Scheme principles for mass balance

Version EU 08

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1 Introduction

The term "traceability chain" describes the chronological documentation of a process. It is a tool to track material through every step in the process.

The mass balance system is a central element of the sustainability scheme. It establishes a connection between information or claims related to raw materials or intermediate and end products. It is an essential component of the scheme which ensures that information about the sustainability of raw materials, intermediate and end products is credible in relation to its origin and type and can be verified along the entire production and supply chain.

A mass balance system must be managed for each site by:

1. First gathering points: Companies that buy and resell **biomass** from the farmer/producer and collection points that accept waste/residues from waste producers
2. Processing companies that **process biomass** e.g. oil mills, biodiesel, ethanol plants, refineries, biogas facilities with feed-in to a methane filling station, **produce renewable fuels of non-biological origin** (RFNBO) e.g. electrolysers, methanation plants or **recycled carbon fuels** (RCF) e.g. pyrolysis plants.
3. Suppliers **before** and **after** the **last interface**

The Revised Directive (EU) 2018/2001 (RED III) requires economic operators to use a mass balance system for renewable fuels and recycled carbon fuels.
The application of the mass balance system shall ensure that each consignment of renewable fuel or recycled carbon fuel is counted only once one the targets set out in RED III. If a consignment of raw material or fuel has already been considered in the calculation of the targets set out in the RED III in any member state, no further proof of sustainability shall be issued for the consignment. This behaviour, called "multiple accounting", is not only a major non-conformity with the scheme principles but clearly fraudulent behaviour.

This document describes the requirements for a mass balance system in accordance with the requirements of Revised Directive (EU) 2018/2001 Article 30 (1) and 30 (2) and the Implementing Regulation (EU) 2022/996. They guarantee the traceability in all phases of production and delivery in the supply chain for biofuels, bioliquids, biomass fuels, renewable fuels of non-biological origin and recycled carbon fuels.

2 Definition of terms

In order to establish a common understanding of the terms and definitions used in these scheme principles, please refer to the REDcert-EU document "*Definitions in the REDcertEU scheme*".

3 Scheme principles for mass balancing

Where renewable fuels and recycled carbon fuels are to be counted towards the targets of RED III[1], economic operators must proof that the sustainability and greenhouse gas emissions saving criteria laid down into Article 29(2) to (7) and (10) and Article 29a(1) and (2) for renewable fuels and recycled-carbon fuels have been fulfilled. For this to be ensured economic operators must use a mass balance system that

- allows consignments of raw material or fuels with differing sustainability and greenhouse gas emissions saving characteristics to be mixed,
- allows consignments of raw materials with different energy contents to be mixed for the purposes of further processing at the fuel production plant, provided that the size of the consignments is adjusted according to their energy content; but, in order to reduce the administrative burden, the mass balance system may also be applied to different types of raw materials and fuels provided they belong to the same product group,
- requires information about the sustainability and greenhouse gas emission saving characteristics and sizes of the consignments remain assigned to the mixture, and
- provides for the sum of all consignments removed from the mixture to be described as having the same sustainability characteristics, in the same quantities, as the sum of all consignments added to the mixture and requires that this balance be achieved over an appropriate period of time.

[1] Targets referred to in Article 3(1), Article 15a(1), Article 22a(1), Article 23(1), Article 24(4) and Article 25(1)

These requirements are to be considered "minimum requirements" that have to be met by the economic operators. Depending on their individual process related to scope and complexity, they can opt for "stricter" specifications such as the identity preservation method.

Options for the traceability chain	Information about the biomass properties ("certificate"/delivery slip) for every consignment	The biomass can be completely traced back to cultivation/production	Complete separation of certified and non-certified biomass at one site
"Book & claim"	YES	NO	NO
"Mass balancing"	**YES**	**YES**	**NO**
"Identity preservation (hard/soft IP)"	YES	YES	YES

The methods mentioned are described below.

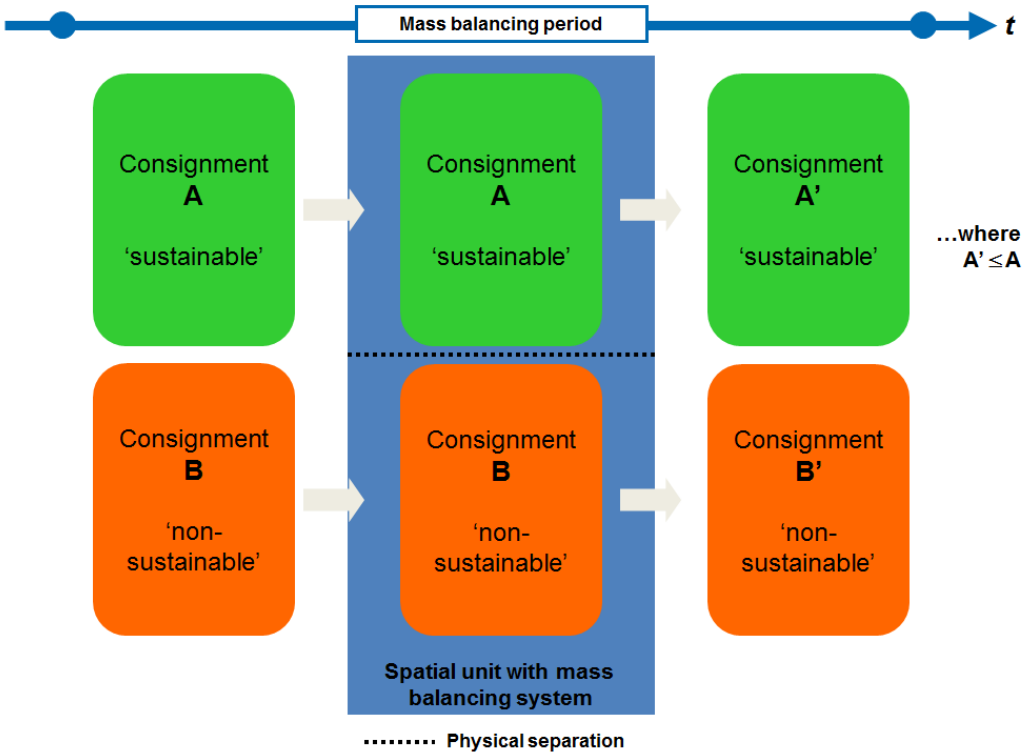
3.1 Identity preservation through physical separation

The most reliable process of preserving identity is the "hard IP method".

When this method is used, the economic operators ensure that no consignment of biomass, renewable fuel or recycled carbon fuel is mixed with other products. It also has to be ensured that the sustainable product can be identified as sustainable throughout the entire process with no changes.

Individual consignments that are certified as sustainable are kept strictly separate from other products and raw materials during processing and storage so that their original characteristics are retained through to the end of the supply chain.

Fig. 1: Identity preservation ('hard-IP')



Consignments are also kept strictly separate during processing. This gives rise to the following mass balancing formula:

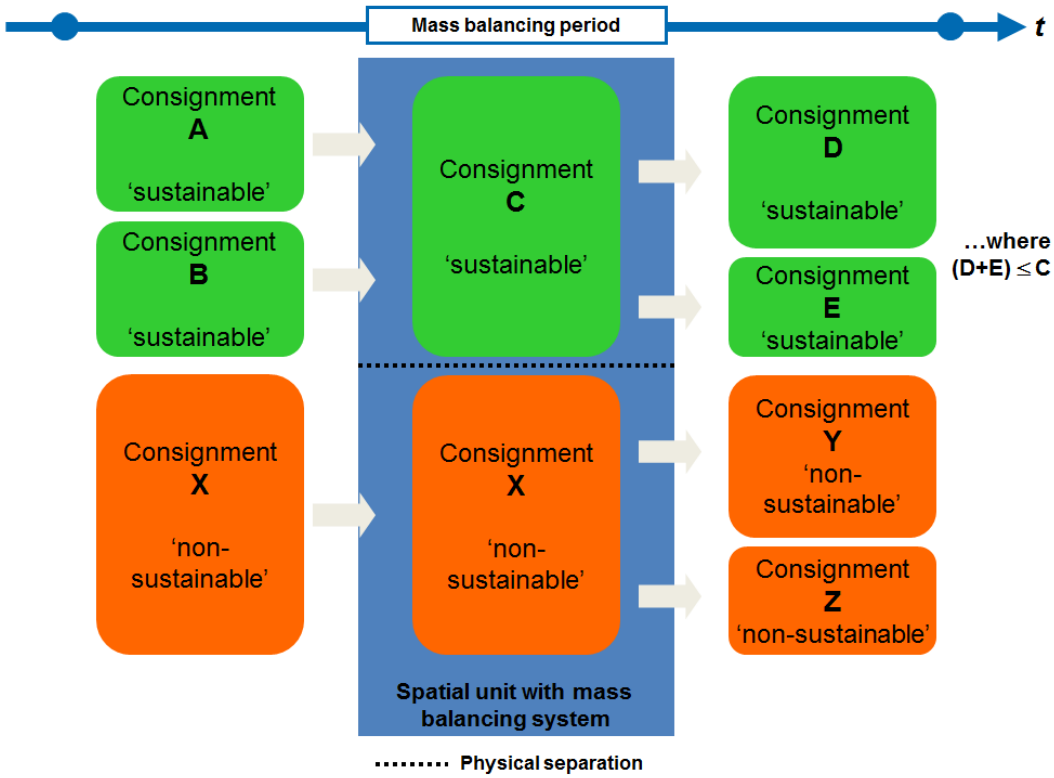
$$\mathbf{A}' \leq \mathbf{A}$$

Where $\mathbf{A}' = \mathbf{A} \times$ conversion factor

Note: Conversion factors describe the ratio of input and output after a conversion process or after natural leakage, e.g. during storage or transport.

Another way to preserve identity is the "soft IP" method. Sustainable and non-sustainable biomass, renewable fuel or recycled carbon fuel is also segregated here. However, consignments with sustainable products can also be mixed if they belong to the same product group or for the purpose of further processing at the fuel production plant (e.g. in a co-digestion plant), as long as the requirements shown in Fig. 2 are met.

Fig. 2: Identity preservation ('soft-IP')



Sustainable and non-sustainable consignments are kept separate during processing. This gives rise to the following mass balancing formula:

$$(\mathbf{D} + \mathbf{E}) \leq \mathbf{C}$$

Where $(\mathbf{D} + \mathbf{E}) = \mathbf{C} \times$ conversion factor

3.2 Mass balance

The principle of mass balancing requires that a certain set of sustainability characteristics remain assigned to a physical consignment. This means that these characteristics can only be transferred from one interface to the next when this transfer is accompanied with physical transfer of the consignment.

Sustainability characteristics are e.g.:

- evidence showing compliance with the RED III sustainability criteria, and/or
- a statement that the raw materials used were obtained in a way that complies with the Directive's land related sustainability criteria, and/or
- a greenhouse gas emission value and/or
- a description of the raw materials used while preserving product identity before the first processing step as well as their origin, and/or
- the statement "production has been awarded a certificate of type X from recognised voluntary scheme Y", etc.
- where relevant, information on whether support has been provided for the production of that consignment, and if so, on the type of support scheme.

The minimum of sustainability characteristics and information to be documented and transferred through the entire value chain of renewable fuels or recycled carbon fuels are listed in chapter 4.2 and 4.3.

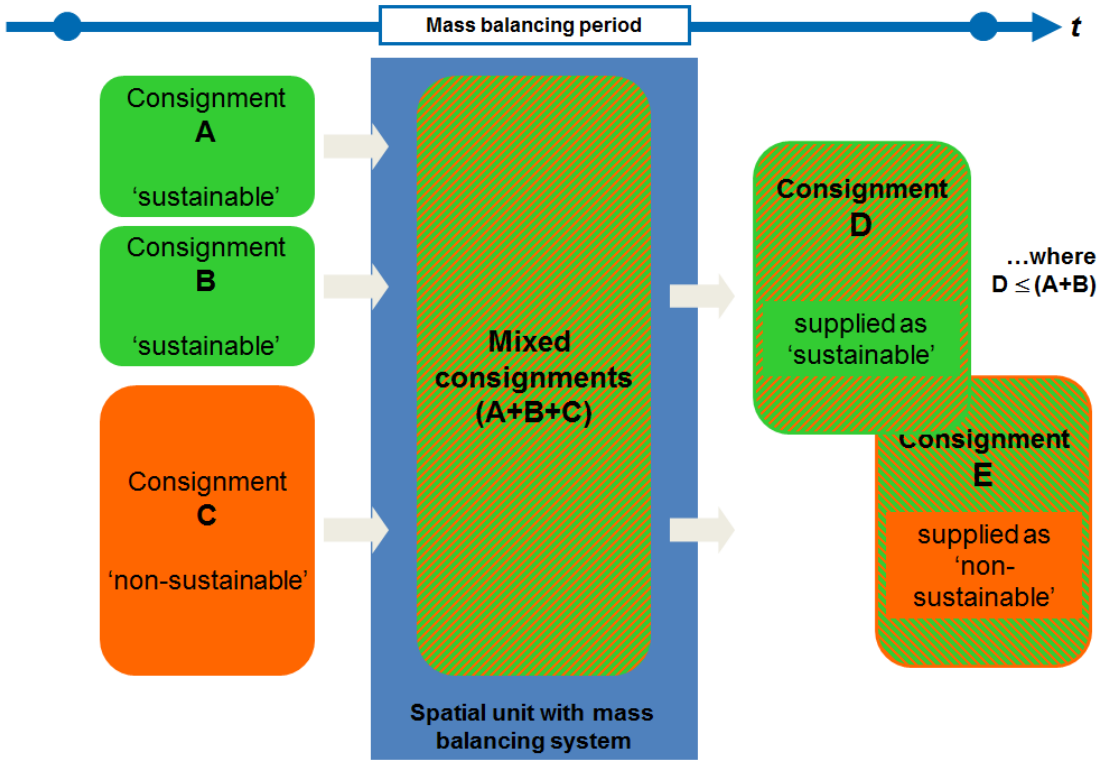
The mass balance system must include both information on the input/output of raw materials and fuels for which the sustainability characteristics listed in chapter 4 have been determined (sustainably certified raw materials and fuels) and information on the input/output of raw materials and fuels, including fossil fuels, for which no sustainability characteristics have been determined. This applies only to raw materials used for the production of renewable fuels and recycled carbon fuels and to finished fuels that can be produced from these raw materials.

Please note that only actual GHG emission values are to be recorded/transmitted along the supply chain in the appropriate unit (i.e. dry matter basis for raw materials and intermediate products and MJ basis for renewable fuels and recycled carbon fuels). Furthermore, actual values for each specific element must be reported (if appropriate). If (disaggregated) default values are applied, then it should simply be stated "(Disaggregated) default value applied" or similar. For more information, see the *Scheme*

principles for the production of biomass, biofuels, bioliquids and biomass fuels, *Scheme principles for GHG calculation* or *Scheme principles for the Production of RFNBO and RCF*. **It is important that the "product identity" be preserved within a site for raw materials before the first processing phase. This means that sustainability characteristics can only be assigned to the same material type from which they originated.**

In addition, information about raw materials may not be flexibly re-assigned if the final fuels/fuels have different rules for calculating their contribution to renewable energy targets (e.g. Annex IX fuels, high/low ILUC fuels).

Fig. 3: Mass balancing



This gives rise to the following mass balancing formula:

$$(\mathbf{A} + \mathbf{B}) \geq \mathbf{D}$$

Where $\mathbf{D} = \mathbf{A} \times$ conversion factor(A) + $\mathbf{B} \times$ conversion factor(B)

When consignments with different sustainability characteristics (e.g. A, B) or no sustainability characteristics (e.g. C) are mixed, the respective conversion factors and sustainability characteristics as well as the size of the individual consignments remain assigned to the mixture.

If different GHG emissions, however, are assigned to these sustainability characteristics, these values must be kept separate for the respective consignments. These values cannot be averaged by aggregating batches to prove that the sustainability requirements are fulfilled. Exceptions to this rule are the production of biomethane via co-digestion of substrates and the production of renewable fuels of non-biological origin and recycled carbon fuels[2].

