Scheme principles for the production of RFNBO and RCF

Version EU 01

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1 Introduction

The European Commission, through Directive (EU) 2018/2001, has set a common framework to promote the share of energy from renewable sources in gross final consumption of energy, especially in the transport sector.

With the adoption of Delegated Regulation (EU) 2023/1184 and Delegated Regulation (EU) 2023/1185, the European Commission has defined the requirements for the production of renewable fuels of non-biological origin (RFNBOs) and recycled carbon fuels (RCFs) in addition to the requirements for the production of biofuels, bioliquids and biomass fuels already laid down in Directive (EU) 2018/2001.

RFNBOs are defined as liquid and gaseous fuels the energy content of which is derived from renewable sources other than biomass. This means that all energy stored in the RFNBO must originate from the respective renewable energy sources through the supply of renewable energy, usually renewable electricity. A possible production pathway of an RFNBO is the electrolysis of water using renewable electricity to produce hydrogen (H_2). This can either be used directly as a fuel or used to reduce carbon dioxide (CO_2) to synthesise fuels such as what is known as e-methanol.

RCFs are defined as liquid and gaseous fuels that are produced from liquid or solid waste streams of non-renewable origin which are not suitable for material recovery in accordance with Article 4 of Directive 2008/98/EC, or from waste processing gas and exhaust gas of non-renewable origin which are produced as an unavoidable and unintentional consequence of the production process in industrial installations. This type of fuel is typically obtained through thermochemical conversion, e.g. gasification or pyrolysis of the waste streams mentioned above.

This document is part of the scheme documentation of the REDcert-EU certification scheme and defines the specific requirements for the certification of RFNBOs and RCFs. The basic requirements of the REDcert-EU scheme apply without restriction unless not explicitly described in this document.

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 REDcert-EU scheme”.

Where the term "fuel producer" is used within this document, it refers to an economic operator that produces liquid or gaseous renewable fuels of non-biological origin or recycled carbon fuels.

3 Basic requirements

3.1 Requirements for the production of RFNBOs

For a fuel to qualify as an RFNBO, proof must be provided that the requirements for electricity used as an input (i.e. to enhance the heating value of the fuel) have been satisfied as well as the requirements for reducing greenhouse gas (GHG) emissions. Only renewable electricity may be used as an input for the production of RFNBO (described in section 4). If the electricity does not meet the requirements described in section 4, fuel originating from this energy source is classified as non-renewable liquid or gaseous fuel of non-biological origin (non-RFNBO). It is possible to use non-renewable electricity that is not intended to enhance the heating value of the fuel, i.e. to operate infrastructure such as pumps. However, this must be included in the calculation of the total emissions arising from the use of the fuel.

In accordance with Article 29a (1) of Directive (EU) 2023/2413 (revision of Directive (EU) 2018/2001) the GHG-emissions savings from the use of the RFNBO must be at least 70 % of the fossil fuel comparator regardless of the date the installation producing the fuel went into operation. The methodology described in section 7 applies for the calculation of the emission savings.

3.2 Requirements for the production of RCFs

For a fuel to qualify as an RCF, it must first be shown that the requirements for waste origin or unintentional production of the liquid or solid waste streams or (waste) gases of non-renewable origin used as an input, as well as the requirements for GHG emissions savings have been fulfilled. Liquid or solid waste streams of non-renewable origin can only be used as an input for the production of RCF if they are no longer eligible for recycling and thus comply with the waste hierarchy from Article 4 of Directive 2008/98/EC.

In accordance with Article 29a (2) of Directive (EU) 2023/2413 (revision of Directive (EU) 2018/2001) the GHG emissions savings from the use of the RCF must be at least 70 % of the fossil fuel comparator. The methodology described in section 7 is used for the calculation of the emissions saving.

3.3 Requirements for points of origin of material streams

Points of origin of material streams are companies that produce CO_2 or exhaust gas suitable for use in the production of RFNBO or RCF or determine that the resulting liquid or solid waste stream is not suitable for recycling (e.g. disposal or waste processing companies).

In general, points of origin must ensure that the material streams delivered have not been produced intentionally and must submit a signed self-declaration to the fuel producer as proof that the material stream can be accounted for as avoided emission in the GHG emission calculation described in chapter 7, indicating the existing use or fate of the material stream (further details for RCF production in section 7.5). The existing use or fate of the material stream is that which has been employed to dispose of the material stream in the previous three calendar years.

