditors upstream the supply chain is challenging, especially in supply chains with no strict feedstock segregation.

Austrian case (related to 2.3.3.)
In Austria there is an ongoing discussion whether a feedstock is classified as a co-product or as waste because the sustainability criteria apply differently and the fuel counts towards different targets. If there is a new feedstock introduced, the discussion on the feedstock classification needs to happen. The Netherlands and Austria both have a national interpretation of the RED Annex IX, Part A(d). During the in-depth interview with Austria, it was stated that feedstock should never be a waste but a co-product because "we don't throw it away" like we do with waste. So, the waste has an economic value, but if the waste has a value, it is not a waste "because it is reused". There is a vicious circle in categorization and definitions on those terms. The classification of feedstock into waste/residue/co-product exists in different regions, which means the classification of the feedstock depends on where you are located. The exact same material can be waste, final product or raw material (e.g. wood chips). If the characteristics of the material meet the sustainability and quality characteristics for a raw material, it can be used as in input. (If the production process or sourcing is problematic it must be excluded, irrespective if the selling party or regulator considered the material waste). Whether a material has been given the status of waste, is not relevant in 'this' context therefor.

However, waste is used in several schemes creating unclarity: Can the input be seen as sustainable, because upgrading a waste, or problematic because it is a waste e.g. for laws regarding environmental permits; and because the material itself might not have characteristics that separate it from (by)products.

In European legislation, the waste definition depends on the intention of the discarding party. In a scenario that the demand for waste products would be a driver for the increase of the waste production, this product would no longer be considered a waste as it was created specifically for this purpose. The determination of the driver behind the waste production is difficult to determine for auditors as this isn't always transparently communicated. A formal decision by an official authority might be helpful in case of doubt.

Brazilian case (related to 2.3.3)
Brazil has a different point of view in comparison to inputs from the other countries. In RenovaBio there is no distinction between conventional and advanced biomass. Only a distinction between residues or crops is made. There are only 2 types of categorizations. In EU: with conventional we mean "crop based" and commonly associated with 1st generation production technologies. The distinction whether something is in conventional or advanced (RED II Annex IX Part A or Part B) is based on whether the biomass can be converted using a mature technology. In Brazil it doesn't matter if you use 1st or 2nd generation[13] technology for classification. E.g. for eucalyptus as an energy crop, you use 2nd generation technologies to convert into biofuel.

[13] 1st generation biofuels are also known as conventional biofuels. Conventional biofuels have reached technological and market maturity and are commercially available. Typical conventional biofuels include sugarcane ethanol, starch-based or 'corn' ethanol, biodiesel and Pure Plant Oil (PPO). Feedstock used in the production of conventional biofuels can consist of sugars, starches, oil bearing crops, and animal fats – in some cases these can be used as food or animal feed.
2nd generation biofuels are also know as advanced biofuels. Advanced biofuels use pre-commercial technologies using non-food crops, agricultural and forest residues. These materials are composed of 3 primary building blocks: cellulose, hemicellulose or lignin. Advanced fuels can be produced from waste materials, stalks of wheat and corn, wood and dedicated energy crops.
IEA Bioenergy – Task 39: Biofuels to decarbonize transport, *Definitions* (2024).

2.4. CERTIFICATION/VERIFICATION

Harmonization and streamlining among policy frameworks and underlying certification/verification schemes may improve the robustness of the sustainability claims. Policy frameworks intentionally leave room for interpretation which may lead to diverging implementation between market actors. Third party verification and certification with a variety of independent private schemes, challenge the verification/certification process even more. IEA Task 45[14] concludes that there needs to be a balance between the level of detail set-out in policy frameworks, and the flexibility allowed to the schemes to use their expertise to implement these criteria.