If consignments with identical sustainability characteristics are mixed, only the size of the consignment is adjusted accordingly. Sustainability characteristics are likely to be the same where the same raw materials are used, and use is made of "default values" or "actual regional values" for the GHG calculation.

If a mixture is split, any consignment taken out of it (e.g. $\mathbf{D_1}$ … $\mathbf{D_n}$) can be assigned any of the sets of sustainability characteristics as long as the combination of all consignments taken out of the mixture – in addition to the weight – has the same sizes for each of the sets of sustainability characteristics that were in the mixture. A "mixture" can have any form where consignments would normally be in contact, such as in a container, processing or logistical facility or site (defined as a geographical location with precise boundaries within which products can be mixed) as well as in a transmission and distribution infrastructure. Raw materials or fuels are only considered to be part of a mixture if they are physically mixed. Only raw materials or fuels that are physically identical or belong to one product group can be considered as part of a mixture if they are not physically mixed. However, they must be stored in the same interconnected infrastructure, processing or logistical facility, transmission and distribution infrastructure or site.

Different raw materials are only considered to be part of a mixture if they belong to the same product group, except where the raw material is mixed for the purpose of further processing at the fuel production plant for the purpose of producing renewable fuels or recycled carbon fuels (e.g. in a co-digestion plant). Vegetable oils used for the production of biofuels and bioliquids may belong to the same product group.

Raw materials, however, that can be used to produce biofuels, bioliquids and biomass fuels which are subject to different rules in terms of their contribution to the targets for

[2] See *Scheme principles for GHG calculation* and *Scheme principles for the production of RFNBO and RCF*

renewable energy should generally not be considered to be part of the same product group as this would risk undermining the objectives of Revised Directive (EU) 2018/2001.

A separate mass balance system must be kept for different mixtures or for raw materials and fuels that cannot be considered part of a mixture. The transfer of information about the sustainability characteristics is not permitted between different mass balance systems. For example, if raw materials in different product groups (e.g. rapeseed oil and used cooking oil) are kept on the same site, the sustainability characteristics for outgoing consignments need to correspond to the raw material actually delivered etc.

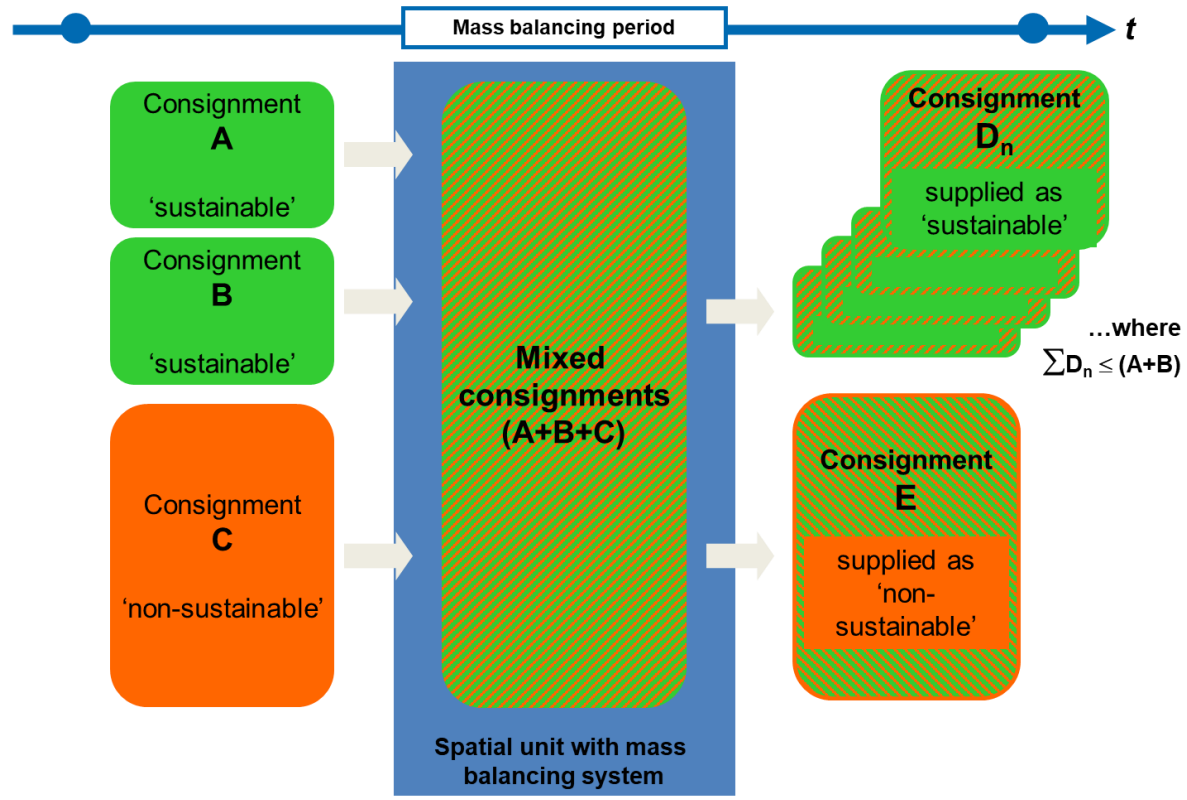
In processing plants where different raw materials are processed together for the purpose of producing fuels, a separate mass balance system does not need to be kept.

Where a consignment of raw material or fuel is delivered to an economic operator, even if the operator is not participating in a voluntary scheme or national scheme confirming compliance with Revised Directive (EU) 2018/2001, the delivery must be reflected in the mass balance system by withdrawing an equivalent quantity of raw material or fuel from the balance. The type of fuel to be booked out must correspond to the physical nature of the raw material or fuel delivered. This also applies if the consignment of a fuel is used to comply with an obligation placed on a fuel supplier by a member state.

At each processing step or in the event of losses, appropriate conversion factors must be used to adjust the size of a consignment. If processing of a raw material consignment results in only one output, the information on sustainability characteristics and characteristics related to greenhouse gas savings must be adapted to the consignment and assigned to the output intended for fuel production – expressed in the size of the consignment and the associated quantities of sustainability characteristics and characteristics related to greenhouse gas savings, using a conversion factor representing the ratio between the mass of the output intended for such production and the mass of the raw material entering the process (see Art. 30 (2a) of Revised Directive (EU) 2018/2001).

Furthermore, it should be kept in mind that the sustainability characteristics of the processed raw materials must be assigned in the same ratio to products and residues of this process. For example, if 50% of a mixture has been declared sustainable, 50% of all products and residues of this mixture should also be considered sustainable. The only exception is the allocation of greenhouse gas emissions, which is subject to the rules in Annex V (biofuels and bioliquids) or Annex VI (biomass fuels) of Revised Directive (EU) 2018/2001 or the Annex of Delegated Regulation (EU) 2023/1185 (RFNBO and RCF).

Fig. 4: Mass balancing



This gives rise to the following mass balancing formula:

$$(\mathbf{A} + \mathbf{B}) \geq \sum_n \mathbf{D_n}$$

Where $\mathbf{D} = \mathbf{A} \times$ conversion factor(A) + $\mathbf{B} \times$ conversion factor(B)

When a raw material consignment is processed into more than one output declared "sustainable" for the production of renewable fuels or recycled carbon fuels, the economic operator must apply a separate conversion factor and mass balance for each output (see Art. 30 (2b) of Revised Directive (EU) 2018/2001).

3.3 Mass balance period

Economic operators are required to define a balancing period after which the balance is positive (less outgoing than incoming biomass). In the case of producers of agricultural and forest biomass and first gathering points that **only source agricultural or forest biomass**, it is possible to extend the balance period to **12 months**, provided the parties do not have a negative balance from the 4th balance month onwards. For all other scopes, a mass balance period of maximum **3 month** is allowed.

The start and the end of the mass balance period shall be aligned with the calendar year or, where applicable, the four quarters of the calendar year. As alternatives to the calendar year, economic operators may also use either the economic year that they use for bookkeeping purposes or another starting point, provided that the choice is clearly indicated and applied consistently.