By submitting the signed self-declaration, the point of origin gives a consent to periodic inspections to verify the information provided in the self-declaration. During the inspection, auditors must verify the information provided in the self-declaration such as quantity, the existing use or fate and properties of the material stream (e.g. waste properties or type of CO_2).

3.3.1 Point of origin of carbon dioxide (CO_2)

In the case of CO_2, only CO_2 from specific sources may be accounted as avoided emission. For the credit to be possible, the point of origin must proof that the CO_2 is not produced deliberately, and a credit has not already been issued for its capture in another scheme. If CO_2 stems from one of the following sources and is incorporated in the molecular structure of the fuel during its production, the emissions saved as a result can be credited by the fuel producer:

- the CO_2 has been captured from an activity listed under Annex I of Directive 2003/87/EC[1] and has been taken into account upstream in an effective carbon

[1] Directive 2003/87/EC Annex I

pricing system[2] (only permitted until 2036; if the CO_2 stems from a source other than the combustion of fuels for electricity generation, it may be used until 2041), or

- the CO_2 has been captured directly from the air, or
- the captured CO_2 stems from the production or the combustion of biofuels, bioliquids or biomass fuels complying with the sustainability and greenhouse gas saving criteria and the CO_2 capture did not receive credits for emission savings from CO_2 capture and replacement, set out in Annex V and VI of Directive (EU) 2018/2001
- the captured CO_2 is of biogenic origin and stems from a process which is out of the scope of the sustainability and greenhouse gas saving criteria set out in Directive (EU) 2018/2001[3]
- the captured CO_2 stems from the combustion of RFNBO or RCF complying with the greenhouse gas emissions savings criteria, set out in Article 25(2) and Article 28(5) of Directive (EU) 2018/2001 and Delegated Regulation (EU) 2023/1185, or
- the captured CO_2 stems from a geological source of CO_2 and the CO_2 was previously released naturally.

CO_2 is considered to be taken into account upstream in an effective carbon pricing system, if the activity listed under Annex I of Directive 2003/87/EC falls under a carbon pricing system that has been positively assed by the European Commission and the point of origin of the CO_2 can prove that allowances for the amount of CO_2 have been cancelled. The list of positively assessed carbon pricing systems can be found below or in the Annex to the document "*Q&A for the certification if RFNBOs and RCF*" published on the voluntary schemes homepage[4] of the European Commission.

According to the above-mentioned document, the following systems can be considered to fulfil the requirement of upstream accounting in an effective carbon pricing system:

- EU ETS which applies in 30 States of the European Economic Area: the EU-27 Member States and in three EFTA States Iceland, Liechtenstein and Norway
- SWISS ETS

[2] Only carbon pricing systems that are positively assessed by the European Commission can be considered to be an effective carbon pricing system. The list of positively assessed carbon pricing systems can be found in the Q&A Document provided on the voluntary schemes homepage.

[3] If the CO_2 source is located in a third country and the economic operator does not want to export the biofuel, bioliquid or biomass fuel to the EU, this does not justify the conclusion that the activity falls outside the scope of Directive (EU) 2018/2001.

[4] voluntary schemes homepage

- UK ETS

Any changes to the list of effective carbon pricing systems in the document "*Q&A for the certification if RFNBOs and RCF*" by the European Commission take effect in the scheme immediately after publication.

The criteria that a carbon pricing system must fulfil in order to be considered effective by the European Commission are provided in Chapter 12.2.

> Requests to assess carbon pricing systems of specific countries regarding their compliance with the Delegated Regulation (EU) 2023/1185, can be addressed at the Commission by the relevant competent authorities. The same applies to carbon pricing systems on sub-national levels.

If biogenic CO_2 is captured from a biofuel, bioliquid or biomass fuel production or combustion plant that meets the sustainability and greenhouse gas emissions saving criteria of Directive (EU) 2018/2001, no signed self-declaration is required since the point of origin is already subject to certification processes conducted annually.

3.3.2 Point of origin of off gases and liquid or solid waste streams

Energy-containing off gases (e.g. blast furnace gas) and liquid or solid waste streams are typically of non-renewable origin and therefore serve as sources for the production of RCFs (for CO_2 in off gases, see section 3.3.1). Point of origins of this type of material streams must comply with the requirements described above.

In the case of solid and liquid waste streams, the waste hierarchy stipulated in Article 4 of Directive 2008/98/EC must be followed, meaning that only waste streams may be used for the production of RCF that are not suitable for material recovery. If it has been determined that material recovery is no longer possible, both pre-consumer and post-consumer waste may be used.

