Department for Transport

# RTFO and SAF Mandate Technical Guidance

## 2026: 01/01/26 to 31/12/26

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# Contents

# 1. Introduction

## This guidance

1.1 This document provides guidance on technical matters related to the Renewable Transport Fuel Obligations Order 2007 ("RTFO") and the Renewable Transport Fuel Obligations (Sustainable Aviation Fuel) Order 2024 ("SAF Mandate"). This document relates to fuels that pass the assessment time between 1 January 2026 and 31 December 2026, i.e. the 2026 obligation period.

1.2 The RTFO is intended to deliver reductions in greenhouse gas (GHG) emissions from fuel used for transport purposes by encouraging the supply of renewable and low carbon fuels.

1.3 The SAF Mandate is intended to deliver reduction in GHG emissions from fuels used in aviation by encouraging the supply of sustainable aviation fuels.

1.4 The RTFO and SAF Mandate specify the Secretary of State for Transport as the Administrator of each scheme. The Low Carbon Fuels (LCF) Delivery Unit, an operational team within the Department for Transport (DfT), administers both schemes on behalf of the Secretary of State.

1.5 This document provides guidance on technical requirements which are largely consistent between the RTFO and SAF Mandate. Specifically, it covers the following:

- Chapter 1: Introduction
- Chapter 2: Classification and assessment of fuels and feedstocks
- Chapter 3: Mass balance
- Chapter 4: Determining the eligible portion of a fuel (coprocessing, additionality)
- Chapter 5: Carbon and sustainability criteria
- Chapter 6: GHG calculations
- Chapter 7: Wider sustainability criteria
- Chapter 8: Evidence requirements

1.6 This document is provided for use by obligated fossil fuel, renewable fuel and low carbon fuel suppliers, as well as verifiers acting on the behalf of suppliers, relevant trade associations and other interested parties. It is recommended that interested parties familiarise themselves with the information contained on the RTFO webpages before reviewing this detailed guidance. This document should be read in conjunction with the other guidance documents on the RTFO and SAF Mandate as appropriate.

1.7 Queries or comments should be directed to the DfT's LCF Delivery Unit at rtfo-compliance@dft.gov.uk for RTFO specific queries or saf-compliance@dft.gov.uk for SAF Mandate specific queries.

## Naming conventions

1.8 In this document, unless otherwise specified, the guidance provisions apply to both the RTFO and SAF Mandate. Specifically:

- References to “Certificates” refer to both Renewable Transport Fuel Certificates (RTFCs) and SAF Certificates.
- References to the “Administrator” refer to the LCF Delivery Unit, as Administrator of both the RTFO and SAF Mandate schemes

# 2. Classification and assessment of fuels and feedstocks

**Chapter summary**

A wide range of renewable and low carbon fuels and feedstocks can be eligible for support under the RTFO and SAF Mandate. This chapter outlines how these fuels and feedstocks are categorised. This categorisation then determines the amount and type of Certificates received, as set out in the respective compliance guidance documents for the RTFO and SAF Mandate.

## Introduction

2.1 The categorisation of fuels under the RTFO and SAF Mandate is mostly determined by the feedstock used in its production. Some fuels are also categorised based on the nature of the finished fuel.

2.2 The categorisation is important as it can affect the following:

- Whether the fuel is eligible for support
- The type and number of Certificates received (see the respective RTFO and SAF Mandate Compliance Guidance documents as appropriate)
- Which of the RTFO and SAF Mandate sustainability criteria have to be met and how the GHG emissions are calculated (see Chapters 5, 6 and 7).
- The assessment time at which the fuel becomes eligible for Certificates.

2.3 To ensure the correct treatment of each application of fuel, reporting under the RTFO and SAF Mandate must take place on an individual feedstock and individual fuel-type basis, i.e. each consignment must consist of only one fuel-type produced from only one feedstock.

2.4 Suppliers must be able to demonstrate for each consignment of fuel that the feedstock information provided is accurate. Examples of evidence that can be used to support claims are included in Chapter 8.

2.5 If a supplier submits an application for a renewable fuel which is judged by the Administrator to not meet the RTFO and SAF Mandate carbon and sustainability criteria, this fuel will then be considered a fossil fuel and may incur an obligation under the RTFO or SAF Mandate if it is of an obligated fuel type and supplied for an obligated use in the UK (see the respective RTFO Compliance Guidance and SAF Mandate Compliance Guidance for more details).

2.6 This chapter provides guidance on how to categorise fuels and feedstocks under the RTFO and SAF Mandate. It starts by defining the different feedstock categories before defining the eligibility criteria for development fuels for the purpose of the RTFO, and power to liquid fuels for the purpose of the SAF Mandate.

2.7 The information contained in this chapter should enable suppliers to determine the following for a given consignment of fuel:

- Whether the fuel is an eligible low carbon fuel
- Which category of feedstock it is made from
- Whether the fuel qualifies as a development fuel (for the purpose of the RTFO)
- Whether the fuel qualifies as a power to liquid fuel (for the purpose of the SAF Mandate)

## Low carbon fuel feedstock and fuel types

### RTFO

2.8 Fuels supplied under the RTFO can be made from any of the following feedstock types:

**Renewable sources**

A. Wastes and residues of biological origin, which can arise as a result of a production process or be derived directly from agriculture, aquaculture, fisheries or forestry.

B. Products of biological origin, which include relevant crops and energy crops, and co products of biological origin arising as a result of production processes.

C. Renewable sources (other than biomass), used to produce renewable fuels of non-biological origin (RFNBOs).

**Low carbon sources**

D. Non-renewable fossil wastes that have been designated by the administrator as recycled carbon fuel (RCF) feedstocks.

2.9 For the purpose of the RTFO, low carbon fuel made from feedstocks falling under A or B above is considered to be biofuel, while fuel made from non-biomass renewable sources (C) is considered to be RFNBO. Fuel made from designated non-renewable fossil waste (D) is considered to be RCF. Nuclear

derived fuel is eligible under the SAF Mandate and not currently eligible under the RTFO.

| | Biofuel | RFNBO | RCF |
|---|---|---|---|
| Wastes and residues of biological origin, which can arise as a result of a production process or be derived directly from agriculture, aquaculture, fisheries or forestry. | ✓ | | |
| Products of biological origin, which include relevant crops and energy crops. | ✓ | | |
| Renewable sources (other than biomass), used to produce renewable fuels of non-biological origin (RFNBOs). | | ✓ | |
| Non-renewable fossil wastes that have been designated by the administrator as recycled carbon fuel (RCF) feedstocks. | | | ✓ |

**Table 1** Categorisation of fuels under the RTFO

2.10 In addition, suppliers should take note of the following restrictions and multipliers applied to fuels made of certain feedstock types.

2.11 For the purposes of the RTFO, products (falling in category B in Paragraph 2.8) are materials that are not wastes or residues and are single rewarded. In biofuel applications, these will typically, though not exclusively, be crop-derived materials and may also be materials that are produced at the same time as other products from a process (i.e. a co-product).

2.12 In addition, the RTFO sets an upper limit, by volume, on the contribution that fuels derived from relevant crops (falling within category B in Paragraph 2.8 above) can make towards discharging a supplier's obligation (referred to as the 'crop cap') see 2.21.

2.13 The exception to this is dedicated energy crops which are not subject to the crop cap and are double rewarded.

## SAF Mandate

2.14 Fuels supplied under the SAF Mandate can be made from any of the following feedstock types:

Renewable sources

A. Wastes and residues of biological origin, which can arise as a result of a production process or be derived directly from agriculture, aquaculture, fisheries or forestry.
B. Renewable sources (other than biomass), used to produce power to liquid (PtL) fuel, or renewable hydrogen.

Low carbon sources

C. Non-renewable fossil wastes that have been designated by the Administrator as recycled carbon fuel (RCF) feedstocks.
D. Nuclear energy used to produce PtL fuel or low carbon hydrogen

2.15 For the purpose of the SAF Mandate, fuel made from feedstocks falling under A is considered biofuel, fuel made from feedstocks falling within B and D with a final fuel type of avtur is considered ‘power to liquid fuel’ (PtL) see 2.14. Fuel made from non-recyclable fossil wastes and falling within C above is considered RCF. Fuel made from feedstocks defined as products, such as relevant crops and dedicated energy crops, is not eligible for support.

| | Biofuel | PtL | RCF |
|---|---|---|---|
| Wastes and residues of biological origin, which can arise as a result of a production process or be derived directly from agriculture, aquaculture, fisheries or forestry. | ✓ | | |
| Renewable sources (other than biomass) or nuclear sources, used to produce power-to-liquid (PtL) fuels. | | ✓ | |
| Non-renewable fossil wastes that have been designated by the administrator as Recycled Carbon Fuel (RCF) feedstocks. | | | ✓ |

**Table 2** Categorisation of fuels under the SAF Mandate

2.16 In addition, suppliers should take note of the following restrictions and multipliers applied to fuels made of certain feedstock types.

2.17 For the purpose of the SAF Mandate, fuels made from feedstocks defined as products, such as relevant crops and energy crops, are not eligible for support.

2.18 The SAF Mandate sets an upper limit, by energy content, on the contribution that fuels derived from segregated oils and fats (falling within category A in Paragraph 2.14 above) can make towards discharging a supplier's obligation (referred to as the ‘HEFA’ cap). See 2.37.

2.19 Figure 1 provides a general overview of how fuels and feedstocks can be classified under the SAF Mandate and RTFO.

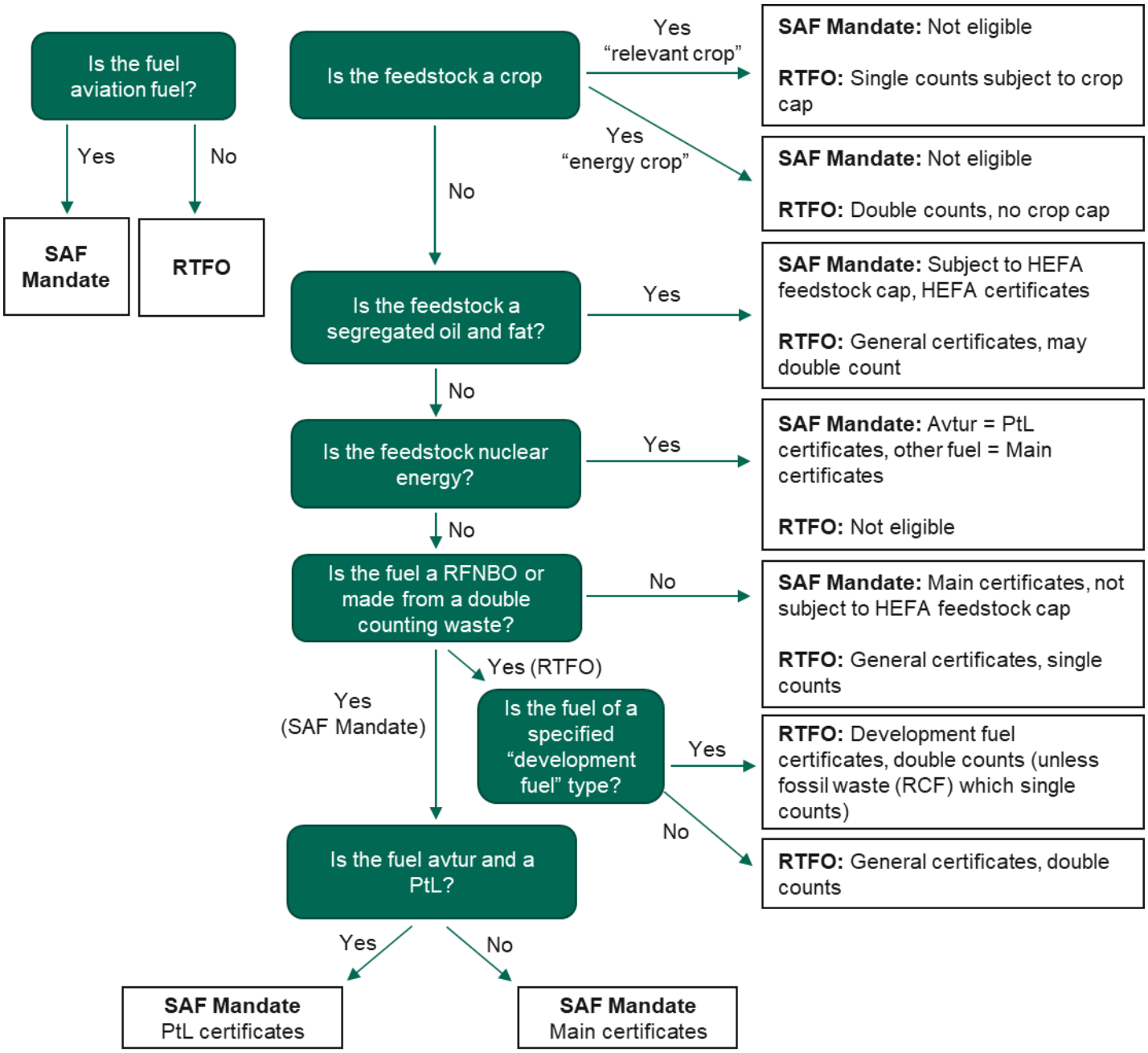


**Figure 1** Flow chart outlining how fuels can be classified under the RTFO and the SAF Mandate depending on their feedstock and fuel type

# Further detail on specific feedstock types

## Crops

2.20 Fuels produced from crop-based feedstocks are not eligible for reward under the SAF Mandate.

2.21 Under the RTFO, low carbon fuels made from relevant crops are subject to the crop cap (see the RTFO Compliance Guidance).

2.22 Relevant crop feedstocks are defined according to the amended RTFO as starch-rich crops, sugars, oil crops and main crops, where “starch-rich crops” include:

- Cereals (regardless of whether only the grains are used or the whole plant).
- Tubers and root crops, including potatoes, Jerusalem artichokes, sweet potatoes, cassava and yams.
- Corm crops, including taro and cocoyam.

2.23 Under the RTFO, dedicated energy crops are not considered relevant crops and are therefore excluded from the crop cap.

## Dedicated Energy crops

2.24 Dedicated energy crops are crops that consist of non-food cellulosic material or lignocellulosic material, except saw logs and veneer logs, which:

- Are grown for the purpose of being used as fuel or energy.
- Are not a residue or a waste.
- Would not normally be used for food or feed.

2.25 For the purposes of the RTFO, 'lignocellulosic material' means material composed of lignin, cellulose and hemicellulose such as biomass sourced from forests, woody energy crops and forest-based industries' residues and wastes.

2.26 For the purposes of the RTFO, 'non-food cellulosic material' means feedstocks mainly composed of cellulose and hemicellulose, and having a lower lignin content than lignocellulosic material. It includes food and feed crop residues (such as straw, stover, husks and shells), grassy energy crops with a low starch content (such as ryegrass, switchgrass, miscanthus, giant cane, cover crops before and after main crops), industrial residues (including from food and feed crops after vegetal oils, sugars, starches and protein have been extracted), and material from biowaste.

2.27 For the purposes of the RTFO, biofuels derived from dedicated energy crops are double rewarded and are also required to comply with the land criteria (see Chapter 7). Biofuels produced from dedicated energy crops do not count towards the crop cap or the development fuel target

2.28 Dedicated energy crops are not eligible under the SAF Mandate.

## Wastes and residues

2.29 For the purposes of the RTFO and SAF Mandate, the following relevant definitions apply:

- 'Waste' means any substance or object which the holder discards or intends or is required to discard. This definition excludes substances that have been intentionally modified or contaminated for the purpose of transforming it into a waste.
- 'Residues from agriculture, aquaculture, fisheries or forestry' means residues that are directly generated by agriculture, aquaculture, fisheries or forestry; they do not include residues from related industries or processing.
- 'Processing residue', in relation to a production process, means a substance that is not the end product sought directly from the process; the production of which is not a primary aim of the process; and in respect of which the process has not been deliberately modified in order to produce it.
- ‘Segregated oil and fat’, means a material that is capable of being used as a transport fuel directly, after extraction, or after conversion by transesterification, irrespective of any blend wall limits on use.

2.30 The definition of residues from agriculture, aquaculture, forestry and fisheries, applies specifically to those generated in the process of harvesting the material being sought. Once the product is removed from the point of harvest and processed elsewhere, any residues generated become processing residues.

2.31 For the purpose of the RTFO, most wastes and residues are eligible for double reward of Certificates. However, eligibility for double reward is determined on a case-by-case basis by the Administrator through the assessment process outlined later in this chapter at paragraph 2.53. This assessment process considers any negative or diversionary impacts that could arise from redirecting the waste stream to fuel production. Where risks are identified the waste will be categorised as eligible for single reward.

2.32 Agricultural wastes and residues are considered by the Administrator to be those that are derived directly from agricultural land and are subject to the land (paragraph 5.14) and soil carbon criteria (paragraph 5.16)

2.33 Forestry wastes and residues are considered by the Administrator to be those that are derived directly from forested land and are subject to the forestry criteria (5.15).

2.34 Wastes and residues produced from agriculture- or forestry-derived materials but that only become a waste or residue during processing after collection from the land are likely to be classified as processing residues and therefore not subject to the land, forestry or soil carbon criteria.

## Segregated oils and fats

2.35 Segregated oils and fats (SOFs) are a sub-category of wastes and residues.

2.36 For the purpose of the RTFO, fuels derived from segregated oils and fats cannot be used to make development fuels.

2.37 For the purposes of the SAF Mandate, the HEFA Cap applies to fuels made from segregated oils and fats irrespective of the upgrading or processing methods used to make them.

2.38 A 'segregated oil and fat' is a material that is capable of being used as a transport fuel directly, after extraction, or after conversion by transesterification, irrespective of any blend wall limits on use. Examples include:

- Waste vegetable oils, fish oils and animal fats (tallow and greases), mono, di and tri glycerides however mixed and extracted.
- Segregated or mixes of free fatty acid, fatty acid esters and any derivative thereof.

2.39 Waste or residue-derived materials that require upgrading (via thermochemical or catalytic cracking) in order to produce fuels, are not considered segregated oils and fats.

## Renewable energy (feedstocks for RFNBOs and PtL)

2.40 RFNBOs are renewable liquid or gaseous transport fuels for which none of the energy content of the fuel comes from biological sources. These fuels are considered renewable where the energy content of the fuel comes from renewable energy sources[1] but excluding bioenergy. This means that RFNBOs could be made using electricity and/or heat from wind, solar, aerothermal, geothermal or water (including hydrothermal sources, waves and tides), and under the SAF Mandate, Nuclear energy but **not bioenergy**.

2.41 RFNBOs cannot be derived from bioenergy sources and therefore would not be able to be derived from biomass, landfill gas, sewage treatment plant gas or biogases. As the available energy source of RFNBOs comes from electricity or heat, the input raw materials must contain no usable energy. In practice this means that RFNBOs must be made from either water and/or carbon dioxide ($CO_2$).

2.42 The simplest RFNBO is renewable hydrogen (for example from wind or solar powered electrolysis) that is directly used in transport applications: either in an internal combustion engine or a fuel cell electric vehicle. A range of other renewable transport fuels can also be generated by reacting this RFNBO hydrogen precursor with $CO_2$ to produce RFNBO products such as methane,

[1] Energy from renewable sources is defined as 'energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases'.

methanol, ethanol, di-methyl ether, petrol, kerosene and diesel. It can also be reacted with nitrogen through the Haber process to produce renewable ammonia.

2.43 If a RFNBO is produced from $CO_2$, the $CO_2$ can come from waste fossil sources (for example, waste flue gases from coal and natural gas power generation or similar industrial combustion processes), from biological sources (e.g. alcohol fermentation or anaerobic digestion) or from atmospheric or naturally-occurring/geothermal sources.

2.44 If the $CO_2$ is generated from fossil energy sources specifically for the purposes of producing transport fuel, this $CO_2$ must be accounted for as fossil $CO_2$ emissions in the reported carbon intensity of the RFNBO (see paragraph D.12). Upstream supply-chain emissions associated with extracting, refining and transporting the fossil energy source must also be accounted for.

2.45 Where non-waste biogenic $CO_2$ is used to produce a RFNBO, the biomass used to produce the biogenic $CO_2$ is considered to be a feedstock. This feedstock must not have been generated specifically for the purpose of converting it into a fuel for use in transport. Refer to paragraph 2.43 for use of waste biogenic $CO_2$ in the production of a RFNBO.

## Designated fossil wastes (feedstocks for RCFs)

2.46 RCFs are fuels made from a fossil waste which cannot be recycled, reused or prevented, and which has been designated as a relevant feedstock following the process and criteria outlined later in this chapter.

2.47 To classify as a RCF, the fuel must also be a development fuel or avtur (see paragraph 2.73 and Chapter 5 of the RTFO Compliance Guidance), and in the case of RCF hydrogen, the production pathway must include substantial carbon capture and storage (CCS) of the otherwise emitted carbon see 2.50.

2.48 To be eligible for Certificates, RCFs must also have been assessed against the criteria for eligibility set out in the RTFO and SAF Mandate.

2.49 A list of currently eligible RCF feedstocks is available online – see 2.51. Where a feedstock is not listed, suppliers can apply for a feedstock assessment following the process introduced in 2.53 and set out in more detail Chapter 2 of the RTFO and SAF Mandate Guidance for Recycled Carbon Fuels.

2.50 For the purposes of paragraph 2.47, to meet the requirement for “substantial CCS” for hydrogen produced from methane (e.g. by reformation), a supplier should be able to demonstrate that at least 50% of the carbon produced and otherwise emitted in the conversion process (e.g. as $CO_2$ or $CH_4$) has been captured and permanently stored in line with RTFO guidance on CCS (see Annex E paragraph E.9). It is permissible to count carbon captured and stored elsewhere in the supply chain towards meeting the 50% requirement.

# Process for assessing and classifying feedstocks

2.51 The government has separately published tables to provide guidance as to which feedstocks (i.e. materials used in the production of fuels) are considered products, residues, wastes or dedicated energy crops for the purposes of the RTFO and SAF Mandate, their eligibility and their level of reward. The tables list the key materials the Administrator is aware of that might be used to produce low carbon fuels at the time of publication. Additional materials approved for use as feedstocks will be added to this list in due course.

2.52 The Administrator may periodically review and update the tables on the Department's website to add new materials or change the listing of existing ones if sufficient evidence emerges to indicate that they should be treated differently.

## Assessment process

2.53 Where a supplier wishes to use a material not included in the tables of materials as a feedstock, the operator must apply to the Administrator for the material to be assessed by filling in a form available from the Administrator by contacting rtfo-compliance@dft.gov.uk or SAF-compliance@dft.gov.uk.

2.54 It is the responsibility of suppliers to demonstrate to the Administrator's satisfaction the appropriate classification of the feedstock. The Administrator will ask the supplier to provide information on the process that results in the material, its economic value and other uses. This information will be considered according to the principles set out in this guidance.

2.55 The Administrator will seek further advice and information, including through public consultation where appropriate. To protect commercial confidentiality, consultation will be limited to unclear cases. In any case, the Administrator will set out with the applicant what procedure will be followed. The Administrator will then come to a view on the appropriate classification of the feedstock for the purposes of the RTFO and SAF Mandate and, where appropriate, the level of reward.

2.56 Once a material has been assessed and a decision made, it will be included in the list of materials in the guidance and all suppliers will be informed. The Administrator will provide a decision as soon as possible, however each feedstock assessment differs in complexity, leading to varying assessment timeframes.

2.57 Categorisations of materials will be applicable from the date of the Administrator's decision and applied to all low carbon fuel produced from that material from that point forwards. Low carbon fuel supplied (and reported in ROS as associated with a month or quarter) before the new categorisation must report using the old categorisation (e.g. if it was not a waste it would have to meet the land criteria).

2.58 The Administrator's position on whether a material is a residue or a waste and on the level of reward is relevant to the RTFO and SAF Mandate schemes only and is not applicable to the status of the material under any other government policy.

2.59 The application for, and/or issuance of, Certificates under the RTFO does not certify that the fuels supplied are compliant with the Motor Fuel (Composition and Content) Regulations 1999 or any other regulations. Suppliers are reminded that they have a wider obligation to consider the risks to human health and the environment. These impacts include that of air quality resulting from the combustion of novel and potentially contaminated feedstocks.

## Assessment principles (biogenic material)

2.60 In considering the appropriate classification for materials, in addition to the definitions outlined above the Administrator will take into account the following considerations:

- Products are generally materials that would be attributed GHG emissions for the purpose of calculating GHG default values (Chapter 6)
- Materials that represent a significant economic value[2] in relation to the main product, and that have other uses than energy applications, are likely to be considered as products
- Any material that has been intentionally modified to count as a waste (e.g. by adding waste to non-waste) will be considered as a product

2.61 Those handling materials considered waste under the Waste Regulations, such as those who process it, should also have regard to their duty to apply the waste hierarchy when passing it on for further processing or use[3].

2.62 It is not possible to lay down definitive or absolute rules as to when materials will be classed as wastes or residues or not, or on the level of reward. A judgment has to be made taking into account the circumstances of each material. The lists are not exhaustive.

2.63 Should a feedstock meet the definition of a waste or residue as set out in the previous section, the Administrator will then decide whether fuel derived from that feedstock should be eligible for double Certificates.

2.64 Under s.125A(2) of the Energy Act 2004, as amended, the Administrator must promote the supply of renewable transport fuel whose production, supply or use causes or contributes to the reduction of carbon emissions and contributes to

[2] The Administrator considers that materials typically trading for around 10% or more of the main product in £/tonne is an indicator of economic significance, but other factors may be taken into account, including the amount of material produced and its other uses.

[3] In England and Wales, the duty is included in regulation 12 of the Waste (England and Wales) Regulations 2011. Guidance on how to apply the hierarchy and when departures may be justified is at: http://www.defra.gov.uk/publications/files/pb13530-waste-hierarchy-guidance.pdf.

sustainable development or the protection or enhancement of the environment generally.

2.65 Article 17A(3) of the RTFO Order requires the Administrator to consider the effects under s.126(4) of the 2004 Act, to determine if a fuel is eligible for additional certificate. The five effects are as follows:

- Carbon emissions
- Agriculture
- Other economic activities
- Sustainable development
- The environment generally

2.66 If the Administrator decides that the fuel produces one or more of those effects, the Administrator will then decide whether, based on those effects, to award an additional RTFC.

2.67 When making a decision, the Administrator must consider any alternative uses and alternative disposal outcomes which could have been adopted or used for the relevant residue or waste.

## Assessment principles – Fossil wastes (RCF feedstocks)

2.68 To be eligible for support as an RCF feedstock under the RTFO or SAF Mandate, the material is required to be a fossil waste which meets the RTFO and SAF Mandate definition of waste[4] and must be a waste that cannot be prevented, reused, or recycled – in accordance with the waste hierarchy.

2.69 Should a feedstock meet the definition of a waste or residue as set out in the previous section, consistent with paragraphs 2.46 to 2.50, the Administrator will then decide whether the derived fuel produces one or more of the 'effects' set out in the Energy Act (2004) S.126(4) – see paragraph 2.65.

2.70 When making a decision the Administrator must consider any alternative uses and alternative disposal outcomes which could have been adopted or used for the relevant material. The decision will ultimately determine whether the feedstock is eligible for support, rather than whether or not the material should be double rewarded (for the purpose of the RTFO). If deemed eligible the material will single count, due to the fossil nature of the feedstock.

2.71 A material will not be considered eligible for support if there is a risk of adverse environmental outcomes. For example, if there is evidence that eligibility of a material might incentivise the increased production of the waste, disincentivise good waste management practices (e.g. separation of waste), or if the material is currently recyclable using best available techniques (BAT). In determining whether a material is recyclable, the Administrator may also take into account

[4] As per the RTFO Order: *'waste' means any substance or object which the holder discards, or intends or is required to discard, but does not include any substance or object that has been intentionally modified or contaminated for the purpose of transforming it into a waste.*

new technological developments anticipated in the short- to medium-term, such as a recycling technology which is proven but not yet scaled-up.

2.72 In considering alternative uses and disposal outcomes, a feedstock is unlikely to be deemed eligible if there is a risk that RCF eligibility will divert feedstock from end-of-life (EoL) fates with high counterfactual emissions (such as cases where the feedstock would be replaced purely by fossil fuels) or risks undermining the ability of other industries to decarbonise. Fuel producers are expected to seek out and maximise the use of feedstocks where they are not already critical to another sector's decarbonisation efforts. Where this is a potential risk, RCF producers will need to demonstrate to the Administrator that there is not a risk of diversion.

## Development fuels under the RTFO

2.73 A 'development fuel' is a fuel made from certain (double rewarded) sustainable feedstocks specified in paragraph 2.74 that **is also** of one of the fuel types specified in paragraph 2.75.

2.74 To be classified as a development fuel, the fuel must be one of the following:

- Made from sustainable wastes or residues which the Administrator considers are eligible for double Certificates, apart from segregated oils and fats such as used cooking oil and tallow (see paragraph 2.35)
- A RFNBO (see paragraph 2.8C)
- An RCF

2.75 In addition to paragraph 2.74, A development fuel must be one of the following fuel types:

- Hydrogen (and, in the case of a RCF hydrogen, must include substantial carbon capture and storage)
- Substitute natural gas - renewable methane produced from the product of gasification[5] or pyrolysis[6]
- A fuel that can be blended such that the final blend has an eligible fraction of at least 25%[7] whilst still meeting BS EN: 228 (for petrol, as revised or reissued from time to time) or BS EN: 590 (for diesel, as revised or reissued from time to time)

[5] “gasification” means the substoichiometric oxidation or steam reformation of a substance to produce a gaseous mixture containing at least two of the following: oxides of carbon, methane or hydrogen.

[6] “pyrolysis” means the thermal degradation of a substance in the absence of an oxidising agent (other than that which forms part of the substance itself) to produce char and at least one or both of gas and liquid.

[7] It should be noted that the minimum blend limit, of 25%, refers to the eligible fraction of the final fuel, not the fraction of the fuel that was blended with petrol or diesel. E.g. if a novel fuel is 50% renewable and is blended in equal parts with regular fossil diesel, the relevant fraction in this instance would be 25%.

2.76 Qualifying fuels are rewarded with double 'development fuel' Certificates. Except for RCF fuels which are rewarded single ‘development fuel’ Certificates.

2.77 Suppliers wishing to apply for development fuel Certificates should first contact the Administrator to request an initial assessment of the potential new development fuel production pathways against our requirements. The Administrator will then assess whether the fuel type, feedstock and production pathway meet the criteria for a development fuel and will use the information provided in RTFC applications to issue new 'development fuel' Certificates accordingly.

2.78 In the case of novel fuels (i.e. those not specifically listed in paragraph 2.75), the Administrator will need to be satisfied that the fuel meets the criteria, including that it can be blended such that the final blend has a renewable fraction of at least 25% whilst still meeting the relevant fuel standard (BS EN: 228/BS EN: 590).

2.79 The Administrator will need to be satisfied that the information contained within an application is accurate. Where deemed appropriate, the Administrator will validate this information itself. The Administrator will also have the power to require independent assurance to either a 'limited' or 'reasonable' assurance level using the standards set out in ISAE 3000 where it believes this is necessary.

## Power to liquid target under the SAF mandate

2.80 The SAF Mandate includes a separate power to liquid (PtL) mandate from 2028 which can be discharged using PtL certificates. A PtL fuel is defined as a low carbon avtur for which the energy content of the fuel is derived from renewable (excluding bioenergy) or nuclear energy sources combined with an eligible source of $CO_2$. This means that PtL certificates will only be awarded where the resulting fuel is avtur, while avgas and hydrogen will be awarded main certificates.

# 3. Mass balance and chain of custody rules

**Chapter summary**

It is necessary to be able to track C&S data back to its original source to demonstrate that the renewable or low carbon fuel supplied meets the sustainability criteria. This chapter outlines the acceptable chain of custody systems permitted under both the RTFO and SAF Mandate and provides guidance on setting up a mass balance chain of custody system where none exists.

## Guiding principles

3.1 The purpose of the chain of custody is to ensure that claims made about products are correct. Economic operators must put in place systems that are accurate, reliable and protected against fraud, and to get independent verification that their systems meet these requirements.

3.2 It is the reporting party's responsibility to ensure that appropriate chains of custody are in place to the origin of the material, and that mass balance systems are being implemented correctly. The chain of custody is subject to verification.

3.3 It is the responsibility of each supplier in the chain of custody to keep records and evidence to demonstrate that the chain of custody has operated correctly. Where necessary, verifiers and the Administrator may require access to these records and evidence. Although it is not necessary for evidence to be passed along the chain of custody, it must be available for review by the verifier or Administrator if requested. Where an obligated party fails to provide sufficient information or evidence to substantiate claims, Certificates will not be issued, and the fuel will be treated as fossil for the purposes of calculating the supplier's obligation. More information about the checks the Administrator may undertake can be found in Annex A of the respective RTFO and SAF Mandate Compliance Guidance documents. Descriptions of the types of evidence that may be available can be found in Chapter 8.

3.4 For wastes and residues, it is particularly important that the following principles are followed to ensure a robust chain of custody:

- Traceability of wastes and residues needs to cover the whole chain of custody, going back to the origin of the material, i.e. where the waste or residue material arises.
- A group auditing approach is only permitted at the origin of the material.
- The frequency and intensity of the auditing procedure needs to reflect the level of risk.
- Auditors should have the right to do on-site audits at the origin (e.g. restaurants) if required.
- Economic operators need to declare to auditors the name of all voluntary schemes they operate in and make available all relevant information, e.g. full mass balance records for a site.

## Terminology

3.5 Throughout this chapter the following terminology will be used:

- **Origin:** the farm or plantation where the crop was grown or the site/facility/premises which first generated the waste or residue. The origin of UCO, for example, is the restaurant or food processing facility where the oil was used, not the biofuel processing plant or where the UCO is aggregated.
- **Country of origin:** the country in which the 'origin' is located, not the country where the renewable or low carbon fuel was produced, i.e. the renewable or low carbon fuel processing plant. In the case of wastes this is the country where the waste arises.
- **Input:** any physical input sourced by any party in the supply chain, e.g. rapeseed sourced by a rapeseed crusher or rapeseed oil sourced by a biodiesel producer.
- **Output:** any physical output supplied by any party in the supply chain, e.g. rapeseed supplied by a rapeseed farm or rapeseed oil supplied by a rapeseed crusher.
- **Conversion factor:** refers to the amount of output produced per unit of input, e.g. the oil extraction rate or the amount of biodiesel produced per unit of vegetable oil.
- **Inventory:** refers to a stock of the physical product or C&S data.
- **Chain of custody:** A chain of custody is a system that links the reported quantities of renewable or low carbon fuel with certain C&S characteristics to the quantities of feedstocks that possess the same C&S characteristics. An essential aspect of the chain of custody system, therefore, is that it must be able to guarantee that for each unit of renewable or low carbon fuel with certain C&S characteristics reported to the Administrator, an equivalent amount of feedstock with the same C&S characteristics has been added to the market.
- **Consignment:** any amount of product with an identical ‘set of sustainability characteristics’. With the exception of carbon intensity in certain instances, all characteristics must be identical.

3.6 These sustainability characteristics which need to be identical within each consignment of fuel are:

- Fuel type
- Fuel feedstock
- Fuel production process
- Country of origin
- Voluntary scheme(s) (including any supplementary checks where these have been performed)
- Land use on 1 January 2008
- Carbon intensity (see paragraph 3.7 onwards below)

## Aggregating multiple consignments into an application

3.7 Multiple consignments can be aggregated at any point in the supply chain provided the individual consignments have identical ‘sets of sustainability characteristics’ as defined above.

3.8 Consignments with different carbon intensities can be aggregated into one application for reporting purposes if all the other sustainability data is identical and as long as aggregation does not enable consignments that would not otherwise have met the minimum GHG emission threshold to do so.[8]

3.9 The overall carbon intensity for aggregated consignments (i.e. an application) is given by calculating a weighted average (by volume for liquids and mass for gases) of all the carbon intensities of the different consignments.

## Which chain of custody systems are permitted for C&S reporting?

3.10 To validate the accuracy of C&S reports a chain of custody must be established from the original party which generates the first C&S information to the reporting party (in most cases, this will be the "point of origin" of the feedstock). In general, three different types of chain of custody systems are distinguished:

- Bulk commodity systems (physical segregation)
- Mass balance systems (units in = units out)
- Book and claim systems (tradable certificates)

3.11 Mass balance is the only chain of custody system currently permitted under the RTFO and SAF Mandate. Other more stringent chain of custody systems such as bulk commodity systems are permitted because they are consistent with the principles of mass balance – the output is the same as the input.

3.12 Book and claim systems are not allowed.

[8] Suppliers and verifiers should use the disaggregated defaults as a guideline when assessing whether a consignment is on track to meet the GHG saving threshold at earlier stages of the supply chain. So, in general, GHG savings from a single step or up to a point in the fuel chain combined with defaults for the rest of the fuel chain should meet the GHG threshold if combining with other consignments of biofuel to report a single weighted average carbon intensity.

3.13 Suppliers wishing to use evidence from a voluntary scheme to support sustainability claims should consider whether the voluntary scheme includes an approved chain of custody and whether it covers the entire supply chain, or only a part of it.

## When to set up a chain of custody

3.14 It is the responsibility of suppliers to satisfy the Administrator that mass balance systems are being implemented correctly. Although it is not strictly necessary for evidence to be passed along the chain of custody, it must be available for review by the verifier or Administrator if required.

3.15 To enable suppliers to provide evidence that mass balance principles have been correctly adhered to, suppliers are encouraged to seek transparency along their supply chain and are advised to seek access to the information required to demonstrate compliance with the chain of custody as part of their commercial contracts.

3.16 In some instances, voluntary schemes recognised by the Administrator may be used to support sustainability claims, but suppliers should be aware that use of a voluntary scheme does not guarantee issuance of Certificates, and the Administrator may require additional information and evidence from each stage of the supply chain. Where an obligated party fails to provide sufficient information or evidence to substantiate their claims, Certificates will not be issued, and the fuel will be treated as fossil for the purposes of calculating the obligation. See Chapter 5 and Annex A of the respective RTFO and SAF Mandate Compliance Guidance documents for more information on the additional checks and evidence that the Administrator may require in order to approve an application for Certificates. Voluntary schemes may also have some limitations to their use, including:

- Voluntary scheme operators may not be in the position to provide suppliers with the necessary information required to evidence chain of custody compliance.
- Operators of voluntary schemes may opt to seek recognition that the voluntary scheme meets some, but not all, of the RTFO or SAF Mandate criteria. For example, there are recognised voluntary schemes that do not include a chain of custody element or that do not contain GHG data.
- The chain of custody under a voluntary scheme may not cover the whole chain from feedstock producer (or origin of the waste/residue) to the reporting party supplying renewable or low carbon fuel across the duty point (or alternative assessment time). For example, it might only extend from the feedstock producer to the low carbon fuel producer and, therefore, may not be in place between the low carbon fuel producer and the reporting party who is applying for Certificates.

3.17 Guidance on how to set up a chain of custody and on the detailed rules of operating a mass balance system is provided below.

# Guidance for operating a mass balance type of chain of custody

3.18 Each party in the renewable or low carbon fuel supply chain, from the origin of the feedstock to the reporting party, needs to put in place the administration necessary to maintain the chain of custody. If any party in the supply chain who takes legal ownership over the product does not keep the required records, the chain of custody stops at this point and no claims related to C&S data can be made by parties further downstream. The consequence of such a break in the chain of custody is that the fuel supplier will not be able to demonstrate that the fuel meets the RTFO or SAF Mandate's sustainability criteria, and the fuel will therefore not be considered sustainable low carbon fuel for the purposes of the RTFO or SAF Mandate.

## Responsibilities and procedures

3.19 To be able to produce data that is of sufficient quality to apply for Certificates, fuel suppliers need to ensure that they and others in their supply chain have effective systems to manage the chain of custody and obtain and retain sufficient and appropriate evidence to support their C&S claims. Suppliers should:

- Appoint a person or position with overall responsibility for compliance with the chain of custody procedures.
- Have written procedures or work instructions to ensure implementation of the requirements.

3.20 It is good practice to:

- Liaise with the supply chain to ensure awareness of the need for cooperation and for a chain of custody
- Produce data in a manner that is transparent and is as consistent as possible between years (allowing for improvements in method)
- Remove unnecessary complexity from the reporting system
- Organise internal checks of the data
- Organise external checks of the data where commercial confidentiality may prevent the reporting party from making these checks for themselves
- Ensure all people supplying data are aware of the rigour required and that responsibility for supplying the data is allocated
- Map the data flow within the organisation, such as between spreadsheets
- Minimise the manual transfer of data
- Ensure adequate controls around the data
- Document the system
- Track data over time to help identify any misstatement

## The level at which the mass balance should operate

3.21 The mass balance approach must be operated at the level of a site or at a more detailed level of granularity (e.g. tank level). This applies to all locations along a supply chain regardless of which company owns, operates or controls these assets - they may not necessarily be the owner(s) or final supplier of the fuel (e.g. third-party storage is permitted). The RTFO and SAF Mandate do not allow companies to operate one single mass balance (units in = units out) approach over more than one geographical location.

3.22 A 'site' is defined as 'one geographical location with precise boundaries within which products can be mixed'. A site is not a collection of facilities that are located in different geographical locations, even if that is in the same region. A site can include multiple silos or tanks on the same physical site as illustrated in Figure 2.

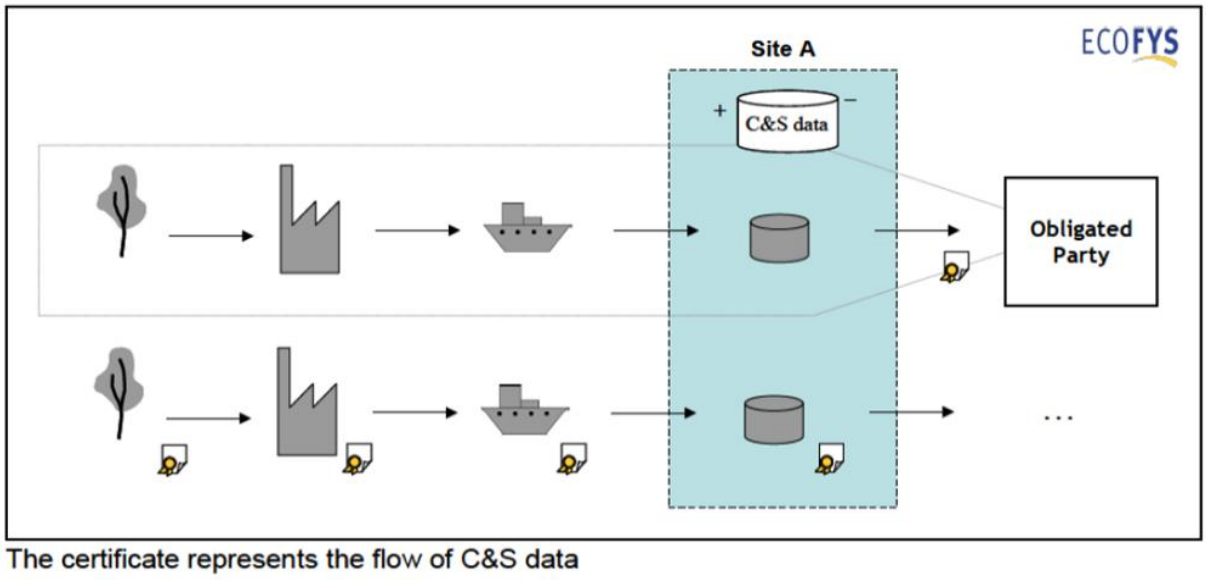


**Figure 2** Example of a transfer of C&S data at a site

3.23 Suppliers of biomethane, or fuels for which biomethane is a precursor (for example biomethanol or MTBE), can use national or international gas grid systems as part of their chain of custody provided that certain conditions are met. These conditions are specified in separate Biomethane guidance.