During a three-month balancing period, the balance may be temporarily negative (temporarily more sustainable biomass sold/delivered than received). At the end of the mass balancing period, however, the overall result must be balanced out by receiving corresponding quantities of sustainable biomass.

If the economic operator decides to balance the sustainability data on an ongoing basis, the balance may never be negative.

Crediting of a consignment in a mass balance must, without exception, coincide with its physical movement to or from the permanent operating site (date of input/output). Other business transactions such as contract/purchase or invoice date cannot be taken into account.

If the quantity of sustainable raw material or fuel in the balance exceeds the physical quantity of raw material or fuel in the company, only the physically existing raw material or fuel can be carried forward to the next balancing period. This means at the end of the mass balance period, the sustainability data carried forward should be equivalent to the physical stock. Credit balances of sustainable raw material or fuel that does not physically exist may not be carried over into the subsequent accounting period. This kind of situation can occur, for example, if sustainable raw material is included in the mass balance but during the balancing period a large quantity of it was sold for a use other than for the production of renewable fuels or recycled carbon fuels.

Upon initial certification in the REDcert-EU scheme, biomass feedstocks received no more than 12 months before the initial audit or prior to the initial extension to include scope 101 can be considered sustainable biomass in the mass balance, if

- the biomass has not been processed and has already been included in the mass balance,
- conformity with sustainability requirements in the REDcert-EU scheme is fully documented, and
- a self-declaration of the farm or the point of origin (waste and residue producer) was submitted retroactively.

3.4 Spatial boundaries

For every company that produces, processes or stores biomass or renewable fuels or recycled carbon fuels, the property line of the premises defines the geographic location. This demarcation is to be identified by clearly stating the address of the property where the facility is located.

A mass balance system must be set up for every site. The mass balance systems can either be physically separate in the operation, or every site can have its own balancing system if every consignment is documented is clearly identified by its location (site). For example, a first gathering point can operate two similar facilities in close proximity to one another (e.g. on both sides of a street). If these facilities have different addresses, two mass balance systems have to be set up (one for each facility).

If more than one legal entity operates a site, each legal entity must set up its own mass balance.

3.5 External storage facilities/storage facilities with several users

If several economic operators/companies supply biomass or renewable fuels or recycled carbon fuels to an external storage facility, e.g. forwarding, leased or tank warehouse, for storage, each of these economic operators/companies has to keep a mass balance system for the product delivered.

If more than one legal entity operates a site, each legal entity must set up its own mass balance.

3.6 Gas or fuel infrastructure for transmission and distribution

Infrastructure for the transmission and distribution of gaseous or liquid fuels serves as both the distribution infrastructure and the storage facility at the same time. Renewable biogas, for example, is processed into biomethane (additional conversion step) – if it is not consumed directly on site for electricity generation – and injected into the natural gas grid. Both gaseous fuels (e.g. biomethane in the European gas grid) and liquid fuels (e.g. biodiesel in a pipeline network) can therefore be mixed in this transmission and distribution infrastructure, provided the infrastructure is interconnected.

The input (injection) and output (withdrawal) of gas or fuel in interconnected infrastructure must be documented by economic operators as part of their mandatory mass balance records, which are essential for the certification procedure. For this purpose, the quantities of gas injected and withdrawn must be measured using calibrated systems. If consignments of gas or fuels with different sustainability characteristics, which are part of the same mass balance system, are injected into an interconnected transmission and distribution infrastructure, the sustainability characteristics must be assigned to the respective consignment which is injected into the transmission and distribution infrastructure and withdrawn from the transmission and distribution infrastructure.

In case of gaseous fuels injected into or withdrawn from an interconnected infrastructure, the certification of mass balancing energy units of gaseous fuels within this interconnected infrastructure or between interconnected infrastructures can only be provided if economic operators use the **Union Database** (see section 4.5) to support their mass balance system. Therefore, the use of the Union Database is mandatory, and sustainability characteristics can only be assigned to consignments of gas that have been registered in the Union Database. The mass balance of the European **interconnected** gas grid (**or other grid**) carrying the gas has to be in its entirety covered by the Union Database.

The input (injection) and output (withdrawal) of gas in interconnected infrastructure must be documented by economic operators and subject to independent auditing.

Traders of gas or fuels from renewable or recycled resources must set up their own balancing system. The balancing group must contain all movements of gas or fuels from renewable resources that have been balanced and certified under the REDcert-EU scheme and is therefore essential for mass balancing. A balancing group is the connected transport and distribution infrastructure (e.g. the European gas grid) that physically connects the injection point with the withdrawal point. Economic operators must grant auditors full access to the balancing group and all associated documentation as part of a certification procedure prior to an audit (see section 4).

Gas from renewable or recycled sources can only be transferred from one country to another via the grid if all countries involved (i.e. also the transferring countries) are connected to the interconnected gas grid. If an economic operator located in a country that is not connected to the European gas grid or to an isolated gas grid ("island grid") wants to import gas, it must demonstrate that the gas was physically transported by another means of transmission to its site/consumption point or the entry point of the island grid.

Both, the liquefaction of gas to (bio-/RFNBO-/RCF-)LNG and the re-gasification of (bio-/RFNBO-/RCF-)LNG to gas, must be subject to certification. Gas losses during the production and processing of gas or its liquefaction into (bio-/RFNBO-/RCF-)LNG, as well as during its transmission and distribution, must be taken into account when calculating GHG emission savings. If (bio-/RFNBO-/RCF-)methane is transported via the European gas grid, the economic operator injecting and transporting (bio-/RFNBO-/RCF-)methane must take gas losses of 0.01 gCH_4/MJ into account. If an actual GHG value is used for gas losses or liquefaction, plausibility checks must be performed by a qualified auditor or technical expert to confirm the accuracy of the data used for the calculation.

The definition of a product group in the REDcert-EU document *Definitions in the REDcert-EU scheme* also makes it possible to transfer sustainability characteristics of methane to already liquefied (bio-/RFNBO-/RCF-)LNG, taking into account gas losses and other factors relevant to liquefaction, provided they are part of the same mass balance system.

In case an economic operator processes different sources of (bio)methane into another fuel (e.g. biomethanol), evidence shall be checked to ensure an appropriate mass balance of bioenergy content claims that enter and leave the process. For example, if biomethane is sourced via a direct connection to a biomethane plant, it must be checked that the capacity coming from the plant is consistent with the claim made by the biomethanol producer and the biomethane raw material is not also claimed by another economic operator. In case of multiple inputs of methane, the renewable energy content of the resulting output (e.g. biomethanol) could be subject to testing in accordance with the verification methods described in the Delegated Regulation (EU) 2023/1640.

4 Documentation requirements

4.1 General requirements

The documentation requirements of the mass balance system do not relate to the format or medium of the documentation, but rather to the type of information to be documented (see 4.2). It is therefore largely left to the facilities and operating sites of the individual

economic operator to decide how to set up a mass balance system for every operating site that produces, processes or stores sustainable biomass or renewable fuel or recycled carbon fuel. Existing enterprise resource planning systems, for example, can be used as long as they have the capability to record and process all of the necessary information.

The general specifications for documentation relate to

- reliability (verifiable accuracy of the balance figures)
- accessibility (time and format of the documentation archive)
- certainty (no subsequent changes to balances)

of the documentation of the mass balance system. This is to be checked by the independent certification bodies as part of the on-site inspections (for more information, see *Scheme principles for neutral inspections*).

All of the documents in the document management system must be kept for a minimum of 5 years or longer where it is required by the relevant national authority.

Economic operators must provide the auditor with all relevant mass balance data in advance of the planned audit. The last mass balances completed during the period under review must be inspected.

During the initial audit, carried out before an economic operator is allowed to participate in a scheme, the auditor must check the existence and functioning of the mass balance system.

4.2 Sustainability characteristics to be documented

Information on the sustainability characteristics of the raw material, intermediate product, and final renewable fuel or recycled carbon fuel must be passed along the supply chain from one production stage to the next. New information can be added, or the existing information can be aggregated at each interface. Sustainability characteristics transferred from one interface to another, as well as between different sites at the same phase, must always be accompanied by a physical transfer of material.