4 Partially and fully renewable electricity

If electricity is used to enhance heating value and thereby produce an RFNBO, only electricity from renewable sources other than biomass may be used. Directive (EU)

2018/2001 differentiates in this regard between partially renewable and fully renewable electricity. A fuel that is produced (i.e. has its heating value enhanced) using only fully renewable electricity can be classified as an RFNBO in its entirety. In contrast, if partially renewable electricity is used, only a share of the fuel produced counts as an RFNBO.

The share of electricity from renewable sources is the average share of electricity from renewable sources measured two years before the year in question in the country where the fuel is produced. The RFNBO share resulting from a process powered by partially renewable electricity is determined using formula 18 (section 7.12).

The two forms of electricity (fully and partially renewable) are treated differently in the calculation of GHG emissions. For electricity that meets the conditions for fully renewable electricity, it is assumed that the GHG emissions are zero. For electricity that counts as partially renewable, GHG emissions need to be determined on the basis of the methodology described in section 7.6.

The annex to this document contains an example showing how the RFNBO share is to be determined and the GHG emissions are to be calculated when both partially renewable electricity and fully renewable electricity are used.

The conditions that electricity must meet to merit the status "fully renewable" are defined in more detail in the following section.

4.1 Fully renewable electricity from direct connection

For self-generated electricity (e.g. a photovoltaic system in the immediate vicinity of the plant) to be considered fully renewable, fuel producers must provide proof of the following:

- the installation generating renewable electricity is connected to the installation producing the fuel via a direct line, or the renewable electricity is generated in the same installation where the fuel is produced, and
- the installation generating renewable electricity fulfils the criteria for additionality, meaning that the installations generating renewable electricity came into operation not earlier than three years (36 months) before the installation producing fuel started operations[5], and

[5] If additional capacity is added to the fuel production plant, the added capacity is considered part of the existing installation, provided that the capacity is added at the same site and the addition takes place no later than three years (36 months) after the initial installation came into operation.

- the installation producing electricity is not connected to the grid, or it is connected to the grid but a smart metering system that measures all electricity flows from the grid shows that no electricity was taken from the grid or that the amount of electricity used as a production input does not exceed the amount of fully renewable electricity actually produced.

4.2 Fully renewable electricity taken from the grid

4.2.1 Share of renewable electricity > 90 %

Fuel producers may count electricity taken from the grid as fully renewable if the installation producing the fuel is located in a bidding zone where the average proportion of renewable electricity exceeded 90 % in the previous calendar year and the production of fuel does not exceed a maximum number of hours set in relation to the proportion of renewable electricity in the bidding zone.[6] The maximum number of hours is calculated using the formula 1 below.

$$t_{maximum} = t_{year} \cdot \frac{I_{renewable}}{I_{total}} \qquad \text{formula 1}$$

$t_{maximum}$	Maximum number of hours that the electricity taken from the grid can be considered fully renewable in [h]
t_{year}	Total number of hours within a year (8,760 h)
$I_{renewable}$	Gross final consumption of renewable electricity in the bidding zone in the previous year in [kWh]; gross final consumption must be calculated in accordance with the provisions of Article 7(2) of Directive (EU) 2018/2001
I_{total}	Gross electricity generation from all energy sources listed in Annex B to Regulation (EC) No 1099/2008, except from water that has

[6] Where bidding zones are identical to countries, the latest data on the RES-E that has been published by Eurostat are to be used for EU Member States and the latest data on the share of renewable electricity that has been published by the IEA for third countries. When IEA data is not available, data from the nation statistical institutes may be used. Where bidding zones are not identical to countries, data from official national statistics that have been derived in line with the methodology applied for determining the RES-E share in the SHARES tool must be used.

previously been pumped uphill, plus imports minus exports of electricity to the bidding zone in the previous year in [kWh]

The relationship described in formula 1 would in case of a 95 % renewable electricity share in the bidding zone mean, that the fuel producer may account 8,322 hours of electricity consumption as fully renewable. Every hour exceeding this number of hours may be considered non-renewable.

Once the average share of renewable electricity exceeds 90 % in a calendar year, it can continue to be considered to be higher than 90 % for the subsequent five calendar years. If, after a 90 % share has been demonstrated for a bidding zone, the average share of renewable electricity is lower than 90 % for five consecutive years, the electricity in that bidding zone is considered only partially renewable.