## Timeframe

3.24 It is recommended that parties in the supply chain undertake a periodic inventory of site-level C&S data on at least a monthly basis. The periodic inventory of C&S data shall not be negative (i.e. when the periodic inventory is undertaken, parties may not have sold more C&S data than they have taken in, nor have more C&S data than they have actual physical feedstock/product). For any transaction, the traded amount of C&S data cannot exceed the traded amount of physical product. At the end of each closing mass balance inventory, the closing balance of C&S data must not be more than the quantity of low carbon fuel on the site.

3.25 It is acknowledged that due to the way the supply chain currently operates it may be challenging for some parties in the supply chain to conduct a monthly mass balance inventory, particularly at the agricultural end of the supply chain. Therefore, the maximum period over which the mass balance has to be achieved under the RTFO and SAF Mandate can be longer than one month but must not exceed three months. In all cases, mass balance time periods of reporting parties should not extend across two different obligation periods.

3.26 Parties must use the specified balancing up periods used by the voluntary scheme, which is typically of three months.

## Record keeping

3.27 Each party in the chain of custody must keep records relating to their inputs and outputs and any conversion factors. This information should concur with the information on invoices and other records, e.g. shipping records, to enable C&S data claims to be traced back through the supply chain. This information must be available for verifiers or the Administrator to check.

## Input and output records of C&S data

3.28 Input records refer to the C&S data of products purchased from a supplier. Output records refer to the C&S data of products sold to a buyer. For each application these records should include at least:

- Invoice reference(s)
- A description of the physical product to which the C&S data refer
- The quantity of physical input/output to which the C&S data refer
- The supplying/receiving company
- Transaction date
- Any C&S data

3.29 When reporting using a voluntary scheme, products should not be entered into the mass balance system until evidence is received (e.g. a proof of sustainability) that the product is compliant with the scheme claimed. Products that do not have the necessary supporting evidence should be recorded separately. When the necessary evidence is received, the fuel can then be moved to the mass balance system recording compliant material. Products should not be sold on as voluntary scheme compliant until the necessary evidence has been received for it.

## Conversion factor records

3.30 These records refer to the conversion factor of inputs to outputs (e.g. rapeseed to rapeseed oil). Each party in the supply chain should maintain records of its own conversion factors.

3.31 A party may have more than one conversion factor. If no records are kept for the conversion factor the default value for the respective conversion factor must be used.[9] For each conversion factor it must be clear from the records:

- To which input product it refers.
- To which output product it refers.
- The units in which the conversion factor is expressed.
- The value of the actual conversion factor.
- When the specific conversion factor was valid (the period of validity is one year).
- The conversion factors may also be integrated into the input, output or inventory records as long as the requirements listed here are met.

## Periodic inventory of C&S data

3.32 These records provide an insight into the balance of C&S data. Besides helping a company to manage its input-output balance these records also assist in the verification of a party's chain of custody records. It is recommended that the period between inventories is no longer than one month, and records should include:

- The inventory of C&S data at the beginning of the respective period (including the carbon intensity of the stock). It must be clearly specified whether this is expressed in input-equivalents (before conversion factor) or output-equivalents (after conversion factor).
- The quantity of inputs with identical C&S data in the respective period. These quantities must coincide with the input records described above.
- The quantity of outputs with identical C&S data in the respective period. These quantities must coincide with the output records described above.
- The conversion factor(s) used in the respective period.
- The inventory of C&S data at the end of the respective period (including the carbon intensity of the stock). It must be clearly specified whether this is expressed in input-equivalents (before conversion factor) or output-equivalents (after conversion factor).

3.33 Example formats for the records described above are included in Chapter 8**.**

## Selling products with C&S data

3.34 Records of commercial transactions must enable the reporting party and other parties in the supply chain, and the verifier appointed by the reporting party, to trace back through the supply chain to check any C&S claims made.

[9] Default inputs and standard values can be found in the RTFO and SAF Mandate standard data online.

3.35 It is suggested that a company that sells products with C&S data should specify the C&S data on the invoice or on a document to which the invoice refers. The invoice or relevant document should include the following information:

- The name and address of the buyer.
- The date on which the invoice was issued.
- Description of the product - this must correspond to the description of the product given in the input and output records.
- The quantity of the products sold with specific C&S data (if the invoice contains products with different C&S data, these shall be identified separately in such a way that it is clear to which products the C&S data refers).

3.36 Such an invoice or document, sometimes referred to as a 'supplier declaration', does not in itself provide conclusive evidence about the veracity of the information contained, but it does provide evidence that can be used to trace C&S data back up the supply chain. Conclusive evidence on the nature of the material can only be provided from the origin of that material.

## Allocation of sustainability information

3.37 In passing C&S information through the supply chain, it is permitted to use a mass balance system to freely allocate C&S information to outgoing consignments, as long as the 'set of sustainability characteristics' remains together and the rules of mass balance are respected (i.e. inputs = outputs). The 'set of sustainability characteristics' includes all C&S information known about a consignment (for example: feedstock, country of origin, voluntary scheme, carbon intensity, etc.).

3.38 For example, if a party has two consignments in a single tank, one of 'rapeseed methyl ester (RME) from protected cropland' and the other of 'palm methyl ester (PME) from non-protected cropland', individual sustainability characteristics could not be swapped between the consignments. For example, it would not be permitted to assign outgoing data as 'RME from non-protected cropland'.

3.39 When eligible fuels are traded, feedstock information can be allocated flexibly to outgoing consignments. In the example above, although the RME and PME were physically mixed, they could be sold to supplier A and supplier B, as 100% RME and 100% PME, respectively.

3.40 The same principle applies when dealing with partially eligible fuels. If a party has two consignments in a single tank, one of renewable methanol (eligible) and one of non-renewable methanol (ineligible), although they are physically mixed, they can be sold to supplier A and supplier B as 100% renewable methanol and 100% non-renewable methanol, respectively.

3.41 For the parts of the supply chain where commodities are traded as single feedstocks, i.e. before conversion into eligible fuel, outgoing consignments of feedstock must be sold with feedstock data consistent with that feedstock. For example, if a site contains silos of pure palm oil and pure rapeseed oil, pure

palm oil sold as a single feedstock from that site must be sold with palm oil data.

3.42 Companies should employ a transparent and consistent approach to reporting the proportion of different feedstocks in the fuel that they bring to the market.

3.43 Once C&S data has been assigned to an eligible fuel at the duty point, the further substitution of the C&S data with a different C&S dataset through the use of mass balance is not permitted[10]. This means that once C&S data has been submitted to a verifier for verification or submitted to the Administrator as part of an application for Certificates it cannot be substituted for another C&S data set. This applies whether or not the verification of that C&S data or the application for Certificates was successful.

## Accounting for gains and losses of low carbon fuels

3.44 Gains and losses of fuel may occur along the fuel chain, for example, through variation in tolerances of meters and tank gauges, spillages and evaporation, or where residual fuel remains in pipework. Suppliers should endeavour to apply appropriate controls to minimise such gains and losses. However, where gains and losses do occur, C&S data should be adjusted in proportion to the quantity of fuel gained/lost at regular intervals. The Administrator recommends that one month would be an appropriate timeframe to make any adjustments.

3.45 Where losses of biomethane occur in the supply chain, such losses must also be included in the carbon intensity calculations (except where defaults are used). This is because biomethane (methane) is a greenhouse gas, therefore losses of biomethane should be counted as a GHG emission. For more information, see the separate guidance for biomethane issued by the Administrator.

## Flexible allocation of C&S data over different 'feedstock-derived products'

3.46 Different feedstock-derived products are different products that are produced from the same feedstock, e.g. sugar and bioethanol are two different types of products that are both produced from the same feedstock. They are destined for different markets (in this example one for 'food', one for eligible fuel).

3.47 Producers are allowed to maximise the amount of certified raw material applied to the biofuel product where it and the other feedstock are produced at the same site. It is not allowed to swap data for certified material higher up the supply chain where one of the products is destined for a non-low carbon fuels market. In the same way, it is not allowed to use rape oil data for palm where the rape oil is actually used in a non-low carbon fuels market. The following two examples clarify this rule.

[10] Note, this is distinct from correcting inaccurate data in relation to the same renewable fuel e.g. as part of the verification process, or due to new information being gleaned from the supply chain.

**Example 1. Flexible allocation of C&S data between sugar and bioethanol produced at the same mill.**

'Mill M' produces and sells sugar cane-derived products (sugar and bioethanol) - see Figure 3. It produces equal quantities of sugar and bioethanol from sugar cane. Mill M has two dedicated plantations, of which only one meets the RTFO sustainability criteria. In total, this mill produces twenty units of sugar cane-derived products: ten units of sugar and ten units of bioethanol. The obligated party to which M sells its bioethanol wishes to claim that the ten units of sugar cane bioethanol it put on the market all meet the RTFO sustainability criteria. This is permitted and the obligated party does not have to ensure that the other sugar cane estate, from which Mill M sources the other ten units of sugar cane, also meets the RTFO criteria. This is acceptable because, in this example, no more sustainable bioethanol was sold by Mill A than the quantity of sustainable sugar cane it sourced and converted into ethanol (taking into account relevant conversion factors).

The sugar produced by Mill M cannot also be sold with a claim of meeting the RTFO criteria, as this would be a double claim. In addition, it cannot be counted towards any international support scheme, nor towards any other UK renewable energy obligations.

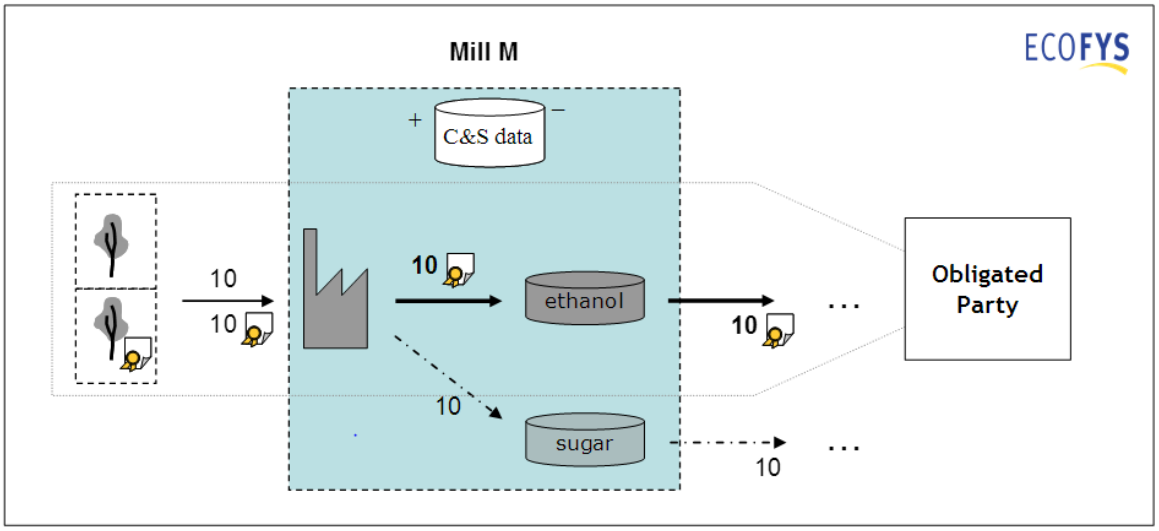


**Figure 3** Example of a transfer of C&S data between different feedstock-derived products that is allowed under the RTFO. The certificate represents the flow of certified products.

**Example 2. Allocation of C&S data between sugar and bioethanol produced at different mills.**

Company A ('Site A') stores and trades in sugar cane-derived products (sugar and bioethanol) - see Figure 4. It sources from several sugar cane mills. One of the sugar cane mills ('Mill M') produces equal quantities of sugar and bioethanol from sugar cane. It has a dedicated plantation that meets the RTFO sustainability criteria. In total, this mill produces twenty units of sustainable sugar cane-derived products (ten units of sugar and ten units of bioethanol). Site A also received ten units of sugar cane bioethanol from another mill (Mill X, which does not meet the RTFO sustainability criteria). Of the total 20 units of bioethanol that Site A sells to the obligated party, only ten can be claimed to meet the RTFO sustainable criteria. Site A is not permitted to transfer the sustainability claim of the sugar it sourced from Mill M to the bioethanol it sourced from Mill X because this would effectively be running the mass balance over several sites. In the same way that sustainability data associated with biodiesel cannot be transferred to bioethanol, it is not possible to transfer the sustainability data that has already been assigned to the sugar at an earlier step in the chain of custody to the ethanol.

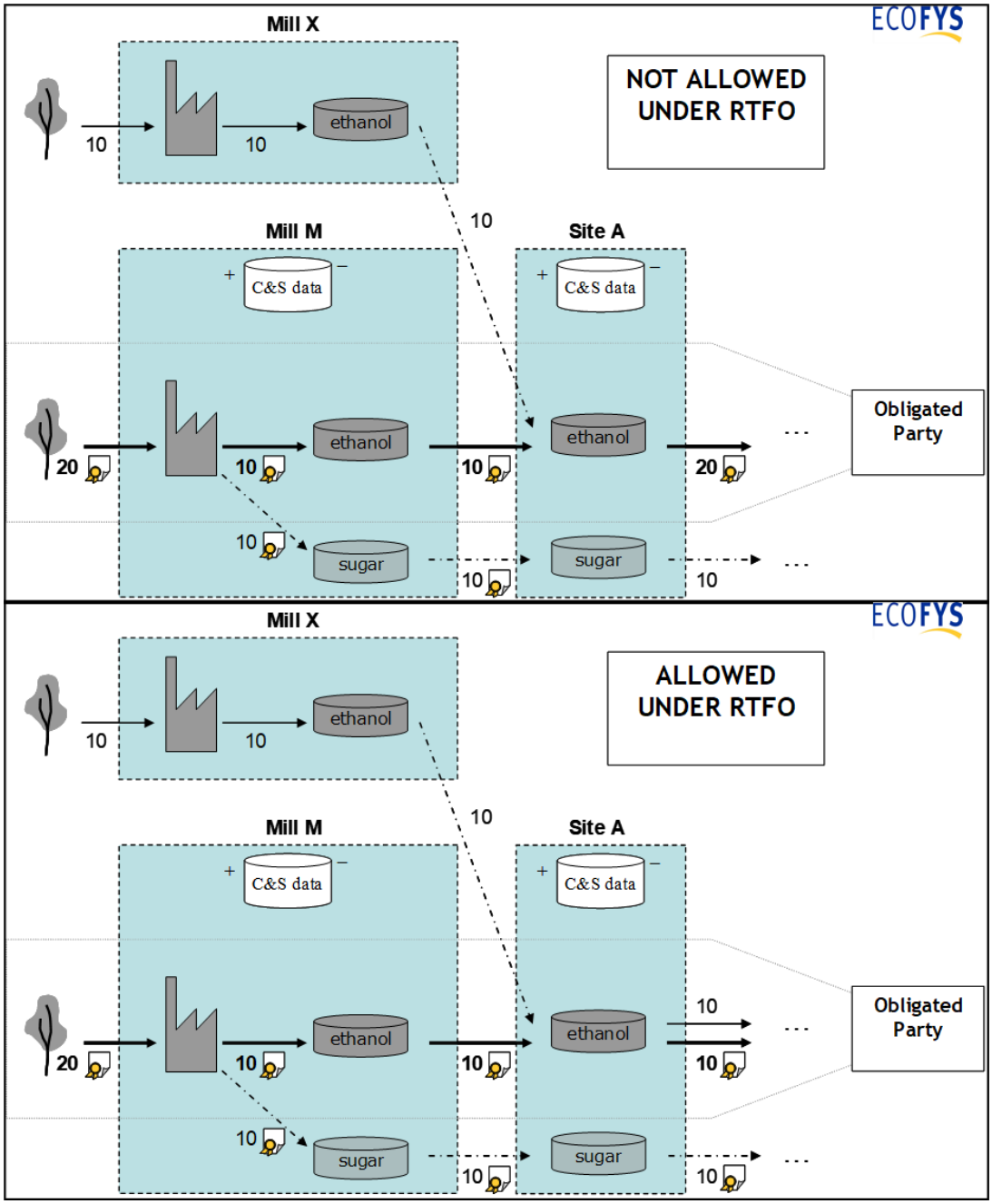


**Figure 4** Examples of transfers of C&S data between different feedstock-derived products. The certificate represents the flow of certified products.

# 4. Determining the eligible portion of a partially eligible fuel.

## Partial low carbon fuels and co-processing

4.1 Some low carbon fuel production processes involve both eligible low carbon and ineligible feedstocks as inputs, for example:

- Where a finished fuel or intermediate is produced by reacting inputs of eligible low carbon origin with inputs of ineligible origin, resulting in a partial low carbon fuel.
- Where intermediate products of eligible feedstocks and intermediate products of ineligible feedstocks are co-processed together in the same refinery (or standalone processing plant), resulting in a blend of eligible low carbon and ineligible fuel

4.2 The guidance in this subsection explains how to calculate the volume of eligible low carbon or renewable fuel produced where a mix of eligible and ineligible feedstocks, or a mix of different kinds of eligible feedstocks (e.g. RFNBOs and biofuels), are used as inputs to the process. This section does not apply when consignments of fuel are blended together after processing. In that case, the guidance on mass balance for assigning quantities of fuel to feedstocks should be followed see Chapter 3.

4.3 In the case of partially eligible fuels, the low carbon portion of the fuel is eligible for Certificates and can count towards meeting a supplier's obligation if it meets the carbon and sustainability criteria (see Chapter 5). The non-eligible or ‘unsustainable’ portion of a partially low carbon fuel is not eligible for Certificates and may add to a supplier's obligation (see paragraph 2.5). The Administrator considers that in the case of co-processed fuels, the non-eligible portion of the resulting fuel is a distinct fuel and therefore is only subject to an obligation if it is of an obligated fuel type (i.e. petrol, diesel, gas oil or kerosene (under the SAF Mandate))

4.4 The guidance in this section applies specifically to biofuels and RCFs. Guidance on calculating the RFNBO/PtL portion of a fuel that is part RFNBO/PtL, part non-RFNBO/PtL follows from paragraph 4.31 onwards.

## Calculating the amount of eligible low carbon fuel produced by a process

4.5 Partially eligible and co-processed fuels do not have discrete volumes that are eligible or ineligible. In order to determine how much of the fuel is eligible for Certificates, the volume of the fuel has to be split into notional eligible and non-eligible portions that are treated as distinct consignments for the purposes of the RTFO and SAF mandate.

4.6 The percentage of a product(s) that is low carbon is determined based upon the percentage (by energy) of all of the feedstocks to the production process that are of eligible low-carbon origin. A feedstock is here defined as any energy containing material[11] entering a processing unit which contributes atoms to the fuel. Therefore, feedstocks include biomass and fossil inputs as well as any process chemicals that contribute atoms to the fuel[12].

4.7 The eligible percentage of the product(s) is then calculated using the following equation:

$$\text{MJ of eligible fuel} = \frac{\text{MJ of eligible feedstocks}}{\text{MJ of all feedstocks}} \times \text{MJ of fuel produced}$$

where the energy within each feedstock in MJ is the feedstock mass flow over a given period multiplied by the respective feedstock lower heating value (LHV) over that period (taking account of water content, see paragraph 4.8). Figure 5 also illustrates this calculation for a simple example.

4.8 Where a feedstock contains water, the energy in MJ contributed by that feedstock should be calculated as follows:

$$\text{MJ of feedstock} = \text{Mass of material}_{wet} \times \text{LHV}_{dry} \times (1 - \%\ \text{water content})$$

4.9 Under the RTFO, the eligible percentage of HVO, FAME, ethyl tert-butyl ester (ETBE), methyl tert-butyl ester (MTBE) is defined in Article 4 of the RTFO Order (see Table 3). These values must be used when reporting the volume of low carbon fuel produced via these processes. If a supplier's process for the production of one of these fuels differs from that defined in Table 3, the supplier should contact the Administrator.

4.10 Under the SAF Mandate, there is an exception to the definition of a feedstock in 4.6 where hydrogen is used in the refining of fuel (e.g. hydrotreating) or in the production of fuel from fuel-like hydrocarbon precursors (e.g. vegetable oils or

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[11] Inputs such as water and $CO_2$ are not considered feedstocks as they do not contribute any energy to the process.

[12] For example, in the case of hydroprocessing, hydrogen used to remove impurities such as sulphur would not be considered a feedstock and so should not be taken into account for the purposes of the calculation in paragraph 4.7 (unless it can be demonstrated that the hydrogen contributes atoms to the finished fuel). Conversely, hydrogen used to saturate the fuel does contribute atoms and so would be considered a feedstock and so should be taken into account for the purposes of the calculation in paragraph 4.7. In uncertain cases, elemental analysis can be used to determine whether a hydrotreating step increases the hydrogen content of the finished fuel.

crude hydrocarbons). In this case the hydrogen is considered a process input not a feedstock and the emissions related to the production of the consumed hydrogen will need to be reflected in the final fuel CI, but the renewability of the hydrogen used in this case will not be considered for the purpose of determining the renewability of the final fuel.

4.11 In contrast, under the SAF Mandate, where hydrogen is used directly in the production of hydrocarbon fuels (synthetic fuels) prepared from smaller carbon molecules (e.g. CO, $CO_2$), the hydrogen should be treated as a precursor and the feedstock used in the production of the hydrogen should therefore be considered in determining the renewability of the final fuel.

4.12 Where ineligible hydrogen is a chemical precursor to the fuel, elemental analysis should be used to determine its contribution to the energy content of the finished fuel.

4.13 If suppliers require further information on the appropriate treatment of hydrogen used in the production of SAF, or the appropriate application of paragraphs 4.10 - 4.12 they should contact the Administrator.

| Fuel | Production process | Eligible proportion of fuel |
|---|---|---|
| Hydrotreated vegetable oil (HVO) and hydroprocessed esters and fatty acids (HEFA) | Vegetable oils wholly from biological sources, hydrotreated with hydrogen (or methane) either wholly from fossil sources or from biomass - could be located at a refinery or as a standalone plant | 100% |
| | Vegetable oils wholly from biological sources, co-processed with fossil crude oil in a refinery | Eligible proportion of each product set using the equation in paragraph 4.7, considering the share of crude oil and vegetable oil inputs (on an energy basis)[13] |
| | Any other production process | Contact Administrator |
| Fatty acid methyl esters (FAME) | Transesterification of vegetable oils wholly from biological sources, with methanol either (i) wholly from biomass or (ii) from fossil sources | 100% |
| | Any other production process | Contact Administrator |
| Bio-ethyl-tertiary-butyl-ether (Bio-ETBE) | Produced from ethanol wholly from biological sources and fossil isobutylene (2-methyl-propene) | 47% (by volume) |
| | Any other production process | Contact Administrator |
| Bio-methyl-tertiary-butyl-ether (Bio-MTBE) | Produced from methanol wholly from biological sources and fossil isobutylene (2-methyl-propene) | 36% (by volume) |
| | Any other production process | Contact Administrator |
| All other partially low carbon fuels | Renewable feedstock only | 100% |
| | Mixed renewable and non-renewable feedstock | Calculated according to equation in paragraph 4.7 |

**Table 3** Eligible portion of partially low carbon fuels

[13] The fossil diesel component of the blended fuel is not eligible for RTFCs.

4.14 Note that, for feedstocks that are a mix of eligible and non-eligible fractions, these should be treated as two separate feedstocks (one wholly eligible, one wholly ineligible), each with their own LHV (MJ/kg) for the purposes of this eligibility calculation.

4.15 Where multiple products are produced in a process from a mix of eligible and ineligible feedstocks, each co-product from the fuel production process should be assigned the same percentage eligibility as the main product, this is illustrated in Figure 5.

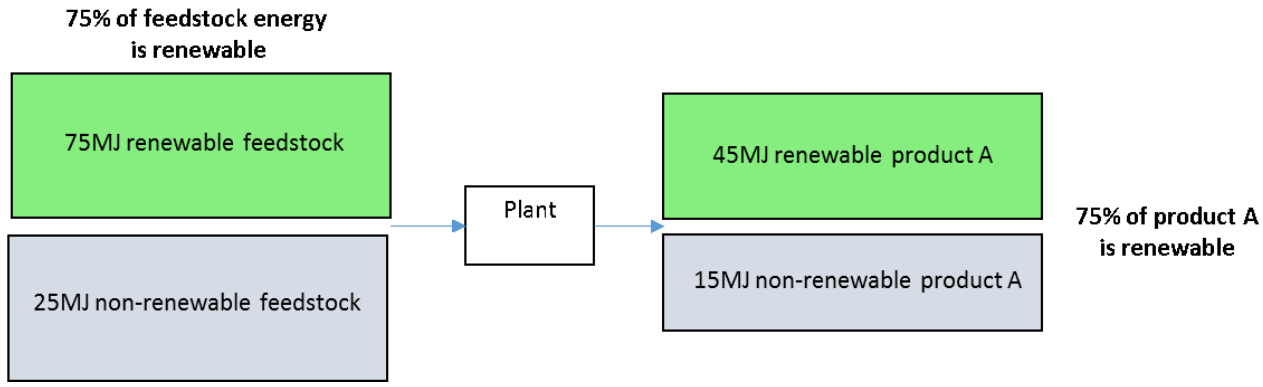


**Figure 5** Calculating the amount of eligible low carbon fuel from a partially low carbon fuel production process

4.16 Where multiple different kinds of eligible low carbon fuels, intermediates, or feedstocks are co-processed together to produce intermediate or finished fuels, the proportion of the intermediate or finished fuel of each type should be calculated on an LHV energy basis using the equation in paragraph 4.7. This is illustrated in Figure 6.

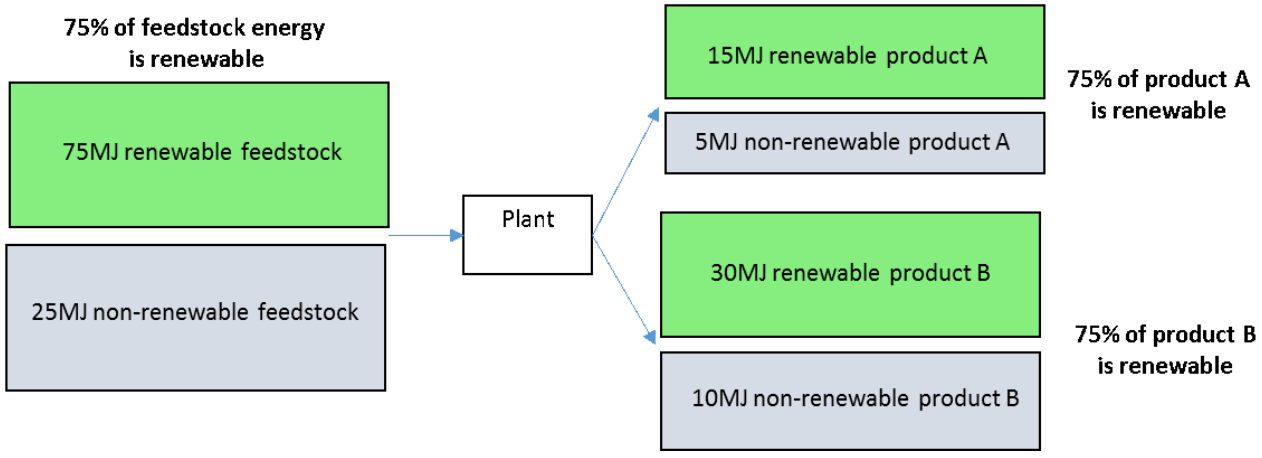


**Figure 6** Calculating the amount of low carbon fuel from a partially low carbon fuel production process when there are multiple products / co-products

4.17 An illustrative example is provided in Figure 7 for a hypothetical process which would produce a part-ineligible fossil, part-RFNBO, part-biofuel and part-RCF fuel.

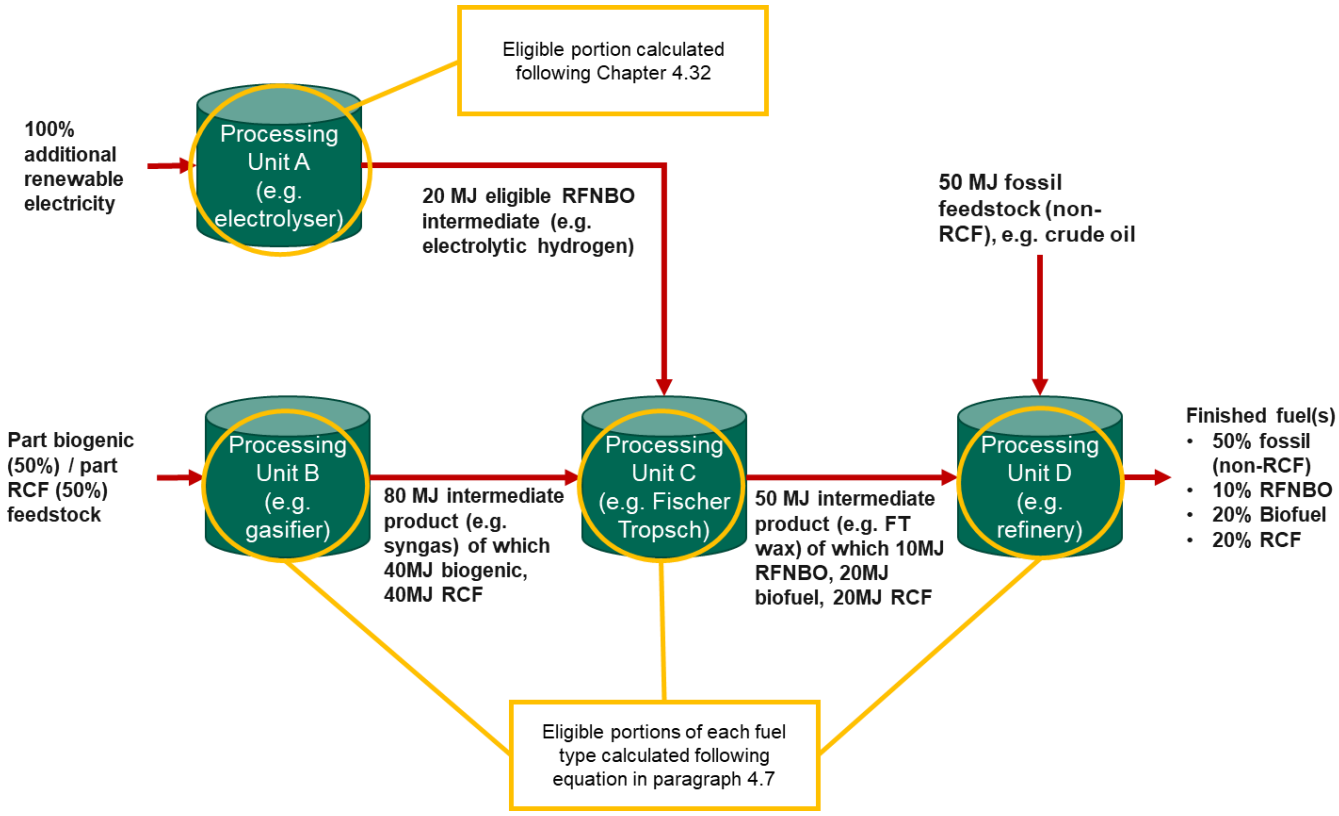


**Figure 7** Illustrative example of how the eligible portion(s) of finished fuel(s) can be calculated for complex production pathways involving multiple fuel/feedstock types and/or processing

4.18 Where a supplier has an alternate method of allocating the proportion of eligibility, the Administrator may consider this on a case-by-case basis. For example, radiocarbon ($^{14}C$) testing or yield-based methods[14]. However, radiocarbon ($^{14}C$) testing is not always suitable for determining the eligibility of the fuel produced (e.g. due to the variable ratio of carbon to hydrogen atoms in different feedstocks), so its use is subject to agreement with the Administrator.

## Evidence required to demonstrate the proportion of eligible feedstock

4.19 The Administrator requires evidence as to the amount of eligible feedstock entering a partially eligible fuel production process. The Administrator will not issue Certificates until satisfied that the percentage of that fuel that is eligible is correct. In order to report the percentage eligibility of their products according to the equation in paragraph 4.7, suppliers must evidence the mass and LHV energy content of each feedstock entering the plant over the time period. If feedstocks enter the plant as a mixture of eligible and non-eligible material (e.g. mixed MSW) then suppliers must evidence the mass and LHVs of both the

[14] Yield-based methods involve using experimentation to establish the relationship between the inputs and outputs to a process. For example, a process could be run with and without the renewable feedstock and the difference in yields calculated to determine the relative contribution of the renewable feedstock to the outputs.

eligible and non-eligible components, as they are considered separate feedstocks for the purposes of the equation in paragraph 4.7.

4.20 The supplier must provide assurance to the Administrator that there is a Feedstock Measurement and Sampling (FMS) regime in place that allows the variability of feedstock characteristics to be known over time. Suppliers must have contacted the Administrator and reached an agreement on the type of FMS to be employed before applying for Certificates.

4.21 As part of the FMS regime, suppliers must agree with the Administrator how often the percentage eligibility of their products must be re-calculated, and the evidence required to support this calculation. This re-calculation is likely to be required at least every three months for the first year that a supplier receives Certificates and will likely be more frequent if the relative mass flows or characteristics of the eligible feedstocks are highly variable. For characteristics that do not vary over time, fixed values can be used for each calculation. Future years might have less frequent re-calculation, but the Administrator may check the supporting evidence for any time period and reinstate more frequent re-calculations if appropriate.

4.22 The frequency of sampling required depends on whether these characteristics change over time. More frequent sampling will be required for production plants:

- With variable mass flows (e.g. operators controlling the fraction of renewable feedstocks they use).
- Using feedstocks with LHVs that vary over time.
- Using feedstocks with a variable mass fraction of renewable and non-renewable components over time.

## Assessing the sustainability of the eligible portion of partially low carbon fuels

4.23 The calculated eligible portion of the partially eligible fuel is treated as an eligible fuel and subject to the same assessment of sustainability as wholly eligible fuels before Certificates are applied for. Should this calculated volume of eligible fuel not meet the sustainability criteria then it adds to, and cannot count towards meeting, the supplier's obligation.

4.24 For the purposes of sustainability reporting, every feedstock is considered to be a separate consignment, and any non-eligible feedstock is not included within the scope of the sustainability assessment.

4.25 Assessment of the sustainability characteristics and GHG emissions of the eligible portion of the partially eligible fuel is outlined in Chapter 5**.**

## Assigning eligibility between different consignments of the same product

4.26 Eligibility cannot be re-assigned between chemically different products coming out of the process. For example, in Figure 6, none of the eligibility of Product A

can be assigned to Product B, so the operator cannot choose to generate more or less than 15 MJ of renewable Product A.

4.27 However, eligibility can be re-assigned between different consignments of the same (chemically identical) product made from a partially eligible process. This means, for example, that if a process produces a product that is 75% eligible (based on the MJ of the input feedstocks), the supplier can choose to do one of the following:

- Sell all of their product as 75% eligible (so that each 1 litre of fuel contains a 0.75 litres consignment of eligible low carbon fuel attracting, say, 1 RTFC per renewable litre). In the example if the volume is 100 litres, this would include 75 renewable litres and at a rate of 1 RTFC per renewable litre would attract 75 RTFCs.
- Sell 75% of the product as a 100% eligible consignment (so that each 1 litre contains 1 litre of low carbon fuel) and sell the remaining 25% of the product consignments as non-eligible consignments (so that each 1 litre contains 0 litres of low carbon fuel), potentially in a different end market or outside of the UK. This gives the supplier flexibility to determine which markets its eligibility should be rewarded by, rather than having to also sell the non-eligible fraction into the UK fuel market, potentially attracting an obligation.

4.28 Any re-assignment of eligibility between chemically identical consignments of a given product is acceptable (e.g. the supplier could sell a particular product as 22% renewable if they wish), provided that the equation in paragraph 4.7 still holds true for the total amount of that product made at that facility.

4.29 For example, if a process uses 75% eligible feedstocks (based on the MJ of the input feedstocks) and produces ethanol and butanol, eligibility can be assigned between different consignments of ethanol to produce some consignments of 100% eligible ethanol and some consignments of 100% ineligible ethanol (because the eligible ethanol and the ineligible ethanol produced in this process are chemically identical). However, eligibility cannot be assigned between the ethanol and butanol: 75% of all butanol produced is eligible and 75% of all ethanol produced is eligible.

4.30 Once eligibility has been assigned from the process, each consignment of each product must be sold with the appropriate eligibility information. Downstream fuel mixing is subject to the usual mass balance rules (see Chapter 3), which provides another potential opportunity to change fuel eligibility percentages, provided the total eligible mass output from the tank equals the total eligible mass input. Any fuel designated as non-eligible must not be sold with the characteristics of eligible fuel in an alternative market.

# Determining the eligible portion of a RFNBO (RTFO) or a PtL fuel (SAF Mandate)

## General conditions

4.31 For the purpose of the RTFO, RFNBOs are generally made using renewable electricity as the energy source. The proportion of the fuel that is considered eligible depends on the status of the electricity the fuel is derived from and whether this electricity meets the criteria for additionality[15] or regionalisation[16] described in this Chapter (paragraphs 4.47 & 4.49). These scenarios are summarised in Table 4 and a flow diagram is provided in Figure 8.

4.32 For the purpose of the SAF Mandate, PtL fuels can be made using renewable (non-bioenergy) or nuclear power as the energy source. To be eligible for PtL SAF Certificates, the final fuel must be avtur certified to the appropriate technical standard. Where the final fuel is not avtur, the same eligibility rules apply, but the final fuel is eligible for Main SAF Certificates. As in the RTFO, the proportion of the fuel that is considered eligible depends on the status of the electricity the fuel is derived from and whether it meets the criteria for additionality[15] or regionalisation[16] described in this Chapter (paragraphs 4.47 & 4.49). These scenarios are summarised in Table 4 and a flow diagram is provided in Figure 8.

4.33 Where additionality is demonstrated for all of the electricity consumed which contributes directly to the energy content of the fuel, and all of that electricity is derived from eligible sources, the fuel can be considered to be 100% RFNBO/PtL. Where some of the electricity input is derived from non-eligible sources, the amount of eligible RFNBO produced should be calculated using the following equation:

$$\text{MJ of RFNBO/PtL} = \frac{\text{MJ of eligible inputs}}{\text{MJ of all energy inputs}} \times \text{MJ of fuel produced}$$

- Under the RTFO eligible inputs are renewable (non-bioenergy) inputs
- Under the SAF mandate eligible inputs are renewable (non-bioenergy) and nuclear energy inputs

4.34 In some situations, the criteria for additionality may only be met for a proportion of the electricity supplied, for example where an electricity production site provides insufficient electricity to the grid to meet the demand from the RFNBO/PtL production site (as calculated in paragraph 4.57). In such cases, the fuel should be divided into consignments, first using the proportion of the eligible electricity supplied that meets the additionality criteria to derive a

[15] "Additionality" refers to whether the renewable energy can be considered additional, in that it is produced from new, upgraded or recommissioned production capacity, and/or it wouldn't have been produced or would have been wasted if it were not consumed in the RFNBO production process.

[16] "Regionalisation" refers to whether the grid in question can be reasonably considered to be a separate electricity grid from the relevant national grid.

RFNBO/PtL consignment (Figure 8). Other consignments derived from electricity which does not meet the additionality criteria should revert to using grid average figures for determining the share of these other consignments that are eligible (Scenarios 1 or 2 in Table 4).

4.35 In all cases, suppliers must be able to demonstrate evidence of where the electricity used in fuel production has been sourced from. Where applicable, suppliers must also be able to provide evidence that their circumstances meet the criteria for regionalisation and/or additionality. Such evidence is likely to take the form of commercial documentation such as contracts, invoices and meter readings.

4.36 If a fuel is made using heat rather than electricity and not all of the heat is from non-bioenergy renewable sources, the amount of eligible RFNBO/PtL produced should be calculated consistent with the formula in paragraph 4.33.

4.37 The default position where a fuel is made using electricity is that the eligible portion of the fuel is equal to the proportion of supply from eligible sources **(non-biomass renewable sources for the RTFO, and non-biomass renewable sources plus nuclear sources for the SAF mandate)** in the national grid they are drawing electricity from (Scenario 1 in Table 4). This should be calculated using either:

- Annual grid averages from the relevant competent authority[17] for the most recent available full year.
- Real-time figures for each 30-minute period, where this supply proportion data, and the corresponding whole life-cycle carbon intensity for the consumed electricity (see Annex D, paragraphs D.16 to D.18), is available from a reliable and authoritative sources[18] (also see paragraph 4.39).

4.38 An individual production site must use either annual grid averages or real-time figures for fuel supplied within a given obligation year, it is not permitted to switch between the two.

Gross imports of electricity into the national grid should be taken into account when calculating the proportion of supply from the national grid that is eligible. Imported electricity should be assumed to be non-eligible unless it can be demonstrated otherwise using reliable data from the relevant competent authority.

4.39 Where real-time figures are used, it is permissible to calculate the eligibility over periods of continuous production longer than 30 minutes (up to a maximum of 12 months). This average should be weighted based on the electricity consumed in each 30-minute period within the period chosen. The period used

[17] For the purposes of this guidance, the “relevant competent authority” might include government departments, regulators or network operators.

[18] The Administrator is not currently aware of any robust data sources that provide the necessary real-time data on both the share of non-bioenergy renewables as well as the whole life-cycle carbon intensity taking into account direct generation, well-to-tank and transmission and distribution emissions (see paragraph D.16). The Administrator will keep this position under review as new data sources emerge.

should exactly match the period used for determining the weighted average carbon intensity of the electricity consumed (see Annex D, paragraph D.15).

4.40 There are three exceptions to the default position set out in paragraph 4.37:

- If a production site is connected to an electricity grid that meets the criteria for regionalisation (paragraph 4.47) then the RFNBO/PtL portion of the fuel produced at that site is calculated in the same way as described in paragraph 4.37 but for the regional rather than national grid (Scenario 2, Table 4)
- If the eligible electricity meets the criteria for additionality (paragraph 4.49) then it can be considered additional eligible electricity and the RFNBO/PtL portion of the fuel should be calculated as described in paragraph 4.33 (Scenario 3, Table 4).
- If the eligible electricity is not new generation capacity (paragraph 4.52[19]) but otherwise meets the criteria for additionality (paragraph 4.49) and associated evidence requirements (Table 5), then it can be considered 100% eligible and the RFNBO/PtL portion of the fuel should be calculated as described in paragraph 4.33 (Scenario 4, Table 4)[20].