2.4.1. Diverging governance structures

The mutual relationship between the actors involved in the certification/verification process, i.e. the governance structure, could diverge significantly between policy frameworks. Whereas the one policy framework relies completely on internal (public) actors for certification/verification and , the other depends mainly on third party (private) actors. As mentioned above, third party verification and certification with a variety of independent private schemes could challenge the verification/certification process. Furthermore, the diverging governance structures complicates understanding the different certification processes and impedes establishing one universal approach to make the system more robust. In addition, for market actors makes the process of claiming GHG-emission reductions in more than one policy framework more difficult .

2.4.2. Double valuation within and between frameworks

Using multiple certification schemes could lead to double valuation of biofuels and their achieved GHG emissions reductions. Double valuation might be allowed in certain cases but not in all[15] (see 'intentional misuse'). Data used to satisfy one certification protocol could be applied to being certified for another. This could occur especially if one of the economic operators uses several certification schemes at one site, within the same policy framework and/or under different policy frameworks.

E.g., when researching public databases of EU-RED approved certification schemes , it became evident that feedstock production sites in Brazil, among others, were certified under multiple RED certification schemes. In addition, under RenovaBio, all feedstock producers in Brazil are required to report their production activities to the national supervisory organization (ANP). This could potentially lead to the same feedstock data being approved and used under different frameworks, where this may not be permitted.
The added complexity of SAF compared to other biofuels is that the aviation industry is a predominantly international sector and planes commonly fly between regions where different policies apply. It is crucial to make sure that all actors (producers, fuel suppliers, airlines) in the SAF supply chain are transparent and explicit under which policy and which criteria the GHG performance of the SAF is claimed
As biofuel supply chain certification/verification starts at point of origin of the feedstock, double valuation is only traceable and auditable in case verifiers are able to see also the information from all other verification processes, and/or a database exists for all relevant information.

There are different types of double counting risks:

- Double issuance occurs once a certified party, e.g. a SAF producer, issues multiple certificates with corresponding emission reductions from the same batch to users.

[14] Approaches to sustainability compliance and verification for forest biomass – Task 45 (ieabioenergy.com)
[15] https://www.faa.gov/media/67966

This leads to the creation of GHG credits/certificates without the additional environmental benefit, and could in particular happen if SAF production sites (or any other actor in the SAF supply chain) carry multiple certificates (under the same system or from multiple systems);

- Double usage occurs once a given emission reduction claim e.g. from the same batch of SAF is registered more than once in one registry or in multiple operating registries under the same scope. However, for some policies, stacking of the GHG attributes of biofuel batches between different frameworks is allowed. For example, in the US CA-LCFS credits, IRA credits, and CORSIA reductions of the same batch of SAF can be stacked[16]. In the EU, SAF batches accompanied by sustainability certificates (PoS) can be used to fulfill targets in EU-RED, ReFuelEU Aviation and EU-ETS. However, this concept of permitting multiple use of the GHG performance of the same batch of SAF is not necessarily clear within and among all regulatory programmes;
- Double claiming happens when environmental emission benefits of SAF are counted more than once within or between national and international (policy) frameworks under the same scope, contributing to the overall climate goal simultaneously without additional impact. (e.g. different parties in different GHG programs: airline operators claim SAF emission reduction both in EU-ETS and ICAO-CORSIA).

2.4.3. Competition schemes and mutual recognition of different verification/certification schemes

There are multiple policy frameworks and underlying (voluntary) certification/verification schemes available, all with own interpretations of sustainability requirements, including on GHG performance. Schemes with the most flexible requirements with respect to sustainability, traceability and assurance are likely to be chosen more often, as the less stringent requirements are easier to meet and/or less expensive (e.g. in case of clear differences between quotations from different certification bodies/assurance providers[17]). On the other hand, to ensure a well-functioning market, certification/verification schemes should be encouraged to recognize the schemes that certify or verify other parts of the same supply chain (as applied within ICAO-CORSIA and EU-RED), also known as mutual recognition, within and outside country borders. To ensure a well-functioning market, certification/verification schemes should be encouraged to recognize the schemes that certify or verify other parts of the same supply chain, within and outside country borders (as applied within ICAO-CORSIA and EU-RED), also known as mutual recognition.
Both competition and mutual recognition could lead to a potential race to the bottom in terms of audit duration, performance and costs, as described for sustainability criteria in the IEA Task39 Part 1 report[18].