4.2.2 Power purchase agreement and electricity emission intensity < 18 gCO_2eq/MJ

If the fuel production plant is located in a bidding zone where the emission intensity of electricity taken from the grid is lower than 18 gCO_2eq/MJ[7], electricity from the grid may be counted as fully renewable, provided that proof is furnished that the fuel producer concluded one or more renewables power purchase agreements with economic operators producing renewable electricity in one or more installations generating renewable electricity for an amount that is at least equivalent to the amount of electricity that is claimed as fully renewable and the electricity claimed is effectively produced in these installations. The conditions on temporal (section 4.4) and geographical correlation (section 4.5) must be met.

[7] The emission intensity of electricity must be determined following the methodology described in the section 7.6.3 based on the latest available data. Once the emission intensity of the electricity taken from the grid is lower than or equal to 18 gCO2eq/MJ in a calendar year, the average emission intensity of electricity continues to be considered lower than 18 gCO2eq/MJ for the subsequent five calendar years.

4.2.3 Power purchase agreement and electricity emission intensity ≥ 18 gCO_2eq/MJ

If the fuel production plant is located in a bidding zone where the emission intensity of electricity taken from the grid is greater than or equal to 18 gCO_2eq/MJ[7], electricity from the grid may be counted as fully renewable, provided that proof is furnished that the fuel producer concluded one or more renewables power purchase agreements with economic operators producing renewable electricity in one or more installations generating renewable electricity for an amount that is at least equivalent to the amount of electricity that is claimed as fully renewable and the electricity claimed is effectively produced in these installations. The conditions on additionality (section 4.3) and temporal (section 4.4) and geographic correlation (section 4.5) must be met.

4.2.4 Electricity consumption during an imbalance settlement period

If the electricity is consumed during an imbalance settlement period during which the fuel producer can demonstrate that

- power-generating installations using renewable energy sources were redispatched downwards in accordance with Article 13 of Regulation (EU) 2019/943, and
- the electricity consumed for the production of the fuel reduced the need for redispatching by a corresponding amount,

the electricity, taken from the grid, can be counted as fully renewable.

Outside the European Union, this is only an option if the non-EU country has very similar market rules to the European Union, e.g. if institutions exist that assume the responsibilities of the national transmission system operators and rules are in place to govern redispatching. If the fuel producer plans to make use of this energy acquisition option, auditors must examine the market circumstances beforehand to establish whether they are very similar to the circumstance in the European Union.

4.3 Additionality condition

For electricity to qualify as fully renewable electricity, fuel producers, regardless of whether they produce renewable electricity in their own installations or have concluded renewables power purchase agreements for the production of renewable electricity, must provide proof of the following:

- the installations generating renewable electricity came into operation not earlier than three years (36 months) before the installation producing fuel started operations[8,9]
- the installation generating renewable electricity did not receive any support in the form of operating aid or investment aid. This excludes support received by installations before their repowering, financial support for land or for grid connections, support that does not constitute net support, such as support that is fully repaid and support for installations generating renewable electricity that are supplying installations producing renewable liquid and gaseous transport fuel of non-biological origin used for research, testing and demonstration. If installations generating renewable electricity are treated preferentially in terms of taxation compared to installations generating non-renewable electricity, this is also not support considered in the form of operating or investment aid.

Whether, for example, a contract for difference constitutes net support must be assessed ex-ante and verified ex-post. For the ex-ante assessment, fuel producers must demonstrate on the basis of the terms of the contract for difference that the contract is unlikely to result in net support for the contracted installation generating renewable electricity. In the ex-post verification, fuel producers must demonstrate that the contracted installations generating renewable electricity have not received net support.

These conditions do not apply until 1 January 2038 to installations producing RFNBOs that come into operation before 1 January 2028. This exemption does not apply to capacity added to an installation after 1 January 2028. "Come into operation" means in this context the start of production, which includes any form of commercial production of RFNBO that is intended to be used or sold and goes beyond a pure testing of the installation.

[8] If capacity is added to an existing installation producing fuel, the added capacity is considered to have come into operation at the same time as the initial installation, provided that the capacity is added at the same site and the addition takes place no later than three years (36 months) after the initial installation came into operation.

[9] If an installation generating renewable electricity met the conditions for the date of starting operations at the time the first agreement was concluded and this expires, the date the installation generating renewable electricity came into operation may be assumed to be the same as the date the fuel production installation began operation under a new agreement.