4.41 It is also permitted to produce a consignment of RFNBO/PtL using a portion of electricity which meets the criteria for additionality (Scenario 3, Table 4) and a portion of electricity not from new generation capacity but which otherwise meets the criteria for additionality (Scenario 4, Table 4). This mix of Scenario 3 and Scenario 4 is labelled Scenario 5 in Table 4. To make use of this scenario, the following conditions apply:

- The carbon intensity of the electricity used to produce the RFNBO/PtL must be calculated based on a weighted average carbon intensity (see paragraph D.1) over the period chosen by the supplier.
- The weighted average should be calculated over the one single period of continuous operation and for the same production facility[21].
- The maximum period over which the weighted average can be calculated is 12 months.
- The finished fuel must meet the required GHG emission saving requirement, which is 40% of the SAF Mandate and 65% for the RTFO (see paragraph 5.13).

4.42 The GHG emissions associated with the eligible energy consumed must be taken into account when calculating the overall GHG emissions of the RFNBO/PtL following the methodology set out in Annex D. The factor to be used for each scenario is set out in Table 4 and is zero for wholly additional eligible electricity. See Annex D, paragraph D.13 for more details.

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[19] As per paragraph 4.52, new generation capacity in the context includes new, upgraded, life-extended or recommissioned sites.

[20] Note that Scenario 4 cannot be utilized when there is no grid connection.

[21] It is permissible during this continuous period of time for one or more of the sources of renewable electricity to be supplying no electricity for some of this period (e.g. solar power would only be contributing during daylight hours) but the electrolyser itself must be continuously operating over the period chosen.

4.43 Where a supplier produces both eligible and non-low carbon fuel at the same plant, they must keep adequate records that demonstrate that they have followed the principles of mass balance in accounting for and tracking the RFNBO/PtL portion.

4.44 Eligibility can be re-assigned between different consignments of the same chemically identical product made from a part RFNBO/PtL, part non-RFNBO/PtL process, as for partial biofuels (see paragraph 4.27). Eligibility cannot be re-assigned between chemically different products.

4.45 Each consignment of each product must be sold with the correct eligibility information. For example, any non-eligible portion must not be sold as low carbon fuel.

| Scenario | Description of electricity supply | Methodology for calculating RFNBO/PtL portion | GHG intensity of the electricity consumed | Evidence requirements |
|---|---|---|---|---|
| 1 | Electricity drawn from a national grid, no additionality or regional grid demonstrated | Proportional to the percentage supply from eligible sources in the national grid | Grid average or real-time GHG intensity (national) | Evidence of connection to and electricity supply from the national grid |
| 2 | Electricity drawn from a regional grid; no additionality demonstrated | Proportional to the percentage supply from eligible sources in the regional grid | Grid average or real-time GHG intensity (regionalised) | Evidence of connection to and electricity supply from the relevant regional grid |
| 3 | Electricity that meets the criteria for additionality | Proportional to the eligible electricity used in production (paragraph 4.33) | Zero[22] | Evidence of additionality relevant to the specific case (see paragraph 4.51) |
| 4 | Electricity that meets cases B or C in the criteria for additionality (paragraph 4.50) except it is not from new generation capacity (paragraph 4.52)[23] | Proportional to the eligible electricity used in production (paragraph 4.33) | Grid average or real-time GHG intensity (national or regional as appropriate) | Evidence of additionality relevant to the specific case (see paragraph 4.51), excluding paragraph 4.52 |
| 5 | A mix of electricity sources, a portion meeting scenario 3, and a portion meeting scenario 4 (see paragraph 4.41) | Proportional to the eligible electricity used in production (paragraph 4.33) | A weighted average of the electricity supplied under the two scenarios (see paragraph D.17) | As per Scenario 3 and Scenario 4 |

**Table 4** Summary of scenarios for producing RFNBOs using electricity and corresponding renewable portions, input electricity GHG intensity and evidence requirements

[22] For the purposes of the SAF Mandate, in the case of additional nuclear energy, upstream emissions must be accounted for. Please contact the administrator for further detail.

[23] Note that Scenario 4 cannot be applied to cases A or D in Table 5.

4.46 A flow diagram for determining which scenario applies is provided in Figure **8**.

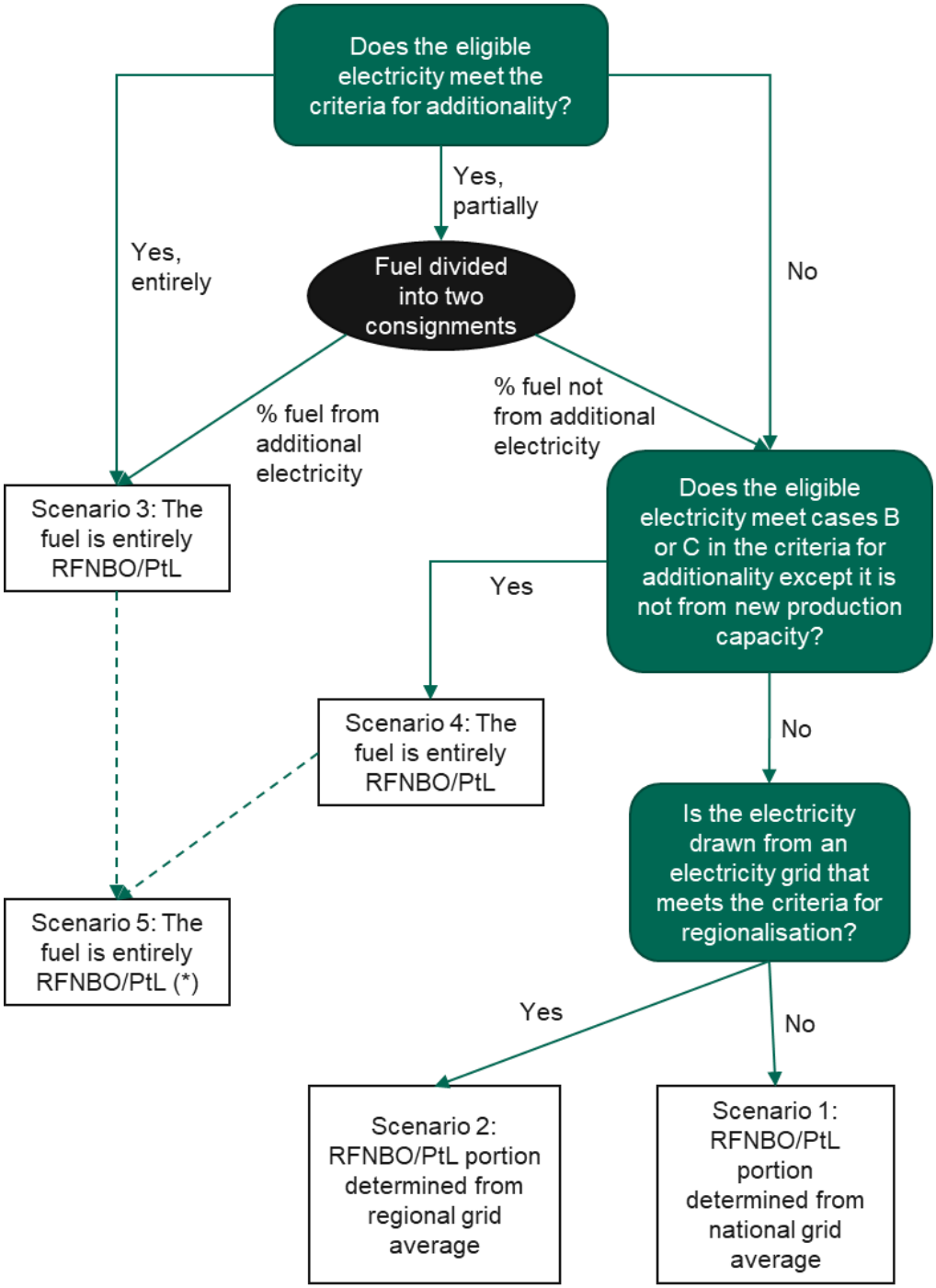


**Figure 8** Flow diagram for determining what methodology to use when determining the proportion of a fuel which can be considered a RFNBO. (*) Scenario 5 corresponds to fuel produced from a mix of electricity meeting Scenario 3 and Scenario 4 – see paragraph 4.41

Eligible energy / electricity sources are as follows: RTFO – non bioenergy renewables only
SAF Mandate – non bioenergy renewables and nuclear

## Criteria for regionalisation

4.47 If the electricity grid a production site is connected to can be reasonably considered under the criteria set out in paragraph 4.48 to be a distinct electricity grid from the relevant national grid, suppliers may use data from that electricity grid rather than the national grid in determining the portion of their fuel which is defined as a RFNBO.

4.48 An electricity grid meets the criteria for regionalisation if it meets one of the following conditions:

- The relevant competent authority[24] considers and manages the grid in question as a physically separate electricity grid which does not directly reflect national boundaries, as is the case in North America.
- It can be demonstrated that there is no physical connection between the electricity grid that the production site is connected to and the national grid of the country in which the production site it is located.
- It can be demonstrated that there is a systematic grid congestion which prevents eligible energy generated supplied into a sub-grid from being supplied to the wider national grid.

## Criteria for additionality

4.49 The eligible electricity used in RFNBO/PtL production is considered to be "additional eligible energy" if the electricity would not have been produced, or would have been wasted, if not consumed by the RFNBO/PtL production site. Suppliers can demonstrate that their process is consuming additional renewable energy if they can provide evidence to satisfy one of the criteria listed in paragraph 4.50.

4.50 Eligible electricity meets the criteria for additionality if it meets one of the following cases (subject to also meeting the conditions and evidence requirements outlined in paragraphs 4.51-4.60 and Table 5):

**A - Direct line, no grid connection:** The electricity production site is directly connected to the RFNBO/PtL production site with no connection to an electricity grid.
**B- Direct line, grid connection:** The electricity production site is connected directly to the fuel production plant and the electricity grid, and the fuel production plant can evidence that their consumption has been provided by the electricity production site without importing electricity from the wider grid.
**C- Additional capacity via an electricity grid:** The electricity production site (or a proportion of it) is new, upgraded or recommissioned, and/or it was specifically built, upgraded, life-extended or brought back into service for the purposes of providing electricity via an electricity grid to a given RFNBO/PtL production site.

[24] For the purposes of this guidance, the "relevant competent authority" might include government departments, regulators or network operators.

**D- Curtailment and wastage:** The eligible electricity used is electricity which would have led to curtailment or been wasted if not consumed by the RFNBO/PtL production site.[25]
**E - Other:** The supplier can provide evidence relating to a case not specified above that satisfies the Administrator that the eligible electricity is additional.

4.51 The specific conditions and evidence requirements for cases A to D described in paragraph 4.50 are summarised in Table 5 and described in paragraphs 4.52-4.60. The evidence requirements for case E will depend on the specific situation and will be at the discretion of the Administrator.

| Case | New generation capacity (Par. 4.52) | Temporal correlation (Par. 4.54) | Purchase agreement (Par. 4.56) | Grid losses (Par. 4.57) | Grid congestion (Par 4.59) |
|---|---|---|---|---|---|
| A – Direct line, no grid connection | ✓ | ✗ | ✗ | ✗ | ✗ |
| B – Direct line, grid connection | ✓ | ✗ | ✗ | ✗ | ✗ |
| C – Additional capacity via an electricity grid | ✓ | ✓ | ✓ | ✓ | ✓ |
| D – Curtailment and wastage | ✗ | ✓ | ✓ | ✓ | ✓ |
| E - Other | ? | ? | ? | ? | ? |

**Table 5** Summary of conditions and evidence requirements for each case described in paragraph 4.49

4.52 For cases A to C in paragraph 4.50, a supplier must demonstrate that the eligible electricity consumed is from new generation capacity at a new, upgraded, life-extended or recommissioned site. For new, upgraded or recommissioned sites, evidence should be provided to demonstrate that the new generation capacity came online at the same time or after the RFNBO/PtL production site started operating. For life-extended sites, it should be demonstrated that the electricity production site would have ceased being able to operate without investment as a result of demand from the RFNBO/PtL production site and that this life-extension was completed at the same time or after the RFNBO/PtL production site started operating.

4.53 At the discretion of the Administrator, an exception to paragraph 4.52 may be permitted if it can be demonstrated that there was a clear intention before the new generating capacity came online for the eligible electricity generated, or a portion of it, to be consumed by the RFNBO/PtL production site. This could be demonstrated through:

- planning permissions or other appropriate documentation that show that the fuel production plant was intended to start operation before or at the same time

[25] Curtailment and wastage could involve electricity that has been consumed as part of a balancing mechanism or from a eligible electricity generation facility which would have been curtailed but instead provided electricity to the electrolyser. Exact evidence requirements will depend on the specific case and should be discussed with the Administrator.

as the new generation capacity came online but was delayed due to unforeseen circumstances

- contractual arrangements (e.g. heads of terms, exclusivity agreements) between the electricity generator and the RFNBO/PtL producer, in place before the new generating capacity came online, demonstrating a clear intention for the RFNBO/PtL production site to consume electricity from the electricity production site

4.54 For cases C and D in paragraph 4.50, temporal correlation between electricity generation and electricity consumption must be demonstrated for example through the provision of metering data. This can be demonstrated over a settlement period of up to 30 minutes.[26] For each balancing period it must be demonstrated that the amount of eligible electricity consumed by the RFNBO/PtL production site was not more than the eligible electricity supplied by the electricity production site(s) exclusively for use by the RFNBO/PtL production site.

4.55 For the purposes of demonstrating temporal correlation (paragraph 4.54), it is permissible to use energy storage such as batteries to buffer the electricity supply because the use of electricity by an on-site energy storage asset would be considered electricity consumption by the RFNBO/PtL production plant. However, for any electricity stored rather than immediately consumed by an electrolyser, evidence must be provided to demonstrate that this power was stored in the energy storage asset between the time of consumption from the electricity grid to the time of consumption by the electrolyser.

4.56 For cases C and D in paragraph 4.50, an eligible power purchase agreement (PPA), or equivalent contractual mechanism, must be in place between the electricity producer and the RFNBO/PtL producer for an amount of electricity equivalent to the amount that is claimed as additional eligible electricity. Both direct/sleeved and portfolio/aggregated PPAs are permitted. Where the same legal entity operates both the electricity and RFNBO/PtL production sites a PPA is not required but equivalent documentation must be provided to demonstrate that the claimed eligible electricity was supplied to the grid exclusively for use by the RFNBO/PtL production site and was not consumed or sold for use elsewhere.

4.57 For cases C and D in paragraph 4.50, suppliers must take into account grid technical losses when determining the amount of additional eligible electricity supplied. This means that the corresponding amount of eligible electricity (EE) that needs to be supplied to the grid should be calculated as follows:

EE supplied to grid (kwh) = EE extracted from grid (kwh) × (1 + grid loss factor)

[26] Please note that this does not mean that there needs to be one consignment of fuel per 30-minute settlement period. Consignments of fuel simply need to have the exact same sets of 'set of sustainability characteristics' and associated with a particular reporting month or quarter. See paragraph 4.39.

4.58 For the purposes of paragraph 4.57, suppliers may use a default grid loss factor of 0.1 (i.e. 10%) for UK networks. Alternatively, figures provided by the relevant network operator (or other reliable source) for technical losses may be used.

4.59 For cases C and D in paragraph 4.50, a supplier must be able to demonstrate that there is no systematic grid congestion between the eligible electricity production site(s) and the RFNBO/PtL production site.

4.60 For cases C and D in paragraph 4.50 where RFNBOs/PTL are produced from additional eligible electricity supplied through the electricity grid in a country where a guarantees of origin (GOs) or equivalent system is in place, suppliers must be able to demonstrate evidence on request, that the Certificates associated with the renewable electricity consumed have not been transferred to a party other than either the hydrogen producer or the original generator/supplier of the electricity.

# 5. Carbon and sustainability requirements

**Chapter summary**

This chapter introduces the requirements for carbon and sustainability (C&S) reporting by fuel suppliers to the Administrator. This reporting is necessary to demonstrate compliance with the sustainability criteria and to gain Certificates. It includes who needs to report, what information should be reported, and when. It also covers verification requirements.

5.1 This chapter aims to provide assistance on carbon and sustainability (C&S) reporting under the RTFO and SAF Mandate.

## Who should report C&S information to the Administrator

5.2 Renewable Transport Fuel Certificates (RTFCs) and SAF Certificates (SAFCs) are the mechanism by which suppliers demonstrate compliance with the RTFO and SAF Mandate. Suppliers may apply for Certificates for all eligible low carbon fuels owned at the duty point (or alternative assessment point) where this is specified in Chapter 1 of the respective RTFO and SAF Mandate Compliance Guidance.

5.3 Any parties wishing to claim Certificates are required to report all fuel quantities to the Administrator. Reporting of fuel quantities and obligations are covered separately in the RTFO Compliance Guidance and the SAF Mandate Compliance Guidance.

5.4 All suppliers wishing to apply for Certificates for their eligible fuels must report independently verified information on the sustainability of their fuels to the Administrator. To do this, suppliers must submit verified C&S reports which demonstrate compliance with the RTFO or SAF Mandate sustainability criteria via an IT system called the Renewable fuels Operating System (ROS). Account holders who purchase Certificates do not have any C&S reporting requirements with respect to the purchased Certificates. The Administrator may still request

additional information or evidence for any or all steps in the supply chain, so the supplier must ensure that evidence of compliance with the relevant criteria for each step in the supply chain is available on request. Where an obligated party fails to provide sufficient information or evidence to substantiate claims, Certificates will not be issued, and the fuel will be treated as fossil for the purposes of calculating the supplier's obligation.

5.5 Note that any eligible fuels which do not meet the mandatory sustainability criteria, or which do not receive independent verification will not be awarded Certificates and will be treated as fossil fuel and will incur an obligation under the RTFO or SAF Mandate.

## C&S requirements

5.6 To be awarded Certificates, suppliers must be able to demonstrate that the supplied fuel meets the C&S requirements of the RTFO/SAF Mandate. These requirements are that the fuel meets the relevant sustainability criteria and that a complete chain of custody can be demonstrated in order to track C&S data back to its original source following the principles of mass balance.

5.7 Under the RTFO, additional sustainability information must also be reported for crop-derived biofuels (see paragraph 5.20 onwards). This information is not explicitly required for Certificate applications but if it is not provided in full within verified Certificate applications suppliers must submit a separately verified annual report containing the missing information.

5.8 All C&S information reported to the Administrator must be independently verified.

5.9 This subsection outlines the above-described requirements which are then described in more detail in the subsequent chapters of this document.

### Sustainability criteria

5.10 To be eligible for Certificates under either the RTFO or SAF Mandate, a fuel must demonstrate compliance with the relevant carbon and sustainability criteria.

5.11 The exact criteria which a given low carbon fuel application must meet depends on the feedstock from which it is made, as set out in Table 6:

| Feedstock | GHG emissions saving threshold | Land criteria | Forest criteria | Soil carbon criteria | Sustainable waste management criteria |
|---|---|---|---|---|---|
| Crops and any other eligible feedstock not falling within entries listed below | ✓ | ✓ | ✗ | ✗ | ✗ |
| Forest biomass, including residues from forestry or wastes from forestry | ✓ | ✗ | ✓ | ✗ | ✗ |
| Residues, including processing residues, which are not residues from agriculture, aquaculture, fisheries or forestry | ✓ | ✗ | ✗ | ✗ | ✗ |
| Wastes, which are not wastes from agriculture, aquaculture, fisheries or forestry | ✓ | ✗ | ✗ | ✗ | ✗ |
| Wastes of fossil origin | ✓ | ✗ | ✗ | ✗ | ✓ |
| Residues or wastes from agriculture | ✓ | ✓ | ✗ | ✓ | ✗ |
| Renewable energy of non-biomass origin / Power-to-liquid | ✓ | ✗ | ✗ | ✗ | ✗ |
| Nuclear energy (SAF mandate only) | ✓ | ✗ | ✗ | ✗ | ✗ |

**Table 6** Relevant sustainability criteria that fuels produced from different kinds of feedstock must meet

5.12 Further information on the different requirements are detailed below.

5.13 **GHG emissions saving threshold** (Chapter 6): all eligible fuels must meet an emissions saving threshold to be eligible for certificates.

**Under the RTFO,** this minimum threshold depends on feedstock type and when the production installations were built. The thresholds are as follows:

- Biofuels produced in installations operating on or before 5 October 2015 must achieve at least a 55% GHG emissions saving;
- Biofuels produced in installations which started operating after 5 October 2015 must deliver at least a 65% GHG emissions saving;
- RFNBOs must deliver at least a 65% GHG emissions saving;
- RCFs must deliver at least a 46% saving for the 2026-2027 compliance year (equivalent to a maximum allowable carbon intensity of 50.7 $gCO_2e/MJ$).

**Under the SAF mandate,** the minimum threshold is set at a 40% GHG emissions saving for all fuel and feedstock combinations. The carbon intensity reported must also be an actual value (refer to Annex C, Annex D, or Annex E for calculation methodologies). The supplier must be able to provide evidence for the carbon intensity value on request. See further requirements on the Sustainability

Compliance Policy, available in Annex A of the SAF Mandate Compliance Guidance.

5.14 **Land criteria** (Chapter 7): Biofuels made from feedstocks subject to the land criteria (such as crops, products and agricultural residues) cannot be made from raw material obtained from land with high biodiversity value at any point during or since January 2008 and may not be made from raw material obtained from land with high carbon stock or land that was undrained peatland in January 2008 unless strict criteria are met.

5.15 **Forest criteria** (Chapter 7): Biofuels made from forest biomass must come from land where there are appropriate monitoring and enforcement systems in place to ensure legal harvesting, forest regeneration and the maintenance of soil carbon.

5.16 **Soil carbon criteria** (Chapter 7): Biofuels made from agricultural residues or wastes must come from land where there are monitoring or management plans in place to address the impacts on soil quality and soil carbon of the harvesting of the feedstock concerned.

5.17 **Sustainable waste management criteria** (Chapter 7): RCF fuels must meet the sustainable waste management criteria, as defined in Schedule 1 of the RTFO Order 2007. These require that in the production of all consignments of RCF, adequate monitoring or management plans are in place to address the local environmental impacts caused as a result of sourcing or processing the waste.

## Chain of custody and mass balance requirements

5.18 As set out in Chapter 3, it is necessary to be able to track C&S data back to its original source to ensure that it can be verified. Mass balance (or more stringent systems) are the only chain of custody systems currently permitted under the RTFO/SAF Mandate. A mass balance system requires suppliers throughout the supply chain to account for their product on a units in - units out basis but does not require physical separation of certified feedstock or fuel from uncertified material. It ensures that for every unit of sustainable low carbon fuel sold, the corresponding sustainable feedstock has been produced.

5.19 Bulk commodity systems are permitted because they are consistent with the principles of mass balance, i.e. the output is the same as the input. A more detailed explanation of these systems and advice on when it is appropriate to use existing systems and how to establish a new one if necessary can be found in Chapter 3.

## Additional sustainability information – RTFO Only

5.20 The RTFO requires that suppliers submit certain additional sustainability information in addition to demonstrating that the RTFO sustainability criteria are

met and that this 'additional sustainability information' must be verified. The information has been included as part of the RTFC application process on ROS.

5.21 Additional sustainability information is only required in the case of agricultural crops (energy crops or relevant crops). Suppliers of fuels made from wastes, residues and RFNBOs do not need to provide this information.

5.22 The additional sustainability information required is outlined in Table 7, along with an explanation of what action suppliers need to take to meet the additional sustainability information reporting requirements.

5.23 In most cases, where the additional sustainability information was verified in a supplier's RTFC applications, no action is required by suppliers. If some or all of the information is not supplied and verified in RTFC applications, suppliers must provide the information with a verifier's assurance report relating to the data by 15 May immediately following the obligation period during which the fuel was supplied.

| Additional sustainability information requirement | Acceptable responses for 'additional information' requirements |
|---|---|
| Whether the fuel has been certified or accepted as fulfilling the requirements of a scheme that has been recognised by the RTFO | Any voluntary scheme from the drop-down list or 'none - feedstock not certified.' If this is left blank, it will be treated as 'no'. |
| Whether the GHG bonus of 29 $gCO_2eq/MJ$ has been applied (for degraded land) | 'Degraded land' in 'land use on 1 Jan 2008' or any other land use category from the list |
| Whether emission savings from soil carbon accumulation via improved agricultural management been used for the GHG calculation | 'Yes' or 'No' in 'Soil carbon accumulation' |

**Table 7** Additional sustainability information reporting requirements

## Accounting for indirect land-use change (RTFO only)

5.24 Indirect land-use change (ILUC) is land-use change where the cause is at least one step removed from the effects. It is the knock-on effect on expansion of agricultural land use resulting from the cultivation of biofuel feedstocks.

5.25 Estimations of the effects of ILUC derived from economic modelling - known as 'ILUC values' - suggest that some crop-derived biofuels can lead to an increase rather than a decrease in carbon emissions. When ILUC is included crop-derived biodiesel can increase carbon emissions compared to fossil fuels, whilst the GHG savings for crop-derived bioethanol are more modest than previously estimated.

5.26 To help tackle ILUC, the RTFO encourages the supply of fuel created from the most sustainable feedstocks via additional rewards for waste feedstocks and an additional development fuels target that takes into account both the fuel type and the feedstock. Crop-derived biofuels cannot be used to meet the development fuel target. In addition, the main obligation includes a crop cap

which limits the maximum contribution that crop-derived biofuels can deliver to supplier obligations (see the RTFO Compliance Guidance).

5.27 In addition to the existing sustainability reporting requirements in this Guidance, the Administrator also gathers information on estimated ILUC emissions from land-based (crop) biofuels.

5.28 The ILUC values used by the Administrator are shown in Table 8 below and show a weighted average of the individually modelled feedstock values. The mean values are given for groups of feedstocks including cereals and other starch-rich crops, sugars, and oil crops. These values are **automatically applied on the ROS IT system** based on the feedstock information already reported by suppliers.

5.29 ILUC values are calculated for reporting purposes only and are not taken into account for the purposes of meeting the GHG emissions saving threshold.

| Feedstock group | ILUC values |
|---|---|
| Cereals and other starch-rich crops | 12 |
| Sugars | 13 |
| Oil crops | 55 |

**Table 8** Estimated ILUC emissions from biofuel and bioliquid feedstocks ($gCO_2e/MJ$)

5.30 Estimated ILUC emissions are considered to be zero in the following situations:

- For feedstocks that are not listed in Table 8.
- If there has been a (RTFO-compliant) direct land-use change (see Chapter 7).

5.31 Suppliers must contact the Administrator before making an application in relation to fuel derived from a relevant crop (see paragraph 2.22 for definitions) where the ILUC emissions are considered to be zero due to one of the situations detailed above. This is to help ensure that the correct requirements and values are applied.

## Reporting C&S data

5.32 C&S reports must contain the information required to demonstrate compliance with the RTFO and SAF Mandate sustainability requirements. For detailed guidance on how to demonstrate compliance with the sustainability criteria, see Chapters 6 and 7. Evidence requirements for demonstrating compliance are set out in full in Chapter 8.

5.33 C&S reports are submitted through the ROS IT system.

### Supporting sustainability claims through the use of voluntary scheme evidence

5.34 Suppliers may choose to use documentation from voluntary schemes recognised by the Administrator, as supporting evidence to help substantiate sustainability claims and demonstrate compliance with the RTFO and SAF

Mandate C&S criteria. Many suppliers are now sourcing all of their low carbon fuel through voluntary schemes. These schemes are well established for road transport fuels (RTFO) but more nascent for aviation fuel pathways.

5.35 Account holders are advised to contact the Administrator if they have any questions on the availability/suitability and extent to which documentation from voluntary schemes can be used to help demonstrate compliance with the C&S requirements of the SAF Mandate.

5.36 Suppliers that choose to utilise voluntary scheme evidence to support their applications must be able to provide documentation to show that they have sourced the relevant feedstocks through the voluntary scheme via a valid Proof of Sustainability (POS) document, or equivalent, and should the Administrator request it, the supplier must be able to provide additional evidence for each stage in the supply chain. Where an obligated party fails to provide sufficient information or evidence to substantiate claims, Certificates will not be issued, and the fuel will be treated as fossil for the purposes of calculating the supplier's obligation.

5.37 Further information on using voluntary schemes to demonstrate compliance with the sustainability criteria can be found in Chapter 5 of the respective RTFO and SAF Mandate Compliance Guidance documents and additional evidence examples can be found in Chapter 8 of this document.

## C&S reporting by application

5.38 An application can contain any amount of fuel which has an identical set of sustainability characteristics. The sustainability characteristics that must be identical within an application are:

- Fuel type
- Low carbon fuel feedstock
- Low carbon fuel production process (if applicable)
- Country of origin
- Voluntary scheme(s)
- Land use on 1 January 2008 (if applicable)
- Carbon intensity

5.39 Evidence that the applicable C&S requirements have been met must be available for every application if requested by the Administrator.

5.40 Suppliers may operate a site-based mass balance system to allocate sustainability data (by application) to physical consignments of low carbon fuel. See Chapter 3 for further information and rules on operating a mass balance system.

5.41 A physical batch of fuel may contain more than one application. Conversely, an application can cover different physical batches of fuel.

5.42 Each application must be associated with a particular month's volume of supply (or quarter for those suppliers who report fuel quantities quarterly) and separate applications are required for each fuel type. The total volume of the consignments associated with a particular period cannot exceed the volume of low carbon fuel supplied in that period.

5.43 Consignments may be split and entered as separate consignments for more than one period to accommodate this requirement.

## Verification

5.44 Once data is complete for one or more application, and the other requirements set out in this guidance have been met, suppliers can choose to apply for Certificates or hold data for a future application. To apply for Certificates suppliers must arrange for the data to be verified. A verifier's statement is required for every application for Certificates - Certificates will not be issued where no such information has been provided.

5.45 Suppliers can 'forward' their C&S data to the verifier on ROS, and the verifier is able to examine the data directly. Once verification is complete, the verifier returns the data to the supplier and uploads their assurance opinion. The supplier will then be responsible for submitting the application, including the assurance opinion, to the Administrator.

5.46 Verification must be carried out to the requirements of ISAE 3000 to at least the 'limited' assurance level for carbon and sustainability criteria being met under both the RTFO and SAF Mandate, and to at least the “reasonable” level for the verification of aviation fuel quantities under the SAF Mandate, defined by that standard (or an equivalent standard[27]). Further details on the verification requirements are available in the RTFO and SAF Mandate Third-Party Assurance Guidance. Verification must be undertaken by a person who is independent of the supplier and who has the necessary expertise. Information on the process by which a verifier may be recognised by the Administrator as competent to perform this work is available in the RTFO and SAF Mandate Third-Party Assurance Guidance.

5.47 The RTFO and SAF Mandate Third-Party Assurance Guidance gives further information on appointing a verifier. This includes guidance on independence and expertise and the ISAE 3000 standard. It also lists the roles and responsibilities of suppliers in respect of this process and gives a brief outline of the steps a verifier should undertake.

5.48 The RTFO and SAF Mandate Third-Party Assurance Guidance provides detailed information on the processes which verifiers will undertake. This guidance also provides a useful reference for suppliers preparing for verification.

[27] The Administrator is not aware of any equivalent standards at the time of publication.

### Changing C&S data

5.49 Once C&S data has been assigned to a consignment of low carbon fuel at the duty point, the further substitution of the C&S data with a different C&S dataset through the use of mass balance is not permitted[28]. Note that this is distinct from correcting inaccurate data in relation to the same low carbon fuel - see below.

5.50 Once data has been forwarded to a verifier, it cannot be changed (it is 'locked'), unless the verifier passes the data back without providing an assurance opinion.

5.51 Once a verifier has provided an opinion on data, any corrections of that data would require a new verification process to take place. Data on ROS will be 'locked' such that this kind of change cannot take place accidentally.

5.52 After Certificates have been issued, data cannot be amended. If suppliers become aware of inaccuracies in their data, they must inform the Administrator within 20 days. Certificates may be revoked in this case and suppliers may reapply.

5.53 Data cannot be amended after the reporting deadline following the end of the obligation period for which the Certificates are being applied for, unless the Administrator expressly authorises it. However, suppliers are still required to inform the Administrator if they become aware of any inaccuracies in the data.

5.54 The deadline for Certificate applications to be received is 14 May following the end of the calendar obligation year. Please see the appropriate RTFO / SAF Mandate compliance guidance for full details.

## Further guidance and resources

### Tools for greenhouse gas calculations

5.55 Several tools and resources are supplied on the RTFO and SAF Mandate guidance webpages to assist suppliers wishing to calculate the GHG emission savings of their low carbon fuels:

- **Carbon Calculator**[29]**:** The Carbon Calculator is a free software tool to help reporting parties determine the GHG emissions from consignments of low carbon fuels they have supplied under the RTFO, using either default or actual values for all or part of the fuel chain. A *User Manual* is also available online. The Carbon Calculator can also be used to produce C&S reports which can be uploaded to ROS as part of the application for Certificates.

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[28] This applies whether or not the verification of that C&S data or the application for certificates was successful.

[29] Note that the Carbon Calculator can also be used by economic operators in the Republic of Ireland reporting under the Irish Biofuel Obligation System. When prompted to select the reporting scheme upon opening the calculator, economic operators reporting under the RTFO should select "UK - Renewable Transport Fuel Obligation or Renewables Obligation".

- **RTFO and SAF Mandate standard data:** This spreadsheet provides standard values such as global warming potentials, lower heating values (LHVs), transport efficiencies and emission factors for commonly used inputs. These values should be used in suppliers' GHG calculations where they are available. It also lists carbon defaults which can be used when reporting carbon intensities of specific fuel chains.

5.56 For those uploading their C&S data as CSV files to ROS, these can be generated by the Carbon Calculator or created in Excel. A list of standard terms for each C&S data field is provided online.

### Information on fuels and feedstocks

5.57 A list of feedstocks including wastes and residues is maintained online alongside a list of low carbon fuels.

### Additional documents

5.58 Additional sources and documents relevant to this guidance, including relevant legal instruments, are available online.

## Publication of information

5.59 The Administrator publishes regular reports on the sustainability characteristics of low carbon fuel supplied under the RTFO. Similar reports will be published on the sustainability characteristics of low carbon fuel supplied under the SAF Mandate.

5.60 Information on renewable fuel supply by each company is published annually. Reports are available on the DfT website. Individual applications for Certificates, information on supplier fuel quantities and verifiers' opinions will not be published.

# 6. Demonstrating compliance with the greenhouse gas emissions saving criteria

**Chapter summary**

This chapter sets out the GHG requirements of the RTFO and SAF Mandate and details how suppliers can demonstrate compliance with those requirements. Guidance is provided on how to assess the carbon intensity of low carbon fuel consignments through the use of defaults, actual values or a mix of actual and default values.

## Key distinctions between the SAF Mandate and the RTFO

6.1 **For the RTFO**, to be eligible for the award of Certificates, a consignment of fuel must achieve a GHG saving which is equal to or greater than the minimum GHG saving threshold as set out in the RTFO. The threshold applicable to a consignment of fuel is determined by two key factors - the type of fuel and the date at which the fuel production plant began operation. These thresholds are set out in Table 9. A consignment will either comply or not comply with the GHG saving requirement, and there is no link between the GHG saving value achieved and the number of Certificates issued.

6.2 **For the purpose of the SAF Mandate**, to be eligible for the award of Certificates, a consignment of fuel must achieve a GHG saving equal to or greater than the minimum GHG saving set out in Table 10 of this guidance (40%). This minimum GHG saving requirement is the same for all fuels. If the GHG saving achieved by a consignment is below this threshold, the consignment will not be eligible for Certificates. If the GHG saving of a consignment is equal to or exceeds this threshold (and providing all other eligibility criteria are met) then the number of Certificates issued to the fuel will be proportional to the GHG saving and energy density of the consignment.

# Terminology

6.3 The following terminology will be used throughout this chapter:

- The **carbon intensity** of a renewable fuel refers to the life-cycle emissions of greenhouse gases (GHGs) from the fuel supply chain. It is expressed in units of grams of carbon dioxide equivalent per megajoule of fuel using lower heating values ($gCO_2e/MJ$).
- **Carbon defaults** are carbon intensity values provided for a number of biofuel production pathways, also referred to as **defaults**. **These values can only be used under the RTFO.**
- The carbon defaults are the sum of **disaggregated defaults** for cultivation, processing and transport emissions.
- **Carbon saving or greenhouse gas saving** refers to the GHG emissions saving of the low carbon fuel relative to the fossil fuel it replaced. It is calculated by comparing the carbon intensity of the fuel with the fossil fuel comparator.
- **Fossil Fuel Comparator.** For the purpose of the RTFO, the fossil fuel comparator represents the assumed carbon intensity of transport fuel based on the petrol and diesel split and is currently set by the Administrator at 94 $gCO_2e/MJ$. For the purpose of the SAF Mandate, the fossil fuel comparator represents the assumed carbon intensity of avtur and is currently set by the Administrator at 89 $gCO_2e/MJ$. The different values reflect the different GHG intensities of the different fuels.
- **The term 'installation'** includes any processing installation used in the production process. It does not include production facilities that might have been intentionally added to the production chain only to qualify for the exemption foreseen in this provision.
- The term **'old chain installation'** refers to any processing installation that was in operation on or before 5 October 2015[30].
- The term **'new chain installation'** refers to any processing installation that began operation after 5 October 2015. **'Grandfathering'** refers to renewable fuels produced in installations before certain dates and affects the GHG savings requirements.

# Demonstrating compliance with the GHG emissions saving criteria

## Required GHG emissions saving

6.4 The direct GHG emissions saving of an eligible fuel is established by comparing the eligible fuel's carbon intensity against the displaced fossil fuel's carbon intensity. This comparison must be done using carbon intensity values given on an energy basis i.e. $gCO_2e/MJ$. For all fuels, it is assumed that the energy

[30] If an installation has converted from production of non-renewable fuel to production of renewable fuel, the operational date is deemed as the date on which renewable fuel was first produced at the facility.

efficiency (i.e. kilometres per MJ) of vehicles is the same and, therefore, that one megajoule of low carbon fuel displaces one megajoule of fossil fuel.

6.5 When converting carbon intensities from $gCO_2$/kg or $gCO_2$/l to $gCO_2$/MJ, suppliers should use the lower heating values (LHVs) provided in the RTFO / SAF Mandate standard data. Suppliers are also permitted to use application specific LHVs if these can be supported with evidence. If no energy content value is available, suppliers should contact the Administrator.

6.6 **Under the RTFO**, the carbon intensity for all fossil fuels (e.g. petrol, diesel, etc.), referred to as the fossil fuel comparator, is 94 $gCO_2e$/MJ.

6.7 **Under the SAF Mandate**, the carbon intensity for all fossil fuels (e.g. Avtur) referred to as the fossil fuel comparator is 89 $gCO_2e$/MJ.

6.8 GHG emissions saving percentages from eligible low carbon fuels should be calculated as follows:

$$\text{GHG Saving (\%)} = \frac{(E_{FF} - E_{EF})}{E_{FF}} \times 100$$

Where:

- $E_{EF}$ = total emissions from the eligible fuel
- $E_{FF}$ = total emissions from relevant fossil fuel comparator for transport

6.9 To be eligible for Certificates, fuels must meet the GHG emissions saving threshold. **Under the RTFO**, the threshold that a fuel has to meet depends on the fuel type and when the production installations were built (see Table 9). **Under the SAF Mandate**, all fuels must meet or exceed the same minimum threshold of 40% (see Table 10).

6.10 **Under the RTFO**, biofuels produced in installations operating on or before 5 October 2015 must achieve at least a 55% saving (equivalent to a maximum allowable carbon intensity of 42.3 $gCO_2e$/MJ). Biofuels produced in installations that started operating after 5 October 2015 and all RFNBOs must deliver at least a 65% saving (equivalent to a maximum allowable carbon intensity of 32.9 $gCO_2e$/MJ). RCFs must meet at least a 46% saving for the 2026 compliance year (equivalent to a maximum allowable carbon intensity of 50.7 $gCO_2e$/MJ. This is calculated in accordance with the methodology set out in the RCF specific guidance published by the Administrator.

6.11 In practice, **for the purpose of the RTFO**, suppliers are not required to calculate the GHG emissions saving of a fuel directly. Instead, compliance can be demonstrated by reporting a verified carbon intensity (for example by reporting an appropriate default value) of less than or equal to the relevant maximum allowable carbon intensity, (Paragraph 6.10, Table 9).

| Fuel type | Installation start date | GHG emissions saving threshold | Maximum permitted carbon intensity |
|---|---|---|---|
| Biofuel | On or before 5 October 2015 | 55% | 42.3 |
| Biofuel | After 5 October 2015 | 65% | 32.9 |
| RFNBO | Any | 65% | 32.9 |
| RCF | Any | 46% (See RCF guidance) | 50.7 (for 2026) |

**Table 9** GHG emissions saving thresholds and maximum permitted carbon intensity under the RTFO

6.12 **Under the SAF Mandate**, suppliers are required to report the verified actual GHG emissions saving of the fuel supplied. The GHG saving must be calculated in accordance with the guidance in paragraphs 6.17 to 6.20. This is because the number of Certificates issued to the fuel is directly proportional to the GHG emissions savings achieved. To be eligible for support under the SAF mandate, all fuels must achieve at least a 40% saving (equivalent to a maximum allowable carbon intensity of 53.4 $gCO_2e/MJ$ – see Table 10), but the Mandate will reward Certificates in proportion to the emission savings of a given SAF consignment.

| Fuel type | Installation start date | GHG emissions saving threshold | Maximum permitted carbon intensity |
|---|---|---|---|
| SAF | Any | 40% | 53.4 |

**Table 10** GHG emissions saving thresholds and maximum permitted carbon intensity under the SAF Mandate

## Determining the carbon intensity of eligible fuels

### RTFO

6.13 **Under the RTFO,** the carbon intensity of a consignment of biofuels can be determined by one of the following options:

- Selecting the appropriate default value
- Collecting information about the way in which it was produced to calculate an actual carbon intensity
- Combining actual data with default input data or disaggregated default values

6.14 Further guidance on how to assess the carbon intensity of **biofuels** through each of the three options listed above is provided in the subsequent sections of this chapter and Annex C.

6.15 For RFNBOs, suppliers must calculate and report actual GHG emissions using a distinct methodology set out in Annex D. There are no default figures available for RFNBOs.

6.16 For RCFs, suppliers must calculate and report actual GHG emissions using the methodology set out in Annex E. There are no default figures available for RCFs.

### SAF Mandate

6.17 **Under the SAF Mandate,** it is imperative that the carbon intensity is calculated as accurately as possible due to the nature of the Certificate reward system. Any errors or uncertainties could potentially lead to the over- or under-rewarding of Certificates. Therefore, suppliers must calculate and report actual values using the appropriate methodology for the fuel type as follows. Default values applying to all fuel from a particular feedstock or fuel chain are not provided, but this will be kept under review.

6.18 For biofuels, suppliers must calculate actual values in accordance with the requirements set out in Annex C and should note that the use of default values is not permitted.

6.19 For PtL and RCFs, suppliers must calculate and report actual GHG emissions using the appropriate methodology for the fuel type. These methodologies can be found in Annex D and Annex E.