2.5. AUDITOR QUALIFICATIONS

2.5.1. Variation in governance structure & auditor requirements

Policy frameworks have diverging requirements regarding auditor competencies. This may lead to variety in the quality of the certification/verification audits. States may employ their own auditors or use a private certification body that employs the auditors. Furthermore, third-party accreditation of certification bodies and state oversight may also differ in their approach to auditor qualifications. For example EU-RED requires not only ‘being able to audit’ but auditing against 'this particular' standard.

[16] https://www.faa.gov/media/67966
[17] Ketenanalyse biodiesel | Publicatie | Nederlandse Emissieautoriteit (in Dutch)
[18] IEA Bioenergy T39 (2022): Improvement opportunities for policies and certification schemes promoting sustainable biofuels with low GHG emissions – Part 1: A review of policy frameworks.

The governance structure of the auditing process in the analyzed policy frames can be found in the regulatory flowcharts included in our report. More information on this topic can also be found in the IEA Task39 part 1 report[19]. Without strong and coherent auditor qualification requirements, in proportion to the scope of the different policy frameworks, the robustness of the sustainability claims and the integrity of the certification/verification approach is at risk.

2.5.2 Audit quality

The thoroughness of the audit is dependent on the execution of the risk assessment of the auditor. For example, under the EU RED, audits on the proofs of sustainability (PoS) may apply only limited assurance, while the audit of the economic operator's systems have to be done with reasonable assurance (at least for the initial audit). Later audits may choose an appropriate level of assurance based on a risk assessment. This implies that the quality and assurance level of the audit is largely dependent on the ability of the auditor to perform an adequate risk assessment. This is especially important for the determination of complex matters like e.g. direct land-use change (dLUC) and low iLUC risk certification.
In EU Member States that implemented (e.g. Germany) or plan to implement (e.g. the Netherlands) the EU RED as an emission reduction crediting system (instead of a renewable energy crediting system, with only a threshold value for emission reduction) the verification of the emission values on the PoS become much more important and might not be in proportion to a limited assurance audit required in the overarching legislation. 2.5.1 emphasizes the importance of having solid auditor requirements. However, it should be emphasized that the quality of the audit does not solely depend on the auditors' knowledge or qualification (based on fulfilling the auditor requirements) or the performance of the risk assessment. The audit quality also depends on:

- Having sufficient time for conducting the audit and reporting afterwards;
- Completeness of documentation; Auditor's competence and having sufficient time to recognize weak spots in the system and document those in the audit report;
- Supervision and external supervision being present during audits.

Last, it should be noted that private certification bodies have to compete on efficiency (time, hiring specialists and supervision) which all risk the quality of the audit.

ETS case (related to 2.5.1 & 2.5.2)

In order to be EU ETS [20]compliant, aircraft operators are responsible for the collection of accurate and reliable data to be audited. During the data collection process, aircraft operators carry out a risk assessment, where the risk of misstatements for each point in the data flow that monitors the emissions of all aviation activity is analyzed . When possible, risks for misstatements (such as paper copies being transported from one department to another, where delays may occur, or copy and paste errors may be introduced) are identified, the aircraft operator is obliged to implement mitigating measures and to document these risk-reducing procedures in a monitoring plan. It is then up to the aircraft operators themselves to re-evaluate the risk assessment. The fact that the aircraft operator is the sole entity to carry out its own risk assessment, makes it difficult to check if all mitigating measures have been correctly implemented and have the desired effect to reduce risk sufficiently. Therefore, the lack of a four eyes principle regarding the risk assessment and lack of independent scrutiny of adequate implementation of risk-reducing measures, may jeopardize accurate and reliable data collection and thus auditing quality.