4.4 Temporal correlation conditions

Rule until 31 December 2029: Fuel producers must ensure that the amount of electricity used for fuel production that has been declared fully renewable was produced by renewable energy installations within the same calendar month. This means that the amount of fuel produced, taking conversion rates into account, must be equivalent to the electricity that is declared fully renewable and has been verifiably produced in the calendar month.

This requirement is also complied with, if the fuel producer can prove that renewable electricity has been sourced from a new storage asset that is located behind the same network connection point as the electrolyser or the installation generating renewable electricity, that has been charged during the same calendar month in which the electricity has been produced.

Rule starting 1 January 2030: Fuel producers must ensure that the amount of electricity used for fuel production that has been declared fully renewable has been produced by renewable energy installations within the same one-hour period. This means that the amount of fuel produced, taking conversion rates into account, must be equivalent to the electricity that is declared fully renewable and has been verifiably produced in this one-hour period.

This requirement is also complied with, if the fuel producer can prove that renewable electricity has been sourced from a new storage asset that is located behind the same network connection point as the electrolyser or the installation generating renewable electricity, that has been charged during the same one-hour period in which the electricity has been produced.

The temporal correlation condition is considered complied with if the fuel is produced during a one-hour period where the clearing price of electricity resulting from single day-ahead market coupling in the bidding zone, as referred to in Article 39(2)(a) of Commission Regulation (EU) 2015/1222, is a maximum of EUR 20 per MWh or lower than 0.36 times the price of an allowance to emit one tonne of carbon dioxide equivalent during the relevant period for the purpose of meeting the requirements of Directive 2003/87/EC of the European Parliament and of the Council.[10]

[10] The price of the previous trading day for December futures for the ongoing year must be applied. Suitable sources for this values are the ICE index or the EEX.

In the case that a Member State applies the requirements on hourly correlation already from 1 July 2027, fuel producer must comply with this requirement in the Member State that introduced the requirement earlier.

4.5 Geographical correlation conditions

The conditions for geographical correlation are considered met if at least one of the following criteria is fulfilled at the location of the electrolyser:

- the installation generating renewable electricity was located at the time when it came into operation in the same bidding zone as the electrolyser, or
- the installation generating renewable electricity is located in an interconnected bidding zone or is connected to a continuous electricity grid and electricity prices in the relevant time period on the day-ahead market in the interconnected bidding zone is equal or higher than in the bidding zone where the electrolyser is located, or
- the installation generating renewable electricity is located in an offshore bidding zone that is interconnected with the bidding zone where the electrolyser is located.

If a Member State introduces additional criteria concerning the geographical correlation, fuel producer must comply with this requirement in the Member State that introduced the additional requirements.

5 Renewable power purchase agreements and renewable-energy attribute certificates

The renewables power purchase agreement, that the fuel producer must conclude for electricity to be counted as fully renewable (sections 4.2.2. and 4.2.3), must be concluded by the fuel producer directly or via an intermediary with the economic operator of the installation generating renewable electricity. Intermediaries may be involved by various means and for various purposes, including as a contracting party. For example, intermediaries can represent the electricity producers. However, a direct relationship between the electricity producer and the fuel producer must be maintained.

Independent of whether the fuel producer concluded the renewables power purchase agreement directly or via an intermediary, the installation in which the renewable electricity is produced must be clearly identifiable by the information included in the agreement.

Furthermore, the data included in the renewables power purchase agreement must be sufficient to ensure compliance with the requirements set out in Article 5 to Article 7 of the Delegated Regulation (EU) 2023/1184. Therefore, the renewable power purchase agreement must contain at least the following elements:

- the name of the operator of the installation generating renewable electricity
- the name of the fuel producer
- the exact location (address, longitude and latitude coordinates) of the installation producing renewable electricity (including the bidding zone and the registration number if applicable)
- the location of the fuel producer (including the bidding zone)
- the identity and capacity of the installation producing renewable electricity
- information on the energy source
- the date on which the installation producing renewable electricity became operational
- information on the frequency with which feed-in statements are transmitted
- the amount of renewable electricity supplied in [MJ]
- the duration of the agreement
- consent from the economic operator generating renewable electricity that auditors from certification bodies recognised by REDcert may verify the data specified in the renewables power purchase agreement and the amount of electricity supplied to the fuel producer by means of on-site inspections

The amount of fully renewable electricity used by the fuel producer to produce RFNBO and made available by the operator of the installation producing renewable electricity must be covered by a corresponding number of guarantees of origin or renewable-energy attribute certificates. If guarantees of origin or renewable-energy attribute certificates are used for demonstrating compliance with Article 5 to Article 7 of the Delegated Regulation (EU) 2023/1184 and as evidence for the amount of electricity produced, they must have been issued for the specific installation covered by the renewables power purchase agreement.