The following type of information must be documented at each interface (if applicable) and passed on to the next interface.

- name of voluntary scheme and certificate number
- proof of sustainability number (only for renewable fuels and recycled carbon fuels)

- name of the raw material
- scope of raw material certification (e.g. statement on whether the raw material complies with sustainability criteria)
- waste or animal by-product permit number (if applicable) (waste code and/or biomass code according to "nabisy")
- fuel type
- country of origin of raw material
- country of fuel production
- GHG emissions data (clear statement of the default or actual value per interface of the supply chain)
- description of when the fuel production installation started operation
- information on any support/subsidies and the type of support (in the renewable energy sector) that the material has received so far (important for biogas/biomethane because it can be used in both the transport and electricity sectors)
- if applicable, statement on whether the raw material or fuel complies with the criteria set out for low indirect land-use change-risk biofuels (low ILUC)

4.3 Tracing information to be documented

To be able to trace a consignment of raw materials, intermediate products, renewable fuels or recycled carbon fuels along the supply chain, transaction data is required and must be documented:

- supplier company name and address
- buyer company name and address
- unique transaction ID (e.g. consignment number)
- date of (physical) loading
- place of (physical) loading or logistical facility or distribution infrastructure entry point
- place of (physical) delivery or logistical facility or distribution infrastructure exit point

- volume or weight (at a certain density) of the consignment. For fuels, the quantity of energy must also be included. To calculate the energy quantity, the conversion factors in Annex III of Revised Directive (EU) 2018/2001 must be used.

4.4 Issuing proofs of sustainability

Economic operators must issue a proof of sustainability (PoS) containing all the necessary information on the sustainability characteristics of a consignment. Generally, this proof is issued at the time of delivery to provide the recipient with all necessary information for further processing and handling, but not later than the end date of the relevant mass balance period. For users of the nabisy system, the BLE has set the end date of a quarter (31 March, 30 June, 30 September, 31 December) as the deadline for issuing a proof of sustainability.

Taking into account the special circumstances in the methane sector, these deadlines may be postponed by another 30 days due to the additional time needed for the confirmation of the grid operators about the injected amount of biomethane, which may differ from the values measured at the injection point.

4.5 Documentation in the Union database

The Union database spans the entire value chain of liquid or gaseous renewable fuels and recycled carbon fuels that are eligible for being counted towards the targets of Revised Directive 2018/2001. **Economic operators that are part of the above-mentioned value chain are required to enter all relevant information on incoming and outgoing sustainably produced supplies into the Union database in a timely manner.**

Relevant information are transactions made and the sustainability characteristics, including their life-cycle greenhouse gas emissions, starting from their point of production to the moment they are placed on the market in the Union. Referring to Article 18 (1) of the Implementing Regulation (EU) 2022/996 the information shall include data to be transmitted through the whole supply chain as well as data that is specific for the individual transaction, as described in Chapter 4.2 and 4.3.

In case of liquid or gaseous fuels injected into an interconnected infrastructure, the information (e.g. sustainability characteristics) must be registered in the Union database at the first entry point (point of first injection) and registered out as consumed at the point

of final consumption. If gaseous fuels are withdrawn from an interconnected infrastructure and further transformed into gaseous or liquid fuels, the point of final consumption is considered to be the point of final consumption of the final gaseous or liquid fuels. In such a case, all intermediary stages from the withdrawal of the gaseous fuels from the interconnected infrastructure until the point of final consumption of the final gaseous or liquid fuels have to be registered in the Union database. The interconnected gas infrastructure shall be considered to be a single mass balance system. Data on whether support has been provided for the production of a specific consignment of fuel, and if so, on the type of support scheme, shall also be entered into the Union database.

Economic operators shall, in the event that the Member State decides to complement a mass balance system by a system of guarantees of origin, enter into the Union database data on the transactions made and on the sustainability characteristics and other relevant data, such as greenhouse gas emissions of the fuels up to the injection point to the interconnected gas infrastructure.

Auditors need to verify that the entries in the Union Database or relevant national database of the certified economic operator correspond with the figures that are part of the economic operator's bookkeeping and net mass balance data or other encoded information on their entities or sites. Any deviations between data that has been registered in the Union Database and the respective data from the economic operator's documentation must be included in the audit report and immediately reported to REDcert. Such discrepancies can lead to major non-conformities identified in the audit report and trigger a suspension of the certificate of the economic operator.

5 Requirements for co-processing fossil fuels and biofuels

Economic operators that co-process biomass and fossil fuels are required to determine the share of biofuel, and biogas for transport, resulting from that common process pursuant to Delegated Act (EU) 2023/1640. This must be performed on the basis of the testing methods described in the present section.

So that the amounts of each type of biomass processed as well as the amounts of biofuel and biogas resulting from that co-processing can be verified, economic operators must document the source streams with all possible precision and regularly substantiate the results of the testing method used by means of suitable verification tests (radiocarbon testing).

5.1 Testing methods

To determine the biogenic share of the co-process output, at least one of the following main testing methods must be used within the system boundaries defined in section 5.2:

1. mass balance method
2. energy balance method
3. yield method
4. radiocarbon (^{14}C) testing

The calculation using the main testing method or the analysis to determine the bio-content using radiocarbon testing as the main testing method must be performed for each batch or for each consignment.

In addition, the results of main testing methods 1, 2 and 3 must be reviewed and verified on a regular basis using radiocarbon testing. The frequency for carrying out the main testing method, and the radiocarbon testing method to check the alternative main testing method, must be determined on the basis of the complexity and variability of the key parameters of the co-processing. This must be done in such a way as to ensure that, at any time, the claims about the bio-content share are within the permissible margins for error or inaccuracy. Economic operators take account of at least the following points in assessing the complexity and variability:

- system boundaries (whole refinery or installation-specific)
- amount and quality of the biogenic input
- variability of the biogenic input
- share of biogenic input in the total input subjected to co-processing.

Economic operators must document, and provide to auditors **prior to any audit**, the assessment of complexity and variability as well as a detailed description of the testing method they used, including an indication of its accuracy and precision as also verified through the application the radiocarbon testing. The auditor must also be provided with a procedure for applying the main testing method.

The main testing methods must be reviewed on a regular basis to correct potential system errors which may lead to deviations and calibrate the testing method if needed. Economic operators must ensure that the detection limit of the testing method can effectively determine the biofuel share.

5.2 Defining system boundaries

Economic operators can define the system boundaries within which the main testing method is used on the basis of local circumstances.

System boundaries may be chosen as follows:

- whole refinery
- installation co-processing fuels
- installation co-processing waste inputs (e.g. gasification)

Testing and verification based on radiocarbon testing must be carried out in respect of the output of the whole refinery, the installation co-processing fuels or the installation co-processing waste inputs before it is blended with other fuels (e.g. biofuel).

One and the same testing method must be used within the selected system boundary. If installations are not connected and there are no flows between them, then different testing methods can be applied.

Installations co-processing waste-based, partially biogenic inputs, can use a main testing method together with verification by means of radiocarbon testing if a reliable and representative set of samples can be performed at the level of the inputs that make it possible to establish the bio content in the total inputs.

5.3 Main testing methods

5.3.1 Mass balance method

Under the mass balance method, full mass balance analysis of the total mass of inputs and outputs must be performed. Non-fuel impurities, such as moisture content, must be taken into account both when assessing the feedstock used and when calculating the outputs of co-processing. The bio-content of all outputs is proportional to the bio-content of the inputs. The characteristics "biofuel" or "biogas" are allocated to the specific fuel outputs on the basis of output-specific conversion factors. These should be determined on the basis of the bio-content share, as actually measured in radiocarbon testing, of the specific fuel output.

Mass lost in conversion (e.g. in off-gases, in liquid industrial wastewaters and in solid residues) must be considered when calculating the sustainability characteristics of the output and reflected in pro-rata reductions.

In addition to the balance-based analysis, analytic characterization of feedstocks and products must be carried out. This might involve, for example, ultimate and proximate analyses of system mass flows.