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[19] IEA Bioenergy T39 (2022): Improvement opportunities for policies and certification schemes promoting sustainable biofuels with low GHG emissions – Part 1: A review of policy frameworks.
[20] The EU-RED sustainability framework is also applicable to the EU-ETS SAF deliveries

2.6. POTENTIAL MISUSE

Misuse in certification/verification could occur in different ways: e.g. reporting incorrect/misleading information on feedstock characteristics or multiple issuing of the same sustainable batch of biofuel. The design of policy targets for SAF supply chains (e.g. threshold vs actual emission reduction), or other incentives like carbon intensity credits or multipliers, could potentially increase the risk of misuse either intentional or unintentional.
Intentional misuse is mostly related to a low chance of getting caught, together with the complexity of the system and therefore limited supervision. Misuse in certification on SAF imposes risks on actual GHG-emissions and therefore on the environmental impact.

2.6.1. Intentional registration of misleading feedstock characteristics

As elaborated on in section 2.3, sustainability criteria, including GHG performance, are linked to the categorization of feedstocks. Misleading categorization of feedstocks as wastes (mislabeling)/co-products is not uncommon in the EU regarding imports from e.g.[21][22].
Misuse in feedstock categorization is often seen in the classification of virgin oil as wastes/residues, for example used cooking oil (UCO).
To avoid misuse, especially with bio-derived wastes (e.g. UCO), the right checks and balances in governance need to be implemented to ensure sustainability, including GHG performance. Suggestions include extending the supervision of States beyond their own borders and enabling the exchange of critical supply chain data. EU RED Implementing Regulation 2022/996 art 17.1 is an example were RED-approved voluntary schemes are required to exchange information with supervising authorities throughout the biofuel supply chain.

Recently an extensive assessment was carried out commissioned by the European Commission to understand weaknesses in feedstock categorization[23]. Several historical and ongoing cases of fraud in the EU and US biofuels industry were reviewed. Reported cases of soy biodiesel being fraudulently sold as used cooking oil methyl ester (UCOME) were documented, as well as fraud cases from the forestry industry. In addition, cases of fraudulent creation of biofuel credits/certificates (double issuance) were recorded. Moreover, general concerns over UCO and certification violations were considered[24].

2.6.2. Intentional double valuation of GHG-emission reduction claims

Double valuation is already elaborated on in 2.4.2. Double valuation could happen unintentionally as well as intentionally. Coordination and exchange of information is necessary within and among (policy)frameworks and auditors to prevent doubling of claims in cases where this is not permitted. An example is the ISCC-format for auditing, that requires information on other sustainability audits done at the same location. In such cases the auditor should use this information to do the surveillance audit. This is consistent with the previously mentioned exchange of information about audits among RED-approved sustainability certification schemes that has become formalized with the Implementing Regulation 2022/996 EU in addition to the REDII. A requirement with the intention to prevent doubling of GHG claims is also included in the ICAO CORSIA framework[25]: *"The aeroplane operator shall provide a declaration of all other GHG schemes it participates in where the emissions*

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[21] Belgium: EPPO arrests two suspects in €3.1 million biodiesel fraud investigation | European Public Prosecutor's Office (europa.eu)
[22] https://policy.trade.ec.europa.eu/news/european-commission-examine-allegations-unfairly-traded-biodiesel-china-2023-12-20_en
[23] Assessment of the potential for new feedstocks for the production of advanced biofuels - Publications Office of the EU (europa.eu)
[24] Assessment of the potential for new feedstocks for the production of advanced biofuels - Publications Office of the EU (europa.eu)
[25] https://www.faa.gov/media/67966

reductions from the use of sustainable aviation fuels may be claimed, and a declaration that it has not made claims for the same batches of sustainable aviation fuel under these other schemes."

Since biofuel supply chain certification and verification begin at the collection point, unpermitted double counting can only be traced if verifiers have access to information from other verification processes (e.g. via a centralized database that preferably contains information on all the essential data for proper verification).