The guarantees of origin or renewable-energy attribute certificates must meet the requirements set out in Article 19 of Directive (EU) 2018/2001 and must contain at least the following information:

- the name of the operator of the installation producing renewable electricity
- the energy source from which the energy was produced and the start and end dates of production
- that it relates to electricity
- the identity, location, type and capacity of the installation where the energy was produced
- whether the installation has benefited from investment support and whether the unit of energy has benefited in any other way from a national support scheme, and if so, the type of support
- the date on which the installation producing renewable electricity became operational
- the date and country of issue and a unique identification number

It must be ensured that guarantees of origin for renewable electricity are always cancelled before the end of their validity and that the amount corresponds to the amount of electricity specified in the renewables power purchase agreement. The requirements on guarantees of origin also apply in cases where the Delegated Regulation (EU) 2023/1184 does not require the conclusion of a renewable energy power purchase agreement.

Where guarantees of origin or other valid energy attribute certificates for renewables have been issued from a national register, the technical and legal requirements have already been checked by an independent expert in the context of registering the installation and can be recognised accordingly. Further inspection of the economic operator that runs the installation generating renewable electricity is therefore not mandatory. However, if the risk assessment of the certification body reveals an increased risk, an inspection of the installation generating renewable electricity must be carried out.

6 Bidding zones

A bidding zone is the largest geographical area within which market participants are able to exchange energy without capacity allocation; it is an important element of the design of the electricity market in the European Union. However, this principle of market design is not implemented in an equivalent manner everywhere outside the European Union, which is why specific rules apply in respect of geographical correlation. Their purpose is to guarantee the practicability of the requirements of the Delegated Regulations outside the European Union.

Prior to the audit, the auditors must familiarise themselves with the circumstances of the electricity market in the country where the fuel producer operates and conduct checks in relation to bidding zones in line with the following methodology:

- Auditors should assess whether at the location of the electrolyser, market regulations apply which are similar to the rules set out for bidding zones in Regulation (EU) 2019/943. Similar means in this context that there are rules requiring establishing hourly prices for electricity in a geographical area. If such rules are in place, the geographical area for which the prices are established should be considered as a bidding zone for the purpose of the implementation of the methodology.
- If such rules are not in place, auditors should assess whether the electricity network in the country of production is integrated or whether there are several separated networks. If there are several networks, each network should be considered as a bidding zone for the purpose of the implementation of the methodology.
- If the electricity network of the country is integrated, the whole country may be considered as one bidding zone for the purpose of the implementation of the Delegated Regulation.

Where the methodology requires certain conditions to be met related to the concept of a bidding zone, e.g. on the average proportion of renewable electricity (section 4.2), the conditions can only be considered fulfilled if compliance can be demonstrated on the basis of reliable data from official sources.

7 Determining the total emissions from the use of the fuel

The total greenhouse gas emissions from the use of the RFNBOs or RCFs must be calculated using formula 2.

$$E = e_i + e_p + e_{td} + e_u - e_{ccs} \quad \text{formula 2}$$

where

$$e_i = e_{elastic} + e_{rigid} - e_{ex\text{-}use} \quad \text{formula 3}$$

E	Total emissions from the use of the fuel in [gCO_2eq/MJ]
e_i	Emissions from supply of inputs in [gCO_2eq/MJ]
$e_{elastic}$	Emissions from elastic inputs in [gCO_2eq/MJ]
e_{rigid}	Emissions from rigid inputs in [gCO_2eq/MJ]
$e_{ex\text{-}use}$	Emissions from inputs' existing use or fate in [gCO_2eq/MJ]
e_p	Emissions from processing in [gCO_2eq/MJ]
e_{td}	Emissions from transport and distribution in [gCO_2eq/MJ]
e_u	Emissions from combusting the fuel in its end-use [gCO_2eq/MJ]
e_{ccs}	Emission savings from carbon capture and geological storage in [gCO_2eq/MJ]

In contrast to the biofuels value chain, where a clear distinction can be made between intermediate products and final fuels, this distinction is not always possible in the RFNBO and RCF value chain. For example, RFNBO-H_2 can be used both as a fuel in a fuel cell and as an input and thus as an intermediate product in the value chain for methanol production.