6.20 When calculating actual values, suppliers are permitted to use disaggregated default values provided by the Administrator to calculate **downstream emissions only** – see Annex B (those emissions associated with the transport and distribution of the final fuel). Where downstream disaggregated default values are provided, suppliers are not obliged to use them and still have the opportunity to provide actual values should they wish.

## Voluntary schemes and verification

6.21 In order for a consignment of eligible fuel to be deemed eligible for Certificates, reported carbon intensity values must be verified along with the rest of the data contained in the C&S report.

6.22 Reporting GHG values using one or more recognised voluntary schemes can help to demonstrate compliance with the GHG emission saving criteria. However, regardless of voluntary scheme recognition, a carbon intensity value must always be reported and this value must meet the thresholds set out in paragraphs 6.9 to 6.11 and Table 9 **for the RTFO**, and 6.12 and Table 10 **for the SAF Mandate**.

6.23 Some voluntary schemes cover actual GHG calculations whilst others only cover the use of default values. Where the voluntary scheme only covers the use of default values, it is still permitted to report a carbon intensity calculated using actual data; however, as this is not covered within the scope of the voluntary scheme, this information is subject to full verification.

6.24 Suppliers should be mindful of the differences between the RTFO and SAF Mandate requirements outlined here, and the requirements followed by voluntary schemes. For example, voluntary schemes may permit the averaging of carbon intensity values across multiple feedstocks co-digested in the same anaerobic digestor – this is not permitted under the RTFO or SAF Mandate where all carbon intensities must be calculated and reported on an individual

feedstock basis. In such cases, it is still permissible to report using a recognised voluntary scheme. However, where carbon intensities calculated on an individual feedstock basis are not provided through a voluntary scheme, carbon intensities will need to be calculated separately in line with the RTFO methodology (see Annex C paragraph C.33). These calculations should then be submitted and verified alongside the relevant voluntary scheme evidence (e.g. a proof of sustainability).

## Using default values to demonstrate compliance (RTFO ONLY)

6.25 **For the purpose of the RTFO**, default values are provided in Annex A for many of the more commonly used biofuel production pathways. These values may be used when calculating the GHG emissions of biofuels and are intentionally set conservatively to account for deviation from normal processes.

6.26 Suppliers should report actual values if:

- They wish to demonstrate a higher GHG emissions saving.
- The default does not meet the required GHG emissions saving.
- There have been emissions due to land-use change.
- Where no default has been published for a particular production pathway.

Guidance on reporting actual values is provided in the next subsection.

6.27 For partially renewable fuels, the sustainability criteria apply to the renewable part of the fuel. Therefore, it is permitted to report an appropriate carbon default for the volume of the partially renewable fuel that has been reported as renewable.

6.28 Several of the default values require information on the process used to produce the biofuel to determine the appropriate default value. In most cases, this information relates to the specific process fuel used. These default values must not be reported unless the relevant process information is known and matches that of the default value.

6.29 For a consignment to be RTFO-compliant, there are specific conditions under which default values **must not** be reported as the carbon intensity of a consignment:

- Where the carbon default does not meet the relevant GHG saving threshold.
- Where a default value requires process information, but the process is unknown.
- When emissions from land-use change are greater than zero, a calculation of the emissions from land-use change should also be added to the default value (note that the previous land use must be determined, and unknown land-use change cannot be reported) - guidance on calculating land-use change emissions is provided in Annex C paragraph C.52 onwards.

# Calculating actual values for the carbon intensity of low carbon fuels

6.30 Suppliers of low carbon fuels wishing to report actual values should follow the appropriate calculation method consistent with the type of fuel supplied. This methodology is based on a well-to-wheels (or equivalent) approach that includes all significant sources of direct GHG emissions.

6.31 The methodology for biofuels is set out in Annex C.

6.32 The methodology for RFNBOs/PtL is set out in Annex D.

6.33 The methodology for RCFs is set out in Annex E.

# 7. Demonstrating compliance with the sustainability criteria

**Chapter summary**

This chapter sets out the land, forest, soil carbon, and sustainable waste management criteria of the RTFO and SAF Mandate and outlines how suppliers can demonstrate compliance. This chapter is not applicable to RFNBOs, PtL or biofuels derived from wastes and residues which are not from agriculture, aquaculture, fisheries or forestry. For certain feedstocks, the land criteria are automatically satisfied including those categories of tallow that do not double count.

## Introduction

7.1 In addition to meeting the GHG emissions saving threshold (Chapter 6), fuels made from certain feedstocks must also meet additional criteria, namely the land, forest, soil carbon and sustainable waste management criteria (Table 6).

7.2 Unless exempt, all fuels must meet the land criteria. Fuels made from residues and wastes from agriculture also must meet the soil carbon criteria. RCFs must meet the sustainable waste management criteria.

7.3 RFNBOs, as well as wastes and residues which are not from agriculture, aquaculture, fisheries[31] or forestry, are exempt from the land criteria. Certain kinds of products not derived from the land are also exempt, as set out in the list of feedstocks online.

7.4 Fuels made from any kind of forest biomass (including wastes and residues) must meet the forest criteria rather than the land criteria.

[31] In many cases materials from aquaculture and fisheries will automatically meet the land criteria because these materials are not usually sourced from land. However, suppliers should check with the Administrator which criteria must be demonstrated on a case-by-case basis.

7.5 One option that suppliers can use to support claims of compliance with the land, forest and soil carbon criteria is to submit evidence that a voluntary scheme has recognised the consignment of fuel as demonstrating compliance with the relevant criteria. See paragraphs 7.23 to 7.27 for more information. The Administrator may still request additional information or evidence for any or all steps in the supply chain, so the supplier must ensure that evidence of compliance with the relevant criteria for each step in the supply chain is available on request. Where an obligated party fails to provide sufficient information or evidence to substantiate claims, Certificates will not be issued, and the fuel will be treated as fossil for the purposes of calculating the supplier's obligation. See Chapter 8 of this guidance document for examples of evidence that may be requested, and Chapter 5 and Annex A of the respective RTFO and SAF Mandate Compliance Guidance documents for more information on use of voluntary schemes to show compliance with the respective schemes and process for requesting additional evidence.

7.6 The land, forest, soil carbon, and sustainable waste management requirements imposed under the RTFO and SAF Mandate are identical, as such where fuel is considered compliant with the RTFO sustainability criteria, it should also be considered compliant with the SAF mandate sustainability criteria.

## The land criteria

7.7 The land criteria ensure that biofuel feedstocks are sourced in a way that preserves biodiversity and carbon stocks. To achieve this, it is prohibited to source biofuels from land that has or previously had a certain status (high biodiversity or carbon stock). In some cases, it is permitted to source material from land of a certain type if specific criteria are met.

7.8 The land criteria are made up of two sub-criteria, one which covers biodiversity and the other carbon stocks and peatlands.

### Biodiversity criteria

7.9 To satisfy the biodiversity criteria, biofuels may not be made from raw material obtained from land with high biodiversity value in or after January 2008. The prohibited land categories are:

A. Primary forest or other wooded land of native species where there is no clearly visible indication of human activity and ecological processes are not significantly disturbed.
B. Highly biodiverse forest or other wooded land which is species-rich and not degraded except in cases where the land is designated for nature protection purposes and the production of relevant feedstock is a necessary management action that did not interfere with the purposes for which the land concerned was designated for nature protection purposes.
C. Land designated for nature protection purposes, including those designated for the protection of rare, including for the protection of rare, threatened or

endangered ecosystems or species, unless production of the relevant feedstock can be shown not to have interfered with those nature protection purposes.

D. Natural highly biodiverse grassland[32] spanning more than one hectare.

E. Non-natural highly biodiverse grassland spanning more than one hectare, unless harvesting of the raw material is necessary to preserve its status as highly biodiverse grassland.

7.10 For the exemptions permitted in paragraph 7.9 for land categories B, C and E listed, evidence must be provided that satisfies the Administrator that the exemption is valid.

### Carbon stocks and peatlands criteria

7.11 Biofuels must not be made from raw material if the sourcing of such biomass would cause adverse effects on land carbon stocks or to peatlands. To satisfy the carbon stocks and peatlands criteria, each of the criteria outlined in paragraph 7.12, 7.13 or 7.14.

7.12 Biofuels may not be made from raw material obtained from land which had the following land status at any time in January 2008 and no longer has that status:

- Wetlands, defined as land that is covered with or saturated by water permanently or for a significant part of the year.
- Continuously forested areas spanning more than one hectare with trees higher than five metres and a canopy cover of more than 30%, or trees able to reach those thresholds in situ.

7.13 Where raw material is sourced from land which at any time in January 2008 was a forested area spanning more than one hectare with trees higher than five metres and a canopy cover of between 10% and 30%, or trees able to reach those thresholds in situ, and the land no longer has that status, suppliers must be able to demonstrate that any biofuel made from that raw material meets the GHG emission saving criteria. Special care must be taken to ensure that any GHG emissions due to land-use change are taken into account following the equation in Annex C paragraph C.41

7.14 Biofuels may not be made from raw material obtained from land which was peatland at any time in January 2008, unless it can be demonstrated that the cultivation and harvesting of that raw material did not involve drainage of previously undrained soil.

## The soil carbon criteria

7.15 The soil carbon criteria apply specifically to fuels made from wastes and residues derived from agriculture and is in addition to the land criteria.

[32] Natural grassland is grassland that would remain as grassland and that maintains its natural species composition and ecological characteristics and processes in the absence of human intervention.

7.16 To meet the soil carbon criteria, it must be demonstrated that monitoring or management plans are in place to address the impacts on soil quality and soil carbon of the harvesting of the relevant feedstock concerned.

7.17 To comply with the soil carbon criteria, it should be demonstrated that appropriate monitoring or management practices are either:

- Required by law in the country of origin of the feedstock, and that their implementation is monitored and enforced.
- In place at the farms from which the material was sourced.

## The forest criteria

7.18 The forest criteria apply to fuels derived from forest biomass including wastes and residues. Such fuels do not have to meet the land criteria.

7.19 Where a fuel is derived from such feedstocks, it must be demonstrated that the feedstocks meet the following criteria:

- The material has not been harvested from wetlands, peatlands or protected land areas unless the land is designated for nature protection purposes and the production of the relevant feedstock did not interfere with the purposes for which the land concerned was designated for nature protection purposes.
- The material has been legally harvested.
- The material has been harvested in such a way that negative impacts on soil quality and forest biodiversity are minimised and which maintains or improves the long-term production capacity of the forest from which it was harvested.
- That areas that have been harvested are subject to forest regeneration[33].
- That changes in carbon stock associated with forest biomass harvest are accounted for in submissions related to the country's commitment to reduce or limit greenhouse gas emissions through the 'Paris Agreement', or the material has been harvested in such a way that carbon stocks and sinks levels in the forest are maintained or increased over the long term.

7.20 To comply with the forest criteria, it should be demonstrated that appropriate monitoring or management practices which ensure the criteria described in paragraph 7.19 are satisfied are either:

- Required by law in the country of origin of the feedstock, and that their implementation is monitored and enforced.
- In place at forest sourcing area[34] from which the material is sourced.

[33] "Forest regeneration" means the re-establishment of a forest stand by natural or artificial means following the removal of the previous stand by felling or as a result of natural causes, including fire or storm.

[34] "Sourcing area" means the geographically defined area from which the forest biomass 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.

## The sustainable waste management criteria

7.21 The sustainable waste management criteria, as defined in Schedule 1 of the RTFO Order 2007, require that in the production of all consignments of RCF, adequate monitoring or management plans are in place to address the local environmental impacts caused as a result of sourcing or processing the waste.

7.22 The sustainable waste management criteria can be met at a national or production plant level, depending on whether existing regulatory frameworks are in place and enforced in the location in which the RCF production takes place.

## Demonstrating compliance with the sustainability criteria through voluntary scheme evidence

7.23 A reporting party can provide evidence to support claims of compliance with one or all of the RTFO/SAF Mandate sustainability criteria by using evidence provided by one or more voluntary schemes. The scope and version of the scheme being reported must be recognised by the Administrator as suitable for providing evidence of compliance with the specific criteria it is being used to evidence compliance against. The Administrator may still request further evidence of compliance from the Supplier (see paragraph 7.5).

7.24 Where a recognised scheme is being used as evidence to support an application, this should be reported on ROS. Verifiers may consider evidence of compliance provided through other voluntary schemes, but these will not be available for reporting on ROS.

7.25 Voluntary schemes are recognised for a specific scope. For example, they might be recognised as providing evidence for one or more of the land criteria, forest criteria, soil carbon criteria, the GHG emissions saving criteria (including the possibility to calculate actual values), and/or the mass balance chain of custody. Where a voluntary scheme does not provide evidence for all of the land, forest and/or soil carbon criteria, then suppliers will need to provide additional evidence to demonstrate compliance with those criteria, it may be possible to do this by providing evidence from another voluntary scheme or by following one of the compliance routes outlined in paragraph 7.30.

7.26 The chain of custody rules of a voluntary scheme must be complied with for a supplier to claim that their renewable fuel complies. A supplier should either be certified under the voluntary scheme or, where it is not certified, check with the voluntary scheme before a claim is made. Gaps within a chain of custody are generally not permitted by voluntary schemes, although some schemes may allow the final party reporting to the Administrator to make a claim if they have sourced directly from a certified supplier. In such cases the final party reporting to the Administrator does not need to be certified by a voluntary scheme.

7.27 Suppliers must have evidence that the biofuel in question complies with a voluntary scheme. For example, it is not sufficient to purchase from an

economic operator that has been certified against a voluntary scheme unless the biofuel supplied by that entity is accompanied by evidence of meeting the scheme, e.g. a Proof of Sustainability. This is because being certified under a voluntary scheme does not require that an entity only supplies sustainable biofuel. As well as requiring evidence of the fuel complying with the voluntary scheme, the Administrator may request additional information or evidence from any or all stages in the supply chain, so suppliers must ensure that such information or evidence is available on request. Where an obligated party fails to provide sufficient information or evidence to substantiate claims, Certificates will not be issued, and the fuel will be treated as fossil for the purposes of calculating the supplier's obligation. See Chapter 8 of this guidance document for examples of evidence that may be requested, and Chapter 5 and Annex A of the respective RTFO and SAF Mandate Compliance Guidance documents for more information on use of voluntary schemes to show compliance with the respective schemes and process for requesting additional evidence.

7.28 When voluntary scheme evidence is used to support compliance claims, it is permitted to report a land use of 'Voluntary scheme - met land criteria' on ROS if the land use information was not passed down the chain of custody. However, where the land use is known it should always be reported. See Table 11 for a summary of land use categories.

## Alternative options for demonstrating compliance with the land criteria

7.29 One option that suppliers can use to support claims of compliance with the land criteria is to submit evidence that a voluntary scheme has recognised a consignment of fuel as demonstrating compliance with the land criteria. See paragraphs 7.23 to 7.27 for more information. The Administrator may still request additional information or evidence for any or all steps in the supply, so the supplier must ensure that evidence of compliance with the relevant criteria for each step in the supply chain is available on request. Where an obligated party fails to provide sufficient information or evidence to substantiate claims, Certificates will not be issued, and the fuel will be treated as fossil for the purposes of calculating the supplier's obligation. See Chapter 8 of this guidance document for examples of evidence that may be requested, and Chapter 5 and Annex A of the respective RTFO and SAF Mandate Compliance Guidance documents for more information on use of voluntary schemes to show compliance with the respective schemes and process for requesting additional evidence.

7.30 Where a voluntary scheme is not available (e.g. for a particular feedstock or region), suppliers have a number of different options to demonstrate compliance with the land criteria:

- Report one of the RTFO / SAF Mandate-compliant previous land use categories where evidence is available of the land use in January 2008 for the land that the biofuel feedstock was grown on (the sections below provide further detail on which land use categories are compliant with the RTFO / SAF Mandate land criteria).

- Conduct their own field audits against the RTFO / SAF Mandate Sustainable Land Use Standard criteria. It is also possible for suppliers to conduct their own RTFO / SAF Biodiversity Audits to demonstrate compliance with the biodiversity criteria.

## Reporting an RTFO / SAF Mandate-compliant land use

7.31 Suppliers can also meet the land criteria by sourcing feedstocks from qualifying land. This can be reported through the 'land use on 1 Jan 08' field in ROS. Table 11 outlines which land use categories meet the RTFO / SAF Mandate land use criteria and under which conditions.

7.32 Some land use categories are not permitted to be used for biofuel feedstock production under the RTFO / SAF Mandate unless it can be proven that the status of the land was not changed (highly biodiverse grassland, cropland and other land categories protected for nature protection purposes, forestland, undrained peatland, wetland). Other land use categories are permitted to be used, but any change in carbon stock must be taken into account for reporting the carbon intensity of the biofuel (grassland, forest with canopy cover of 10-30%, degraded land, settlement).

7.33 For the land use categories in Table 11 of “Forest greater than 30% canopy cover - no change in status”, “Forest 10 to 30% canopy cover", "wetland - no change in status", and "undrained peatland" these land uses should not be reported if that land was also in a designated protected area, except if evidence is provided that the production of that raw material did not interfere with those nature protection purposes.

7.34 The land use category of “Grassland (and other wooded land not classified as forest)” can only be reported if it can be demonstrated that the land has not been highly biodiverse grassland. “Highly biodiverse grassland - no change in status” should only be reported if it can be demonstrated that harvesting of the raw material is necessary to preserve the grassland status. In both cases, reporting using a recognised voluntary scheme or conducting a successful audit against the Biodiverse Grassland Standard (paragraph 7.44) are acceptable routes to support in demonstrating compliance with the biodiversity conditions. The Administrator may still request additional information or evidence for any or all steps in the supply chain, so the supplier must ensure that evidence of compliance with the relevant criteria for each step in the supply chain is available on request. Where an obligated party fails to provide sufficient information or evidence to substantiate claims, Certificates will not be issued, and the fuel will be treated as fossil for the purposes of calculating the supplier’s obligation.

7.35 The categories 'cropland', 'grassland' and 'forestland' specifically refer to the land cover, while 'undrained peatland' and 'wetland' refer to other characteristics of the land, such as soil properties, that are not mutually exclusive with the former. For example, a forest may be located on undrained peatland, and grassland may be located on a wetland. The land types 'undrained peatland'

and 'wetland' and their variations should always be reported in precedence over the land types 'cropland', 'grassland' and 'forestland' and their variations.[35]

7.36 In some cases, the actual land cover may not be the same as the land category designated in a country's land registry. For example, it is feasible that the land is/was designated for future agricultural purposes in a land registry, but the actual land cover (e.g. determined by site visits or other records) is forestland. The actual land cover or type should always be reported.

7.37 Cropland specifically refers to land that is under the control of the farm or plantation. It is feasible that the land under the control of the farm is not exclusively cropland, but also includes other land uses (e.g. forestland). If the land cover does include forestland, it will have to be demonstrated that there has been no conversion of that forestland after January 2008. However, in an instance where the land used to produce the feedstock is cropland, 'cropland' should be reported.

7.38 Note that reporting 'cropland - protected/protection status unknown', does not demonstrate compliance with the biodiversity criteria. In such cases additional evidence would be needed e.g. reporting a voluntary scheme that is recognised as meeting the biodiversity criteria.

7.39 Suppliers will need to be able to demonstrate evidence of the land use they are claiming. For feedstocks sourced within the UK, a non-exhaustive list of possible evidence sources for demonstrating compliance with the land criteria is available in Annex F.

7.40 Other sources of information include:

- Guidance documents produced by the European Commission for economic operators to help identify the status of the land in January 2008 and therefore demonstrate compliance with the RED land-use criteria: Inventory of data sources and methodologies to help identify land status[36]
- The European Committee for Standardisation (CEN) prepared principles, criteria, indicators and verifiers to show that biofuels and bioliquids are sustainably produced
- UNEP World Database on Protected Areas (WDPA)[37] - a global resource for highly biodiverse and protected areas
- IUCN Red List[38] - a global list of threatened species and examples of their known geographical ranges, relevant to biodiversity and protected areas
- WWF Wildfinder[39] - a global resource for species distribution, relevant to biodiversity and protected areas
- Reference maps provided by recognised voluntary schemes

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[35] For example, if a plantation is located on land that was undrained peatland on 1 January 2008, this should always be reported as undrained peatland, irrespective of whether it had forest, grassland or cropland on it.

[36] http://ec.europa.eu/energy/en/topics/renewable-energy/biofuels/sustainability-criteria

[37] http://www.wdpa.org/

[38] http://www.iucnredlist.org/

[39] http://worldwildlife.org/pages/wildfinder

- GlobCover[40] - land cover maps based on satellite images
- Biocarbontracker[41] - based on GlobCover, includes analyses of satellite images highlighting vegetation cover change, above-ground biocarbon loss and events of deforestation
- MODIS[42] - temporal data on vegetation cover (250m resolution)
- Landsat[43] - temporal data on vegetation cover (30m resolution), updated on an ongoing basis by the US government
- US Department of Agriculture (USDA) Cropland Data Layers[44] - crop-specific land cover data for the US
- Harmonised World Soil Database, FAO/IIASA[45] - global database on soil information and land cover

| Land use at 1 January 2008 | Description | Carbon stock conditions | Biodiversity conditions |
|---|---|---|---|
| Cropland - non-protected | This category includes cropped land, (including rice fields and set-aside), and agroforestry systems where the vegetation structure falls below the thresholds used for the forest categories[46] .<br>The cropland is not in a nature-protected area. | None | None |
| Cropland - protected - no interference with nature protection purpose | Same as above, but the cropland is in a nature protection area and the production of the raw material did not interfere with the nature protection purpose. | None | Evidence that the production of the biofuel feedstock did not interfere with the nature protection purposes of the land. |
| Cropland - protected/protection status unknown | This category of cropland should be reported where:<br>a) the cropland had protected status, but evidence could not be provided that there was no interference with the nature protection purpose; or<br>b) the protection status could not be determined. | None | This status of land does not comply with the biodiversity criteria and additional evidence is therefore required to demonstrate compliance (see paragraph 7.38). |
| Grassland (and other wooded land not classified as forest) | This category includes rangelands and pasture land that are not considered cropland, but which have an agricultural use. It also includes grasslands without an agricultural use but excludes highly biodiverse grassland and cropland lying temporarily fallow for less than 5 years. | GHG emissions from any land-use change must be taken into account in GHG calculations. | Evidence that the land has not been highly biodiverse grassland (see paragraph 7.34). |

[40] http://due.esrin.esa.int/globcover/
[41] http://biocarbontracker.com/
[42] http://modis-land.gsfc.nasa.gov/vi.html
[43] http://landsat.gsfc.nasa.gov/
[44] http://www.nass.usda.gov/research/Cropland/metadata/meta.htm
[45] http://webarchive.iiasa.ac.at/Research/LUC/External-World-soil-database/HTML/index.html?sb=1
[46] Note that perennial crop plantations are classed as cropland under the RTFO and are not eligible under the SAF Mandate.

| Land use at 1 January 2008 | Description | Carbon stock conditions | Biodiversity conditions |
|---|---|---|---|
| | It additionally includes systems with woody vegetation and other non-grass vegetation such as herbs and brushes that fall below the threshold values used in the forest land categories including both those with and without an agricultural use. It includes extensively managed rangelands as well as intensively managed (e.g. with fertilisation, irrigation, species changes) continuous pasture and hay land. | | |
| Highly biodiverse grassland - no change in status | Highly biodiverse grassland is defined as any grassland spanning more than one hectare which is included as a priority grassland habitat under the UK Biodiversity Action Plan.[47] For grasslands located outside of the UK, definitions of highly biodiverse grassland according to the relevant competent authority in that country may be used.<br><br>This category cannot be reported for natural grassland that is highly biodiverse. It should only be reported for non-natural highly biodiverse grasslands that would cease to be grassland in the absence of human intervention, where evidence is provided that harvesting of the raw material is necessary to preserve its grassland status. | None | Evidence that harvesting of the raw material is necessary to preserve the grassland status (see paragraph 7.34). |
| Highly biodiverse forest – no change of status | Highly biodiverse forest and other wooded land which is species-rich and not degraded.[48] | None | Evidence that harvesting of the raw material did not interfere with nature protection purposes. |
| Forest greater than 30% canopy cover - no change in status | Continuously forested areas, namely land spanning more than one hectare with trees higher than five metres and a canopy cover of more than 30%, or trees able to reach those thresholds in situ. | Evidence of no change in status compared to January 2008. | Evidence that the forest in question was not primary forest and that the land, not in a protected area (see paragraph 7.33) or a highly biodiverse forest. |
| Forest 10 to 30% canopy cover | Land spanning more than one hectare with trees higher than five metres and a canopy cover of between 10% and 30%, or trees able to reach those thresholds in situ. | GHG emissions from any land-use change must be taken into account in GHG calculations. | Evidence that the forest in question was not primary forest and that the land, not in a protected area (see paragraph 7.33) or a |

[47] Further guidance on what constitutes a priority grassland habitat is also available in Annex 2 of the JNCC Guidelines for the Selection of Biological Sites of Special Scientific Interest (SSSIs).

[48] The Administrator is currently developing specific guidance on how to determine if land is highly biodiverse forest and will provide updated guidance on this matter as soon as it is available.

| Land use at 1 January 2008 | Description | Carbon stock conditions | Biodiversity conditions |
|---|---|---|---|
| | | | highly biodiverse forest. |
| Wetland - no change in status | Land that is covered with or saturated by water permanently or for a significant part of the year. | Evidence of no change in status compared to January 2008. | Evidence that the wetland in question was not primary forest, in a designated protected area (see paragraph 7.33) or a highly biodiverse grassland. |
| Undrained peatland - no change in status | Undrained peatland is peatland that was not completely drained in January 2008.<br><br>This includes peatland that was not drained at all and peatland that was partially drained. | Evidence that the land has not been further drained. | Evidence that the peatland in question was not primary forest, in a designated protected area (see paragraph 7.33) or a highly biodiverse grassland. |
| Settlement | Includes all developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other categories. Examples of settlements include land along streets, in residential (rural and urban) and commercial lawns, in public and private gardens, in golf courses and athletic fields, and in parks, provided such land is functionally or administratively associated with particular cities, villages or other settlement types and is not accounted for in another land use category[49]. | None | None |

**Table 11** Land use categories and RTFO / SAF Mandate compliance

## The Sustainable Land Use Standard

7.41 The Sustainable Land Use Standard can be used to demonstrate compliance with the RTFO / SAF Mandate land criteria. It comprises five environmental and two social principles. These are sub-divided into criteria and indicators which are set out in Annex G. Suppliers can undertake independent third-party audits against these criteria as one means of demonstrating compliance with the RTFO / SAF Mandate land criteria. The audit guidelines outlined in Annex L should be followed.

7.42 To demonstrate compliance with the full Sustainable Land Use Standard, parties must carry out an independent third-party audit against the full Sustainable Land Use Standard criteria, in which the requirements of the RTFO's norm for audit quality are met Annex L The requirements of the norm

[49] This definition is taken from the 2006 IPCC Guidelines for National GHG inventories (Vol 4).

for audit quality are divided into 'major musts' which have to be met in order to comply, and 'minor musts' which should be treated as recommendations only.

7.43 Audits against the Sustainable Land Use Standard should take place annually in order to demonstrate continuing compliance with the land criteria.

### The Biodiverse Grassland Standard

7.44 Suppliers can conduct independent third-party audits against the Biodiverse Grassland Standard as a means of demonstrating compliance with the RTFO/SAF Mandate land criteria. Specific requirements for the audit of highly biodiverse grassland are detailed in Annex H. The audit guidelines outlined in Annex L should also be followed.

## Alternative options for demonstrating compliance with the forest and the soil carbon criteria

7.45 One option that suppliers can use to support claims of compliance with the forest and soil carbon criteria is to submit evidence that a voluntary scheme has recognised a consignment of fuel as demonstrating compliance with the forest and soil carbon criteria. See paragraphs 7.23 to 7.27 for more information. The Administrator may still request additional information or evidence for any or all steps in the supply chain, so the supplier must ensure that evidence of compliance with the relevant criteria for each step in the supply chain is available on request. Where an obligated party fails to provide sufficient information or evidence to substantiate claims, Certificates will not be issued, and the fuel will be treated as fossil for the purposes of calculating the supplier's obligation. See Chapter 8 of this guidance document for examples of evidence that may be requested, and Chapter 5 and Annex A of the respective RTFO and SAF Mandate Compliance Guidance documents for more information on use of voluntary schemes to show compliance with the respective schemes and process for requesting additional evidence.

7.46 Where there is no voluntary scheme available, suppliers can commission independent third-party audits against the relevant RTFO standards provided in the annexes of this document. The audit guidelines outlined in Annex L should also be followed. Any supplier wishing to demonstrate compliance through this route should contact the Administrator for further guidance.

7.47 The relevant standards are as follows:

- For the forestry criteria, the Sustainable Forestry Standard (see Annex I)
- For the soil carbon criteria, the Soil Carbon Standard (see Annex J)

7.48 Audits against the Sustainable Forestry and Soil Carbon standards should take place annually in order to demonstrate continuing compliance with the relevant criteria.

## Demonstrating compliance with the sustainable waste management criteria

7.49 The Administrator will ask for evidence that the criteria outlined in paragraph 7.21, and detailed in Annex K, have been met as part of the existing fuel pathway in-principle assessment process. The Administrator will likely ask for evidence, such as an environmental permit and description of processes, to ensure that a given site is following these principles.

7.50 The Administrator may ask the reporting party to undertake Third-Party Audits against the Sustainable Waste Management Standard (Annex K) to demonstrate that the required criteria have been met.[50] This will be determined on a case-by-case basis. Any audits should follow the audit guidelines outlined in Annex L.

# 8. Evidence requirements

**Chapter summary**

This chapter provides guidance on the types of evidence suppliers should be able to identify in the supply chain and the reliance that can be placed upon them.

## Introduction

8.1 As set out in Chapter 3, each party in the chain of custody must keep records relating to the feedstock or eligible fuel that they have received and supplied. In order to ensure that a full chain of custody is in place, records for both the C&S data and the physical product will need to be complete. This information may need to be made available in the following circumstances:

- for the final reporting party to check before submitting an application for Certificates to the Administrator
- for a verifier to review whilst undertaking an assurance engagement on a supplier's application for Certificates
- for the Administrator to review whilst checking the accuracy of information provided with an application for Certificates or undertaking an investigation as per Annex A in the respective RTFO and SAF Mandate Compliance Guidance documents

8.2 Various types of evidence will exist depending on the nature of the feedstock, its country of origin, and the supply chain. The following sections describe the types of evidence that may be available to demonstrate compliance with the sustainability criteria. Different types of documentation are also provided along with guidance on the level of reliance that should be placed on them. Administrator will reference this guidance when conducting its own checks.

# Evidence requirements for key C&S data

## Evidence of compliance with RTFO recognised voluntary schemes

8.3 The LCF Delivery Unit will publish a list of voluntary schemes recognised as suitable for supporting sustainability claims related to SAF in due course. The link will be made available in the RTFO and SAF Mandate Third-Party Assurance Guidance. In the interim, suppliers may consider using evidence provided by RTFO recognised schemes to support claims of compliance with the SAF Mandate requirements in accordance with the following paragraphs.

8.4 Reporting that a biofuel, RFNBO/PtL or RCF meets a voluntary scheme that has been recognised as meeting one or more of the sustainability criteria for that fuel type, will be considered to be supporting evidence of compliance with those criteria. However, use of a voluntary scheme does not guarantee issuance of Certificates, and the Administrator has the ability to request more information where necessary to ensure that the specific requirements of the RTFO / SAF Mandate have been met. Therefore, obligated parties must ensure they can provide the Administrator with information and evidence to show each stage in the supply chain back to the origin of the feedstock for the fuel meets the RTFO and SAF Mandate requirements (further detail can be found in Chapter 5 and Annex A of the respective RTFO and SAF Mandate Compliance Guidance documents).

8.5 Voluntary schemes may not cover all of the mandatory criteria. In this case, a scheme can only be accepted as evidence for the criteria it has been recognised for. Other evidence is required to demonstrate compliance with criteria not covered by the scheme.

8.6 For eligible fuels covered by a voluntary scheme, a Certificate or Proof of Sustainability generated by the scheme must exist relating to the fuel in question. Additional evidence is not generally required to substantiate the C&S information included on the Certificate. However, where an application is undergoing additional checks (see Annex A of the respective RTFO and SAF Mandate Compliance Guidance documents), if requested by the Administrator, the obligated party must be able to provide additional evidence from all steps in the supply chain. Where an obligated party fails to provide sufficient information or evidence to substantiate claims, Certificates will not be issued, and fuel will be treated as fossil for the purposes of calculating the supplier's obligation. The claim of compliance with the scheme and the Certificate must be legitimate, the recognised version of the scheme must be used, and the quantity of renewable fuel must be reported accurately.

8.7 A Certificate issued under the scheme is the only acceptable form of evidence that the renewable fuel in question was certified and meets the sustainability criteria of the scheme. Neither membership of a voluntary scheme or an audit of an individual supplier to scheme requirements provides certification for consignments of renewable fuel.

8.8 Suppliers should ensure that the Certificate includes the necessary information to apply for Certificates. Where mandatory or other reported C&S information is not included in the scheme's Certificate then other evidence will need to be obtained to cover the missing information.

8.9 If a voluntary scheme does not include all of the suppliers in the fuel chain, a separate chain of custody must be in place for the stages of the supply chain not covered by the scheme. Evidence must be available to demonstrate that the fuel meets the RTFO or SAF Mandate requirements at each stage of the supply chain (whether covered by the voluntary scheme or not) and this evidence must be made available to the Administrator upon request. Where an obligated party fails to provide sufficient information or evidence to substantiate claims, Certificates will not be issued, and the fuel will be treated as fossil for the purposes of calculating the obligation.

8.10 Each scheme has its own system for tracking registrations and any Certificates issued. Some include numbered Certificates that can be cross-checked using an online database. Some have strict rules on the claims that can be made, such as a requirement for all parties in the chain of custody, including the reporting party, to be registered and certified for a claim to be legitimate. Certificates issued outside of scheme rules are not legitimate and should not be relied upon.

### Evidence of the eligible fuel feedstock

8.11 Evidence from the origin is the only form of acceptable evidence to prove feedstock type and any C&S data relating to the land on which a crop was grown. As with all evidence, evidence from the origin is subject to checks on its credibility, e.g. that the entity carries out a business that is expected to produce an appropriate quantity of the feedstock whether it is a crop or a waste or a residue.

8.12 Evidence from the origin is expected to include, as a minimum, the entity's name and address, the date of transfer, and the quantity and nature of the material transferred. See Table 12.

8.13 Formal documents are preferred and are required where they may normally be expected to be available. The availability of formal documents may depend on the country of origin. For example, a formal waste transfer note (WTN) should exist for waste products within the UK, and any registered business is required to produce sales invoices.

### Evidence of feedstock type in claims for double counted feedstocks

8.14 Considering the financial incentive that double counting of certain feedstocks presents, it will be particularly important to examine evidence of feedstock type for these claims. Evidence will be required that the fuel is indeed made from the feedstock that has been claimed and this evidence must come from the origin. Evidence will vary with feedstock type and source. For example, in the case of

used cooking oil, evidence of the original collection of the oil from restaurants or other catering establishments would be required.

8.15 For RFNBOs / PTL, evidence of the amounts of each type of eligible electricity and/or eligible heat purchased will be required, providing assurance that bioenergy or fossil energy inputs have not been used to generate wholly RFNBO / PtL fuel quantities. Evidence that the feedstocks (materials providing atoms to the fuel) used (e.g. water, $CO_2$) do not contain any energy will also be needed. In addition, evidence will be required that the fuel is indeed made from the process energy that has been claimed, and this evidence regarding the process energy must come from the origin (see section 8.12). For example, in the case of solar electricity, a power purchase agreement and invoices, or proof of ownership of the solar generation plant by the RFNBO /PtL plant, and meter readings would be required, plus a statement regarding the connection to the grid.

8.16 Whether a feedstock is categorised as a waste, residue or dedicated energy crop under the RTFO is determined by the Administrator. A list of feedstocks is available online.

## Evidence supporting carbon intensity data

8.17 Where a default value for the carbon intensity is used, it is necessary to ensure that the feedstock (and process if applicable) is correct and that the correct default value has been applied. For all crop-derived feedstocks, it is also necessary to determine that no change in (RTFO-compliant) carbon stocks took place.

8.18 Where a reporting party has reported an actual value for the carbon intensity, records and evidence relating to the calculation must be kept and be available for review.

8.19 Where actual carbon emissions data is provided part-way along the chain of custody (including through a voluntary scheme) e.g. for cultivation and/or processing, reporting parties and verifiers should check that the calculation includes any additional carbon emissions which may have occurred along the rest of the fuel chain.

## Evidence for previous land use

8.20 Guidance is given in Chapter 7 on sources of evidence that may be available to demonstrate compliance with the land use criteria.

# Evidence from audits within the supply chain

## Third-party audits or assurance

8.21 Evidence of third-party audits may be provided in a number of circumstances. These include:

- where a supplier has used a voluntary scheme that has not been recognised by the Administrator
- where a member of the supply chain has arranged independent verification of the data to that point in the fuel chain
- as proof of compliance with the one of the RTFO Standards (Annexes E-J)
- as evidence for the use of actual carbon data

8.22 For third-party assurance to be credible enough to be relied upon exclusively, the following conditions must be met:

- the subject matter (i.e. the data that is being assured) must cover the data that is being reported to the Administrator
- the assurance must be provided by a suitably competent and independent person
- the assurance provider must be working to a standard appropriate to the data they are verifying
- the assurance provider must have used appropriate assurance criteria and specify these in the assurance statement
- testing procedures must be undertaken to an appropriate methodology and sufficient sample size to be relied upon (for example, the assurance provider should have tested, using an appropriate sample size, that the C&S information is traceable back to the party or parties that generated the original information through an appropriate chain of custody)
- the assurance conclusions must be sufficient to mitigate the need for further testing
- the assurance report must convey the above information clearly or be accompanied by other referenced documentation which provides the information required

8.23 If an audit states that it has been conducted to one of the RTFO Standards (Annexes E-J), it must be clear from the audit report (or accompanying documentation) how compliance with each criterion has been assessed and what evidence has been relied upon.

8.24 If the above conditions have not been met, suppliers should ensure that there is additional evidence available to substantiate the C&S data. When conducting its own investigations, the Administrator may also require evidence that has already been reviewed by an independent auditor.

8.25 In the case of actual carbon emission data, additional technical expertise is required when auditing the calculations and results. Suitable indicators of the competency of an auditor to provide assurance over carbon data may include:

- the auditor is accredited to issue annual GHG emission opinions under the UK or EU Emissions Trading Scheme
- the auditor meets the requirements for organisations that validate or verify GHG emission assertions or claims, as set out in ISO 14065

the auditor has experience of issuing public assurance statements on an organisation's GHG emissions in accordance with a recognised assurance methodology standard (e.g. ISAE 3000)

8.26 Audits on individual suppliers within the supply chain that do not include auditing of parties earlier in the supply chain may form part of a body of evidence and may provide conclusive evidence about the operation of mass balance systems within the supply chain which has been subject to audit. However, it should be noted that such reports are not considered to be evidence of a complete chain of custody and therefore do not in themselves provide conclusive evidence of meeting the sustainability criteria.

8.27 Where proof of compliance with the RTFO Standards (Annexes E-J) is being presented, there must be evidence that a positive field audit was undertaken, and that the auditor(s) met the norm for audit quality. No assessment of the content of audit reports is necessary, as the audit norm serves as a proxy for audit quality (see Annex L).

### Second-party audits

8.28 Second-party audits are those undertaken on behalf of a supplier, but which are not 'independent'. For example, where a reporting party has hired experts to undertake checks on the supply chain but has not engaged them under an assurance framework that requires independence such as ISAE 3000.

8.29 Second-party audits may be used as evidence subject to the same requirements as for third-party audits, with the exception of the requirement for independence. Where second-party audits are used, the relationship between the individual or organisation undertaking the checks, and the supplier must be considered. The level of independence required for undertaking credible checks will vary based on risk, including the complexity of the information being checked.

## Transport evidence and contracts

8.30 It is necessary to be able to demonstrate a chain of custody for both the sustainability data and the physical shipments. For feedstocks and other material prior to the conversion to eligible fuel, the C&S data and physical material must be consistent. It would therefore be expected that any C&S data included in the shipping documentation would be consistent with the C&S data transferred.

8.31 Once the feedstock has been processed into eligible fuel, physical shipments do not have to contain the same information as the C&S data under a mass balance system, but a physical quantity must have been shipped between the

two entities to comply with the rules. For example, it may be legitimate to have a physical shipment of RME that has sustainability data for UCOME.

## Transport documentation

8.32 Transport documentation should be available from the origin of the material to the final supply. This can be expected to include vehicle and shipping documentation, loading and discharge inspection reports, weighbridge receipts and laboratory reports.

8.33 Prior to conversion of the feedstock into eligible fuel, the mass balance rules prevent allocation of C&S data to another feedstock. The chain of custody must therefore show shipping and other transportation documents and data transfers that relate directly to each other.

8.34 A bill of lading is a document issued by a carrier, such as a shipping company, confirming that specified goods have been received as cargo for transportation. In addition, a bill of lading should state the particular vessel on which the goods have been placed, their destination and the intended recipient.

8.35 Bills of lading should be available for all eligible fuels or feedstocks that have been shipped into the UK. Feedstocks produced within the UK may not have bills of lading, but there should be equivalent transportation documentation that provides evidence of product type, quantity, delivery route and date of delivery. Renewable fuel quantity data from bills of lading should be consistent with the data in the application for Certificates.

## Contracts

8.36 Suppliers may have contracts in place which help demonstrate their credibility. For example, a UCO supplier may have contracts for UCO collection.

8.37 Reporting parties should be able to provide contract documentation (including any amendments) that describes the eligible fuel that the supplier was contracted to supply, and which links to the invoices and bill(s) of lading that demonstrate that the specified renewable fuel was supplied.

8.38 Contract documentation may also set out requirements on the supplier to provide data, results of analytical testing, assurance to a particular standard or access to evidence. Contracts do not however provide conclusive evidence that a product was supplied to the specified requirements, and therefore additional evidence will be required to demonstrate compliance.

## Waste Transfer Notes and regulated documents

8.39 In the UK, a Waste Transfer Note (WTN) is a document that is required, by law, to be completed when waste is transferred from one entity to another. There is a list of information that must be included in the document and there are

penalties for falsifying the documents. Information on UK WTNs can be found on the UK Government website.

8.40 Documents describing themselves as WTNs relating to transactions in countries other than the UK may not be subject to the same levels of regulation, and therefore are not considered to provide the same level of evidence unless there is a similar regulatory system in place in the country in question. If a document claiming to be a waste transfer note is not subject to regulation, it is considered to be a self-declaration from the supplier concerned.

8.41 Suppliers moving animal by-products will also usually have regulatory controls and related documentation. In the UK for example the transport of such materials requires an 'Animal By-Products Movement Document'.

### Fraudulent documents

8.42 Some shipping companies and other organisations host 'blacklists' of examples of fraudulent documents on their websites[51] which may give some indication of the types of fraudulent documents that exist. None of these lists can be considered official and therefore the nature of the hosting organisation must be taken into account when considering the validity of any evidence provided.