5.3.2 Energy balance method

Under the energy balance method, economic operators determine the biofuel or biogas share in the total fuel output on the basis of the biofuel or biogas share in the energy content of all the co-processing inputs in accordance with formula 1.

$$S_{bio} = \frac{\varepsilon_{bio,relevant}}{\varepsilon_{total}} = \frac{M_{bio,relevant} \cdot LHV_{bio}}{\sum_i M_{feedstock,i} \cdot LHV_{feedstock,i} + \varepsilon_P} \quad \text{formula 1}$$

S_{bio}	Biofuel and/or biogas share in the total output of the common process
$\varepsilon_{bio,relevant}$	Relevant energy input in the process from biomass [MJ]
ε_{total}	Total relevant energy input in the process [MJ]
$M_{bio,relevant}$	Mass of the biomass input in the common process [kg]
LHV_{bio}	Heating value of the biomass input in the common process [MJ/kg]
$M_{feedstock,i}$	Mass of the feedstock i input in the common process [kg]
$LHV_{feedstock,i}$	Heating value of the feedstock i input in the common process [MJ/kg]
ε_P	Process energy input in the common process [MJ]

The characteristics “biofuel” or “biogas” are allocated to the specific fuel outputs on the basis of output-specific conversion factors. These should be determined on the basis of the bio-content share, as actually measured in radiocarbon testing, of the specific fuel output. This means that, for example, if 10% of the total relevant energy input in the common process comes from biomass, then a maximum of 10%, in sum, of the total fuel output can count as biofuel or biogas, while individual fuel fractions may, as a result of the specific conversion factors, have a fuel share greater or smaller than 10%.

5.3.3 Yield method

The yield method is based on the change in the total fuel output resulting from the addition of biomass to a process. Economic operators have the methods described in the following at their disposal. These can only be used as main testing methods if the process is run constantly under the defined reference operating conditions (e.g. biomass fraction, process temperature), including feedstock quality, within the system boundaries.

The continuous operation of the process in respect of feedstock quality must be demonstrated by running each specific bio-input through ^{14}C analysis by mean of radiocarbon testing and using that, in turn, as the basis for calculating its specific conversion factor.

For the yield method, the share of biogenic carbon in the co-processing output should be checked in accordance with the stipulations described in section 5.4.1.

Method A

Under Method A, economic operators determine the biofuel or biogas share in the co-processing fuel output by observing and recording the increase in fuel output resulting from the additional input of biomass into the process (Figure 5). First, the fuel yields resulting from operation with only pure fossil feedstock should be determined. For pilot-scale units, even when using limited concentrations of biogenic or waste-based inputs, all conditions should be selected to be representative of the planned commercial-scale operation. The reference data thus established serve as the basis for determining the increase in fuel output caused by the addition of biomass to the process.

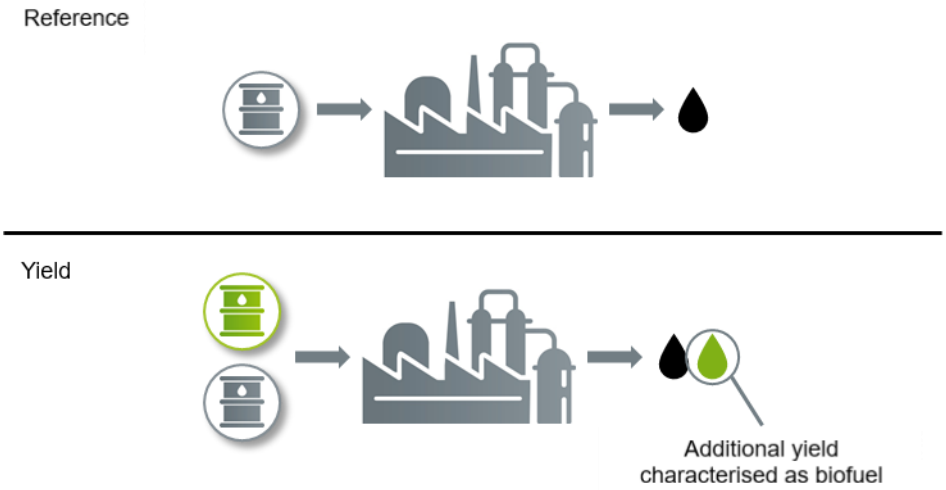


Figure 5: Example showing how to determine the increase in yield caused by the inclusion of additional biomass in a process.

The characteristics "biofuel" or "biogas" must be allocated to the fuel in question on the basis of the increase in output specific to that fuel. That yield factor is valid only for the operation conditions (biomass fraction and relevant process parameters) for which it was established. Economic operators can determine different yield factors to refer to different processes and operating conditions. If economic operators switch from one operating condition for which a yield factor has been determined to another operating condition for which a yield factor has been determined, then the biofuel or biogas yield must be checked using radiocarbon testing and, if necessary, the yield factor updated.

If specific yield factors have been defined in the Member State in which economic operators are active, then they must use those yield factors.

Method B

Under Method B, economic operators determine the relationship between the bio-share of input and the bio-share of output on the basis of reference measurements. To that end, several batches of feedstock of known composition are processed at constant processing conditions. To determine the relationship between the bio-input and the bio-output, both the input and the output need to be fully characterised.

The relationship thus determined can be applied to biogenic feedstock of the same type and quality. In line with the determined relationships, economic operators can use different feedstock compositions and attribute the bio-shares on the basis of the yield factors.

5.4 Radiocarbon testing

Radiocarbon testing (^{14}C spectrometry) can be deployed either as a main testing method or as a verification method for one of the main testing methods described above. When radiocarbon testing is used as a verification method, all the outputs of the co-processing for which a bio-share is declared must be verified. If a deviation of more than 1% in absolute terms is found compared to the results of the main testing method, the values of the radiocarbon testing are considered valid.[3]

The following requirements must be fulfilled in this context and when carrying out radiocarbon testing:

[3] In the first year of application of this methodology, an increased deviation of 3 % instead of 1 % in absolute terms can be applied.

- Testing and verification of the bio-share of the co-processing output must be carried out in respect of the output of the whole refinery, the installation co-processing fuels or the installation co-processing waste inputs before the co-processing output is blended with other fuels (e.g. biofuel).
- If a mass spectrometry method is used, then the Accelerator Mass Spectrometry (AMS) method must be chosen.[4]
- Economic operators must ensure that the method of analysis selected can reliably detect and quantify the bio-share of the sample. Details on the accuracy and precision of the results must be documented.
- Any loss of carbon of biogenic origin due to the process of removing oxygen from the biogenic feedstock must be quantified. This is done by making a comparison between the biogenic and fossil carbon in the inputs and the biogenic and fossil carbon in the output products.

5.4.1 Radiocarbon testing as a verification method

Where radiocarbon testing is used as a verification method for a main testing method which cannot map the operating conditions related to carbon content in the output for each batch or consignment, radiocarbon testing must be carried out every time that

- a change in the share of biogenic input or
- a change in the amount of hydrogen and catalyst inputs or
- a change in the process parameters (in terms of process temperature in absolute [K] or process pressure in absolute pressure [Pa]) or
- a change in the product composition[5]

of more than 5% compared to the baseline conditions is effected or occurs.

If no change is effected or occurs in the co-processing for which the carbon content in the output cannot be mapped for each batch or consignment, then measurements using radiocarbon testing must be carried out after no more than 4 months to verify the biogenic carbon content that has been calculated using the main testing method.

[4] If the bio-share is expected to be at least 1 vol%, the Liquid Scintillation Counting (LSC) method may be used instead, if the sample is suitable for that testing method, especially regarding particles present in the liquid.

[5] An elemental analysis of carbon, oxygen and nitrogen, together with an analysis of the water and solids con-tent, must be provided as a basis for assessing the parameters of the product composition.

5.5 Establishing the share of hydrogen of biological origin

If renewable hydrogen of biological origin is used in a hydrotreater or other co-processing unit, economic operators using renewable hydrogen of biological origin in a production system must provide proof that the hydrogen used

- has not been counted as renewable energy elsewhere, in order to avoid double-counting, and
- has been incorporated into the final fuel and not simply used to remove impurities.