Annex 3: Work package 4 Verification of data quality ('on paper' vs 'in practice') - case study

Work package 4 focuses on the impact of implementing the verification/certification process in practice on data quality. For this purpose, this task will assess the impact of the existing verification/certification approach and structure on the robustness of GHG data quality. This work builds on previous insights from IEA Task 39-part 2 work package 3: Theoretical sensitivities of GHG emissions verification and Certification of SAF supply chains.

The selection of SAF related policy frameworks (with underlying verification /certification activities) is: US IRA, California LCFS, EU RED, Brazilian RenovaBio and ICAO-CORSIA. The case study includes current biofuel supply chains of SAF (HEFA and AtJ), from feedstock sourcing and processing up to blending and distribution of the biofuel (aircraft refueling).

3.1 Methodology

In order to validate and supplement the theoretical sensitivities based on practical experience, we organized three group interviews. The group interviews are categorized according to the main target groups with representatives at different levels in the verification process (execution and supervision):

- The first interview is with certification schemes and auditors working with multiple policy frameworks in practice;
- The second is with the supervisory councils of the Task 39 countries;
- The third group interview is with the SAF producers in the market.

This combination of stakeholder interviews will provide an overview of data verification in practice from different perspectives. To provide stakeholders with an opportunity to participate in this work package, and to make the most out the interviews, a survey is shared with the all experts proposed by the IEA T39 P3 task members. This ensures that we connect to the right experts within the organization and have a good view where the sensitivities are in practice before the interviews.

The survey starts with specific information about the responder: name, organization, function, and experience. Followed by the different theoretical risks, summarized in a few bullets. The respondent is asked to answer, for each of these risks, if they have a) encountered this challenge in their work, b) if they recognize the risk in the market, c) don't recognize the risk or d) need more information. Respondents get the opportunity to already include example cases and/or comments regarding the sensitivity. Respondents are then invited to the group interview. In table 3.1 you find the aim of interview for each of the interview groups, as well as number of participants in each group.

Table 3.1. Interviews & surveys

Interview	Aim of the interview	Participants
1) Voluntary schemes and certification bodies (auditors)	- Validation of inconsistencies between frameworks. - Indication which framework can be considered most stringent in terms of GHG saving threshold and GHG factors included in the calculation. - Challenges for them to comply with different policy frameworks.	Invited: 18 Survey respondents: 3 Interview participants: 2
2) Supervision bodies of committed countries	- Validation of challenges with the respective policy frameworks in practice (transparency of underlaying aspects of the calculations). - Experience on best practices and challenges when supervising the (different)policy framework. - List of example situations where they received/found signals that there was room for interpretation.	Invited: 10 Survey respondents: 4 Interview participants: 3
3) Market players currently involved in the SAF market	- Validity of challenges for them as 'the market' to comply with different policy frameworks. - Experience with criteria that are 'less clear' to them or experiences of results they disagreed with.	Invited: 27 Survey respondents: 9 Interview participants: 4

The summarized input of each individual group interview can be found in the sections below.

3.2 Input group 1: Voluntary schemes and certification bodies (auditors)

The gathered input of the voluntary schemes and certification bodies (auditors) participating in the survey and/or the interviews can be found in the table below. The policy frameworks in scope for this interview are ICAO-CORSIA, Californian LCFS & EU-RED.