## Other evidence

### Technical testing

8.43 On receipt of deliveries, reporting parties may perform tests of the feedstocks or renewable fuel for conformity with required physical and chemical properties. At this time, the Administrator does not consider that any chemical test is definitive for the identification of a feedstock or a resulting renewable fuel such as used cooking oil. However, these test results may provide supporting evidence about the type of feedstock and the percentage split for mixed feedstocks.

### Supplier self-declarations

8.44 Declarations from upstream suppliers on the C&S characteristics of a renewable fuel feedstock, supported by contractual obligations upon suppliers to provide such information, are a means of obtaining and maintaining control over C&S information that is used by many reporting parties.

8.45 Whilst self-declarations are a form of evidence, they must be credible, and they must form part of a complete chain of custody to the origin of a material.

[51] For example see http://www.rosneft.com/Investors/beware/examples/

## Management reports

8.46 Parties in the supply chain may also have internal management reports which provide supporting evidence for their supply. This might include for example reports recording collection at restaurants.

## Supplier lists and customer endorsements

8.47 Lists of upstream suppliers can provide supporting evidence of credible supply that can be checked. For example, a party supplying used cooking oil should have a list of collectors, who in turn should have a list of restaurants that they collect from.

## Other forms of evidence

8.48 First-hand evidence, such as interviewing personnel, observing processes and controls and, potentially, physical inspections, are all important sources of evidence. Interviews and observations of processes and controls may form part of the evidence gathered for every RTFO audit by suppliers of verifiers. Physical inspections may be required for certain information where documented evidence has not been passed up the chain of custody; an example might be examining local land use records and speaking to local community members to verify the previous land use of an area.

8.49 Research reports produced by independent third parties that support a claim being made by a reporting party. For example, this might relate to an assertion that a renewable fuel feedstock was sourced from an area with no land-use change.

8.50 Other forms of evidence may also be available, in addition to those included here.

## Example chain of custody records

8.51 The following tables contain examples of chain of custody records for different economic operators along the supply chain.

# Example records from a crop-based chain of custody

| Order no. | Transaction date | Receiving company | Quantity (tonne) | Product | Country of origin | Voluntary scheme[52] | Land use on 1 Jan 2008 | Crop yield (t/ha) | Nitrogen fertiliser (kg/ha) |
|---|---|---|---|---|---|---|---|---|---|
| 22001 | 15-4-2011 | C1 | 1,000 | Rapeseed | UK | Red Tractor | Cropland - non-protected | 3.0 | 180 |

**Table 12** Example of an output record from a farm[53] supplying certified rapeseed to crusher C1

| Order no. | Transaction date | Supplying company | Quantity (tonne) | Product | Country of origin | Voluntary scheme | Land use on 1 Jan 2008 | Carbon intensity ($gCO_2e/MJ$) |
|---|---|---|---|---|---|---|---|---|
| 22001 | 15-4-2011 | F1 | 1,000 | Rapeseed | UK | Red Tractor | Cropland - non-protected | 29.3 |
| 22002 | 15-4-2011 | F2 | 1,000 | Rapeseed | UK | Red Tractor | Cropland - non-protected | 29.3 |
| 22001 | 15-4-2011 | F3 | 1,000 | Rapeseed | UK | - | Cropland - non-protected | 29.3 |

**Table 13** Examples of an input record from a rapeseed crusher. This crusher takes in certified rapeseed from farm F1 and F2 and non-certified rapeseed from farm F3.

[52] It is possible that the renewable fuel or renewable feedstock met the requirements of more than one voluntary scheme.

[53] Note: a farmer (or any other supply chain actor) has the option of passing either raw data or a calculated carbon intensity figure along the chain. In this example the farmer has chosen to provide raw data for crop yield and nitrogen fertiliser application rate - the oilseed crusher must then use default values for the remaining inputs from cultivation for the carbon intensity calculation.

| | |
|---|---|
| **Input** | Rapeseed |
| **Output** | Rapeseed oil |
| **Unit** | kg rapeseed oil / kg rapeseed |
| **Value** | 0.40 |
| **Valid from** | 1-1-2011 |
| **Valid until** | 1-6-2011 |

**Table 14** Example record of rapeseed crusher conversion factor

| Order number | Transaction date | Receiving company | Quantity (tonne) | Product | Country of origin | Voluntary scheme | Land use on 1 Jan 2008 | Carbon intensity ($gCO_2e/MJ$) |
|---|---|---|---|---|---|---|---|---|
| 23001 | 20-4-2011 | B | 400 | Rapeseed oil | UK | Red Tractor | Cropland - non-protected | 32 |
| 23002 | 20-4-2011 | B | 400 | Rapeseed oil | UK | - | Cropland - non-protected | 32 |

**Table 15** Example of an output record from a crusher

| Order number | Transaction date | Supplying company | Quantity (tonne) | Product | Country of origin | Voluntary scheme | Land use on 1 Jan 2008 | Carbon intensity ($gCO_2e/MJ$) |
|---|---|---|---|---|---|---|---|---|
| 23001 | 20-4-2011 | C1 | 400 | Rapeseed oil | UK | Red Tractor | Cropland - non-protected | 32 |
| 23002 | 20-4-2011 | C1 | 400 | Rapeseed oil | UK | - | Cropland - non-protected | 32 |

**Table 16** Example of an input record from a eligible fuel producer. This producer takes in certified rapeseed oil from crusher C1.

| Product | Country of origin | Voluntary scheme | Land use on 1 Jan 2008 | Carbon intensity ($gCO_2e/MJ$) | Inventory (tonne) 15 Apr 2008 | Input (tonne) | Output (tonne) | Inventory (tonne) 15 May 2008 |
|---|---|---|---|---|---|---|---|---|
| OSR | UK | Red Tractor | Cropland - non-protected | 32 | 1,000 | 800 | 400 | 1,400 |
| OSR | Romania | - | Cropland - non-protected | 32 | 2,000 | 0 | 0 | 2,000 |
| OSR | UK | - | Cropland - non-protected | 32 | 0 | 400 | 400 | 0 |

**Table 17** Example of an inventory record of C&S data for crusher C1

| Order number | Transaction date | Supplying company | Quantity (tonne) | Product | Country of origin | Voluntary scheme | Land use on 1 Jan 2008 | Carbon intensity ($gCO_2e/MJ$) |
|---|---|---|---|---|---|---|---|---|
| 22001 | 20-4-2011 | C1 | 1,200 | Rapeseed oil | UK | Red Tractor | Cropland - non-protected | 42.5 |
| 22002 | 20-4-2011 | C1 | 4,800 | Rapeseed oil | Unknown | - | Unknown | 42.5 |
| 22005 | 20-4-2011 | C2 | 400 | CPO | Malaysia | RSPO | Cropland - non-protected | 42.5 |
| 22006 | 20-4-2011 | C2 | 600 | CPO | Malaysia | - | Unknown | 42.5 |

**Table 18** Examples of an input record from eligible fuel company B

| Order no. | Transaction period | Receiving company | Quantity (tonne) | Fuel type | Feedstock | Eligible fuel production process | Country of origin | Voluntary scheme | Land use on 1 Jan 2008 | Plant in operation on or before 5 October 2015 | Carbon intensity (gCO2e/MJ) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 33001 | 4-2011 | X | 300 | Biodiesel | Rapeseed oil | - | UK | Red Tractor | Cropland - non-protected | Yes | 52 |
| 33002 | 4-2011 | X | 1,400 | Biodiesel | Rapeseed oil | - | Unknown | - | Unknown | Yes | 52 |

**Table 19** Example of an output record from eligible fuel company B

| Order number | Transaction period | Supplying company | Quantity (tonne) | Fuel type | Feedstock | Eligible fuel production process | Country of origin | Voluntary scheme | Land use on 1 Jan 2008 | Plant in operation on or before 5 October 2015 | Carbon intensity (gCO2e / tonne) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 33001 | 4-2011 | B | 300 | Biodiesel | Rapeseed oil | - | UK | Red Tractor | Cropland - non-protected | Yes | 52 |
| 33002 | 4-2011 | B | 1,400 | Biodiesel | Rapeseed oil | - | Unknown | - | Unknown | Yes | 52 |
| 33005 | 4-2011 | B | 100 | Biodiesel | CPO | No methane capture | Malaysia | RSPO | Cropland - non-protected | Yes | 68 |
| 33006 | 4-2011 | B | 200 | Biodiesel | CPO | Unknown | Unknown | - | Unknown | Yes | 68 |

**Table 20** Examples of an input record from oil major X. Oil major X receives 2,000 tonnes biodiesel from biodiesel producer B, of which 400 tonnes report a voluntary scheme.

# Example records from a waste-based chain of custody

| Ref. no. | Supply date | Receiving company | Material supplied | Quantity, litres | Origin |
|---|---|---|---|---|---|
| 1234 | 16 Mar 13 | Collector 1 | UCO | 100 | UK |

**Table 21** Example of an output record from a restaurant; The restaurant is supplying used cooking oil (UKO) to a UCO collector.

| Ref. no. | Date collected | Supplier | Material collected | Quantity, litres | Origin | CI |
|---|---|---|---|---|---|---|
| 1234 | 16 Mar 13 | Restaurant 1 | UCO | 100 | UK | Default |
| 2345 | 17 Mar 13 | Restaurant 2 | UCO | 200 | UK | Default |

**Table 22** Example of an input record from a UCO collector/aggregator. The UCO collector collects UCO from a number of restaurants.

| Ref. no. | Date supplied | Receiving company | Material supplied | Quantity, litres | Origin | Voluntary scheme | CI |
|---|---|---|---|---|---|---|---|
| 3456 | 20 Mar 13 | BPP 1 | UCO | 300 | UK | none | Default |

**Table 23** Example of an output record from a UCO collector/aggregator. The UCO collector supplies the UCO to an eligible fuel production plant. The collector may also process the UCO into eligible fuel but in this example, it is done by a separate economic operator.

| Ref no. | Date received | Supplier | Material supplied | Quantity, litres | Origin | Voluntary scheme | CI |
|---|---|---|---|---|---|---|---|
| 3456 | 20 Mar 13 | Coll 1 | UCO | 300 | UK | none | Default |
| 4567 | 20 Mar 13 | Coll 2 | UCO | 500 | France | none | Default |
| 4568 | 22 Mar 13 | Coll 3 | UCO | 400 | Germany | ISCC EU | Default |

**Table 24** Example of an input record from an eligible fuel production plant. The eligible fuel production plant receives UCO from a number of UCO collectors.

| Ref no. | Date supplied | Supplier | Material supplied | Feedstock | Quantity, litres | Origin | Voluntary scheme | Plant in operation on or before 5 October 2015 | CI | Type of GHG data |
|---|---|---|---|---|---|---|---|---|---|---|
| 5678 | 30 Mar 13 | Oil major 1 | FAME | UCO | 270 | UK | None | Yes | 14 | Default |
| 6789 | 30 Mar 13 | Oil major 1 | FAME | UCO | 450 | France | None | Yes | 14 | Default |
| 7890 | 30 Mar 13 | Oil major 1 | FAME | UCO | 360 | Germany | ISCC EU | Yes | 14 | Default |

**Table 25** Example of an output record from an eligible fuel production plant. The eligible fuel production plant supplies FAME to an oil major. The conversion efficiency from UCO to FAME is 90% so the quantities are adjusted accordingly. Separate records are kept of the conversion factors.

| Ref. no. | Date supplied | Supplier | Material supplied | Feedstock | Quantity, litres | Origin | Voluntary scheme | Plant in operation on or before 5 October 2015 | CI | Type of GHG data |
|---|---|---|---|---|---|---|---|---|---|---|
| 5678 | 30 Mar 13 | BPP1 | FAME | UCO | 270 | UK | None | Yes | 14 | Default |
| 6789 | 30 Mar 13 | BPP1 | FAME | UCO | 450 | France | None | Yes | 14 | Default |
| 7890 | 30 Mar 13 | BPP1 | FAME | UCO | 360 | Germany | ISCC EU | Yes | 14 | Default |
| 8901 | 5 Apr 13 | BPP2 | FAME | UCO | 40,000 | UK | None | Yes | 14 | Default |
| 9012 | 5 Apr 13 | BPP2 | FAME | UCO | 40,000 | UK | None | Yes | 12 | Actual for entire chain |

**Table 26** Example of an input record for an oil major. The oil major receives FAME from a number of different eligible fuel production plants. Eligible fuel production plant 2 has used actual data to calculate the CI of consignment 9012 and has evidence of the input data used in the calculations.

| AC ref. no. | Fuel type | Quantity, litres | Feedstock | Eligible fuel production process | Country of origin | Previous land use | Voluntary scheme | Plant in operation on or before 5 October 2015 | CI | Type of GHG data |
|---|---|---|---|---|---|---|---|---|---|---|
| 1111 | Biodiesel ME | 40,270 | UCO | n/a | UK | n/a | none | Yes | 14 | Default |
| 2222 | Biodiesel ME | 450 | UCO | n/a | France | n/a | none | Yes | 14 | Default |
| 3333 | Biodiesel ME | 360 | UCO | n/a | Germany | n/a | ISCC | Yes | 14 | Default |
| 4444 | Biodiesel ME | 40,000 | UCO | n/a | UK | n/a | none | Yes | 12 | Actual data for entire fuel chain |

**Table 27** Example C&S record for an oil major for reporting in ROS. Consignments 5678 and 8901 from suppliers BPP1 and BPP2 have been aggregated as they have homogeneous C&S characteristics.

# Annex A Default and disaggregated default values for biofuels (RTFO only)

A.1 Default values are provided in this section for many of the more commonly used biofuel production pathways. These values may be used when calculating the GHG emissions of biofuels as set out in Chapter 6. The defaults are intentionally set conservatively to account for deviation from normal processes.

A.2 Total default values covering the entire production pathway are provided in Table 28 while associated disaggregated default values for individual components of the production pathway are provided in Table 29 & Table 30.

A.3 Where appropriate disaggregated default values can be used alongside actual values to determine total actual values. See C.9

A.4 Suppliers should take note that not all of the total default values in Table 28 meet the GHG emissions saving requirements of the RTFO (see paragraph 6.9) and therefore cannot be used in support of RTFC applications. However, in these circumstances, it is still possible to use the disaggregated default values for that production pathway alongside actual value calculations for the remainder of the pathway to determine the total actual value. (see 6.13)

# Default values for biofuels

| Biofuel production pathway | Default GHG emissions (gCO2e/MJ) | Default GHG emission saving[1] |
|---|---|---|
| Sugar beet ethanol (no biogas from slop, natural gas as process fuel in conventional boiler) | 38.2 | 59% |
| Sugar beet ethanol (with biogas from slop, natural gas as process fuel in conventional boiler) | 25.5 | 73% |
| Sugar beet ethanol (no biogas from slop, natural gas as process fuel in CHP plant[2]) | 30.4 | 68% |
| Sugar beet ethanol (with biogas from slop, natural gas as process fuel in CHP plant[2]) | 22.5 | 76% |
| Sugar beet ethanol (no biogas from slop, lignite as process fuel in CHP plant[2]) | 50.2 | 47% |
| Sugar beet ethanol (with biogas from slop, lignite as process fuel in CHP plant[2]) | 33.9 | 64% |
| Corn (maize) ethanol (natural gas as process fuel in conventional boiler) | 56.8 | 40% |
| Corn (maize) ethanol, (natural gas as process fuel in CHP plant[2]) | 48.5 | 48% |
| Corn (maize) ethanol (lignite as process fuel in CHP plant[2]) | 67.8 | 28% |
| Corn (maize) ethanol (forest residues as process fuel in CHP plant[2]) | 30.3 | 68% |
| Other cereals[3] excluding maize ethanol (natural gas as process fuel in conventional boiler) | 58.5 | 38% |
| Other cereals[3] excluding maize ethanol (natural gas as process fuel in CHP plant[2]) | 50.3 | 46% |
| Other cereals[3] excluding maize ethanol (lignite as process fuel in CHP plant[2]) | 71.7 | 24% |
| Other cereals[3] excluding maize ethanol (forest residues as process fuel in CHP plant[2]) | 31.4 | 67% |
| Sugar cane ethanol | 28.6 | 70% |
| The part from renewable sources of ethyl-tertio-butyl-ether (ETBE) | Equal to the ethanol production pathway used | Equal to that of the ethanol production pathway used |
| The part from renewable sources of tertiary-amyl-ethyl-ether (TAEE) | Equal to that of the ethanol production pathway used | Equal to that of the ethanol production pathway used |
| Rape seed biodiesel | 50.1 | 47% |
| Sunflower biodiesel | 44.7 | 52% |
| Soybean biodiesel | 47 | 50% |
| Palm oil biodiesel (open effluent pond) | 75.5 | 20% |
| Palm oil biodiesel (process with methane capture at oil mill) | 51.4 | 45% |
| Waste cooking oil biodiesel | 14.9 | 84% |
| Animal fats from rendering biodiesel[4] | 20.7 | 78% |
| Hydrotreated vegetable oil from rape seed | 50.1 | 47% |
| Hydrotreated vegetable oil from sunflower | 43.6 | 54% |
| Hydrotreated vegetable oil from soybean | 46.5 | 51% |

| Biofuel production pathway | Default GHG emissions (gCO2e/MJ) | Default GHG emission saving[1] |
|---|---|---|
| Hydrotreated vegetable oil from palm oil (open effluent pond) | 73.2 | 22% |
| Hydrotreated vegetable oil from palm oil (process with methane capture at oil mill) | 47.9 | 49% |
| Hydrotreated oil from waste cooking oil | 16 | 83% |
| Hydrotreated oil from animal fats from rendering[4] | 21.8 | 77% |
| Pure vegetable oil from rape seed | 40 | 57% |
| Pure vegetable oil from sunflower | 34.3 | 64% |
| Pure vegetable oil from soybean | 36.9 | 61% |
| Pure vegetable oil from palm oil (open effluent pond) | 65.5 | 30% |
| Pure vegetable oil from palm oil (process with methane capture at oil mill) | 40.3 | 57% |
| Pure oil from waste cooking oil | 2.2 | 98% |
| Wheat straw ethanol | 15.7 | 83% |
| Waste wood Fischer-Tropsch diesel in free-standing plant | 15.6 | 83% |
| Farmed wood Fischer-Tropsch diesel in free-standing plant | 16.7 | 82% |
| Waste wood Fischer-Tropsch petrol in free-standing plant | 15.6 | 83% |
| Farmed wood Fischer-Tropsch petrol in free-standing plant | 16.7 | 82% |
| Waste wood dimethylether (DME) in free-standing plant | 15.2 | 84% |
| Farmed wood dimethylether (DME) in free-standing plant | 16.2 | 83% |
| Waste wood methanol in free-standing plant | 15.2 | 84% |
| Farmed wood methanol in free-standing plant | 16.2 | 83% |
| Fischer – Tropsch diesel from black-liquor gasification integrated with pulp mill | 10.2 | 89% |
| Fischer – Tropsch petrol from black-liquor gasification integrated with pulp mill | 10.4 | 89% |
| Dimethylether (DME) from black-liquor gasification integrated with pulp mill | 10.2 | 89% |
| Methanol from black-liquor gasification integrated with pulp mill | 10.4 | 89% |
| The part from renewable sources of methyl-tertio-butyl-ether (MTBE) | Equal to that of the methanol production pathway used | Equal to that of the methanol production pathway used |
| Wet manure (Open digestate, no off-gas combustion[5]) | 150.5 | -60% |
| Wet manure (Open digestate, off-gas combustion[6]) | 129.5 | -38% |
| Wet manure (Close digestate, no off-gas combustion[5]) | 37.2 | 60% |
| Wet manure (Close digestate, off-gas combustion[6]) | 16.2 | 83% |

| Biofuel production pathway | Default GHG emissions (gCO2e/MJ) | Default GHG emission saving[1] |
|---|---|---|
| Maize whole plant (Open digestate, no off-gas combustion[5]) | 78.1 | 17% |
| Maize whole plant (Open digestate, off-gas combustion[6]) | 57.1 | 39% |
| Maize whole plant (Close digestate, no off-gas combustion[5]) | 55.5 | 41% |
| Maize whole plant (Close digestate, off-gas combustion[6]) | 34.5 | 63% |
| Biowaste[7] (Open digestate, no off-gas combustion) | 75.3 | 20% |
| Biowaste[7] (Open digestate, off-gas combustion) | 54.3 | 42% |
| Biowaste[7] (Close digestate, no off-gas combustion) | 39.6 | 58% |
| Biowaste[7] (Close digestate, off-gas combustion) | 18.6 | 80% |

**Table 28** Default values for biofuels if produced with no net carbon emissions from land-use change as calculated in accordance with paragraph C.41.

1. GHG savings relative to the fossil fuel comparator for transport of 94 $gCO_2e/MJ$.

2. Default values for processes using CHP are valid only if all the process heat is supplied by CHP.

3. “Other cereals” can be barley, wheat, triticale or rye.

4. Applies only to biofuels produced from animal by-products classified as category 1 and 2 material (see guidance issued by the Department for Environment, Food & Rural Affairs for more details on the categorisation of animal by-products). Emissions related to hygienisation as part of the rendering are not considered.

5. This category includes the following categories of technologies for biogas upgrade to biomethane: Pressure Swing Adsorption (PSA), Pressure Water Scrubbing (PWS), Membranes, Cryogenic, and Organic Physical Scrubbing (OPS). It includes an emission of 0.03 MJCH4/MJ biomethane for the emission of methane in the off-gases.

6. This category includes the following categories of technologies for biogas upgrade to biomethane: Pressure Water Scrubbing (PWS) when water is recycled, Pressure Swing Adsorption (PSA), Chemical Scrubbing, Organic Physical Scrubbing (OPS), Membranes and Cryogenic upgrading. No methane emissions are considered for this category (the methane in the off gas is combusted, if any).

7. Biowaste is defined as biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants and agro-industrial processing. It does not include forestry residues, manure, sewage sludge, or other biodegradable waste such as natural textiles, paper or processed wood. It also excludes those by-products of food production that never become waste.

# Disaggregated default values for biofuels

| Biofuel production pathway | Cultivation, $e_{ec}$ (incl. $N_2O$) | Cultivation, $e_{ec}$ ($N_2O$ only) | Processing, $e_p$ | Processing, $e_p$ (Oil extraction only) | Transport, $e_{td}$ | Transport, $e_{td}$ (final fuel only) |
|---|---|---|---|---|---|---|
| Sugar beet ethanol (no biogas from slop, natural gas as process fuel in conventional boiler) | 9.6 | 4.9 | 26.3 | 0 | 2.3 | 1.6 |
| Sugar beet ethanol (with biogas from slop, natural gas as process fuel in conventional boiler) | 9.6 | 4.9 | 13.6 | 0 | 2.3 | 1.6 |
| Sugar beet ethanol (no biogas from slop, natural gas as process fuel in CHP plant[1]) | 9.6 | 4.9 | 18.5 | 0 | 2.3 | 1.6 |
| Sugar beet ethanol (with biogas from slop, natural gas as process fuel in CHP plant[1]) | 9.6 | 4.9 | 10.6 | 0 | 2.3 | 1.6 |
| Sugar beet ethanol (no biogas from slop, lignite as process fuel in CHP plant[1]) | 9.6 | 4.9 | 38.3 | 0 | 2.3 | 1.6 |
| Sugar beet ethanol (with biogas from slop, lignite as process fuel in CHP plant[1]) | 9.6 | 4.9 | 22 | 0 | 2.3 | 1.6 |
| Corn (maize) ethanol (natural gas as process fuel in conventional boiler) | 25.5 | 13.7 | 29.1 | 0 | 2.2 | 1.6 |
| Corn (maize) ethanol, (natural gas as process fuel in CHP plant[1]) | 25.5 | 13.7 | 20.8 | 0 | 2.2 | 1.6 |
| Corn (maize) ethanol (lignite as process fuel in CHP plant[1]) | 25.5 | 13.7 | 40.1 | 0 | 2.2 | 1.6 |
| Corn (maize) ethanol (forest residues as process fuel in CHP plant[1]) | 25.5 | 13.7 | 2.6 | 0 | 2.2 | 1.6 |
| Other cereals[2] excluding maize ethanol (natural | 27 | 14.1 | 29.3 | 0 | 2.2 | 1.6 |

| Biofuel production pathway | Cultivation, $e_{ec}$ (incl. $N_2O$) | Cultivation, $e_{ec}$ ($N_2O$ only) | Processing, $e_p$ | Processing, $e_p$ (Oil extraction only) | Transport, $e_{td}$ | Transport, $e_{td}$ (final fuel only) |
|---|---|---|---|---|---|---|
| gas as process fuel in conventional boiler) | | | | | | |
| Other cereals[2] excluding maize ethanol (natural gas as process fuel in CHP plant[1]) | 27 | 14.1 | 21.1 | 0 | 2.2 | 1.6 |
| Other cereals[2] excluding maize ethanol (lignite as process fuel in CHP plant[1]) | 27 | 14.1 | 42.5 | 0 | 2.2 | 1.6 |
| Other cereals[2] excluding maize ethanol (forest residues as process fuel in CHP plant[1]) | 27 | 14.1 | 2.2 | 0 | 2.2 | 1.6 |
| Sugar cane ethanol | 17.1 | 2.1 | 1.8 | 0 | 9.7 | 6 |
| The part from renewable sources of ethyl-tertio-butyl-ether (ETBE) | Equal to that of the ethanol production pathway used | | | | | |
| The part from renewable sources of tertiary-amyl-ethyl-ether (TAEE) | Equal to that of the ethanol production pathway used | | | | | |
| Rape seed biodiesel | 32 | 17.6 | 16.3 | 4.2 | 1.8 | 1.3 |
| Sunflower biodiesel | 26.1 | 12.2 | 16.5 | 4 | 2.1 | 1.3 |
| Soybean biodiesel | 21.2 | 13.4 | 16.9 | 4.4 | 8.9 | 1.3 |
| Palm oil biodiesel (open effluent pond) | 26 | 16.5 | 42.6 | 29.2 | 6.9 | 1.3 |
| Palm oil biodiesel (process with methane capture at oil mill) | 26 | 16.5 | 18.5 | 5.1 | 6.9 | 1.3 |
| Waste cooking oil biodiesel | 0 | 0 | 13 | 0 | 1.9 | 1.3 |
| Animal fats from rendering biodiesel[3] | 0 | 0 | 19.1 | 6.1 | 1.6 | 1.3 |
| Hydrotreated vegetable oil from rape seed | 33.4 | 18 | 15 | 4.4 | 1.7 | 1.2 |
| Hydrotreated vegetable oil from sunflower | 26.9 | 12.5 | 14.7 | 4.1 | 2 | 1.2 |

| Biofuel production pathway | Cultivation, $e_{ec}$ (incl. $N_2O$) | Cultivation, $e_{ec}$ ($N_2O$ only) | Processing, $e_p$ | Processing, $e_p$ (Oil extraction only) | Transport, $e_{td}$ | Transport, $e_{td}$ (final fuel only) |
|---|---|---|---|---|---|---|
| Hydrotreated vegetable oil from soybean | 22.1 | 13.7 | 15.2 | 4.6 | 9.2 | 1.2 |
| Hydrotreated vegetable oil from palm oil (open effluent pond) | 27.3 | 16.9 | 38.9 | 30.7 | 7 | 1.2 |
| Hydrotreated vegetable oil from palm oil (process with methane capture at oil mill) | 27.3 | 16.9 | 13.6 | 5.4 | 7 | 1.2 |
| Hydrotreated oil from waste cooking oil | 0 | 0 | 14.3 | 0 | 1.7 | 1.2 |
| Hydrotreated oil from animal fats from rendering[3] | 0 | 0 | 20.3 | 6 | 1.5 | 1.2 |
| Pure vegetable oil from rape seed | 33.4 | 17.6 | 5.2 | 4.4 | 1.4 | 0.8 |
| Pure vegetable oil from sunflower | 27.2 | 12.2 | 5.4 | 4.2 | 1.7 | 0.8 |
| Pure vegetable oil from soybean | 22.2 | 13.4 | 5.9 | 4.7 | 8.8 | 0.8 |
| Pure vegetable oil from palm oil (open effluent pond) | 27.1 | 16.5 | 31.7 | 30.5 | 6.7 | 0.8 |
| Pure vegetable oil from palm oil (process with methane capture at oil mill) | 27.1 | 16.5 | 6.5 | 5.3 | 6.7 | 0.8 |
| Pure oil from waste cooking oil | 0 | 0 | 0.8 | 0 | 1.4 | 0.8 |
| Wheat straw ethanol | 1.8 | 0 | 6.8 | 0 | 7.1 | 1.6 |
| Waste wood Fischer-Tropsch diesel in free-standing plant | 3.3 | 0 | 0.1 | 0 | 12.2 | 1.2 |
| Farmed wood Fischer-Tropsch diesel in free-standing plant | 8.2 | 4.4 | 0.1 | 0 | 8.4 | 1.2 |
| Waste wood Fischer-Tropsch petrol in free-standing plant | 3.3 | 0 | 0.1 | 0 | 12.2 | 1.2 |
| Farmed wood Fischer-Tropsch petrol in free-standing plant | 8.2 | 4.4 | 0.1 | 0 | 8.4 | 1.2 |

| Biofuel production pathway | Cultivation, $e_{ec}$ (incl. $N_2O$) | Cultivation, $e_{ec}$ ($N_2O$ only) | Processing, $e_p$ | Processing, $e_p$ (Oil extraction only) | Transport, $e_{td}$ | Transport, $e_{td}$ (final fuel only) |
|---|---|---|---|---|---|---|
| Waste wood dimethylether (DME) in free-standing plant | 3.1 | 0 | 0 | 0 | 12.1 | 2 |
| Farmed wood dimethylether (DME) in free-standing plant | 7.6 | 4.1 | 0 | 0 | 8.6 | 2 |
| Waste wood methanol in free-standing plant | 3.1 | 0 | 0 | 0 | 12.1 | 2 |
| Farmed wood methanol in free-standing plant | 7.6 | 4.1 | 0 | 0 | 8.6 | 2 |
| Fischer – Tropsch diesel from black-liquor gasification integrated with pulp mill | 2.5 | 0 | 0 | 0 | 7.7 | 2 |
| Fischer – Tropsch petrol from black-liquor gasification integrated with pulp mill | 2.5 | 0 | 0 | 0 | 7.9 | 2 |
| Dimethylether (DME) from black-liquor gasification integrated with pulp mill | 2.5 | 0 | 0 | 0 | 7.7 | 2 |
| Methanol from black-liquor gasification integrated with pulp mill | 2.5 | 0 | 0 | 0 | 7.9 | 2 |
| The part from renewable sources of methyl-tertio-butyl-ether (MTBE) | Equal to that of the methanol production pathway used | | | | | |

**Table 29** Disaggregated default values for biofuels (excluding biomethane). All values are in gCO2e/MJ.

1. Default values for processes using CHP are valid only if all the process heat is supplied by CHP.

2. “Other cereals” can be barley, wheat, triticale or rye.

3. Applies only to biofuels produced from animal by-products classified as category 1 and 2 material (see guidance issued by the Department for Environment, Food & Rural Affairs for more details on the categorisation of animal by-products). Emissions related to hygienisation as part of the rendering are not considered.

| Biomethane production pathway | Cultivation | Processing | Upgrading | Transport | Compression at filling station |
|---|---|---|---|---|---|
| Wet manure (Open digestate, no off-gas combustion[1]) | 0 | 117.9 | 27.3 | 1 | 4.6 |
| Wet manure (Open digestate, off-gas combustion[2]) | 0 | 117.9 | 6.3 | 1 | 4.6 |
| Wet manure (Close digestate, no off-gas combustion[1]) | 0 | 4.4 | 27.3 | 0.9 | 4.6 |
| Wet manure (Close digestate, off-gas combustion[2]) | 0 | 4.4 | 6.3 | 0.9 | 4.6 |
| Maize whole plant (Open digestate, no off-gas combustion[1]) | 18.1 | 28.1 | 27.3 | 0 | 4.6 |
| Maize whole plant (Open digestate, off-gas combustion[2]) | 18.1 | 28.1 | 6.3 | 0 | 4.6 |
| Maize whole plant (Close digestate, no off-gas combustion[1]) | 17.6 | 6 | 27.3 | 0 | 4.6 |
| Maize whole plant (Close digestate, off-gas combustion[2]) | 17.6 | 6 | 6.3 | 0 | 4.6 |
| Biowaste[3] (Open digestate, no off-gas combustion) | 0 | 42.8 | 27.3 | 0.6 | 4.6 |
| Biowaste[3] (Open digestate, off-gas combustion) | 0 | 42.8 | 6.3 | 0.6 | 4.6 |
| Biowaste[3] (Close digestate, no off-gas combustion) | 0 | 7.2 | 27.3 | 0.5 | 4.6 |
| Biowaste[3] (Close digestate, off-gas combustion) | 0 | 7.2 | 6.3 | 0.5 | 4.6 |

**Table 30** Disaggregated default values for biomethane. All values are in gCO2e/MJ.

1. This category includes the following categories of technologies for biogas upgrade to biomethane: Pressure Swing Adsorption (PSA), Pressure Water Scrubbing (PWS), Membranes, Cryogenic, and Organic Physical Scrubbing (OPS). It includes an emission of 0.03 MJCH4/MJ biomethane for the emission of methane in the off-gases.

2. This category includes the following categories of technologies for biogas upgrade to biomethane: Pressure Water Scrubbing (PWS) when water is recycled, Pressure Swing Adsorption (PSA), Chemical Scrubbing, Organic Physical Scrubbing (OPS), Membranes and Cryogenic upgrading. No methane emissions are considered for this category (the methane in the off-gas is combusted, if any).

3. Biowaste is defined as biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants and agro-industrial processing. It does not include forestry residues, manure, sewage sludge, or other biodegradable waste such as natural textiles, paper or processed wood. It also excludes those by-products of food production that never become waste.

# Annex B SAF Mandate disaggregated default values for downstream transport and distribution

B.1 Disaggregated default values for downstream transport and distribution for common SAF pathways are provided in this section. These can be used to determine the emissions associated with the downstream transport and distribution of SAF from UK import terminals and UK production sites.

| **SAF production pathway** | **Downstream Transport and distribution, $e_{td}$ (final fuel only) $gCO_2eq/MJ$ LHV** |
|---|---|
| HEFA (jet) | 1.2 |
| Fischer-Tropsch Jet | 1.2 |

# Annex C Methodology for calculating the carbon intensity of biofuels

## Using default values to demonstrate compliance (RTFO ONLY)

C.1 For the purpose of the RTFO, default values are provided in Annex A for many of the more commonly used biofuel production pathways. These values may be used when calculating the GHG emissions of biofuels and are intentionally set conservatively to account for deviation from normal processes.

C.2 Suppliers should report actual values if:

- they wish to demonstrate a higher GHG emissions saving
- the default does not meet the required minimum GHG emissions saving
- there have been emissions due to land-use change
- no default has been published for a particular production pathway

Guidance on reporting actual values is provided in the next subsection.

C.3 For partially eligible fuels, the sustainability criteria apply to the eligible part of the fuel. Therefore, it is permitted to report an appropriate carbon default for the volume of the partially eligible fuel that has been reported as eligible.

C.4 Several of the default values require information on the process used to produce the biofuel to determine the appropriate default value. In most cases, this information relates to the specific process fuel used. These default values must not be reported unless the relevant process information is known and matches that of the default value.

C.5 For a consignment to be RTFO-compliant, there are specific conditions under which default values **must not** be reported as the carbon intensity of a consignment:

- where the default value does not meet the relevant GHG saving threshold
- when emissions from land-use change are greater than zero a calculation of the emissions from land-use change should also be added to the default value (note that the previous land use must be determined, and unknown land-use change cannot be reported) - guidance on calculating land-use change emissions is provided later in this chapter
- where a default value requires process information, but the process is unknown

## Calculating actual values - RTFO and SAF mandate

C.6 The methodology for calculating GHG emissions outlined in this section applies to all renewable transport fuels that are derived from biomass regardless of state (i.e. both gaseous and liquid biofuels).[54]

C.7 This methodology is based on a well-to-wheels (or equivalent) approach that includes all significant sources of direct GHG emissions.

C.8 GHG emissions from the production and use of biofuels shall be calculated as follows:

$$E = e_{ec} + e_{l} + e_{p} + e_{td} + e_{u} - e_{sca} - e_{ccs} - e_{ccr}$$

Where:

- E = total emissions from the production and use of the fuel
- $e_{ec}$ = emissions from the extraction or cultivation of raw materials (RTFO only)
- $e_{l}$ = annualised emissions from carbon stock changes caused by land-use change (RTFO only)
- $e_{p}$ = emissions from processing
- $e_{td}$ = emissions from transport and distribution (upstream and downstream)
- $e_{u}$ = emissions from the fuel in use
- $e_{sca}$ = emission savings from soil carbon accumulation via improved agricultural management
- $e_{ccs}$ = emission savings from carbon capture and storage
- $e_{ccr}$ = emission savings from carbon capture and replacement

C.9 Under the RTFO where default values exist for a particular fuel chain (see Annex A), it is permissible to use a mix of actual and disaggregated default values when calculating the carbon intensity of a given consignment of fuel. Disaggregated default values relevant to the RTFO collectively make up the total default values and can be used individually to account for emissions from a whole portion of the emissions calculation set out in paragraph C.8, such as transport or processing. Disaggregated default values approved for use under the RTFO are also provided in Annex A.

C.10 Under the SAF Mandate suppliers are required to calculate actual values but it is permissible to use disaggregated default values to determine emissions for the downstream portion of the emissions calculation set out in C.8. Disaggregated default values for downstream transport and distribution approved for use under the SAF are provided in Annex B

C.11 The Administrator provides standard values for commonly used inputs. These can be found in the RTFO and SAF mandate standard data sheets, and include values for global warming potentials, LHVs, transport efficiencies and emission factors for commonly used inputs. These values should be used in suppliers' GHG calculations

[54] Note that this is different from the methodology outlined in Directive (EU) 2018/2001, whereby gaseous renewable fuels derived from biomass are defined separately from liquid biofuels and have a distinct methodology. Under the RTFO, the GHG emissions from gaseous and liquid biofuels should be calculated using the same methodology. As of January 2024 no manure credit may be applied for gaseous biofuels derived from manure.

where they are available. Where they are not available, the figures used should primarily be based on official statistical data from government or other independent bodies, or peer-reviewed academic work. In all cases, the figures used should be the most recent available and of good quality.

C.12 A free software tool is provided by the Administrator called the Carbon Calculator which can be used to calculate carbon intensity values using actual data for some fuel chains for the purpose of the RTFO.

C.13 When presenting actual value calculations, fuel suppliers are recommended to separate out the constituent elements of the GHG calculation (e.g. $e_{ec}$, $e_{td}$, etc). See C.8 for details.

**Structure of a fuel chain**

C.14 If planning to report actual values, it is important that suppliers understand the structure and boundaries of their fuel chain. Wherever practicable, it is strongly recommended to select from the common modules shown in Figure 9, which are grouped to line up with the key stages in the calculation methodology set out in paragraph C.8. Further description of each of these modules is provided in Table 31.

C.15 A fuel chain can be constructed by arranging common modules into a series of sequential stages, an example of which is shown in Figure 10.

C.16 Note that the depot and filling station (and the transport between those) are typically beyond the duty point, that is, the point at which the owner of the biofuel (the reporting party) reports C&S data to the Administrator.

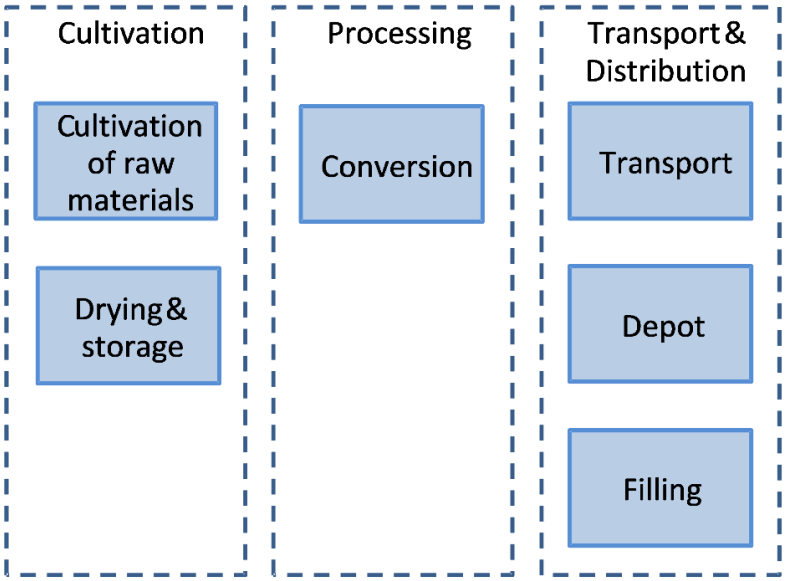


**Figure 9** Modules used to define a biofuel chain

| Module name | Description |
|---|---|
| Cultivation of raw materials | Growing a biofuel feedstock (e.g. palm, wheat, soy etc). Cultivation includes harvesting. |
| Drying and storage | Drying and storage of biofuel feedstocks (where this is done outside of a biofuel conversion plant). |
| Conversion | Any process which changes the physical nature of a feedstock or a biofuel (e.g. oilseed crushing, fermentation etc). The process may also result in the production of co-products (e.g. soy meal). |
| Transport | Transport of a primary, intermediary or final product (e.g. transport of liquid biofuel from a biofuel conversion plant to a refinery). |
| Depot | Road fuel depot station. |
| Filling | Road fuel filling station. |

**Table 31** Description of the modules constituting a typical biofuel fuel chain

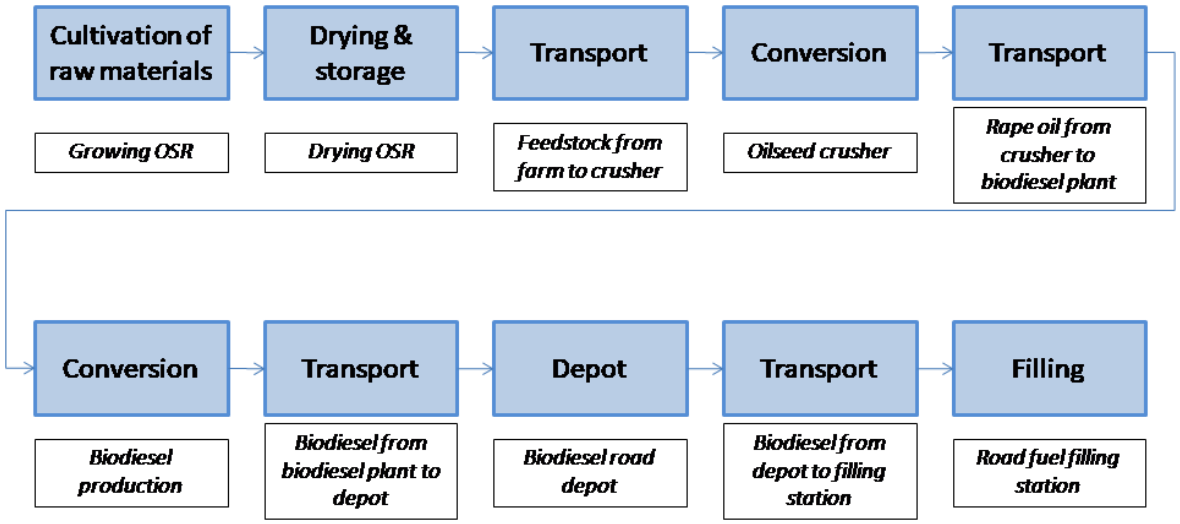


**Figure 10** Example of fuel chain defined using common modules (OSR = oilseed rape)

## Calculating actual values for partially eligible fuels

C.17 For partially eligible fuels, the sustainability criteria apply to the eligible part of the fuel. Therefore, any GHG calculations apply to the volume of the partially eligible fuel that has been reported as eligible and should take into account only the eligible feedstock. The emissions from the non-eligible part of the partially eligible biofuels do not need to be taken into consideration for the purposes of the RTFO or the SAF Mandate. Note that distinct conditions apply for RFNBOs/PtL and RCFs (see Annex D for RFNBOs and Annex E for RCFs).