The evidence that the hydrogen has been incorporated into the fuel can be quantified using the CHN test. To that end, scheme participants must document the hydrogen content of the fuel before and after hydro treating. If the hydrogen content of the fuel has risen, an amount equivalent to the increase can be declared as additional biofuel or biogas in the output.

For hydrogen of biological origin to be used as such, it must have proof of sustainability in a form recognised under the REDcert-EU scheme.

5.6 Specific documentation requirements for co-processing

Economic operators must document the amount and type of co-processed biomass and the amount of biofuels and biogas resulting from the process in such a way as to guarantee the reliable implementation of the selected main testing method. In addition, an overall mass balance calculation that indicates the biogenic share of input and output must be performed alongside the main testing method. For downstream mixing and further processing, a mass balance system must be maintained in accordance with chapter 3.

Economic operators must document details on the accuracy and precision of the testing method used as well as any inaccuracies in their measurements of flows or heating values. Any inaccuracies found must be explained.

The results of the main testing method calculations or radiocarbon analysis to determine the bio-share (regardless of whether the latter was used as the main testing or verification method), as well as records, must be archived for at least 5 years, or longer if required by the competent national authority. Physical samples must be kept for at least 2 years.

5.7 Specific requirements for the co-processing certification process

During audits, not only the general scheme requirements but particularly the consistency between the amounts of biomass entering the process and the amounts of biofuel and biogas that are recorded as being produced from the biomass need to be verified. The evidence supplied by economic operators for the plausibility of those amounts must be assessed with reference to industry standards. The focus here is on the main testing method chosen by the economic operator as well as, in the case of the mass balance, energy balance or yield methods, the verification method.

If an audit finds significant deviations in the main testing method or the final calculation of the bio-share, these must be treated as critical non-conformity. In the context of the agreed corrective measures, economic operators must update the calculation of the bio-share in the output, doing so on the basis of the lowest value determined by radiocarbon testing.

6 Relevant documents

The documentation structure of the REDcert-EU scheme includes the following:

No.	Document	Published/revised
1	Scope and basic scheme requirements	The current version of the REDcert-EU scheme principles is published on the website at www.redcert.org.
2	Scheme principles for the production of biomass, bioliquids and biofuels	
3	Scheme principles for GHG calculation	
4	Scheme principles for mass balancing	
5	Scheme principles for neutral inspections	
6	Scheme principles for integrity management	
7	Phase-specific checklists	
8	Definitions in the REDcert-EU scheme	
Revised Directive (EU) 2018/2001. Available via: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02018L2001-20240716		

REDcert reserves the right to create and publish additional supplementary scheme principles if necessary.

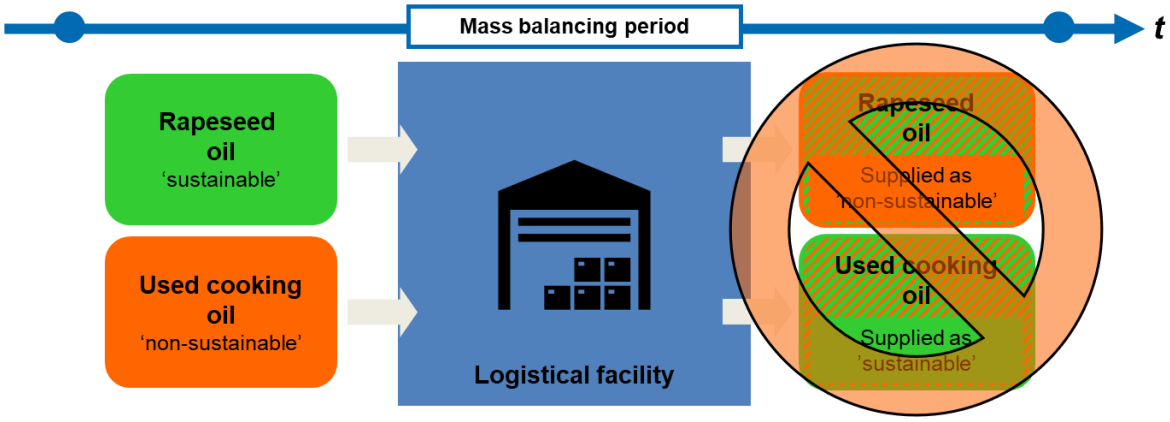
The legal EU regulations and provisions for sustainable biomass as well as biofuels, bioliquids and biomass fuels including other relevant references that represent the basis of the REDcert-EU documentation are published separately on REDcert's website at www.redcert.org. When legal regulations are referenced, the most current version is always assumed.

7 Annex

7.1 Examples for mass balancing

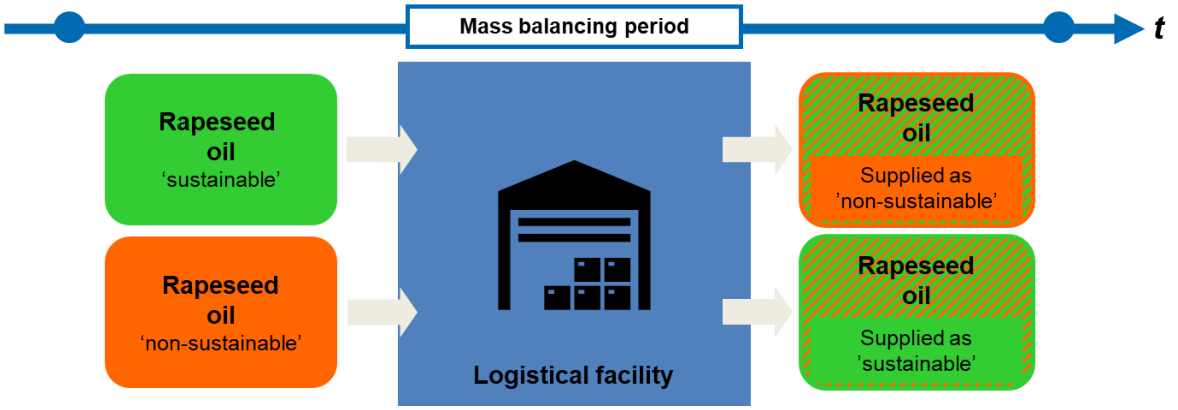
In general, allocation of sustainability characteristics to the output is only permissible if materials can be considered as part of a mixture (identical materials, same product group or physically mixed feedstocks for the purpose of further processing). Below several examples are given to explain the principles of allocating sustainability characteristics in the context of the product group and physical mixing.

Example 1 shows a trader that received a consignment of sustainable rapeseed oil and a consignment of non-sustainable used cooking oil (UCO) in a mass balancing period. As the two raw materials are neither identical nor belong to the same product group, the economic operator is not allowed to allocate the set of sustainability characteristics of the rapeseed oil to the UCO.