Economic operators that are part of the RFNBO and/or RCF value chain must determine the emissions at their specific production step/position in the value chain, i.e. that emissions must be determined where they occur.

Fuel producers that supply an intermediate product to a company downstream must determine the GHG emission intensity for the intermediate product they produce based on the methodology described in this document. Emissions from the combustion of intermediate fuel products (e_u) do not have to be calculated, as these are only relevant for the final fuel.

The fuel producers who produce the final fuel resulting from the value chain represent what is known as the last interface in the RFNBO and RCF value chain. They must calculate the total emissions from the use of the fuel, including downstream transport and distribution and e_u of the final fuel. In addition, the last interface must determine the GHG savings resulting from the use of the fuel compared to the fossil fuel comparator.

Fuel producers who distribute a fuel both as the final fuel resulting from the value chain and as an intermediate product (e.g. methanol) must document which quantities were supplied for direct distribution of the fuel and which quantities were supplied to downstream companies.

The formula elements in formula 2 and the total emissions from the use of the RFNBO or RCF (E) must be calculated in the unit [gCO_2eq/MJ_{fuel}]. To do this, the total emissions of the process are divided by the total amount of fuel stemming from the process (in MJ).

If intermediate products are traded between fuel producers, the GHG emissions resulting from the processes up to the stage of value creation must also be communicated in the unit [$gCO_2eq/MJ_{intermediate}$].

The greenhouse gases methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2) must be taken into account in emissions calculations and converted into CO_2 equivalents as specified in paragraph 4 of Annex V, part C, of Directive (EU) 2018/2001.

Fuel producers must ensure that the calculation of the GHG emissions is based on accurate, well-documented and up-to-date data. Whenever standard values and/or grid emission factors listed in Part B or Part C of the Delegated Regulation (EU) 2023/1185 are used, fuel producers must use the latest version of the values. Any change or update of these values will become effective immediately in the REDcert-EU scheme.

If the total amount of fuel resulting from a process consists of a mixture of RFNBO, RCF and other fuel types, the same GHG emission intensity must be assumed for all fuels resulting from the process. The exception to this rule is the case of co-processing where RFNBOs and RCFs only partially replace a conventional input (e.g. of fossil origin) or biomass in a process. In this process, the GHG emissions from fuel production are allocated proportionally to the respective fuel type based on the energy of the inputs (see sections 7.12 and 7.13).

Emissions from the manufacture of infrastructure needed for the production of RFNBOs or RCFs (e.g. pipelines) do not need to be included. Furthermore, it is not required to include inputs in the calculation which have little or no effect on the result, e.g. low quantities of chemicals used in processing. Inputs with little or no effect are those that have a calculated impact of less than 0.5 % on the emissions of the respective formula element in formula 2.

7.1 Calculation period

The greenhouse gas emissions intensity may be calculated as an average for the entire production of fuels occurring during a period of time. The maximum permitted period is one calendar month. Where electricity qualifying as fully renewable (see section 4) is used as an input that enhances the heating value of the fuel, the time interval must be in line with the requirements applying for temporal correlation. It is also possible to make the calculation batch-specific, if compatible with temporal correlation. This means that the total emissions from the use of the fuel have to be determined for each particular batch.

Where relevant, greenhouse gas emissions intensity values calculated for individual time intervals may then be averaged out (formula 4). This is permitted as long as the time interval for which the average is determined is no longer than one month and the individual values meet the minimum savings threshold of 70 % compared to the fossil fuel comparator.

$$E_{av} = \sum_i S_i \cdot E_i \qquad \text{formula 4}$$

E_{av}	Average total emissions from the use of the fuel in [gCO_2eq/MJ]
S_i	Share of fuel in the total amount of fuel in the time interval
E_i	Total emissions from the use of the share of the fuel in [gCO_2eq/MJ]

7.2 Emissions from the supply of inputs (e_i)

The emissions from the supply of inputs required for the production of the fuel must be calculated using formula 3. Formula 3 shows formula elements for the emissions from the supply of elastic and rigid inputs as well as emissions from the existing use or the existing fate of the input. These are described in the following section in more detail.

7.3 Emissions from the supply of rigid inputs (e_{rigid})

Rigid inputs are inputs whose supply cannot be increased in the short term to produce extra quantities of fuel. For example, the carbon sources qualifying for the production of RCF are all rigid inputs. Inputs are also considered rigid if they originate from incorporated processes[11] that have outputs produced in fixed ratio and the input used to produce the fuel (equivalent to output of the incorporated process) represents less than 10 % of the economic value of the output.