C.18 For ETBE, TAEE and MTBE, the GHG emissions from the finished fuel are equal to that of the ethanol or methanol production pathway used. For example, if a supplier reports ETBE which contains bioethanol derived from sugar beet, any GHG calculations would apply to the bioethanol component and might include actual data on the cultivation of the sugar beet, processing of the sugar beet into bioethanol and/or transport.

C.19 For all other partially eligible fuels, the GHG emissions must be calculated for the eligible portion in the same way as they are calculated for fuels which are wholly eligible.

### Calculating actual values for fuels made from wastes and residues

C.20 Wastes and residues are considered to have zero life-cycle greenhouse gas emissions up to the process of collection of those materials. The 'process of collection' means the beginning of the process of collection. For example, used cooking oil may be collected from different restaurants and food processing plants. The GHG emissions from transportation of the collection of the feedstock will need to be calculated and allocated to the final biofuel.

C.21 When calculating actual GHG emission values, all emissions from transport involved in collecting the waste or residue and transporting it for further processing should be included.

C.22 When calculating actual GHG values all emissions from processing the waste material to extract the useful portion must also be included. For example, if palm sludge oil is extracted from palm oil mill effluent, the GHG emissions from this extraction process will need to be calculated and allocated to the final biofuel.

## What data to collect

C.23 Only a small number of data points have a significant influence on the final carbon intensity of a biofuel. Table 32 highlights the data points which have the most influence on the final carbon intensity and which should be the focus of data collection efforts. Likewise, these should also be the focus in efforts to reduce the carbon intensity of your fuel.

C.24 When constructing a new fuel chain, care must be taken to include all sources of emissions likely to contribute one percent or more of the total fuel chain carbon emissions from the origin of the biofuel to the filling station.[55]

| Step in the supply chain | Focus for data collection/ GHG reduction |
|---|---|
| Crop production (RTFO only) | Agrochemical application rate (e.g. nitrogen fertiliser)<br>Crop yield and moisture content<br>Fuel consumption for cultivation |
| Drying and storage | Fuel type (e.g. diesel) or electricity consumption for drying |
| Feedstock and fuel transport | Transport distances |
| Conversion - e.g. biofuel conversion or oilseed crushing | Yield (output vs input)[56]<br>Fuel type (e.g. natural gas, fuel oil, coal) and demand<br>Electricity demand<br>Chemical inputs |

[55] An initial estimate of carbon emissions associated with an input can be calculated using a proxy to work out the likely magnitude of the carbon emissions of a particular input to understand whether it is likely to contribute >1% of the overall life-cycle carbon emissions of the biofuel.

[56] i.e. tonnes of the product (e.g. biodiesel) per tonne of input (e.g. rapeseed oil).

| Step in the supply chain | Focus for data collection/ GHG reduction |
|---|---|
| | Co-product yields and energy contents |

**Table 32** Aspects of the biofuel chain which most affect the carbon intensity

C.25 Although the fuel depot and filling stations (and associated transport) are beyond the duty point, emissions from these steps must still be included. However, as the reporting party is unlikely to have influence over the GHG emissions associated with these steps or be able to collect the data (as they may no longer own the biofuel) biofuel) it is permitted to use disaggregated default values for these steps (see Annex A for the RTFO and Annex B for the SAF Mandate).

C.26 It is not necessary to have actual data for all sources of emissions: for feedstocks that have defaults provided by the Administrator it is possible to use a combination of actual data and default data in the GHG calculation.

### Validity of actual data over time

C.27 The actual data which can be used does not have to be real-time data (e.g. companies will not be required to assess conversion plant characteristics such as yield and natural gas use at the exact moment that a particular consignment of biofuel is processed). Instead, all actual data in all modules can be based on characteristics averaged over a 12-month period, which should be representative of typical operation.

### Actual data for crop production (RTFO only)

C.28 It is permissible for evidence in support of actual data provided for crop production to take the form of a statistically accurate survey of farm-level data. Such surveys would be considered valid for one crop-growing season and should be based on:

- data specific to an individual field
- average data for all fields of a particular crop grown on a farm (e.g. if a farmer has two fields of wheat, the weighted average crop yield of 11.2 t/ha could be reported, rather than the individual crop yields: field 1: 20 ha, 200 t; field 2: 32 ha, 384 t)

C.29 It is also permitted to use regional cultivation data in the place of actual crop production data for the calculation of fuel chain GHG emissions. The numbers should primarily be based on official statistical data from government bodies when available and of good quality.[57]

C.30 If not available, statistical data published by independent bodies may be used. As a third option, the numbers may be based on peer-reviewed academic work, with the

[57] Regional cultivation data for the UK is available here.

precondition that data used lies within the commonly accepted data range when available.

C.31 The data used must be based on the most recent available data from the above-mentioned sources. Typically, the data should be updated over time, unless there is no significant variability of the data over time.

C.32 In the absence of relevant regional average values, it is permitted to calculate averages based on local farming practices based for instance on data of a group of farms, as an alternative to using actual values, although this shall be at the discretion of the Administrator.

## Overall methodology - Guidance on calculating individual components

C.33 GHG emissions from the production and use of biofuels shall be calculated as follows:

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr}$$

Where:

- E = total emissions from the production and use of the fuel
- $e_{ec}$ = emissions from the extraction or cultivation of raw materials
- $e_l$ = annualised emissions from carbon stock changes caused by land-use change
- $e_p$ = emissions from processing
- $e_{td}$ = emissions from transport and distribution
- $e_u$ = emissions from the fuel in use
- $e_{sca}$ = emission savings from soil carbon accumulation via improved agricultural management
- $e_{ccs}$ = emission savings from carbon capture and storage
- $e_{ccr}$ = emission savings from carbon capture and replacement

C.34 Emissions from the manufacture, construction, replacement, upgrading and decommissioning of machinery and equipment shall not be taken into account.

C.35 GHG emissions from low carbon fuels, E, shall be expressed in terms of grams of $CO_2$ equivalent per MJ of fuel, $gCO_2e/MJ_{LHV}$.

C.36 Where the GHG emissions from the extraction or cultivation of raw materials, $e_{ec}$, are expressed in unit $gCO_2e$/dry-tonne of feedstock, the conversion to $gCO_2e/MJ_{LHV}$ of fuel shall be calculated as follows[58]:

[58] The formula for calculating greenhouse gas emissions from the extraction or cultivation of raw materials $e_{ec}$ describes cases where feedstock is converted into biofuels in one step. For more complex supply chains, adjustments are needed for calculating greenhouse gas emissions from the extraction or cultivation of raw materials $e_{ec}$ for intermediate products.

$$e_{ec}\text{fuel [gCO}_2\text{eq/}MJ_{LHV}\text{ fuel]} = \frac{e_{ec}\text{feedstock [gCO}_2\text{eq/t}_{dry}\text{]}}{\text{LHV}_{feedstock}\text{ [MJ/t}_{dry}\text{]}} \times \text{Feedstock to fuel ratio} \times \text{Fuel allocation factor}$$

Emissions per dry-tonne feedstock shall be calculated as follows:

$$e_{ec}\text{feedstock [gCO}_2\text{eq/t}_{dry}\text{]} = \frac{e_{ec}\text{feedstock [gCO}_2\text{/t}_{moist}\text{]}}{(1 - \%\text{ water content})}$$

The fuel allocation factor shall be calculated as follows:

$$\text{Fuel allocation factor} = \frac{\text{Energy in fuel [MJ]}}{\text{Energy in fuel [MJ]} + \text{Energy in co-products [MJ]}}$$

The fuel allocation factor shall be calculated on a $\text{LHV}_{allocation}$ energy content basis where all LHVs are calculated using the following equation:

$$\text{LHV}_{allocation}\text{ [MJ/kg]} = \text{LHV}_{dry}\text{ [MJ/kg]} \times (1 - \%\text{ water content}) - 2.441\text{ [MJ/kg]} \times \%\text{ water content}$$

The feedstock to fuel ratio shall be calculated as follows:

$$\text{Feedstock to fuel ratio} = \text{[MJ of feedstock required to make 1 MJ fuel]}$$

The feedstock to fuel ratio should be calculated on a $\text{LHV}_{wet}$ energy content basis where the fuel and feedstock LHVs are calculated using the following equation:

$$\text{LHV}_{wet}\text{ [MJ/kg]} = \text{LHV}_{dry}\text{[MJ/kg]} \times (1 - \%\text{ water content})$$

C.37 The greenhouse gases taken into account for the purposes of the equation in C.33 shall be $CO_2$, $N_2O$ and $CH_4$. For the purpose of calculating $CO_2$ equivalence, those gases shall be valued as follows:

- $CO_2$: 1
- $N_2O$: 265
- $CH_4$: 28

C.38 Emissions from the extraction or cultivation of raw materials, $e_{ec}$, shall include emissions:

- from the extraction or cultivation process itself
- from the collection, drying and storage of raw materials
- from the production of chemicals or products used in extraction or cultivation
- from any waste and leakages occuring in this step

The capture of $CO_2$ in the cultivation of raw materials shall be excluded. Several options are available for calculating $e_{ec}$ as set out in paragraphs C.28- C.32.

C.39 Wastes and residues are attributed with zero GHG emissions up to the process of collection of those materials. The process of collection may involve extraction and transportation of the material and any emissions of this step should therefore be included in $e_{ec}$ or $e_{td}$ as appropriate and as set out in paragraphs C.20- C.22.

C.40 For the purposes of the calculation referred to in paragraph C.33 GHG emission savings from improved agriculture management, $e_{sca}$, such as shifting to reduced or zero-tillage, improved crop/rotation, the use of cover crops, including crop residue management and the use of organic soil improver (e.g. compost, manure fermentation digestate), shall be taken into account only if solid and verifiable evidence is provided that the soil carbon has increased or that it is reasonable to expect to have increased over the period in which the raw materials concerned were cultivated while taking into account the emissions where such practices lead to increased fertiliser and herbicide use[59].

C.41 Annualised emissions from carbon stock changes caused by land-use change[60], $e_l$, shall be calculated by dividing total emissions equally over 20 years. These emissions should be calculated as follows[61]:

$e_l = (CS_R - CS_A) \times 3.664 \times (1/20) \times (1/P) - e_B$

Where:

- $e_l$ = the annualised GHG emissions from carbon stock change due to land-use change (in $gCO_2e/MJ$). 'Cropland'[62] and 'perennial cropland'[63] shall be regarded as one land use
- $CS_R$ = the carbon stock associated with the reference land use (i.e. the land use in January 2008 or 20 years before the feedstock was obtained, whichever was later) (in gC/ha)
- $CS_A$ = the carbon stock associated with the actual land use (in gC/ha). In cases where the carbon stock accumulates over more than one year, the value attributed to $CS_A$ shall be the estimated stock per unit area after 20 years or when the crop reaches maturity, whichever was earlier
- P = the productivity of the crop (in MJ/ha/y)
- $e_B$ = a bonus of 29 $gCO_2e/MJ$ if the biofuel feedstock is obtained from restored degraded land (see paragraph C.42)

Further guidance on determining carbon stocks ($CS_R$ and $CS_A$) is provided later in this chapter (see paragraph C.52).

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[59] Measurements of soil carbon can constitute such evidence, e.g. by a first measurement in advance of the cultivation and subsequent ones at regular intervals several years apart. In such a case, before the second measurement is available, an increase in soil carbon would be estimated on the basis of representative experiments or soil models. From the second measurement onwards, the measurements would constitute the basis for determining the existence of an increase in soil carbon and its magnitude.

[60] Please note that all calculations in this section refer to direct land-use change. There are currently no requirements on fuel suppliers to report or include in their carbon intensity calculations emissions from indirect land-use change. The impact of land-use change is not applicable to biofuels derived from wastes and non-agricultural residues.

[61] The quotient obtained by dividing the molecular weight of $CO_2$ (44,010 g/mol) by the molecular weight of carbon (12,011 g/mol) is equal to 3,664.

[62] Cropland as defined by IPCC.

[63] Perennial crops are defined as multi-annual crops, the stem of which is usually not annually harvested such as short rotation coppice and oil palm.

C.42 The bonus of 29 g $CO_2$eq/MJ shall be attributed if evidence is provided that the land satisfies both of the following criteria:

- it was not in use for agriculture or any other activity in January 2008
- it is severely degraded land[64], including such land that was formerly in agricultural use

The bonus of 29 g $CO_2$eq/MJ shall apply for a period of up to 20 years from the date of conversion of the land to agricultural use, provided that a steady increase in carbon stocks as well as a sizable reduction in erosion phenomena are ensured.

C.43 Emissions from processing, $e_p$, shall include emissions:

- from the processing itself
- from waste and leakages (e.g. wastewater treatment and trucking and disposal of ash)
- from the production, supply and use of chemicals or products used in processing, including the $CO_2$ emissions corresponding to the carbon contents of fossil inputs, whether or not actually combusted in the process

In accounting for the consumption of electricity imported from an electricity grid rather than being generated on-site within the fuel production plant, the GHG emissions intensity of the production and distribution of that electricity shall be assumed to be equal to the average emission intensity of the production and distribution of electricity in a defined region.[65] By way of derogation from this rule, the electricity can be attributed a GHG emissions intensity of zero if the electricity can be demonstrated to be wholly additional renewable electricity as per paragraph 4.49 and Chapter 2 of Annex D. Guarantees of Origin are not considered acceptable evidence for demonstrating the use of additional renewable electricity.

In accounting for the consumption of methane or natural gas not produced within the fuel production plant, the gas consumed should be assumed to be entirely fossil gas (and appropriate GHG emissions factors applied). However, if it can be demonstrated that an equivalent quantity of renewable gas has been produced and mass balanced to the point of consumption, the GHG emissions intensity of the gas consumed can be taken to be that of the renewable gas. However, the GHG emissions intensity cannot be taken to be less than zero and the requirements of the RTFO Guidance for Biomethane must be met.

Emissions from processing shall include emissions from drying of interim products and materials where relevant.

[64] 'Severely degraded land' means land that, for a significant period of time, has either been significantly salinated or presented significantly low organic matter content and has been severely eroded.

[65] The figures used should take into account emissions associated with electricity generation and with the extraction, refining and transportation of primary fuels as well as electricity transmission and distribution.

For the purposes of both the RTFO and SAF Mandate, hydrogen cannot be classified as a waste stream. Therefore, where hydrogen is used as a processing input, emissions associated with its production, supply and use must be accounted for.

C.44 Emissions from transport and distribution, $e_{td}$, shall include emissions from the transport of raw and semi-finished materials, from the storage and distribution of finished materials, and from any waste and leakage in these steps. Emissions from transport and distribution to be taken into account under paragraph C.38 shall not be covered by this paragraph.

C.45 Emissions of the fuel in use, $e_u$, shall be taken to be zero for biofuels.

C.46 Emission savings from carbon capture and storage, $e_{ccs}$, that have not already been accounted for in $e_p$, shall be limited to net emissions avoided through the capture and permanent storage of otherwise emitted carbon directly related to the extraction, transport, processing and distribution of the biofuel.[66] Net emissions means the $CO_2$ sequested minus any emissions associated with capture, processing and transport of that $CO_2$ including any fugitive emissions/leakage of $CO_2$. Storage must be demonstrably permanent and stable to the satisfaction of the Administrator. Examples may include geological sequestration of $CO_2$, the permanent sequestration of solid carbon in inert underground storage, or integration into concrete for use in construction.

C.47 Emission savings from $CO_2$ capture and replacement, $e_{ccr}$, shall be related directly to the production of the biofuel they are attributed to, and shall be limited to the net emissions avoided through the capture of $CO_2$ of which the carbon originates from biomass and which is used to replace fossil-derived $CO_2$ in the production of commercial products and services. Net emissions means the $CO_2$ utilised minus any emissions associated with capture, processing and transport of that $CO_2$ including any fugitive emissions/leakage of $CO_2$. In demonstrating this, it would suffice to verify that the $CO_2$ was sold to an economic operator that can reasonably be expected to make direct use of the $CO_2$ and has declared in writing that the purchased $CO_2$ will replace the use of fossil-derived $CO_2$ and that this will lead to emission savings.

C.48 For the purposes of both $e_{ccs}$ and $e_{ccr}$, any and all emissions related to the capturing and storage/replacement must be taken into account in the calculation.

## Allocation of GHG emissions

C.49 Where a biofuel production process produces, in combination, the fuel for which emissions are being calculated and one or more other products (‘co-products’), upstream and relevant process step GHG emissions shall be divided between the fuel or its intermediate product and the co-products in proportion to their energy content using the following equation:

[66] Where carbon is sequestered in a form other than $CO_2$, an equivalent quantity of $CO_2$ sequestered should be calculated based on the amount of elemental carbon sequestered. For example, if 1 kg of solid, pure elemental carbon is captured and sequestered, this would be equivalent to 3.664 kgs of sequestered $CO_2$.

$$\text{Fuel allocation factor} = \frac{\text{Energy in fuel [MJ]}}{\text{Energy in fuel [MJ]} + \text{Energy in co-products [MJ]}}$$

In the case of co-products other than electricity and heat, the energy content of products and co-products should be determined based on their $LHV_{allocation}$, which can be calculated as follows:

$$LHV_{allocation}\ [MJ/kg] = LHV_{dry}[MJ/kg] \times (1 - \%\ water\ content) - 2.441\ [MJ/kg] \times \%\ water\ content$$

The GHG intensity of excess useful heat or excess electricity is the same as the GHG intensity of heat or electricity delivered to the biofuel production process and is determined from calculating the GHG intensity of all inputs and emissions, including the feedstock and $CH_4$ and $N_2O$ emissions, to and from the cogeneration unit, boiler or other apparatus delivering heat or electricity to the biofuel production process. In the case of cogeneration of electricity and heat, the calculation is performed following paragraph C.51.

C.50 For the purposes of the calculation referred to in paragraph C.49, the emissions to be divided shall be $e_{ec} + e_l + e_{sca}$ + those fractions of $e_p$, $e_{td}$, $e_{ccs}$, and $e_{ccr}$ that take place up to and including the process step at which a co-product is produced. If any allocation to co-products has taken place at an earlier process step in the life-cycle, the fraction of those emissions assigned in the last such process step to the intermediate fuel product shall be used for those purposes instead of the total of those emissions.

All co-products shall be taken into account for the purposes of that calculation. No emissions shall be allocated to wastes and residues. Co-products that have a negative $LHV_{allocation}$ shall be considered to have an energy content of zero for the purposes of the emissions allocation calculation.

In the case of fuels produced in refineries, other than the combination of processing plants with boilers or cogeneration units providing heat and/or electricity to the processing plant, the unit of analysis for the purposes of the calculation referred to in paragraph C.49 shall be the refinery.

C.51 Where a cogeneration unit – providing heat and/or electricity to a biofuel production process for which emissions are being calculated – produces excess electricity and/or excess useful heat, the GHG emissions shall be divided between the electricity and the useful heat according to the temperature of the heat (which reflects the usefulness (utility) of the heat). The useful part of the heat is found by multiplying its energy content with the Carnot efficiency, $C_h$, calculated as follows:

$$C_h = \frac{T_h - T_0}{T_h}$$

Where:

- $T_h$ = Temperature, measured in absolute temperature (kelvin), of the useful heat at the point of delivery
- $T_0$ = Temperature of surroundings, set at 273.15 kelvin (equal to 0 °C)

If the excess heat is exported for heating of buildings, at a temperature below 150 °C (423.15 kelvin), $C_h$ can alternatively be defined as follows:

$C_h$ = Carnot efficiency in heat at 150 °C (423.15 kelvin), which is: 0.3546

For the purposes of this calculation, the actual efficiencies shall be used, defined as the annual mechanical energy, electricity and heat produced respectively divided by the annual energy input.

For the purposes of this calculation, the following definitions apply:

- ‘cogeneration’ shall mean the simultaneous generation in one process of thermal energy and electrical and/or mechanical energy
- ‘useful heat’ shall mean heat generated to satisfy an economical justifiable demand for heat, for heating or cooling purposes
- ‘economically justifiable demand’ shall mean the demand that does not exceed the needs for heat or cooling and which would otherwise be satisfied at market conditions

## Calculation of carbon stock for land-use change emissions (RTFO only)

C.52 The equation provided in paragraph C.41 should be used for reporting land-use change. The key part of the land-use change calculation is an estimation of the change in carbon stocks. This is based on the difference between the carbon stock now and the carbon stock in January 2008 (or 20 years before the feedstock was obtained, whichever is the later date). This is set out in Paragraph C.53.

C.53 Carbon stock can be calculated using the following equation:

$CS_i = SOC + C_{VEG}$

Where:

- $CS_i$ is the carbon stock of the land
- SOC is the soil organic carbon (in gC/ha)
- $C_{VEG}$ is the above and below-ground vegetation carbon stock (in gC/ha)

C.54 Carbon stock estimates are based on a number of key parameters which should be determined by suppliers:

- previous land use
- climate and in some cases ecological zone
- soil type
- soil management (for both previous and new land use)
- soil input (for both previous and new land use)

C.55 Definitions of the different land use categories for determining previous land use are provided in Table 11. Climate, ecological zone and soil type can be taken from maps and data provided by the Joint Research Centre (JRC) and the Food and Agriculture Organisation of the United Nations (FAO) - it will be necessary therefore for suppliers to determine the exact location of the land-use change. Soil management (whether full-till, reduced-till or no-till) and soil inputs (low, medium, high-with manure, and high-without manure) are factors that also need to be determined and included in the calculations.

C.56 In most cases, it is possible to use the information above to find the values for the different parameters in the look-up tables in the RTFO and SAF mandate standard data. However, under certain conditions, actual carbon stock measurements or other calculation methodologies will need to be undertaken (e.g. if the soil is a histosol or if no value exists in the look-up tables). In the absence of specified carbon stock, the Administrator requires that the carbon stock is measured for any settlement or degraded land converted for biofuel production.

**Soil organic carbon - mineral soils**

C.57 Parties may use several methods to determine soil organic carbon, including measurements[67]. When measurements are not used, the method used shall take into account climate, soil type, land cover, land management and inputs.

C.58 As a default method, the following equation can also be used:

$$SOC = SOC_{ST} \times F_{LU} \times F_{MG} \times F_I$$

Where:

- $SOC_{ST}$ is the standard soil organic carbon in the 0 - 30 cm topsoil layer (in gC/ha)
- $F_{LU}$ is the land use factor reflecting the difference in soil organic carbon associated with the type of land use compared to the standard soil organic carbon (no unit)
- $F_{MG}$ is the land use factor reflecting the difference in soil organic carbon associated with the principal management practice compared to the standard soil organic carbon (no unit)
- $F_I$ is the land use factor reflecting the difference in soil organic carbon associated with different levels of carbon input to soil compared to the standard soil organic carbon (no unit)

C.59 $SOC_{ST}$ can be looked up in the RTFO and SAF Mandate Standard Data available online depending on climate region and soil type. The climate region can be determined from the climate region data layers produced by the JRC and available

[67] Soil organic carbon levels can traditionally be measured using mass loss on ignition or wet oxidation. However, newer techniques are being developed, which can either be carried out in the field or remotely (near-infrared reflectance spectrometry, remote hyperspectral sensing).

online. The soil type can be determined by following the flow diagram in Figure 11 or following the soil type data layers produced by the JRC and available online.

C.60 $F_{LU}$, $F_{MG}$ and $F_I$ can be looked up in the RTFO and SAF Mandate standard data available online depending on climate region, land use, land management and input.

### Soil organic carbon - organic soils (histosols)

C.61 No default method is available for determining the SOC value of organic soils. However, the method used by parties should take into account the entire depth of the organic soil layer as well as climate, land cover, land management and input. Such methods may include measurements.

C.62 Where carbon stock is affected by soil drainage, losses of carbon following drainage shall be taken into account by appropriate methods, potentially based on annual losses of carbon following drainage.

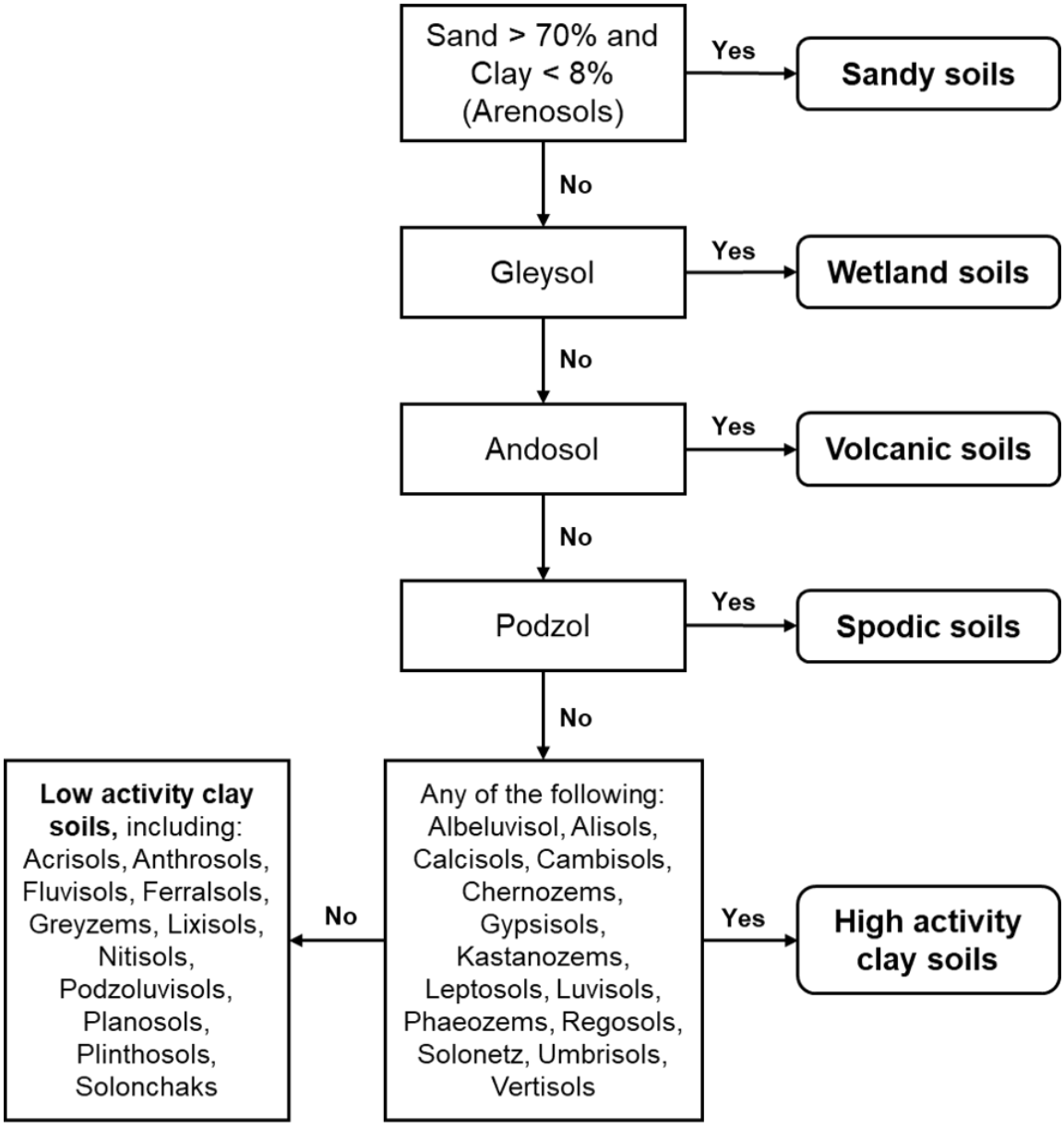

**Figure 11** Flow diagram for classifying soil type

## Increase in soil carbon stock through improved agricultural management

C.63 The same methodology used to calculate the change in carbon stocks should be applied for the calculation of emission savings from soil carbon accumulation via improved agricultural practices, such as the change from full to no-tillage practice. If a supplier does not report a land-use change but wishes the carbon intensity calculation to take into consideration an increase in soil carbon resulting from improved agricultural practices, the same calculations are performed but only $F_{MG}$ and/or $F_I$ will change between $CS_R$ and $CS_A$.

C.64 Where there has been an increase in carbon stock through improved agricultural management, this should be reported in the appropriate field in ROS (see Table 7).

## Above and below-ground vegetation carbon stock

C.65 For some vegetation types, $C_{VEG}$ can be directly read from RTFO SAF Mandate standard values available online. Relevant ecological zones can be determined from maps produced by the FAO.

C.66 If a look-up value is not available, vegetation carbon stock shall take into account both above and below-ground carbon stock in living stock ($C_{BM}$ in gC/ha) and above and below-ground carbon stock in dead organic matter ($C_{DOM}$ in gC/ha). For $C_{DOM}$ the value of 0 may be used, except forest land (excluding forest plantations) with more than 30% canopy cover. These can be calculated based on the equations provided in paragraphs C.67 & C.68.

C.67 Above and below-ground carbon stock in living stock can be calculated using one of the following equations:

$$C_{BM} = B_{AGB} \times CF_B + B_{BGB} \times CF_B$$

Or

$$C_{BM} = (B_{AGB} \times CF_B) \times (1+R)$$

Where:

- $B_{AGB}$ is the weight of above-ground living biomass (in kg dry matter/ha) which shall be taken to be the average weight of the above-ground living biomass during the production cycle for cropland, perennial crops and forest plantations
- $B_{BGB}$ is the weight of below-ground living biomass (in kg dry matter/ha) which shall be taken to be the average weight of the below-ground living biomass during the production cycle for cropland, perennial crops and forest plantations
- $CF_B$ is the carbon fraction of dry matter in living biomass (in kgC/kg dry matter) which can be taken to be 0.47

- R is the ratio of below-ground carbon stock in living biomass to above-ground carbon stock in living biomass which can be read in the RTFO SAF Mandate standard values available online

C.68 Above and below-ground carbon stock in dead organic matter shall be calculated as follows:

$C_{DOM} = DOM_{DW} \times CF_{DW} + DOM_{LI} \times CF_{LI}$

Where:

- $DOM_{DW}$ is the weight of the deadwood pool (in kg dry matter/ha)
- $CF_{DW}$ is the carbon fraction of dry matter in the deadwood pool (in kgC/kg dry matter) which can be taken to be 0.5
- $DOM_{LI}$ is the weight of litter (in kg dry matter/ha)
- $CF_{LI}$ is the carbon fraction of dry matter in the litter (in kgC/kg dry matter) which can be taken to be 0.4

# Annex D Methodology for calculating the carbon intensity of RFNBOs & PtL

## Overall methodology

D.1 Greenhouse gas (GHG) emissions from the production and use of renewable fuels of non-biological origin (RFNBOs) and PtL fuels shall be calculated as follows:

$E = e_{ec} + e_{pp} + e_{td} + e_u - e_{ccs}$

Where:

E = total emissions from the production and use of the fuel

$e_{ec}$ = emissions from the extraction or collection of raw materials

$e_{pp}$ = emissions from production and processing

$e_{td}$ = emissions from transport and distribution

$e_u$ = emissions from the fuel in use

$e_{ccs}$ = emission saving from carbon capture and storage

D.2 Emissions from the manufacture , construction, replacement, upgrading and decommissioning of machinery and equipment needed for renewable fuel production shall not be taken into account.

D.3 GHG emissions from low carbon fuels, E, shall be expressed in terms of grams of $CO_2$ equivalent per MJ of fuel, $gCO_2e/MJ_{LHV}$.

D.4 The greenhouse gases taken into account for the purposes of the equation in paragraph D.1 shall be $CO_2$, $N_2O$ and $CH_4$. For the purpose of calculating $CO_2$ equivalence, those gases shall be valued as follows:

- $CO_2$: 1
- $N_2O$: 265

- $CH_4$: 28

## Guidance on calculating individual components

D.5 Emissions from the extraction or collection of raw materials, $e_{ec}$, include emissions:

- from the extraction process itself
- from the collection of raw materials
- from any waste and leakages in this step[68].
- from the production of chemicals or products used in extraction or collection of the raw materials (this includes the additional energy, and chemicals used in any carbon capture)

D.6 Water, biogenic $CO_2$, atmospheric $CO_2$ and naturally occurring/geothermal $CO_2$ are considered to have zero lifecycle greenhouse gas emissions up to the process of collection of these materials, but emissions associated with the collection (or capture) of the materials must be accounted for. Where naturally occurring or geothermal $CO_2$ sources are utilised, evidence must be provided to the Administrator that these emission sources have not been increased by the extraction of the $CO_2$, or that any additional emissions have been included within the extraction emissions, $e_{ec}$. Where biogenic $CO_2$ sources are utilised, evidence should be provided to the Administrator that this $CO_2$ is not already being used to claim a GHG credit in the original bioenergy supply chain and would otherwise have been emitted to atmosphere[69].

D.7 Suppliers should inform the Administrator if they plan on using naturally occurring, geothermal or biogenic $CO_2$ sources and the Administrator will define what evidence is required to demonstrate compliance with the criteria in D.6.

D.8 Waste fossil $CO_2$ is also considered to have zero lifecycle greenhouse gas emissions up to the process of collection, provided this material meets the definition of a waste[70], evidence is provided that the carbon in this material would have otherwise been emitted to atmosphere, and provided the facility generating this waste material does not claim a reduction in their emissions due to this use of the waste fossil $CO_2$.

D.9 If the waste fossil generating facility does wish to claim a reduction in their emissions[71], then these GHG emissions instead need to be assigned to the waste

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[68] This excludes uncaptured carbon dioxide i.e. uncaptured carbon dioxide that goes up a flue is not considered a waste leakage of the $CO_2$ capture process; it is outside of the system boundary. If however, $CO_2$ is captured and then leaks this is within the system boundary, and will be considered a waste/leakage from the process which means it must be accounted for.

[69] For example, a biofuels producer cannot claim that any biogenic $CO_2$ used to make a RFNBO constitutes an "emission saving from carbon capture and replacement" within their own biofuel supply chain GHG calculation. This would be an erroneous double claim of GHG savings between biofuel and RFNBO supply chains. Due to their consumption and emission to atmosphere, RFNBOs also do not count as an "emission saving from carbon capture and storage" in the biofuels calculation.

[70] 'Waste' means any substance or object which the holder discards or intends or is required to discard. It excludes substances that have been intentionally modified or contaminated for the purpose of transforming it into a waste.

[71] For example, from a desire to reduce their costs under the UK's Emission Trading Scheme, or other national taxes on emissions. The waste fossil generating facility cannot claim a GHG savings whilst the

fossil material used to produce the RFNBO and must contribute to $e_{ec}$, in line with the material's global warming potential (e.g. one tonne of waste fossil $CO_2$ would be assigned 1 $tCO_2e$/tonne). Similarly, if the carbon in the material would not otherwise have been emitted to atmosphere (e.g. waste fossil plastic might have sequestered its carbon for centuries in landfill, or as a building insulation material), then the additional greenhouse gas emissions from this avoided sequestration also need to be assigned to the waste fossil material and contribute to $e_{ec}$.

D.10 If a supplier wishes to carry out either of the practices outlined in paragraph D.9 they should contact the Administrator for further guidance.

D.11 If the $CO_2$ is generated from fossil energy sources specifically for the purposes of producing transport fuel, this $CO_2$ must be accounted for as fossil combustion $CO_2$ emissions in the reported carbon intensity of the RFNBO. Upstream supply chain emissions associated with extracting, refining and transporting the fossil energy source must also be accounted for.

D.12 Emissions from production and processing, $e_{pp}$, shall include emissions:

- from the production and processing itself
- from waste and leakages (e.g. wastewater treatment and trucking and disposal of ash)
- from the production of chemicals or products used in processing including the $CO_2$ emissions corresponding to the carbon contents of fossil inputs, whether or not actually combusted in the process[72]

In accounting for the consumption of methane or natural gas not produced within the fuel production plant, the gas consumed should be assumed to be entirely fossil gas (and appropriate GHG emissions factors applied). However, if it can be demonstrated that an equivalent quantity of renewable gas has been produced and mass balanced to the point of consumption, the GHG emissions intensity of the gas consumed can be taken to be that of the renewable gas. However, the GHG emissions intensity cannot be taken to be less than zero and the requirements of the RTFO Guidance for Biomethane must be met.

Emissions from processing shall include emissions from drying of interim products and materials where relevant.

D.13 Where a RFNBO has been produced using wholly additional renewable electricity (Scenario 3 in Table 4) the GHG emissions associated with the renewable electricity used to produce it can be taken as zero.

D.14 Where a RFNBO has been produced using renewable electricity drawn from an electricity grid and doesn't meet the criteria for additionality outlined in paragraph

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RNFBO manufacturer also claims a low carbon fuel is being made, as this would be an erroneous double claim of only one set of GHG savings - since the original fossil carbon is still ultimately ending up in the atmosphere.

[72] This includes non-waste fossil $CO_2$ used as an input in producing the RFNBO (see D.11)

4.50 (Scenario 1, 2 and 4 in Table 4), the GHG intensity of the production and distribution of that electricity can be calculated as either:

- equal to the average emission intensity of that electricity grid for the most recent available full year which shall be taken to be the national grid average unless the criteria for regionalisation are met (paragraph 4.47), in which case the relevant regional grid average shall be used
- equal to the real-time carbon intensity figures for the given 30-minute periods when the RFNBO was produced, where this data is available from reliable and authoritative sources[73] (also see paragraph D.15)

In all cases, the figures used should meet the requirements of paragraph D.16 and match the methodology used to calculate the RFNBO portion of the fuel as described in Chapter 4 and summarised in Table 4. An individual production site must use either annual grid averages **or** real-time figures for fuel supplied within a given obligation year, it is not permitted to switch between the two.

D.15 Where real-time figures are used, it is permissible to calculate an average carbon intensity over continuous periods longer than 30 minutes (up to a maximum of 12 months). This average should be weighted based on the electricity consumed in each 30-minute period within the period chosen. The period used should exactly match the period used for determining the renewability of the RFNBO (see paragraph 4.39).

D.16 For the purposes of paragraph D.14, figures for the grid average GHG emissions should be sourced from reliable and authoritative sources such as government bodies and/or network operators. The figures used should take into account GHG emissions associated with electricity generation, the extraction, refining and transportation of primary fuels used in electricity generation, as well as electricity transmission and distribution. Emissions associated with the manufacture, construction, replacement, upgrading and decommissioning of electricity generation machinery and equipment should not be taken into account.

D.17 Where a RFNBO has been produced using some electricity which meets the criteria for additionality (Scenario 3, Table 4) and some electricity not from new generation capacity but which otherwise meets the criteria for additionality (Scenario 4, Table 4) – Scenario 5 in Table 4 – the carbon intensity of the electricity should be calculated based on a weighted average as follows:

$$\text{GHG intensity}_{\text{Elec, Scen 5}} = \frac{\text{Electricity}_{\text{Scen 4}} \times \text{GHG intensity}_{\text{Elec, Scen 4}}}{\text{Electricity}_{\text{Scen 3}} + \text{Electricity}_{\text{Scen 4}}}$$

Where:

- GHG intensity $_{\text{Elec,Scen 5}}$ = The weighted average GHG intensity of the electricity used to produce RFNBO in scenario 5 [gCO2e/MJ]

[73] The Administrator is not currently aware of any robust data sources that provide the necessary real-time data on both the share of non-bioenergy renewables as well as the whole life-cycle carbon intensity taking into account direct generation, well-to-tank and transmission and distribution emissions (see paragraph D.16). The Administrator will keep this position under review as new data sources emerge.

- GHG intensity $_{Elec, Scen\ 4}$ = The GHG intensity of the electricity used to produce RFNBO in scenario 4 (see paragraph D.14) [gCO2e/MJ]
- Electricity$_{Scen\ 3}$ = The total electricity supplied which meets the conditions for Scenario 3 in Table 4 [MJ]
- Electricity$_{Scen\ 4}$ = The total electricity supplied which meets the conditions for Scenario 4 in Table 4 [MJ]

**Please note:** For simplicity, the emissions from electricity supplied following Scenario 3 are not included in the above equation, as they are taken to be zero (see paragraph D.13).

D.18 Emissions from transport and distribution, $e_{td}$, includes emissions from the transport and storage of raw and semi-finished materials, from the storage and distribution of finished materials, and from any waste and leakage in these steps. Emissions from transport and distribution to be taken into account under $e_{ec}$ shall not be covered by $e_{td}$.

D.19 Emissions from the fuel in use, $e_u$, shall be taken to be zero for RFNBOs.

D.20 Emission savings from carbon capture and storage, $e_{ccs}$, that have not already been accounted for in $e_{pp}$, shall be limited to net emissions avoided through the capture and permanent storage of otherwise emitted carbon directly related to the extraction, transport, processing and distribution of the fuel.[74]. Net emissions means the $CO_2$ stored minus any emissions associated with capture, processing and transport of that $CO_2$ including any fugivite emissions/leakage of $CO_2$. Storage must be demonstrably permanent and stable to the satisfaction of the Administrator. Examples may include geological sequestration of CO2, the permanent sequestration of solid carbon through inert underground storgage, or integration into concrete for use in construction. The capture of any $CO_2$ at the start of the fuel chain, i.e. the collection of raw materials used to manufacture the assessed fuel, cannot be included within this $e_{ccs}$ emission saving – nor can any recycling of captured $CO_2$ within the fuel chain – as these are not sequestration activities.

## Allocation of GHG emissions

D.21 Where a RFNBO production process produces, in combination, the fuel for which emissions are being calculated and one or more other products ('co-products'), upstream and relevant process step GHG emissions shall be divided between the fuel or its intermediate product and the co-products in proportion to their energy content using the following equation:

$$\text{Fuel allocation factor} = \frac{\text{Energy in fuel [MJ]}}{\text{Energy in fuel [MJ]} + \text{Energy in co-products [MJ]}}$$

[74] Where carbon is sequestered in a form other than $CO_2$, an equivalent quantity of $CO_2$ sequestered should be calculated based on the amount of elemental carbon sequestered. For example, if 1 kg of solid, elemental carbon is captured and sequestered, this would be equivalent to 3.66 kgs of sequestered $CO_2$.