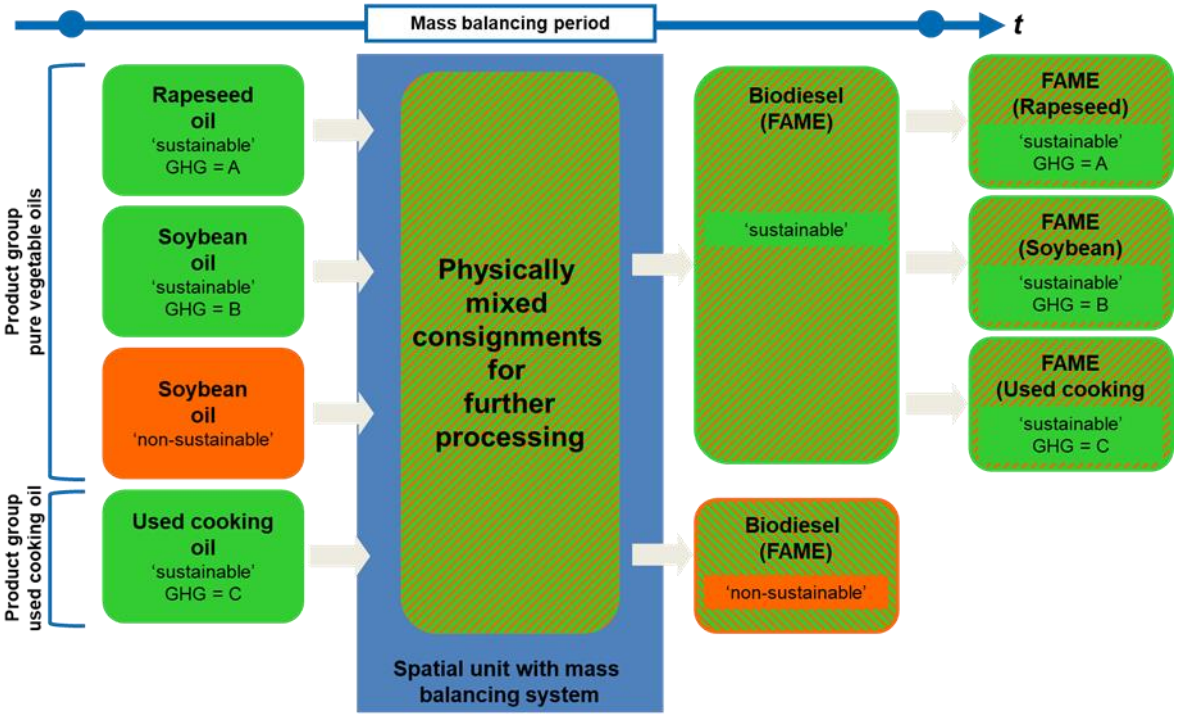
Example 1: Mass balancing of raw materials.

If an economic operator only receives consignments of rapeseed oil with different sustainability characteristics (e.g. sustainable and non-sustainable), these can be considered as part of a mixture without physical mixing as long as the rapeseed oil is stored in the same site (e.g. logistical facility). Therefore, a flexible allocation of the sustainability characteristics to outgoing rapeseed oil consignments is possible as long as the overall balance at the end of the mass balancing period is met.



Example 2: Mass balancing of identical raw materials.

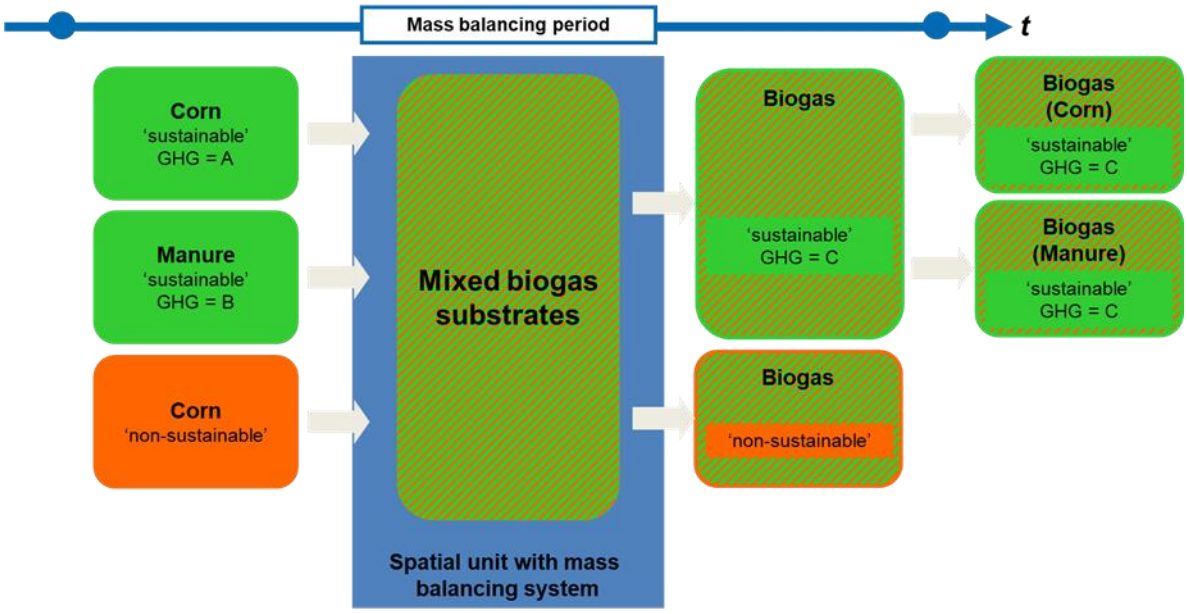
Example 3 shows an economic operator that produces biodiesel (FAME). During a mass balance period, the economic operator receives different consignments of certified sustainable rapeseed oil, soybean oil and UCO. Additionally, a consignment of non-sustainable soybean oil was received. As these raw materials cannot be considered as part of the same product group, it is only possible to transfer sustainability characteristics from the input to the output if the raw materials are physically mixed for the purpose of further processing. Of this mixture, the economic operator can produce the respective amount of sustainable and non-sustainable FAME. The set of sustainability characteristics determined for consignments entering the mixture (including raw material type) can then be flexibly allocated to the outgoing consignments as long as the overall balance at the end of the mass balancing period is met.



Example 3: Biodiesel producer.

Example 4 shows a biogas plant that receives different consignments of certified sustainable corn and manure during a mass balance period. Additionally, a consignment of non-sustainable corn was received. As these raw materials cannot be considered as part of the same product group, it is only possible to transfer sustainability characteristics from the input to the output if the raw materials are physically mixed for the purpose of further processing. In the context of biogas production, this means co-digestion.

The set of sustainability characteristics determined for consignments entering the mixture (including raw material type) can then be flexibly allocated to the outgoing consignments as long as the overall balance at the end of the mass balancing period is met. Since the total emissions from the use of a biomass fuel resulting from a co-digestion of different substrates must be calculated as a sum, taking into account on pro rata the share of the respective inputs and their emission factors, the sustainability characteristic "GHG-emission" is the same for each consignment of outgoing sustainable biogas.



Example 4: Biogas producer.

7.2 Revision information for Version EU 08

Section	Change
General	Wording adapted to the new definition of renewable fuels and in line with the extension of the scope of the REDcert-EU system to include RFNBO and RCF.
3.2	**Deleted:** Sustainability characteristics would have to include information on the country of origin of the raw materials if several countries of origin can be specified for a certain consignment. **Added:** The minimum of sustainability characteristics and information to be documented and transferred through the entire value chain of renewable fuels or recycled carbon fuels are listed in chapter 4.2 and 4.3. Substrates used for the production of biomethane are an exception to this rule. For bio-methane produced from different substrates, it is possible to average the GHG emissions. **Changed to:** Exceptions to this rule are the production of biomethane via co-digestion of substrates and the production of renewable fuels of non-biological origin and recycled carbon fuels.
3.6	For gas losses, an emission factor of 0.17 gCH_4/MJ biomethane must be applied by the last interface. **Changed to:** If (bio-/RFNBO-/RCF-) methane is transported via the European gas grid, the economic operator injecting and transporting (bio-/RFNBO-/RCF-) methane must take gas losses of 0.01 gCH_4/MJ into account.

4.5	Economic operators that are part of the above-mentioned value chain are required to enter all relevant information on incoming and outgoing sustainably produced supplies into the Union database. **Changed to:** Economic operators that are part of the above-mentioned value chain are required to enter all relevant information on incoming and outgoing sustainably produced supplies into the Union database in a timely manner. **Added:** Relevant information are transactions made and the sustainability characteristics, including their life-cycle greenhouse gas emissions, starting from their point of production to the moment they are placed on the market in the Union. Referring to Article 18 (1) of the Implementing Regulation (EU) 2022/996 the information shall include data to be transmitted through the whole supply chain as well as data that is specific for the individual transaction, as described in Chapter 4.2 and 4.3. **Added:** The interconnected gas infrastructure shall be considered to be a single mass balance system. Data on whether support has been provided for the production of a specific consignment of fuel, and if so, on the type of support scheme, shall also be entered into the Union database. Economic operators shall, in the event that the Member State decides to complement a mass balance system by a system of guarantees of origin, enter into the Union database data on the transactions made and on the sustainability characteristics and other relevant data, such as greenhouse gas emissions of the fuels up to the injection point to the interconnected gas infrastructure.

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