	1. Data quality / transparency	2. GHG target setting & calculation methodologies	3. Feedstock categorisation
Impact	- High	- High	- High
Examples	- Information gets lost during the certification process, while in a verification-based system, all information should be available at the end of the supply chain. - Emission factors, Lower Heating Values and allocation factors differ across policy frameworks, leading to much effort for Economic Operators and auditors to collect and assess the data, and eventually different GHG performance for the same batch of fuel. - Even within a policy framework, emission factors diverge. There is no recommended lists of emission factors provided by CORSIA, leading to high variations in emissions factors used within and between countries.	- It is not possible to transfer batches between policies because of the different GHG calculation methodologies. Economic operators have to commit to one policy framework. - Data transparency is not the main challenge, but the diverging criteria and methodologies of the different policy frameworks are. - Key difference between policy frameworks are iLUC/dLUC approaches. Low iLUC risk in the RED has its own certification methodology, while CORSIA default iLUC values are used.	- Feedstock categorization is challenging, especially the process for how 'new' feedstocks are classified. This process looks different under CORSIA vs. RED. - Diverging definitions of waste and co-products. Risk of emissions allocation to co-products which are potentially wastes, leading to reduced GHG emissions for main product. GHG emissions not completely accounted for in the initial steps in the supply chain (e.g. for waste collection and pre-treatment) - Most questions the scheme receive are about classification of POME, UCO, municipal solid waste, manure and Annex IX feedstocks.
Additional remarks		- Schemes try to bridge the gap between policy frameworks. The role of schemes is however to comply with a certain policy framework, the "rules" are set by the polices.	- Feedstock preference creates market distortion because demand is influenced.

	4. Certification/verification	5. Auditor qualifications	6. Potential misuse
Impact	- Medium	- Medium	- Medium
Examples	- Different interpretations by certification bodies about when on-site audits are required under the RED.	- Auditors interpret regulations differently, e.g. also the translation from English to the native language. It differs per language how words and definitions are perceived. - ISO requirements are not implemented everywhere, like in the LCFS.	- Unintentionally, incorrect feedstock classification could lead to misinterpretation (or unintended fraud). - Harmonization across the different policy systems is required if you want one realistic/representative GHG value for SAF. Multiple standards encourage intentional double counting.
Additional remarks			

3.3 Input group 2: Supervision bodies of the committed countries

The gathered input of the supervision bodies of the committed countries participating in the survey and/or the interviews can be found in the table below. The policy frameworks in scope for this interview are ICAO-CORSIA, Californian LCFS & EU-RED & the Netherlands-Policy for Energy on Transport.

	1. Data quality / transparency	2. GHG target setting & calculation methodologies	3. Feedstock categorisation
Impact	- High	- High	- High
Examples	- Who has responsibility to audit the EU certification schemes? We are depending on private certification schemes as public entity. - The entire chain outside the national border is untransparent for the supervising authorities with no supervision audit possible abroad. Need to trust that the data you get is true. - It is unclear when economic operators use (partially) their own calculations or standard values in the calculations. The supervisors only see the final figure (total final value).	- Biofuel policies have diverging purposes leading to different set-ups in different policies. RFS US & RenovaBio: focusing on upscaling SAF production, CORSIA: Aim on GHG as part of claims, LCFS / EU(ETS) focus on reducing carbon intensity. Thus, the choice of sales market must be made in the beginning of the supply chain, since the level of detail and requirement differ per policy framework. - If SAF has different GHG values worldwide, airlines can choose where to get the fuel to comply with policy targets	- Feedstock categorization creates uncertainty - Certification schemes have large number of feedstock categories specified and that doesn't always match with the national framework. -
Additional remarks	- In an ideal world there would be a physical and/or chemical analysis/methods to differentiate UCO from palm oil for example, and methods of what is really in a batch of biofuels.	- If we compare frameworks, we have to be sure we are speaking the same language. The same word can mean different things.	

	4. Certification/verification	5. Auditor qualifications	6. Potential misuse
Impact	- High	- High	- Medium
Examples	- The goal for CORSIA was not to create a market for certification schemes but having an umbrella CORSIA standard. - In the US it is mostly a close cycle: most renewable fuels produced in the US stay here, some are exported to Brazil. When biofuel is imported/exported you need common standards.	- It is hard to find the right people, with the right expertise, in the right place to do certification. - For EU ETS, all auditor qualifications are described, but there remains lots of room for interpretation. Especially as auditors are subject to high workload, may lead to bulk evaluations, rather than detailed verification.	- The biggest risk of intentional misuse is for airline operators because they have reputational risks. - Just because the purpose of policies diverge, economic operators can claim under more than one biofuel policy without ending up in intentional misuse. - Sometimes POS are issued with default values even though default values are not allowed. The main reason for this is confusion, not bad intentions from companies: unclear and too many rules, a lot of administration for companies, unclear what's expected of them.
Additional remarks	- Certification adds to final costs of SAF.		