In the case of co-products other than electricity and heat, the energy content of products and co-products should be determined based on their $LHV_{allocation}$ , which can be calculated as follows:

$LHV_{allocation}$ [MJ/kg] = $LHV_{dry}$[MJ/kg] × (1 - % water content) - 2.441 [MJ/kg] × % water content

The GHG intensity of excess useful heat or excess electricity is the same as the GHG intensity of heat or electricity delivered to the RFNBO production process and is determined from calculating the GHG intensity of all inputs and emissions, including the feedstock and $CH_4$ and $N_2O$ emissions, to and from the cogeneration unit, boiler or other apparatus delivering heat or electricity to the RFNBO production process. In the case of cogeneration of electricity and heat, the calculation is performed following paragraph D.23.

D.22 For the purposes of the calculation referred to in paragraph D.21, the emissions to be divided shall be $e_{ec}$ and those fractions of $e_{pp}$, $e_{td}$ and $e_{ccs}$ that take place up to and including the process step at which a co-product is produced. If any allocation to co-products has taken place at an earlier process step in the life-cycle, the fraction of those emissions assigned in the last such process step to the intermediate fuel product shall be used for those purposes instead of the total of those emissions.

All co-products shall be taken into account for the purposes of that calculation. No emissions shall be allocated to wastes and residues. Co-products that have a negative $LHV_{allocation}$ shall be considered to have an energy content of zero for the purposes of the emissions allocation calculation.

In the case of fuels produced in refineries, other than the combination of processing plants with boilers or cogeneration units providing heat and/or electricity to the processing plant, the unit of analysis for the purposes of the calculation referred to in paragraph D.21 shall be the refinery.

D.23 Where a cogeneration unit – providing heat and/or electricity to a RFNBO production process for which emissions are being calculated – produces excess electricity and/or excess useful heat, the GHG emissions shall be divided between the electricity and the useful heat according to the temperature of the heat (which reflects the usefulness (utility) of the heat). The useful part of the heat is found by multiplying its energy content with the Carnot efficiency, $C_h$, calculated as follows:

$$C_h = \frac{T_h - T_0}{T_h}$$

Where:

- $T_h$ = Temperature, measured in absolute temperature (kelvin), of the useful heat at point of delivery.
- $T_0$ = Temperature of surroundings, set at 273.15 kelvin (equal to 0 °C).
- If the excess heat is exported for heating of buildings, at a temperature below 150 °C (423.15 kelvin), $C_h$ can alternatively be defined as follows:
- $C_h$ = Carnot efficiency in heat at 150 °C (423.15 kelvin), which is: 0.3546

D.24 For the purposes of this calculation, the actual efficiencies shall be used, defined as the annual mechanical energy, electricity and heat produced respectively divided by the annual energy input.

D.25 For the purposes of this calculation, the following definitions apply:

- ‘cogeneration’ shall mean the simultaneous generation in one process of thermal energy and electrical and/or mechanical energy;
- ‘useful heat’ shall mean heat generated to satisfy an economical justifiable demand for heat, for heating or cooling purposes;
- ‘economically justifiable demand’ shall mean the demand that does not exceed the needs for heat or cooling and which would otherwise be satisfied at market conditions;

# Annex E Methodology for calculating the carbon intensity of RCFs (RTFO and SAF Mandate)

## Overall methodology

E.1 Greenhouse gas (GHG) emissions from the production and use of recycled carbon fuels (RCFs) shall be calculated as follows:

$$E = e_{prod} + e_{td} + e_{disp} - e_{ccs}$$

E.2 Where:

- E = total emissions from the use of the fuel ($gCO_2e/MJ$)
- $e_{prod}$ = emissions from production and processing ($gCO_2e/MJ$)
- $e_{td}$ = emissions from transport and distribution ($gCO_2e/MJ$)
- $e_{disp}$ = emissions from displaced energy use ($gCO_2e/MJ$)
- $e_{ccs}$ = emission saving from carbon capture and storage ($gCO_2e/MJ$)

E.3 Emissions from the manufacture of machinery and equipment needed for RCF production shall not be taken into account.

E.4 GHG emissions from RCFs, E, shall be expressed in terms of grams of $CO_2$ equivalent per MJ of fuel, $gCO_2e/MJ$.

E.5 The greenhouse gases taken into account for the purposes of the equation in paragraph E.1 and shall be $CO_2$, $N_2O$ and $CH_4$. For the purpose of calculating $CO_2$ equivalence ($CO_2e$), those gases shall be valued as follows:

- $CO_2$: 1
- $N_2O$: 265
- $CH_4$: 28

## Guidance on calculating individual components

E.6 Emissions from processing ($e_{prod}$) shall include emissions:

- from the fuel production process itself
- from all waste streams and leakages
- from the production of chemicals or products used in processing including the $CO_2$ emissions corresponding to the carbon contents of fossil inputs, whether or not actually combusted in the process

However, for RCFs specifically, $e_p$ does not include emissions of $CO_2$ which derive from the feedstock itself, as these emissions are currently assumed to cancel out with the counterfactual fate.

In accounting for the consumption of electricity imported from an electricity grid rather than being generated on-site within the fuel production plant, the GHG emissions intensity of the production and distribution of that electricity shall be assumed to be equal to the average emission intensity of the production and distribution of electricity in a defined region.[75] By way of derogation from this rule, the electricity can be attributed a GHG emissions intensity of zero if the electricity can be demonstrated to be wholly additional renewable electricity as per paragraph 4.49. Guarantees of Origin are not considered acceptable evidence for demonstrating the use of additional renewable electricity.

In accounting for the consumption of methane or natural gas not produced within the fuel production plant, the gas consumed should be assumed to be entirely fossil gas (and appropriate GHG emissions factors applied). However, if it can be demonstrated that an equivalent quantity of renewable gas has been produced and mass balanced to the point of consumption, the GHG emissions intensity of the gas consumed can be taken to be that of the renewable gas. However, the GHG emissions intensity cannot be taken to be less than zero and the requirements of the RTFO Guidance for Biomethane must be met.

Emissions from processing shall include emissions from drying of interim products and materials where relevant.

For the purposes of both the RTFO and SAF Mandate, hydrogen cannot be classified as a waste stream. Therefore, where hydrogen is used as a processing input, emissions associated with its production, supply and use must be accounted for.

E.7 Emissions from transport and distribution ($e_{td}$) shall include emissions from the transport of raw and semi-finished materials, from the storage and distribution of finished materials, and from any waste and leakage in these steps. In the case of municipal solid waste (MSW), the emissions associated with collecting the MSW from households or other premises need not be accounted for, but $e_{td}$ should include any

[75] The figures used should take into account direct (Scope 2) emissions associated with electricity generation and indirect (Scope 3) emissions associated with the extraction, refining and transportation of primary fuels as well as electricity transmission and distribution.

emissions associated with onward transport from an initial aggregation or processing location.

E.8 Emissions from displaced energy use ($e_{disp}$) shall be calculated in accordance with paragraphs E.13 onwards.

E.9 Emission savings from carbon capture and storage ($e_{ccs}$) that have not already been accounted for in $e_{prod}$, shall be limited to emissions avoided through the capture and permanent storage of otherwise emitted carbon directly related to thetransport, processing and distribution of the fuel.[76] Storage must be demonstrably permanent and stable to the satisfaction of the Administrator. Examples may include geological sequestration of $CO_2$, the permanent sequestration of solid carbon through inert underground storage, or integration into concrete for use in construction.

E.10 Waste fossil $CO_2$ is considered to have zero lifecycle greenhouse gas emissions up to the point of collection, provided this material meets the definition of a waste[77], evidence is provided that the carbon in this material would have otherwise been emitted to atmosphere, and the facility generating this waste material does not claim a reduction in their emissions due to this use of the waste fossil $CO_2$.

E.11 If the waste fossil generating facility does wish to claim a reduction in their emissions[78], then these GHG emissions instead need to be assigned to the waste fossil material used to produce the RCF and must contribute to $E_{RCF}$, in line with the material's global warming potential (e.g. one tonne of waste fossil $CO_2$ would be assigned 1 $tCO_2e$/tonne). Similarly, if the carbon in the material would not otherwise have been emitted to atmosphere (e.g. waste fossil plastic might have sequestered its carbon for centuries in landfill, or as a building insulation material), then the additional greenhouse gas emissions from this avoided sequestration also need to be assigned to the waste fossil material and contribute to $E_{RCF}$.

E.12 If a supplier wishes to carry out either of the practices outlined in paragraph E.11 they should contact the Administrator for further guidance.

## Calculating the displaced emissions ($e_{disp}$)

E.13 Emissions from displaced energy use ($e_{disp}$) reflect the emissions associated with producing the equivalent amount of energy that would have been generated by the same amount of feedstock now moved to produce 1MJ of RCF.

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[76] Where carbon is sequestered in a form other than $CO_2$, an equivalent quantity of $CO_2$ sequestered should be calculated based on the amount of elemental carbon sequestered. For example, if 1 kg of solid, elemental carbon is captured and sequestered, this would be equivalent to 3.66 kgs of sequestered $CO_2$.

[77] 'Waste' means any substance or object which the holder discards or intends or is required to discard. It excludes substances that have been intentionally modified or contaminated for the purpose of transforming it into a waste.

[78] For example, from a desire to reduce their costs under the UK's Emission Trading Scheme, or other national taxes on emissions. The waste fossil generating facility cannot claim a GHG savings if the RCF manufacturer also claims a low carbon fuel is being made, as this would be an erroneous double claim of only one set of GHG savings.

The displaced emissions ($e_{disp}$) shall be calculated as follows:

$$e_{disp} = \frac{Ef_e \times E_e}{Ef_{RCF}}$$

Where:

- $Ef_e$ = LHV net efficiency of converting feedstock to energy in the counterfactual use (%)
- $E_e$ = Emission factor of the displaced energy in counterfactual ($gCO_2e/MJ$)
- $Ef_{RCF}$ = LHV efficiency of converting feedstock to RCF (%)

E.14 The default counterfactual fate for RCF feedstocks is Energy from Waste (EfW) where electricity is exported to the grid, but there is no heat export and no CCS. In this default counterfactual fate

- $Ef_e$ should be taken as 22%, which is determined from the R1 standard, adjusted to account for parasitic load.

- $E_e$ should be taken as the weighted average emission intensity of the electricity grid for the most recent available full year in the country from which the feedstock arose (see paragraph 3.16 in RCF Guidance). This data shall be taken from the national grid unless the Administrator agrees that a regional grid weighted average can be used.

The following example outlines the logic behind calculating $e_{disp}$:

**Example outlining the calculations of displaced emissions under the default counterfactual fate.**

- Default counterfactual fate: Energy from Waste (EfW) producing electricity to the grid
- If feedstock is taken away from EfW for RCF production, the equivalent amount of electricity will need to be supplied from another source. As set out in paragraph E.14, the average emission intensity of the electricity grid will be taken as the emission factor for the counterfactual ($E_e$).

Assume:

| | |
|---|---|
| **Electricity grid average emission intensity** | 70.3 $gCO_2e/MJ$ |
| **EfW process efficiency ($Ef_e$)** | 22% (see paragraph E.14) |

This means for every MJ of electricity produced, there will be 70.3 $gCO_2e$ of emissions. However, only 0.22 MJ of electricity is produced by 1 MJ of feedstock in the EfW process. Therefore, the amount of displaced emissions to replace the 0.22 MJ of electricity, is:

$$0.22\ MJ \times 70.3\ gCO_2e/MJ = 15.466\ gCO_2e$$

Since $e_{disp}$ is measured as a carbon intensity (gCO2e per MJ of RCF), the calculations will need to take into account the efficiency of the RCF production process.

Assume:

| | |
|---|---|
| **RCF process efficiency** | 90% |

That means 1 MJ of feedstock can only generate 0.9 MJ of useful products (including intended RCF and other energetic co-products but excluding recycled co-products). Therefore, to understand the emissions for 1 MJ of useful products:

$$15.466\ gCO_2e / 0.9\ MJ = 17.18\ gCO_2e/MJ$$

**In summary:**

For every MJ of RCF product, 17.18 gCO2e of emissions will be generated to account for the lost energy in the counterfactual scenario (or "displaced emissions").

E.15 For the purposes of paragraph E.14, figures for the grid weighted average GHG emissions should be sourced from reliable and authoritative sources such as government bodies and/or network operators. The figures used should take into account direct (Scope 2) emissions associated with electricity generation and indirect (Scope 3) emissions associated with the extraction, refining and transportation of primary fuels.[79]

E.16 $Ef_{RCF}$ should be calculated as the yield, on an energy basis, as follows:

$$Ef_{RCF} = \frac{\text{Total energy in all useful product streams (accounting for losses)}}{\text{Energy in feedstock}}$$

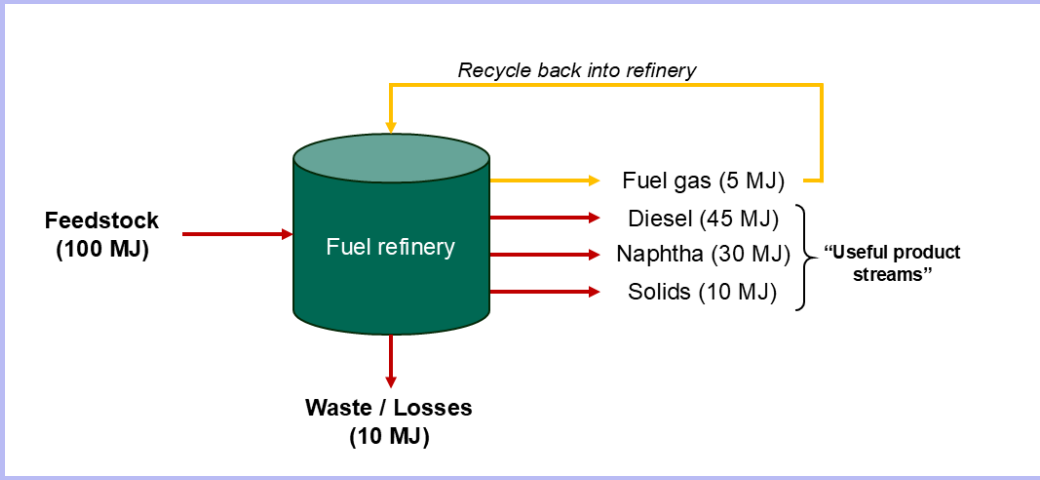
$Ef_{RCF}$ should be calculated over the whole supply-chain, taking into account any losses. For example, if 100 MJ of fuel is initially produced, but 3% of that fuel is lost during subsequent stages of the supply chain, the "total energy in all useful product streams" would be 97 MJ.

$Ef_{RCF}$ should include all energy containing product streams generated from the RCF production process, including but not limited to the intended RCF stream. However, if an output stream is being recycled back into the production process (e.g., energy source to provide power), that stream should be excluded as its carbon emissions will be included in the calculations of processing emissions.

**Example calculating $EF_{RCF}$ where there are waste/loss streams, co-products and output streams recycling energy back into the process.**

[79] For the UK, figures can be taken from the most recent Government conversion factors for company reporting of greenhouse gas emissions: https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting

Figure 12 illustrates the scenario where fuel gas is being recycled back into the production process to act as an energy source, therefore it is not considered as a "useful product stream" for the purposes of calculating $EF_{RCF}$.




8.52

**Figure 12** Flow chart illustrating which output streams will need to be considered as "Useful product streams" for the purposes of calculating $EF_{RCF}$.

As a result, in this example, $EF_{RCF}$ should be calculated as below:

$$Ef_{RCF} = \frac{\text{Diesel (45 MJ)} + \text{Naphtha (30 MJ)} + \text{Solids (10 MJ)}}{\text{Feedstock (100 MJ)}} = 0.85$$

E.17 For non-gaseous RCF feedstocks, the Administrator may define, on a case-by-case basis, alternative counterfactual fates for specific feedstocks (see dedicated RCF guidance). In these cases, the Administrator will also specify any modifications to the $E_{disp}$ calculation which should be followed. We note that EfW facilities are expected to increasingly export useful heat and install CCS, which will impact $E_{disp}$. The Administrator will define additional evidence-based factors for heat export and/or CCS if and when this becomes relevant.[80]

E.18 Similarly, for gaseous RCF feedstocks, derogations from the default counterfactual fate will be determined on an individual production plant level if sufficient evidence is provided. Additionally, suppliers of RCFs produced from industrial gases are required to demonstrate that heat generation is not displaced by the production of RCFs. If there is evidence that increased heating requirements arise due to the production of RCFs then the Administrator would consider heat generation to be the counterfactual use. This will be assessed on a plant-by-plant basis by the Administrator.

[80] Indicatively, we would expect to consider the inclusion of additional factors once at least one quarter of EfW plants in the UK have substantial heat export and/or CCS installed.s

# Allocation of GHG emissions

E.19 Where an RCF production process produces, in combination, the fuel for which emissions are being calculated and one or more other products ('co-products'), upstream and relevant process step GHG emissions shall be divided between the fuel or its intermediate product and the co-products in proportion to their energy content using the following equation:

$$\text{Fuel allocation factor} = \frac{\text{Energy in fuel [MJ]}}{\text{Energy in fuel [MJ]} + \text{Energy in co-products [MJ]}}$$

In the case of co-products other than electricity and heat, the energy content of products and co-products should be determined based on the lower heating value LHV (wet) of the feedstock, which can be calculated as follows:

$$LHV_{wet} = LHV_{dry} \times (1 - \%\ \text{water content}) - 2.441 \times \%\ \text{water content}$$

The GHG intensity of excess useful heat or excess electricity is the same as the GHG intensity of heat or electricity delivered to the biofuel production process and is determined from calculating the GHG intensity of all inputs and emissions, including the feedstock and $CH_4$ and $N_2O$ emissions, to and from the cogeneration unit, boiler or other apparatus delivering heat or electricity to the biofuel production process. In the case of cogeneration of electricity and heat, the calculation is performed following paragraph E.21

E.20 For the purposes of the calculation referred to in paragraph E.19, the emissions to be allocated to the fuel and co-products shall include $e_{disp}$ and those fractions of $e_{prod}$, $e_{td}$ and $e_{ccs}$ that take place up to and including the process step at which a co-product is produced. If any allocation to co-products has taken place at an earlier process step in the life-cycle, the fraction of those emissions assigned in the last process step to the intermediate fuel product shall be used for those purposes instead of the total of those emissions.

All co-products shall be taken into account for the purposes of that calculation. No emissions shall be allocated to wastes and residues. Co-products that have a negative energy content ($LHV_{wet}$) shall be considered to have an energy content of zero for the purposes of the emissions allocation calculation. Wastes and residues shall be considered to have zero life-cycle greenhouse gas emissions up to the point of collection of those materials irrespective of whether they are processed to interim products before being transformed into the final product.

In the case of fuels produced in refineries, other than the combination of processing plants with boilers or cogeneration units providing heat and/or electricity to the processing plant, the unit of analysis for the purposes of the calculation referred to in paragraph E.19 shall be the refinery.

E.21 Where a cogeneration unit – providing heat and/or electricity to an RCF production process for which emissions are being calculated – produces excess electricity and/or excess useful heat, the GHG emissions shall be divided between the electricity and the useful heat according to the temperature of the heat (which reflects

the usefulness (utility) of the heat). The useful part of the heat is found by multiplying its energy content with the Carnot efficiency, $C_h$, calculated as follows:

$$C_h = \frac{T_h - T_0}{T_h}$$

Where:

- $T_h$ = Temperature, measured in absolute temperature (kelvin), of the useful heat at the point of delivery
- $T_0$ = Temperature of surroundings, set at 273.15 kelvin (equal to 0 °C)

If the excess heat is exported for heating of buildings, at a temperature below 150 °C (423.15 kelvin), $C_h$ can alternatively be defined as follows:

$C_h$ = Carnot efficiency in heat at 150 °C (423.15 kelvin), which is: 0.3546

For the purposes of this calculation, the actual efficiencies shall be used, defined as the annual mechanical energy, electricity and heat produced respectively divided by the annual energy input.

For the purposes of this calculation, the following definitions apply:

- ‘cogeneration’ shall mean the simultaneous generation in one process of thermal energy and electrical and/or mechanical energy
- ‘useful heat’ shall mean heat generated to satisfy an economically justifiable demand for heat, for heating or cooling purposes
- ‘economically justifiable demand’ shall mean the demand that does not exceed the needs for heat or cooling and which would otherwise be satisfied at market conditions

# Annex F Land use evidence sources

F.1 This annex contains tables, compiled by Defra, which aim to assist economic operators with the types and sources of evidence that might be used to show that the biofuels from the UK have been sourced in a manner that is consistent with the land-related sustainability criteria of the RTFO.

F.2 It is important to note that the evidence suggestions in the tables have not been designed specifically to show compliance with the sustainability criteria nor are they meant to be an exhaustive list. The tables also attach no priority to the evidence options. It is for the economic operator (and their verifier) to ensure that the evidence provided is sufficient to demonstrate that their biofuel meets all the relevant sustainability criteria.

F.3 In some cases, one piece of evidence could be considered sufficient and in others several pieces might be necessary; it will depend on individual circumstances. In many cases, Local Records Centres[81] will be a useful source of information and evidence. The statutory nature conservation bodies and the Forestry Commission / Forest Service (in Northern Ireland) (for woodland-related evidence) will be able to help in some instances and there are a number of web-based sources which could provide information, particularly on land cover in 2008. Note that some suppliers may levy a charge for their information.

F.4 It is important to note that the suggestions in the tables below are for biofuels sourced in the UK. The suggestions are not meant to demonstrate compliance with other relevant laws, whether they be environmental or otherwise. The economic operator will need to ensure that their biofuel does not contravene any relevant laws.

F.5 Table 33 provides suggested evidence for demonstrating land status and Table 34 provides suggested evidence for demonstrating that the land status has not changed.

[81] Local Records Centres (LRCs) are organisations that collect, collate, manage and disseminate information relating to the biodiversity and geodiversity of a region on a not-for-profit basis. This information plays an essential role in decision-making at all levels, and its use helps to protect and improve biodiversity and geodiversity within the region and beyond.

F.6 As well as the tables this document contains sections covering the following resources:

- Useful websites
- Area types designated for nature protection purposes
- Advisory thresholds and information to show that the harvesting of non-natural grassland is required to maintain the grassland status

| **Sustainability criteria** | **Suggested types of evidence that might show the land status** | **Sources of evidence in the UK (see** Useful websites) |
|---|---|---|
| Areas designated for nature protection purposes<br>Areas designated for the protection of rare, threatened or endangered ecosystems or species recognised by international agreements | Maps of designated areas with details of designation date | Local Record Centres<br>Statutory nature conservation bodies[82]<br>National Biodiversity Network Gateway<br>Other websites |
| Highly biodiverse grasslands, wetlands, continuously forested areas, lightly forested areas and peatlands | Farm and other records (e.g. aerial photos, satellite images, land use/cover maps) showing land status<br>Farm or other records showing land has been cultivated in accordance with the Environmental Impact Assessment (Agriculture) Regulations<br>Habitat inventories for conservation priority habitats | Farm records<br>Local Record Centres<br>Centre for Ecology and Hydrology (land cover map)<br>National Biodiversity Network Gateway<br>Statutory nature conservation bodies |
| Continuously forested areas and lightly forested areas | Woodland and forest inventories | Local Record Centres<br>Forestry Commission<br>Northern Ireland Forest Service<br>Other websites |

**Table 33** Suggested types of evidence that might show land status and the sources of that evidence in the UK

[82] Natural England, Northern Ireland Environment Agency, Natural Resources Wales, Scottish Natural Heritage, Joint Nature Conservation Committee

| Sustainability criteria | Suggested types of evidence that might show the special circumstances are relevant | Sources of Information in the UK (see Useful websites) |
|---|---|---|
| Areas designated for nature protection purposes | Statement from an expert that the cultivation has not interfered with the nature protection purposes of the designated area | Certified expert – The Chartered Institute of Ecology and Environmental Management has details of experts. |
| Areas designated for the protection of rare, threatened or endangered ecosystems or species recognised by international agreements | Farm or other records (e.g. aerial photos, satellite images) showing the land in the designated area has been cultivated in accordance with the Environmental Impact Assessment (Agriculture) Regulations | Farm records<br>Local Record Centres |
| | Forestry Commission-approved forest plan, Forestry Commission-approved woodland management plan, felling licence, woodland grant scheme showing cultivation is in accordance with UK Forestry Standards | Forestry Commission |
| Highly biodiverse grasslands | Farm or other records showing that the harvesting of the grassland is consistent with the management prescriptions for the agri-environment scheme associated with the site or a comparable site | Farm records, including agri-environment agreements |
| | Farm or other records showing that the harvesting of the grassland is consistent with a restoration plan recognised by a nature conservation body for the site or a comparable site | Farm records |
| | Farm or other records showing that the harvesting of the grassland is in line with the advice at the end of this Annex | Farm records |
| | Harvesting practices for the grassland are consistent with published research for comparable sites that clearly shows that the harvesting is necessary to preserve the grassland status | Farm records |
| Highly biodiverse grasslands, wetlands, continuously forested areas, lightly forested areas and peatlands | Land use/cover maps showing the current status of the land (could be used for wetlands, grasslands, woodlands and peatlands)<br>Dated satellite images (could be used for wetlands, grasslands, woodlands, peatlands)<br>Dated aerial photos (could be used for wetlands, grasslands, woodlands, peatlands)<br>Woodland and forest inventories | Local Record Centres<br>Centre for Ecology and Hydrology (for land cover map)<br>Statutory nature conservation bodies<br>Water authorities - Environment Agency, Scottish Environment Protection Agency<br>Forestry Commission<br>Northern Ireland Forest Service |
| Peatlands | Statement from a certified expert that the undrained soil in the peatland has not been drained | Certified expert – The Chartered Institution of Water and Environmental Management and/or the Chartered Institute of Ecology and Environmental Management have details of experts. |

**Table 34** Suggested types of evidence that might demonstrate that the status of the land has not changed and the sources of that evidence in the UK

# Useful websites

- Local Records Centres - http://www.alerc.org.uk

### Certified experts

- The Chartered Institute of Ecology and Environmental Management - http://www.cieem.net/
- The Chartered Institution of Water and Environmental Management - http://www.ciwem.org/

### Statutory nature conservation bodies (and their data/information website links)

- Natural Resources Wales http://naturalresourceswales.gov.uk/
- Welsh protected sites and landscapes map http://www.ccw.gov.uk/landscape--wildlife/protecting-our-landscape/protected-sites-map.aspx?lang=en
- Natural England https://www.gov.uk/government/organisations/natural-england
- MAGIC (Nature on the Map - for England) https://magic.defra.gov.uk/
- Natural England Open Data Geoportal https://naturalengland-defra.opendata.arcgis.com/
- Northern Ireland Environment Agency http://www.doeni.gov.uk/niea/
- Scottish Natural Heritage http://www.snh.gov.uk
- Scottish Natural Heritage Information Service (SNHi) http://www.snh.gov.uk/publications-data-and-research/snhi-information-service/
- Joint Nature Conservation Committee http://www.jncc.defra.gov.uk/

### Other data/information websites

- National Biodiversity Network Gateway (UK biodiversity data) https://data.nbn.org.uk/
- UK Post-2010 Biodiversity Framework http://jncc.defra.gov.uk/page-6189, including the UK Biodiversity Action Plan http://jncc.defra.gov.uk/page-5155
- Back on the Map (Northern Ireland's ancient and long-established woodland inventory) http://www.backonthemap.org.uk/
- Scotland's environmenthttp://www.environment.scotland.gov.uk/

### Other bodies

- Centre for Ecology and Hydrology http://www.ceh.ac.uk/
- Environment Agency http://www.environment-agency.gov.uk/
- Forestry Commission http://www.forestry.gov.uk/
- Forest Service (in Northern Ireland) http://www.dardni.gov.uk/forestservice/
- Scottish Environment Protection Agency http://www.sepa.org.uk/

## Area types designated for nature protection purposes

- Sites of Special Scientific Interest (SSSIs)
- Areas of Special Scientific Interest (ASSIs) – Northern Ireland only
- National Nature Reserves
- Local Nature Reserves
- Areas of Special Protection (for Birds) – England and Wales only
- Forest Nature Reserves
- Special Areas of Conservation, candidate Special Areas of Conservation and Sites of Community Importance
- Special Protection Areas and potential Special Protection Areas
- Ramsar Sites
- Local Sites
- Areas of Outstanding Natural Beauty – England, Northern Ireland and Wales only
- National Parks – England, Scotland and Wales only
- The Broads – England only
- Heritage Coasts – England and Wales only

## Advisory thresholds and information to show that the harvesting of non-natural grassland is required to maintain the grassland status

### For neutral grasslands and fen meadows:

- Neutral grassland and fen meadows will normally be subject to a single summer hay cut between late June and late July. However, a later cut in late August or September, one year in five, may be required to allow seed production of late flowering species. Cutting dates are weather dependent and may be later in the north of Scotland.
- The growth should be cut back to a height of approximately 5cm and the cut grass, weather permitting, should be dried on site and baled within seven days of cutting.
- Sustained early cutting in May to mid-June is known to reduce species richness, harm breeding birds and insects. Persistent late cutting can cause rank, less diverse vegetation.
- Cutting for silage is generally viewed as harmful to these grasslands as it is associated with more intensive farm management practices, such as fertilisation to increase production and enable two or three cuts to be taken. The first cut typically takes place in late May before farmland birds have had their chicks and before meadow species have flowered and set seed. This reduces the quantity of seed that is returned to the soil. However, an occasional silage cut at hay time (see first bullet) is unlikely to change the plant species composition.

### For calcareous or acid grasslands:

- Calcareous or acid grasslands are typically less productive than neutral grasslands and are usually managed as pasture, being grazed as livestock with no hay cut. Where a cutting regime is implemented (e.g. in the absence of grazing), between one and three cuts would normally be taken per year depending on geographic location. Generally, fewer cuts are necessary at higher latitudes in order to maintain sward composition and condition, and therefore closely replicating usual local livestock grazing regimes.
- Precise timings of cutting would be influenced by the composition of the sward, rare species present, the prevailing weather conditions in any given year as well as geographic location, where cutting dates tend to be later at higher latitudes. Cuts in May, June and July to a height of 5cm with the grass removed within three days should help to maintain the conservation interest, although cutting dates may be later than this, for example, in the north of Scotland. Regional differences should always be taken into account.

### Summary of grassland types

- Neutral grasslands include upland hay meadows, and lowland meadows.
- Fen meadows are components of purple moor grass and rush pastures.
- Calcareous grasslands include lowland calcareous grasslands and upland calcareous grasslands.
- Acid grasslands include lowland dry acid grasslands and upland acid grasslands.

Descriptions of these grasslands can be found on the JNCC website at: http://jncc.defra.gov.uk/page-5155 and http://jncc.defra.gov.uk/page-2.

# Annex G Sustainable Land Use Standard

**Annex summary**

This annex describes the criteria of the Sustainable Land Use Standard. The sustainability criteria should be used by suppliers wishing to conduct their own independent field audits of cultivated feedstocks against the Sustainable Land Use Standard.

The Standard provides an optional tool to demonstrate compliance with the land criteria, particularly for use when existing voluntary schemes are not available or operational.

G.1 The Sustainable Land Use Standard contains both environmental and social criteria as well as the norm for audit quality (see Annex L). All criteria and indicators (including those of the norm for audit quality) must be complied with for the Sustainable Land Use Standard to be met.

G.2 The 'recommended' criteria and indicators are not required for the Sustainable Land Use Standard to be met but are considered good practice.

G.3 The Administrator will keep the criteria and indicators for the Sustainable Land Use Standard under review, as well as the status of mandatory and recommended criteria, to ensure their continuing relevance.

## Environmental criteria and indicators

G.4 The environmental sustainability criteria and indicators (and recommended criteria) for the Sustainable Land Use Standard are divided into five principles:

- Principle 1: Carbon Conservation - Biomass production will not destroy or damage large above or below-ground carbon stocks (see Table 35)
- Principle 2: Biodiversity Conservation - Biomass production will not lead to the destruction or damage of high biodiversity areas (see Table 36)

- Principle 3: Soil Conservation - Biomass production does not lead to soil degradation (see Table 37)
- Principle 4: Sustainable Water Use - Biomass production does not lead to the contamination or depletion of water sources (see Table 38)
- Principle 5: Air Quality - Biomass production does not lead to air pollution (see Table 39)

| Criterion | Indicators |
|---|---|
| 1.1 Preservation of above and below-ground carbon stocks (reference date 01/01/2008). | Evidence that biomass production has not caused direct land-use change with a carbon payback time exceeding 10 years.<br>Evidence that the biomass production unit has not been established on soils with a large risk of significant soil stored carbon losses such as forest lands, peatlands, mangroves, wetlands and certain grasslands. |

**Table 35** Criteria and indicators for Principle 1: Carbon Conservation

| Criterion | Indicators |
|---|---|
| 2.1 Compliance with national laws and regulations relevant to biomass production in the area and surroundings where biomass production takes place. | Evidence of compliance with national and local laws and regulations with respect to:<br>- Environmental Impact Assessment;<br>- land ownership and land use rights;<br>- forest and plantation management;<br>- protected and gazetted areas;<br>- nature and wildlife conservation;<br>- land use planning;<br>- national rules resulting from the adoption of CBD[83] and CITES[84].<br>The company should prove that:<br>- it is familiar with relevant national and local legislation;<br>- it complies with these legislations;<br>- it remains informed on changes in legislation. |
| 2.2 No conversion of high biodiversity areas after 1 January 2008. | Evidence that production does not take place in gazetted areas.<br>Evidence that production does not take place in areas with one or more HCV areas[85]: HCV 1, 2, 3 relating to important ecosystems and species;<br>- HCV 4, relating to important ecosystem services, especially in vulnerable areas;<br>- HCV 5, 6, relating to community livelihoods and cultural values.<br>Evidence that production does not take place in any areas of high biodiversity.<br>**List of protected areas referred to in criterion 2.2:**<br>- UNESCO World Heritage Sites[86];<br>- UCN List of Protected Areas categories I, II, III and IV[87], according to the list |

[83] Convention on Biological Diversity: http://www.cbd.int/

[84] http://www.cites.org/

[85] The definition of the 6 High Conservation Values can be found at http://www.hcvnetwork.org. Currently, no comprehensive maps exist which define HCV areas. For many areas it will therefore still be necessary to assess whether HCVs are present or not. The following initiatives are helpful in defining areas with one or more HCVs: Conservation International - Biodiversity Hotspots; Birdlife international - Important Bird Areas; The WWF G200 Eco-regions: the regions classified 'vulnerable' or 'critical/ endangered'.; European High Nature Value Farmland

[86] http://whc.unesco.org/en/list

[87] IUCN defines a protected area as: an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means, and subdivides protected areas into six categories: I a) Strict

| Criterion | Indicators |
|---|---|
| | available from 2003[88] or more up-to-date lists or national data;<br>- RAMSAR sites (wetlands under the Convention on Wetlands)[89], according to the available list90 of more up-to-date lists or national data. |
| 2.3 The status of rare, threatened or endangered species and high conservation value habitats, if any, that exist in the production site or that could be affected by it, shall be identified and their conservation taken into account in management plans and operations. | Documentation of the status of rare, threatened or endangered species (resident, migratory or otherwise) and high conservation value habitats in and around the production site.<br>Documented and implemented management plan on how to avoid damage to or disturbance of the above-mentioned species and habitats. |
| 2.4 Preservation and/or improvement of the surrounding landscape (Recommendation) | Representative samples of existing ecosystems within the landscape shall be protected in their natural state and recorded on maps, appropriate to the scale and intensity of operations and the uniqueness of the affected resources. |

**Table 36** Criteria and indicators for Principle 2: Biodiversity Conservation

| Criterion | Indicators |
|---|---|
| 3.1 Compliance with national laws and regulations relevant to soil degradation and soil management. | Evidence of compliance with national and local laws and regulations with respect to:<br>- Environmental Impact Assessment;<br>- waste storage and handling;<br>- pesticides and agrochemicals;<br>- fertiliser;<br>- soil erosion.<br>Compliance with the Stockholm convention (list of forbidden pesticides).<br>The company should prove that:<br>- it is familiar with relevant national and local legislation;<br>- it complies with these legislations;<br>- it remains informed on changes in legislation. |
| 3.2 Application of good agricultural practices with respect to:<br>- prevention and control of erosion;<br>- maintaining and | Documentation of soil management plan aimed at sustainable soil management, erosion prevention and erosion control.<br>Annual documentation of applied good agricultural practices with respect to:<br>- prevention and control of erosion;<br>- maintaining and improving soil nutrient balance;<br>- maintaining and improving soil organic matter; |

nature reserve/wilderness protection area; I b) Wilderness area; II) National park; III) Natural monument; IV) Habitat/Species management area; V) Protected landscape/seascape; VI) Managed resource protected area.
http://www.iucn.org/about/work/programmes/gpap_home/gpap_quality/gpap_pacategories/

[88] http://www.unep-wcmc.org/un-list-of-protected-areas_269.html

[89] http://www.ramsar.org/

[90] http://www.ramsar.org/cda/en/ramsar-documents-list/main/ramsar/1-31-218_4000_0__

| Criterion | Indicators |
|---|---|
| improving soil nutrient balance;<br>- maintaining and improving soil organic matter;<br>- maintaining and improving soil pH;<br>- maintaining and improving soil structure;<br>- maintaining and improving soil biodiversity;<br>- prevention of salinisation. | - maintaining and improving soil pH;<br>- maintaining and improving soil structure;<br>- maintaining and improving soil biodiversity;<br>- prevention of salinisation.<br>*Recommendations:*<br>- records of annual measurements of:<br>- soil loss in tonnes soil/ha/y;<br>- N, P, K balance;<br>- SOM and pH in topsoil;<br>- soil salts content. |
| 3.3 The use of agricultural residues does not jeopardise the function of local uses of the by-products, soil organic matter or soil nutrients balance.<br>(*Recommendation*) | Documentation that the use of residues does not occur at the expense of important traditional uses (such as fodder, natural fertiliser, material, local fuel etc.) unless documentation is available that similar or better alternatives are available and are applied.<br>Documentation that the use of residues does not occur at the expense of the soil nutrient balance or soil organic matter balance. |

**Table 37** Criteria and indicators for Principle 3: Soil Conservation

| Criterion | Indicators |
|---|---|
| 4.1 Compliance with national laws and regulations relevant to contamination and depletion of water sources. | Evidence of compliance with national and local laws and regulations with respect to:<br>- Environmental Impact Assessment;<br>- waste storage and handling;<br>- pesticides and agrochemicals;<br>- fertiliser;<br>- irrigation and water usage.<br>The company should prove that:<br>- it is familiar with relevant national and local legislation;<br>- it complies with these legislations;<br>- it remains informed on changes in legislation. |
| 4.2 Application of good agricultural practices to reduce water usage and to maintain and improve water quality. | Documentation of water management plan aimed at sustainable water use and prevention of water pollution.<br>Annual documentation of applied good agricultural practices with respect to:<br>- efficient water usage;<br>- responsible use of agrochemicals;<br>- waste discharge.<br>*Recommendations:*<br>- records of annual measurements of:<br>- agrochemical inputs (input/ha/y), such as fertilisers and pesticides (specified per agrochemical);<br>- water sources used (litres/ha/y);<br>- BOD level of water on and nearby biomass production and processing. |

**Table 38** Criteria and indicators for Principle 4: Sustainable Water Use

| Criterion | Indicators |
|---|---|
| 5.1 Compliance with national laws and regulations relevant to air | Evidence of compliance with national and local laws and regulations with respect to:<br>- Environmental Impact Assessment; |

| Criterion | Indicators |
|---|---|
| emissions and burning practices. | - air emissions;<br>- waste management;<br>- burning practices.<br>The company should prove that:<br>- it is familiar with relevant national and local legislation;<br>- it complies with these legislations;<br>- it remains informed on changes in legislation. |
| 5.2 No burning as part of land clearing or waste disposal. | Evidence that no burning occurs as part of land clearing or waste disposal, except in specific situations such as described in the ASEAN guidelines on zero burning or other respected good agricultural practices. |

**Table 39** Criteria and indicators for Principle 5: Air Quality

# Social criteria and indicators

G.5 The social criteria and indicators for the Sustainable Land Use Standard are divided into two principles:

- Principle 6: Workers' Rights - biomass production does not adversely affect workers' rights and working relationships (see Table 40)
- Principle 7: Land Rights - Biomass production does not adversely affect existing land rights and community relations (see Table 41)

| Criterion | Indicators |
|---|---|
| 6.1 Compliance with national law on working conditions and workers' rights. | Certification applicant must comply with all national laws concerning working conditions and workers' rights. |
| 6.2 Contracts | Certification applicant must supply all categories of employees (incl. temporary workers) with a legal contract in which the criteria below are registered. |
| 6.3 Provision of information | Certification applicant must show evidence that all workers are informed about their rights (incl. bargaining rights). |
| 6.4 Subcontracting | When labour is contracted or subcontracted to provide services for the certification applicant, the certification applicant must demonstrate that the subcontractor provides its services under the same environmental, social and labour conditions as required for this standard. |
| 6.5 Freedom of association and right to collective bargaining. | Certification applicant must guarantee the rights of workers to organise and negotiate their working conditions (as established in ILO conventions 87 and 98). Workers exercising this right must not be discriminated against or suffer repercussions. |
| 6.6 Child labour | Certification applicant must guarantee that no children below the age of 15 are employed. Children are allowed to work on family farms if not interfering with children's educational, moral, social and physical development (the workday, inclusive of school and transport time, to be a maximum of 10 hours). |
| 6.7 Young workers | The work carried out shall not be hazardous or dangerous to the health and safety of young workers (age 15 -17). It shall also not jeopardise their educational, moral, social and physical development. |
| 6.8 Health and safety | All certification applicants must meet basic requirements including potable drinking water, clean latrines or toilets, a clean place to eat, adequate protective equipment and access to adequate and accessible (physically and financially) medical care. Accommodation, where provided, shall be clean, safe, and meet the basic needs of the workers. |

| Criterion | Indicators |
|---|---|
| | All certification applicants shall ensure that workers have received regular health and safety training appropriate to the work that they perform.<br>All certification applicants shall identify and inform workers of hazards and adopt preventive measures to minimise hazards in the workplace and maintain records of accidents. |
| 6.9 Wages/ compensation | Workers must be paid wages at least equivalent to the legal national minimum wage or the relevant industry standard, whichever is higher.<br>Workers must be paid in cash, or in a form that is convenient to them and regularly.<br>*Recommendations:*<br>The certification applicant must pay the workers for unproductive time due to conditions beyond their control.<br>Housing and other benefits shall not be deducted from the minimum wage/or relevant industry wage as an in-kind payment without the express permission of the worker concerned.<br>Where the certification applicant uses pay by production (piecework) system, the established pay rate must permit the worker to earn the minimum wage or relevant industry average (whichever is higher) during normal working hours and under normal operating conditions. |
| 6.10 Discrimination | In accordance with ILO Conventions 100 and 111, there must be no discrimination (distinction, exclusion, or preference) practised that denies or impairs equality of opportunity, conditions, or treatment based on individual characteristics and group membership or association like: race, caste, national origin, religion, disability, gender, sexual orientation, union membership, political affiliation, age, marital status, those with HIV/AIDS, seasonal, migrant and temporary workers. |
| 6.11 Forced Labour | Standards shall require that the certification applicant does not engage in, or support forced labour including bonded labour as defined by ILO conventions 29 and 105. The company must not retain any part of workers' salary, benefits, property, or documents in order to force workers to remain on the farm. The company must also refrain from any form of physical or psychological measure requiring workers to remain employed on the farm. Spouses and children of contracted workers should not be required to work on the farm. |
| 6.12 Working hours (*Recommendation*) | Usual working hours shall not exceed eight hours a day and 48 hours a week.<br>Workers must have a minimum of 24 hours rest for every seven-day period.<br>Overtime during seasonal peaks is allowed, but needs to be voluntary, and should be paid at a premium rate. Workers should have adequate breaks (every 6 h, 30 minutes). For heavy or dangerous work shorter periods and longer breaks should be allowed. |
| 6.13 Growers and mills should deal fairly with smallholders and other local businesses (*Recommendation*) | Current and past prices for produce are publicly available.<br>Pricing mechanisms for produce, inputs and services are documented.<br>Evidence is available that all parties understand the contractual agreements they enter into, and that contracts are fair, legal and transparent and that all costs, fees and levies are explained and agreed in advance.<br>Agreed payments are made in a timely manner. |

**Table 40** Criteria and indicators for Principle 6: Workers' Rights

| Criterion | Indicators |
|---|---|
| 7.1 Land right issues | The right to use the land can be demonstrated and does not diminish the legal or customary rights of other users and respects important areas for local people. |
| 7.2 Consultation and communication with local stakeholders | Procedures are in place to consult and communicate with local populations and interest groups on plans and activities that may negatively affect the legal or customary rights, property, resources, or livelihoods of local peoples. |

**Table 41** Criteria and indicators for Principle 7: Land Rights

# Annex H Biodiverse Grassland Standard

**Annex summary**

This annex describes the Biodiversity Standard. This standard can be used by suppliers wishing to conduct their own independent third-party field audits against the requirements on highly biodiverse grassland as a means of demonstrating compliance with the biodiversity aspects of the land criteria. The standard can be used for a stand-alone audit, or alongside the Sustainable Land Use Standard in Annex G.