3.4 Input group 3: Market players currently involved in the SAF market

The gathered input of market players currently involved in the SAF market in the survey and/or the interviews can be found in the table below. The policy frameworks in scope for this interview are the Californian LCFS & EU-RED.

	1. Data quality / transparency	2. GHG target setting & calculation methodologies	3. Feedstock categorisation
Impact	- High	- High	- High
Examples	- In the US, fuel producers are required to have all documentation for the supply chain and they are liable for compliance. - Value for transportation from Indonesia - only a distance was provided of 5000km. This should be 15,000km. Just say that they 'received this from their supplier'. If auditors rush through these files, that can be overlooked. In this case: auditor made the supplier aware of this issue.	- It was required to have a lot of back and forth between producers and auditors on what is and is not included in the GHG calculations.	- The EU has an extensive list with classification of feedstocks. Within the EU there are differences between MS. But it is better than the list provided in the US. - Specifically, definition of waste and Annex IX is an issue.
Additional remarks	- UDB in EU might solve part of this issue.	- Producers choose the most favourable policy framework to produce their SAF.	

	4. Certification/verification	5. Auditor qualifications	6. Potential misuse
Impact	- High	- High	- Medium/low
Examples	- It is difficult to do business with (international) multinational businesses. They want an EU Proofs of Sustainability. However, in US access to such (= EU scope) certified feedstocks is more difficult (although it is similar feedstock). - Even in the US programs are organised differently between states.	- Auditors are struggling with questions and how they should evaluate elements that are not explicitly mentioned by the schemes. Sometimes ISCC / REDCert say 'it is up to the auditor', or even they just refer to the national authorities (Also relates to 2 and 4) - One year, the GHG calculations have been approved, while other year same calculations were not (by different auditor). - In US, auditors (e.g. engineers) are in often, for longer times, check physical calculations, not only accounting numbers (= EU) and they track the whole supply chain (while for EU auditors track only part of the chain, and audit shorter)	- Biggest challenge is with doubling claiming of the fuel content (e.g. UCO). Few cases in UK & NL.
Additional remarks	- Harmonizing schemes is mainly recognizing each other's feedstock.	- Auditors are individuals, we can never get away from that, even with better guidelines	- If you lose the certificate, then you would lose your business in Europe.

Annex 4: Work package 5 ‘Benchmarking’ the GHG mitigation potential of selected policies

This work package contains an assessment (benchmark) of how the various regulatory frameworks “score” for robustness of GHG emission verification and certification. The assessment builds further on the identified sensitivities in work package 3 and work package 4. The aim of the benchmark is identifying how robust perceived sensitivities are mitigated by the regulatory frameworks.

The benchmark was conducted during an interactive workshop in São Paulo in October 2024, with ± 15 experts from T39, T45 & TCP AMF. First, all experts identified individually how ‘robust’ sensitivities in work package 3 and work package 4 are mitigated in the regulatory framework of their knowledge. The scores could be assigned using a 5-category scale, ranging from ++ (very robust) to -- (not robust). Secondly, the experts discussed their scores in small groups with other colleagues being experts on that framework. Jointly, they consolidated all findings into one group score for the respective framework, supported with justification. After these two exercises, the groups elaborated on their justification and discussed the scores in a plenary setting. Finally, a heatmap has been generated with the retrieved results, reflecting a robustness score for all sensitivities for each individual regulatory framework. Prior to the workshop, T39 members were requested to submit robustness scores as well. These results strongly align with the outcome of the heatmap and supports its justification.