H.1 The Biodiverse Grassland Standard can be used to demonstrate compliance with the biodiversity aspects of the land criteria. Third-party field audits against this standard should follow the audit guidelines outlined in Annex L.

H.2 The Administrator strongly recommends that in cases where an existing voluntary scheme is operational that has been recognised by the Administrator to demonstrate compliance with the highly biodiverse grassland criterion, suppliers do not carry out an Biodiversity Audit and instead seek assessment under the voluntary scheme.

H.3 An independent expert with a specific qualification on biodiversity should establish, on a case-by-case basis, whether a specific piece of land is, or in the case of conversion, was highly biodiverse grassland.

H.4 For the purposes of the RTFO and the SAF Mandate, highly biodiverse grassland is defined as any grassland spanning more than one hectare which is included as a priority grassland habitat under the UK Biodiversity Action Plan. Further guidance on what constitutes a priority grassland habitat is also available in Annex 2 of the JNCC Guidelines for the Selection of Biological Sites of Special Scientific Interest (SSSIs). For grasslands located outside of the UK, definitions of highly biodiverse grassland according to the relevant competent authority in that country may be used subject to agreement with the Administrator.

H.5 If it is determined that the land is currently highly biodiverse grassland, it should also be determined whether it is natural or non-natural grassland:

- natural highly biodiverse grassland is grassland that would remain as grassland and that maintains its natural species composition and ecological characteristics and processes in the absence of human intervention
- non-natural highly biodiverse grassland is grassland that would cease to be grassland in the absence of human intervention and that is species-rich and not degraded and which has been identified as being highly biodiverse

H.6 For the purposes of the definition of non-natural grassland in paragraph H.5, species-rich grassland is defined as grassland that satisfies one of the following criteria:

- a habitat of significant importance to critically endangered, endangered or vulnerable species as classified by the International Union for the Conservation of Nature Red List of Threatened Species or other lists with a similar purpose for species or habitats laid down in national legislation or recognised by a competent national authority in the country of origin of the raw material
- a habitat of significant importance to endemic or restricted-range species
- a habitat of significant importance to intra-species genetic diversity
- a habitat of significant importance to globally significant concentrations of migratory species or congregatory species
- a regionally or nationally significant or highly threatened or unique ecosystem

H.7 If, based on the definitions outlined above, the land is judged to currently be non-natural highly biodiverse grassland, the auditor should also seek to establish whether or not the harvesting of material from that land for biofuel production had an impact on biodiversity. The presumption should be that harvesting did have an impact on biodiversity unless evidence is provided to the contrary.

H.8 An audit against the Biodiverse Grassland Standard can have one of the following outcomes with respect to demonstrating compliance with the land criteria:

- If the land is not judged to be or have been highly biodiverse grassland in, or after, January 2008, the assessment only needs to be done once and the land is judged to be compliant with the land criteria
- If the land is judged to have been highly biodiverse grassland and it is now not, then it is judged to be non-compliant with the land criteria
- If the land is judged to be natural highly biodiverse grassland, then it is judged to be non-compliant with the land criteria
- If the land is judged to be non-natural highly biodiverse grassland and no impact on biodiversity can be proven that despite harvesting of material from that land for biofuel production, it can be judged to be compliant with the land criteria, but an annual expert assessment is required to ensure that biodiversity is maintained
- If the land is judged to be non-natural highly biodiverse grassland and it cannot be proven that harvesting of material from that land for biofuel production has no impact on biodiversity, then it is judged to be non-compliant with the land criteria

H.9 If grassland has already been converted to cropland it is not possible to assess the characteristics of the land itself. In such circumstances, other relevant sources of information can be used. For example, information on the typical properties of

grassland in the area, or other reliable information concerning the characteristics of the land. In such cases taking a precautionary approach would be appropriate.

H.10 Any experts conducting the assessment must be external, independent of the activity being audited and have no conflict of interest. Furthermore, experts are required to have the specific technical knowledge and experience on biodiversity with which to be able to perform the assessment. For instance, assessing whether grassland maintains the natural species composition and ecological characteristics and processes and whether grassland is species-rich can only be done by experts that have acquired a specific qualification for this purpose.

H.11 The report outputs from these assessments should be made available to the supplier’s independent verifier and to the Administrator upon request.

# Annex I Sustainable Forestry Standard

**Annex Summary**

This annex describes the criteria of the Sustainable Forestry Standard. The sustainability criteria should be used by suppliers wishing to conduct their own independent field audits of cultivated feedstocks against the Sustainable Forestry Standard.

The Standard provides an optional tool to demonstrate compliance with the forestry criteria, particularly for use when existing voluntary schemes are not available or operational.

I.1 The Sustainable Forestry Standard can be used to demonstrate compliance with the forestry criteria. Third-party field audits against this standard should follow the audit guidelines outlined in Annex L.

I.2 All criteria and indicators (including those of the norm for audit quality outlined in Annex L) must be complied with for the Sustainable Forestry Standard to be met.

I.3 As well as the required criteria and indicators, the tables below provide suggested evidence, although this is not prescriptive. In line with the options for compliance outlined in paragraph 7.20, auditors may judge that it is not necessary to require evidence at the level of the forest sourcing area for specific criteria or indicators if the required practices are already required by law in the country of origin of the feedstock and their implementation is monitored and enforced.

I.4 Audits against the Standard should take place annually in order to demonstrate continuing compliance with the forest criteria.

I.5 The criteria are divided by the following high-level criteria into individual tables outlining specific criteria, indicators and suggested evidence sources:

- High-Level Criterion 1: the material has not been harvested from wetlands, peatlands or protected land areas unless the land is designated for nature protection purposes and the production of that relevant feedstock did not

interfere with the purposes for which the land concerned was an area designated for nature protection purposes (Table 42)

- High-Level Criterion 2: the material has been legally harvested (Table 43)
- High-Level Criterion 3: the material has been harvested in such a way that negative impacts on soil quality and forest biodiversity are minimised and which maintains or improves the long-term production capacity of the forest from which it was harvested (Table 44)
- High-Level Criterion 4: that areas that have been harvested are subject to forest regeneration[91] (Table 45)
- High-Level Criterion 5: that changes in carbon stock associated with forest biomass harvest are accounted for in submissions related to the country's commitment to reduce or limit greenhouse gas emissions through the 'Paris Agreement', or the material has been harvested in such a way that carbon stocks and sinks levels in the forest are maintained or increased over the long term (Table 46)

[91] "Forest regeneration" means the re-establishment of a forest stand by natural or artificial means following the removal of the previous stand by felling or as a result of natural causes, including fire or storm.

| Specific Criteria | Indicators | Evidence |
|---|---|---|
| Biomass has not been harvested from areas protected by local, regional or national laws in the country of origin or under the conservatorship of national/international protection bodies. | All areas of operation should be thoroughly researched to ensure they do not violate any current laws in the country of origin. This research should expand to international treaties which may deem the land as protected. | ▪ Compliance with UK Timber Regulations (Voluntary agreement in place with source country under FLEGT Action plan)<br>Or:<br>▪ Relevant laws and criteria related to wood harvesting in the country of origin should be documented. A strong legal framework should already be in place in the region.<br>▪ GIS or other maps showing the exact land areas biomass is obtained from along with any protected areas/regions.<br>▪ Regional best practices should be adhered to and detailed in standard operating procedures. Field inspections should be used and recorded to verify compliance. |
| Biomass is not harvested from areas of significant value<br>(including wetlands and peatlands) | The legal, tenure and customary rights of indigenous people and local communities who rely on the forest are respected and protected. | ▪ Compliance with UK Timber Regulations (Voluntary agreement in place with source country under FLEGT Action plan) Or:<br>▪ Agreements in place regarding the rights and tenure of indigenous peoples along with mechanisms to resolve disagreements.<br>▪ Availability of documents demonstrating collaboration and meetings with the people in these areas.<br>▪ Interviews by an independent credible third party with these groups and stakeholders to verify there is a good working relationship. |
| Biomass is not harvested from areas of significant value (including wetlands and peatlands) | Natural undeveloped (no evidence of human impact) forest areas, endangered tree species and areas of value to local wildlife (habitats) have been identified and are protected. | ▪ Mapped areas of conservation zones or protected areas (to be protected from logging)<br>▪ Mapped areas of wetlands and peatlands<br>▪ A comprehensive survey should be conducted of protected forest land as well as details of threatened and endangered wildlife species in the area. These surveys should be recorded, and guidance provided to suppliers. Field inspections should be used and recorded to verify compliance.<br>▪ Methods for ensuring these species are protected should be specified in the standard operating procedures/codes of practice.<br>▪ Periodic monitoring of the impact of harvesting activities on local ecological and biological systems should be conducted.<br>▪ Data should be made publicly available. |
| Biomass is not harvested from areas of significant value<br>(including wetlands and peatlands) | Areas of historical and archaeological significance are protected. | ▪ Areas of historical significance should be mapped.<br>▪ Data should be made publicly available. |

**Table 42** Criteria, indicators, and evidence for high-level criterion 1 of the Sustainable Forestry Standard, that the material has not been harvested from wetlands, peatlands or protected land areas unless the land is designated for nature protection purposes and the production of that relevant feedstock did not interfere with the purposes for which the land concerned was an area designated for nature protection purposes.

| Specific Criteria | Indicators | Evidence |
|---|---|---|
| It should be demonstrated that there is a legal right to operate and harvest in the forest. | It should be demonstrated that there is a legal right to harvest wood from the forest and that the harvesting operations have been legally certified. This includes helping to protect the forest from illegal harvesting activities from other parties. | ▪ Documents showing legal right of ownership or tenure of the forest.<br>▪ Written authorisation from the local authority giving permission for harvesting of forestry material.<br>▪ Harvesting company should be a legally recognised company with professional certification/licensing. |
| Awareness and compliance with local, regional and national laws in the country of origin and with international treaties. | Harvesting should be compliant with local, regional and national laws from the government in the country of origin as well as international treaties (e.g. EUTR or CITES). | ▪ Records should be kept documenting all applicable legal requirements and have details on up-to-date forest legislation and regulations.<br>▪ Staff should be interviewed to show they have a good understanding and are up-to-date with relevant laws and legislation.<br>▪ Obtain FLEGT certification |
| Awareness and compliance with local, regional and national laws in the country of origin and with international treaties | Workers' rights should be protected including the payment of minimum wage and protection of their wellbeing through legal requirements and industry standards. | ▪ Records showing payment of at least the minimum wage<br>▪ Employment contracts demonstrating required employment protections |
| Awareness and compliance with local, regional and national laws in the country of origin and with international treaties | Declaration of conflicts of interest are made publicly along with a statement of commitment to offer or receive bribes. | ▪ Complete visibility in the supply chain.<br>▪ Public statement that any conflicts of interest will be made public knowledge imminently.<br>▪ Public statement to commit to not offering or receiving bribes. |
| Awareness and compliance with local, regional and national laws in the country of origin and with international treaties | All royalties, taxes and tariffs are paid throughout the supply chain. | ▪ Comprehensive record of payment receipts and money transactions |

**Table 43** Criteria, indicators and evidence for high-level criterion 2 of the Sustainable Forestry Standard, that the material has been legally harvested.

| Specific Criteria | Indicators | Evidence |
|---|---|---|
| Actions should maintain the land status and the conservation value. | Harvesting must not take place from land that contains dense areas of native tree species where there is no clear evidence of previous human activity (Primary Forest) or where ecological processes are likely to be disturbed. | ▪ Verified by a credible third party. |
| Actions should maintain the land status and the conservation value. | Harvesting and supply activities should not change the forestry status. | ▪ Environmental impact assessments should be conducted before operations start.<br>▪ Adherence to regional best management practices.<br>▪ Harvesting of non-managed native tree species is prohibited through compliance statements and traceability. Field inspections should be used and recorded to verify compliance.<br>▪ Canopy coverage is maintained by the use of mass balances.<br>▪ Monitoring results are recorded.<br>▪ Records of field inspections.<br>▪ GIS mapping.<br>▪ Appropriate safeguards are implemented in the standard operating procedures and codes of practice.<br>▪ Public commitment to enforcing protection of standards/self-declaration of compliance. |
| Actions should maintain the land status and the conservation value. | Harvesting and supply activities should minimise any changes to the ecosystem of the forest. | ▪ Environmental impact assessments should be conducted before operations start.<br>▪ Adherence to regional best management practices.<br>▪ Assessment of operations to define measures to minimise impacts.<br>▪ Soil surveys and monitoring records.<br>▪ Information on methods to protect soil.<br>▪ Interviews with staff should demonstrate appropriate knowledge on best practices and minimising impact.<br>▪ Information on how threatened and endangered habitats and ecosystems can be protected and maintained should be obtained from relevant resources (e.g. resource experts, natural-resource agencies and internet research).<br>▪ Public commitment to enforcing protection of standards/self-declaration of compliance. |

**Table 44** Criteria, indicators and evidence for high-level criterion 3 of the Sustainable Forestry Standard, that the material has been harvested in such a way that negative impacts on soil quality and forest biodiversity are minimised and which maintains or improves the long-term production capacity of the forest from which it was harvested.

| Specific Criteria | Indicators | Evidence |
|---|---|---|
| Regeneration plans should restore harvested and low-stock areas with native and desired tree species to a similar or more natural state than pre-harvest. | Native or desired tree species are planted to restore the pre-harvest natural state within 10 years. | ▪ Management plan should detail plans for regeneration.<br>▪ Documentation of operational practices.<br>▪ Harvesting and regeneration records/inventory are maintained. |
| | Low-stock areas are identified and regenerated to improve the natural state of the forest. | ▪ Management plan should detail plans for regeneration.<br>▪ Documentation of operational practices.<br>▪ Regeneration records/inventory are maintained. |
| | Forest productivity should be maintained. | ▪ Mass balances should be used to ensure forest productivity is maintained.<br>▪ Harvesting and growth rate data should be used to demonstrate that biomass feedstocks are not having a negative impact on forest productivity or health. |

**Table 45** Criteria, indicators and evidence for high-level criterion 4 of the Sustainable Forestry Standard, that areas that have been harvested are subject to forest regeneration.

| Specific Criteria | Indicators | Evidence |
|---|---|---|
| Harvesting of forestry does not impact on the overall effectiveness of the forest as a carbon sink. | Assessment of the impacts of operations on carbon stocks should be conducted. | ▪ Environmental Impact Assessment.<br>▪ Site surveys are recorded and monitored to ensure compliance.<br>▪ Evidence of policies and objectives for environmentally sound forest management and protection |
| | Monitoring and evaluation of changes to carbon stocks should be periodically conducted to demonstrate harvesting is not impacting the soil carbon content. | ▪ Site surveys are recorded and monitored to ensure compliance.<br>▪ Management plan should contain periodic sampling in active areas to ensure changes from operations are minimal.<br>▪ Analysis of historic and current carbon uptake rates should be recorded. |
| Alternatively, if carbon stocks are not being maintained, then evidence must be provided that these changes in carbon stock are accounted for in the country of origin's submissions as part of their obligations under the Paris Agreement. | | |

**Table 46** Criteria, indicators and evidence for high-level criterion 5 of the Sustainable Forestry Standard, that changes in carbon stock associated with forest biomass harvest are accounted for in submissions related to the country's commitment to reduce or limit greenhouse gas emissions through the 'Paris Agreement', or the material has been harvested in such a way that carbon stocks and sinks levels in the forest are maintained or increased over the long term.

# Annex J Soil Carbon Standard

**Annex Summary**

This annex describes the criteria of the Soil Carbon Standard. The sustainability criteria should be used by suppliers wishing to conduct their own independent field audits of cultivated feedstocks against the Soil Carbon Standard.

The Standard provides an optional tool to demonstrate compliance with the soil carbon criteria, particularly for use when existing voluntary schemes are not available or operational.

J.1 The Soil Carbon Standard can be used to demonstrate compliance with the soil carbon criteria. Third-party field audits against this standard should follow the audit guidelines outlined in Annex L.

J.2 All criteria and indicators (including those of the norm for audit quality outlined in Annex L) must be complied with for the Soil Carbon Standard to be met.

J.3 As well as the required criteria and indicators, the tables below provide suggested evidence, although this is not prescriptive. In line with the options for compliance outlined in paragraph 7.17, auditors may judge that it is not necessary to require evidence at the farm level for specific criteria or indicators if the required practices are already required by law in the country of origin of the feedstock and their implementation is monitored and enforced.

J.4 Audits against the Standard should take place annually in order to demonstrate continuing compliance with the soil carbon criteria.

J.5 The criteria and indicators listed in Table 47 as well as those of the norm for audit quality (see Annex L) must be complied with for the Soil Carbon Standard to be met.

| Specific Criteria | Indicators | Evidence |
|---|---|---|
| **Either**: Monitoring of soil carbon content | The biomass producer should conduct an assessment of the soil suitability (risk of organic matter degradation for planned crop rotation). Additionally, the biomass producer should conduct regular testing of soil organic matter content and keep a complete track record of measurements. | Risk analysis detailing any risks to soil organic carbon content over the whole rotation.<br>Documented soil carbon analysis |
| **Or**: Management plan to maintain/enhance soil carbon content | The biomass producer should have a comprehensive soil management plan this should include a nutrient plan and details of actions to prevent soil degradation.<br><br>Methods to maintain soil carbon should include techniques such as the following:<br>▪ A varied crop rotation- this should include a variety of crops with various root depths and longer rotations for high-value crops. Rotations should also include soil regulating/amending crops such as legumes, cover/catch crops for autumn or under-sown crops.<br>▪ Application of manures.<br>▪ At least one residue in every 5 rotations is left in the ground.<br>▪ Applications of high organic carbon such as Biochar, food or green compost, paper crumble, biosolids, mushroom compost or water treatment cake.<br>▪ Minimising soil losses arising from cultivation.<br>▪ Use of temporary grass leys. | Evidence of a soil management plan that demonstrates that rotational cropping is performed utilising a mix of different crop species, and preferably incorporating a root crop or a legume species or a period of short term grass ley, or evidence of use of cover crops to reduce the period of bare fallow and/or adoption of zero tillage (reduced soil disturbance) or evidence of use of application of organic amendments to soil (manures or organic wastes), including retention of residues from other crops in the rotation. |
| Monitoring/management of soil compaction | Regular visual assessments of soil compaction should be recorded, and appropriate remedial action taken. Over winter, soil compaction should be avoided by using dedicated tramlines and avoiding the use of machinery in wet conditions. | Evidence of autumn cultivations to address compaction problems (e.g. moling operations) and any surface flooding |
| Preventing soil erosion | Prevent soil erosion by cultivating compacted tillage soil, leave autumn seedbeds rough, establish winter crops early, prevent livestock from winter grazing, use trees and fences as flood barriers and ensure field drainage is sufficient. | On vulnerable soils (silts and sandy soils) - evidence of timely cultivations and approaches to reduce risk of wind blow and runoff (minimum periods of bare soil) |

**Table 47** Criteria, indicators and evidence for the Soil Carbon Standard

# Annex K Sustainable Waste Management Standard

To demonstrate that the wastes of fossil origin meet the sustainable waste management criteria, the fuel supplier must provide evidence that satisfies the Administrator that adequate monitoring or management plans are in place to address the local environmental impacts caused as a result of sourcing or processing the waste. All applicable waste regulatory controls must be complied with in full in the country of origin, which includes all permissions, licences and permits required of waste management and processing operations and includes compliance with any regulatory controls applicable to trans boundary shipping of wastes. Waste must be handled in compliance with HSE/EA guidelines or an ISO 14001 accredited environmental management system, to the level of ISAE 3000 assurance, which ensures compliance with most of the key required criteria.

| Criterion | Indicators | Evidence |
|---|---|---|
| Compliance with the Waste Hierarchy is demonstrated | Demonstration that material recovery options have been explored and found to be unsuitable based on economic, logistical or sustainability grounds.<br>The process through which the waste feedstock is produced has not been intentionally modified to increase the production of the waste.<br>• For biogenic wastes, there shall be no deliberate contamination of a material with the intention of classifying it as a waste. | Best available techniques have been used to maximise separation of waste and extract any recyclable material.<br>Hazardous Waste Consignment Note confirming compliance with Reg 12 of the Waste (England and Wales) regulations 2011<br>Operating permit under the Environmental Permitting Regulations (England and Wales) Regulations 2010 or equivalent (Guidance) |

| | | |
|---|---|---|
| Operators carrying out waste treatment shall obtain and comply with any relevant permit and registration requirements | The permit should specify:<br>• the types and quantities of waste that may be treated;<br>• for each type of operation permitted, the technical and any other requirements relevant to the site concerned;<br>• the safety and precautionary measures to be taken;<br>• the method to be used for each type of operation throughout the supply chain;<br>• such monitoring and control operations as may be necessary;<br>• such closure and after-care provisions as may be necessary. | Details of the permit shall be made available upon request. The permit shall be in date and apply to the operation in question.<br>In addition:<br>• Evidence of the existence of a waste management plan which should include risk assessment and management, target setting and monitoring performance against targets.<br>• Evidence of any registration of exemptions for low-risk waste treatment operations. |
| Compliance with applicable laws relevant to waste management practices. | Evidence of compliance with applicable international, national and local laws and regulation with respect to waste management. | The operation should prove that:<br>• it is familiar with relevant international, national and local legislation (i.e. Flood Defence Consent, planning permission requirements);<br>• it complies with these legislations;<br>• it remains informed on changes in legislation. |
| Appropriate records shall be kept | Traceability of wastes is ensured. Evidence shall be available to ensure that all prior elements of the supply chain of the waste have relevant permits/accreditations for the handling of the waste.<br>Operators handling waste shall keep a chronological record of:<br>• the quantity, nature and origin of that waste and the quantity of products and materials resulting from preparing for re-use, recycling or other recovery operations;<br>• and where relevant, the destination, frequency of collection, mode of transport and treatment method foreseen in respect of the waste. | • Record keeping is made available to the relevant authority. (e.g. waste transfer/consignment notes)<br>• A Sustainable Waste Management plan (Environmental Management Plans or international equivalent submitted as part of an application to the Administrator) including details of responsible parties in the organisation.<br>• Records of risk assessments, monitoring and management measures undertaken, which shall be kept for at least 5 years.<br>• Proof of no outstanding environmental enforcement actions against the operator |

| | | |
|---|---|---|
| Health and safety of workers handling the waste shall be ensured | The operator shall ensure that workers are trained in the correct handling, transport and storage of waste, in particular for hazardous waste. | Evidence of work-based training<br>• work-related health and safety risks and preventative measures for minimising the risk to health and safety (training as a minimum to ISO 45001 Occupational Health and Safety Standard)<br>• work-related risks to the environment and/or society<br>• correct application, transport, storage and handling of hazardous substances and waste |
| Hazardous waste shall be appropriately handled and stored | Hazardous waste shall be handled and stored safely in a manner appropriate to the risk of the waste.<br>Hazardous waste shall be kept separate and not mixed with other waste unless there is evidence that human and environmental health will not be compromised, and the mixing conforms to Best Available Techniques. | • Any hazardous waste is stored and handled with clear identification.<br>• Warning signs are placed where appropriate. |
| No waste activity is undertaken which endangers human health or harms the environment | • No risk to soil water or air quality.<br>• Wastes shall not be in direct/indirect contact with soils, water sources and air outside processing and production units unless adherence to local or national guidelines is demonstrated.<br>• No nuisance shall be created through noise or odours.<br>• No adverse effects to human health or the environment | • Evidence should be produced to ensure waste is handled and stored in appropriate conditions to prevent any environmental contamination.<br>• Evidence that there is control of emissions of major pollutants including carbon monoxide, nitrogen oxides, volatile organic compounds, particulate matter, sulphur compounds, dioxins and other substances recognised as potentially harmful for the environment or human health.<br>• Evidence of emissions control via an air management plan |
| Energy efficiency | Measures shall be taken to implement efficient processes for conversion of residues, wastes or by-products into fuels, appropriate to the scale and intensity of the operation. | It is recommended that Best Available Techniques are used. |

**Table 2** Criteria and indicators for Sustainable Waste Management

# Annex L Audit Guidelines

## Norm for audit quality criteria

L.1 When auditing a farm, plantation or other biomass producer against any of the standards outlined in Annexes G-J, auditors must also meet the following norm for audit quality (see Table 48 below). The norm is based on criteria which are each assigned a conformance level of either 'major must' (mandatory) or 'minor must' (recommendation).

| Criterion | Norm | Conformance |
|---|---|---|
| **Certification** | | |
| 1. Requirements for Certification Bodies (CBs) | ISO Guide 65: 1996, ISO 17021: 2006, or justified equivalents. | Major must |
| **Audit** | | |
| 2. Management of the audit programme | ISO 19011: 2002, or justified equivalent. | Major must |
| 3. Audit frequency | Once every five years for a full certification audit and once a year for a surveillance audit. | Major must |
| 4. Audit competency | ISO 19011: 2002, or justified equivalent.<br>Specific requirements relevant to the product that the CB is certifying should be added as training requirements where appropriate. | Major must |
| 5. Stakeholder consultation | To include a range of relevant stakeholders. | Minor must |
| 6. Public summaries of the certification audit | To include overall findings of the certification audit, any details of non-compliance and any issues identified during the stakeholder consultation. Information should be available in both English and the relevant local language(s), if applicable. | Minor must |
| **Accreditation** | | |
| 7. Accreditation process for Accreditation Bodies (ABs) | 'Commitment to comply' with ISO 17011: 2004, or justified equivalent, independently peer-reviewed and approved by an auditor that is recognised by either ISEAL or the IAF. | Major must |
| **General** | | |
| 8. Documentation management | Parties (and Certification Bodies):<br>- shall have an auditable system for the evidence related to the claims they make or rely on; | Major must |

| Criterion | Norm | Conformance |
|---|---|---|
| | - keep evidence for a minimum period of five years; and<br>- accept responsibility for preparing any information related to the auditing of such evidence. | |

**Table 48** Norm for audit quality

## Additional field guidance for auditors

L.2 In practice, field audits will almost always find minor non-conformances with standards, which do not normally prevent certification. For certification schemes, this is normal practice, including for those voluntary schemes recognised by the Administrator.

L.3 A definition of minor and major non-conformances is given in the box below. When auditing against the standards (Annexes G-J), minor non-conformances identified in the field are allowed, and will not prevent a supplier from demonstrating compliance. If any major non-conformances are found, a producer could not report that that feedstock meets the requirements of that RTFO.

### Minor and major non-conformances

A non-conformance is 'the non-fulfilment of a requirement', where a requirement is a 'need or expectation that is stated, generally implied or obligatory' (EN ISO 9000:2005). Most certification bodies (auditors) distinguish findings on the basis of major and minor non-conformances.

A minor non-conformance:

- is a temporary lapse; or
- is unusual/non-systematic; or
- the impacts of the non-compliance are limited in their temporal and spatial scale;
- and prompt corrective action has been taken to ensure it will not be repeated;
- and it does not result in a fundamental failure to achieve the objective of the relevant criterion.

A major non-conformance:

- is repeated or systematic; or
- continues for a wide period of time; or
- affects a wide area; or
- is a non-conformance which is not corrected or adequately responded to by the responsible managers once it is identified; or
- results in, or is likely to result in, a fundamental failure to achieve the objectives of the relevant criterion in the Management Unit(s) within the scope of the evaluation.

Note: The definitions for majors and minors above are from the FSC-STD-20-002 V2-1 EN (Structure and Content of Forest Stewardship Standards).

# Annex M Classifying algae-derived fuels

M.1 Algae are a broad family of typically photosynthetic organisms some of which can be used to produce biofuels. Where a supplier wishes to supply fuel derived from algae, they should first contact the Administrator. Where necessary, a feedstock assessment will be undertaken (see 2.53).

M.2 Algae can grow in three different ways (see Table 49) Typically, algae are "autotrophic", meaning that they produce organic compounds (like oils and proteins) from simple carbon substrates like $CO_2$. As these carbon sources have no useful energy content, they derive energy from (sun)light through photosynthesis. Some kinds of algae can also take up and metabolise organic carbon from their surroundings. Certain algal species may be able to perform different types of growth depending on the conditions it is under (e.g. light vs dark, fed vs unfed).

| Scenario | Growth Type | Energy source | Carbon source | Feedstock |
|---|---|---|---|---|
| 1 | (Photo)autotrophic | Light | CO2 | Algae |
| 2 | Heterotrophic | Organic carbon | Organic carbon | The organic carbon source |
| 3 | Mixotrophic | Part light, part organic carbon | Part CO2, part organic carbon | See paragraph M.5 |

**Table 49** Types of algal growth

M.3 For the purposes of the RTFO, it is important to ascertain what the energy source is for the fuel that is produced and whether that energy source is organic carbon or not. This depends on the type of algae and how it grows under the conditions it is put in.

M.4 If the algae derive energy purely from light, then the algae itself would be considered the feedstock for the purposes of the RTFO (Scenario 1). Conversely, if the energy source is purely organic carbon, then the feedstock is whatever the organic carbon is derived from (e.g. a crop or waste) (Scenario 2). If a mix of light and organic carbon provide the energy, then the final product will need to be divided into two consignments as described in paragraph M.5 (Scenario 3). Table 49 summarises these three situations and Figure 13 demonstrates how classification can be achieved through a flow diagram.

M.5 In situations where the energy content of the finished fuel is derived from both light and organic carbon (Scenario 3), then the final product should be split into two consignments:

- Consignment 1: Proportional to the energy coming from sunlight – for this consignment the feedstock would be algae
- Consignment 2: Proportional to the energy coming from the organic carbon source – for this consignment the feedstock would be whatever the organic carbon source is derived from

An energy allocation approach should typically be used for determining the proportion of the finished fuel which falls into each consignment. In line with the approach taken for partially renewable fuels, the Administrator will also consider alternative methods for allocation such as carbon dating on a case-by-case basis.

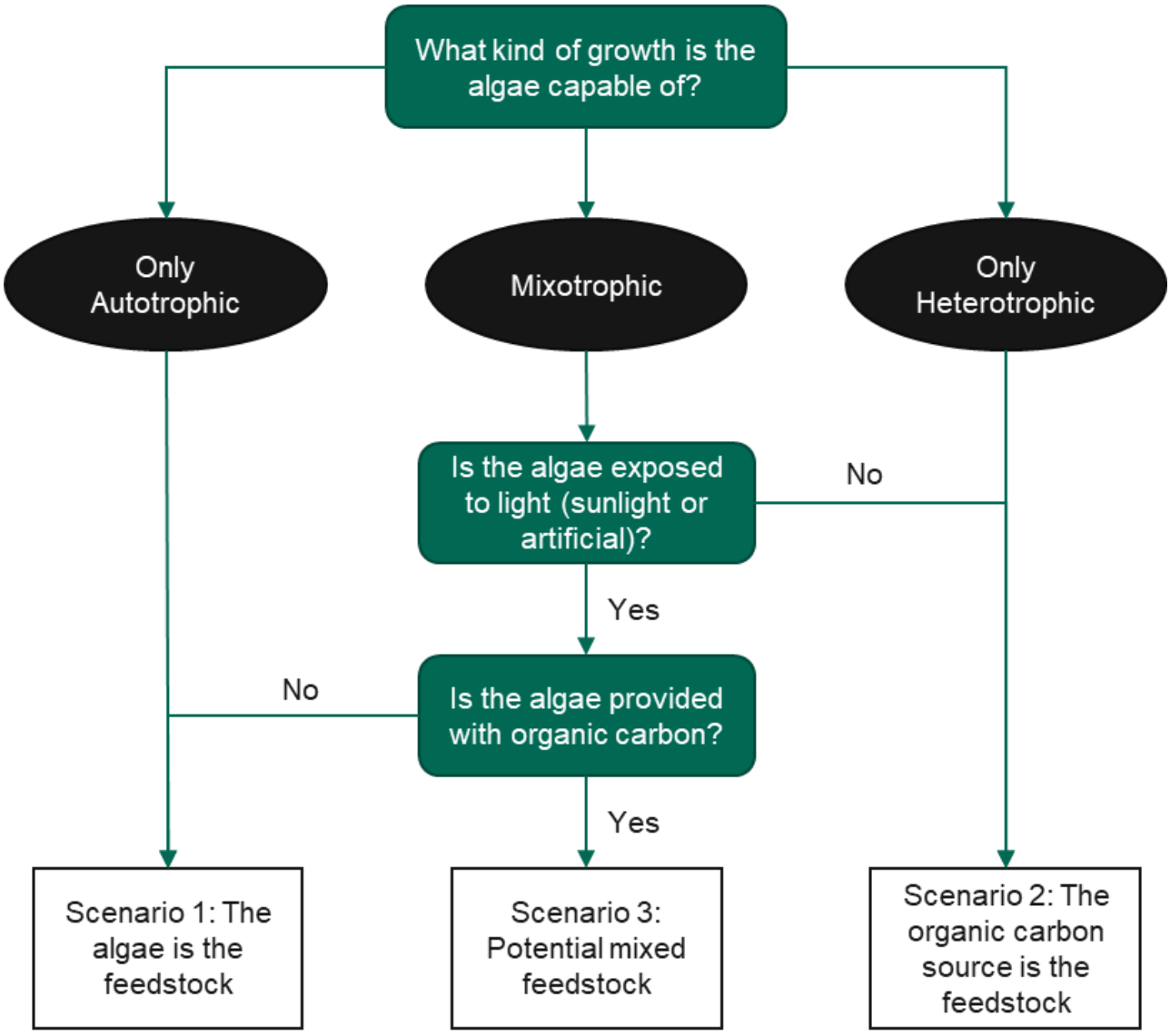



**Figure 13** Flow diagram demonstrating how algae can be classified under the RTFO

M.6 In situations where algae are not considered to be the feedstock (Scenario 2 or consignment 2 in Scenario 3), the status of the feedstock (e.g. as a waste, residue, relevant crop or energy crop) will be determined by the usual process with reference

to the published feedstock list or, where necessary, a new feedstock assessment (see paragraph 2.53).

M.7 Where the feedstock is considered to be algae (Scenario 1 or consignment 1 in Scenario 3), the Administrator will assess the feedstock type on a case-by-case basis. If grown intentionally for the purpose of producing renewable fuel, the Administrator would generally consider algae to be a single counting product. As it does not meet the definition of either a relevant crop or energy crop, under the RTFO it would be awarded a single general RTFC per litre of fuel supplied.

# Annex N Glossary

| Term | Definition |
|---|---|
| **Account holder** | An organisation holding an account with the Administrator. |
| **Application** | An administrative batch of fuel. Any amount of biofuel that has a consistent set of sustainability characteristics. Known as an administrative consignment until January 2023. |
| **Avtur** | Aviation turbine fuel |
| **Biofuel** | Fuel made from recently-living biological material. |
| **Biodiversity** | Measurement of the variety of different life forms in a given area. High biodiversity is viewed as an indication of a healthy ecosystem. |
| **Carbon defaults** | Default carbon intensity values. |
| **Carbon intensity** | The rate at which carbon is emitted in relation to the amount of energy produced. |
| **Carbon stock** | Measurement of the carbon stored in a given area of land which can go up or down depending on the use of that land. Forests and peatland are examples of land with high carbon stocks. |
| **C&S** | Carbon and sustainability |
| **Certificates** | Synonymous with RTFCs in this guidance document |
| **$CO_2$** | Carbon dioxide |
| **$CO_2e$** | Carbon dioxide equivalent |
| **Dedicated energy crop** | Dedicated energy crops are non-food crops including ligno-cellulosic material and non-food cellulosic material, except saw logs and veneer logs. Dedicated energy crops are grown for the purpose of generating heat and electricity, or to produce transport biofuels. |
| **Defaults** | Shorthand for default carbon values (see carbon defaults above). |
| **Development fuels** | Advanced renewable fuels, a target for which applies from January 2019. |
| **Defra** | Department for Environment Food and Rural Affairs |
| **DfT** | Department for Transport |
| **Economic operator** | Any company or organisation involved in the fuel supply chain. |
| **ETBE** | Ethyl-tertiary-butyl-ether. A type of biofuel. |
| **FAME** | Fatty-acid-methyl-ester. A type of biofuel. |
| **Feedstock** | Raw material used to produce renewable fuels |
| **$gCO_2e/MJ$** | Unit of measurement of carbon intensity |
| **GHG** | Greenhouse gas |
| **Grandfathering** | Refers to biofuels produced in installations before certain dates and affects the GHG savings requirements. |

| Term | Definition |
|---|---|
| **ha** | Hectare |
| **HVO** | Hydro treated vegetable oil. A type of biofuel. |
| **Input data** | Any information about the renewable fuel production chain which is used to calculate the carbon intensity of the renewable fuel, for example: yield, nitrogen fertiliser inputs or the amount of fuel used in production plant. |
| **Installation** | A processing plant that leads to a material modification from any of the relevant feedstock to the finished fuel. It does not include installations solely used for the collection, transportation or storage of the feedstocks. |
| **ILUC** | Indirect land-use change. Land-use change (see below) where the cause is at least a step removed from the effect. In the context of this document, it can be taken to mean the knock-on effects on land use resulting from the cultivation of biofuel feedstocks. It is acknowledged to be more difficult to manage or monitor than direct land-use change. |
| **ISO** | International Organisation for Standardisation |
| **ISAE** | International Standard on Assurance Engagements |
| **Land-use change** | The outcome when a particular activity, such as cultivation of biofuel feedstock, results in a change of land use. Generally refers to previously uncultivated land such as forest, peatland or grassland being used for agriculture. |
| **MSW** | Municipal solid waste. A feedstock. |
| **MTBE** | Methyl-tertiary-butyl-ether. A type of biofuel. |
| **Obligated supplier** | A transport fuel supplier upon whom a renewable transport fuel obligation or SAF Mandate is imposed. |
| **OSR** | Oilseed rape. A feedstock. |
| **PtL** | Power to Liguid – A type of sustainable aviation fuel (kerosene) derived from renewable (non bio) or nuclear power |
| **RCF** | Recycled Carbon Fuel |
| **Renewable fuel** | A fuel from a source that is either inexhaustible or can be indefinitely replenished at the rate at which it is used. For the purposes of this document, it refers to biofuels and RFNBOs. |
| **Reporting party** | A fuel supplier reporting to the Administrator. |
| **RME** | Rape methyl ester (biodiesel made from rape seed) |
| **ROS** | Renewable Fuels Operating System. The online reporting platform used for the SAF Mandate and RTFO. |
| **RTFC** | Renewable transport fuel certificate |
| **RTFO** | Renewable Transport Fuel Obligation. The statutory instrument used to implement the transport elements of the RED. |
| **SAF** | Sustainable aviation fuel |
| **SAF CERTIFICATE** | Sustainable aviation fuel certificate |
| **Sustainable Land Use Standard** | Set of criteria against which biofuel feedstock production may be audited. Developed from the RTFO Meta Standard. |
| **Selected default** | For some inputs to renewable fuel production, the user may select from a list of qualitative options (or selected defaults). For example, they could choose between using biomass or natural gas to provide heat and power. These qualitative options have different default emissions associated with them. |
| **Standard value** | Data which is not dependent on the renewable production chain being considered. For example, lower heating values, emissions factors for materials or global warming potentials. |

| Term | Definition |
|---|---|
| **Supplier** | Any company or organisation supplying fuel or its precursors e.g. for biofuel this would include the crop and the virgin oil. |
| **UCO** | Used cooking oil. A feedstock. |
| **UCOME** | Used cooking oil methyl ester (biodiesel made form UCO) |
| **Verifier** | The person who undertakes the assurance of renewable fuel sustainability data on behalf of reporting parties. They must be independent of the reporting party whose data they are verifying. |
| **Voluntary scheme** | Schemes run by independent organisations that offer a route to providing assurance that renewable fuels meet certain sustainability criteria. See approved list online for details. |

# Annex O Summary of changes (since January 2025 version)

| Location | Description |
|---|---|
| Throughout | Update of dates to reflect obligation year 2026. |
| Throughout | Update of references to the Recycled Carbon Fuels (RCF) guidance to reflect that it covers the SAF Mandate as well. |
| Throughout | Small improvement over clarify and conciseness of guidance language, including corrections to typos. |
| 2.9 | Correction of error stating nuclear is not eligible under SAF Mandate. Reality is that it IS eligible under SAF Mandate. |
| 2.40 to 2.45 | Inclusion of further details on renewable energy as a feedstock type for RFNBOs and PtLs. Previously separated in the RFNBO guidance. |
| 2.49 | Removal of references to feedstock tables situated in guidance, this is replaced with the online feedstock list that is regularly updated. |
| 2.56 | Update of feedstock assessment timelines to reflect actual complexities involved. |
| 2.64 to 2.66 | Clarification on the Administrator's application of the Energy Act effects in relation to conducting feedstock assessments. |
| 4.60 | Update language around requirements on Renewable Energy Guarantees of Origin (REGOs) |
| 5.4 | Update to reflect the new name of the IT system since 2025. |
| 5.4, 6.22, Ch.7, Annex I and J | Clarification of the Administrator's power to request additional evidence from the supply chain, regardless of third-party verification or voluntary scheme certifications. This power already exists in the respective RTFO and SAF Mandate Compliance Guidance. |
| 5.13, 6.10, Table 9 | Update of the minimum GHG saving threshold and max CI for RCFs under the RTFO for the obligation year 2026. |
| C.43 | Clarification on the treatment of hydrogen. |
| Annex E, Annex K | Update to mirror latest RCF Guidance. |