Emissions from rigid inputs must include the emissions resulting from the diversion of those inputs from a previous or alternative use. This can be, for example, the operation of pumps for the purpose of diversion or additionally necessary treatment steps such as purification of the input. In addition, GHG emissions that result from the rigid input no longer being available for its previous use must be taken into account. These include the loss of production of electricity, heat or products that were previously generated using the input.

The basic method for determining the GHG emissions due to the diversion of the rigid input is based on multiplying the amount of loss of production output by the corresponding emission intensity to be assumed for compensating the loss (formula 5). Formula 5 is to be used to calculate the emissions for compensation in the cases described in sections 7.3.1, 7.3.2 and 7.3.3. Emissions from the supply of rigid inputs (e_{rigid}) must then be added up and divided by the total amount of fuel produced in the time period of the calculation method (formula 6).

$$e_{compensation} = |Loss| \cdot c_F \qquad \text{formula 5}$$

$$e_{rigid} = \frac{e_{compensation} + e_{supply}}{M_{fuel}} \qquad \text{formula 6}$$

$e_{compensation}$	Emissions resulting from compensating the loss of production output in [gCO_2eq]
|Loss|	Amount of loss in, for example, electricity or heat production resulting from the diversion of the rigid input in [MJ]

[11] Incorporated processes are processes that take place in the same industrial complex as fuel production, or

a) supply inputs via a dedicated supply line, or
b) supply more than half of the energy required for RFNBO or RCF production.

c_F	Emission factor from compensating the loss of necessary production in [gCO_2eq/MJ]
e_{rigid}	Emissions from rigid inputs in [gCO_2eq/MJ]
e_{supply}	Emissions resulting from supply of the rigid input (e.g. transport) in [gCO_2eq]
M_{fuel}	Total quantity of the fuel produced in the calculation period in [MJ]

7.3.1 Rules for taking into account the loss of production of electricity, heat or products

If the diversion of the rigid input results in lost electricity production, the emission factor of the electricity to consider is the factor for grid electricity generation in the country where the diversion occurred.

The emission factor can be found for each country in Table A of Part C of the Annex to Delegated Regulation (EU) 2023/1185. If Table A of the Delegated Regulation does not list an emission factor for grid electricity, it must be taken from Annex IX of Implementing Regulation (EU) 2022/996 or an official source (e.g. governments). Alternatively, the emission factor can be calculated using the method set out in Part C of the Annex to Delegated Regulation (EU) 2023/1185.

If the diversion of the rigid input results in a loss of heat production, the GHG emissions must be determined on the basis of the alternative heat source used.

If the diversion of the rigid input results in the use of alternative inputs, e.g. for use as material, the emissions resulting from the provision of this alternative input must be determined according to the methodology described in this document for e_i.

Determining the loss of electricity, heat and products resulting from the diversion of the input from its previous use must be based on the average production of electricity, heat and products in the first 20 years since the start of RFNBO or RCF production in the installation, for the last three years before the start of production. 20 years after the start of production in the RFNBO or RCF producing plant, the loss is determined on the basis of the minimum energy efficiency targets included in the conclusions on best available technologies (BAT). If BAT does not exist for the process, the loss is estimated using a comparable best available technology.

7.3.2 Rules for taking into account the diversion of material streams of industrial processes as well as the loss of production quantities

In cases of rigid inputs that stem from industrial processes (e.g. coke oven gas, blast furnace gas in a steelworks or refinery gas in an oil refinery) where it is not possible to measure the GHG emissions directly, these must be determined on the basis of simulations of the plant operation before and after modification to produce RCFs. If the modification of the plant caused a reduction of output of some products, the emissions attributed to the rigid input must include the emissions associated with replacing the lost products.

7.3.3 Rules for determining the GHG emissions for new installations

Where the process makes use of rigid inputs from new installations (e.g. a new steelworks), the emissions from the supply of the rigid input must be calculated on the basis of the most economical alternative. The emission implications are calculated according to the energy efficiency derived from the BAT. For processes not covered by a BAT, the saved emissions must be calculated on the basis of a comparable state-of-the-art process.

7.4 Emissions from the supply of elastic inputs ($e_{elastic}$)

Elastic inputs are inputs whose quantity can be increased in the short term to produce extra quantities of RFNBOs or RCFs. These include, for example, petroleum products from refineries, electricity, natural gas and CO_2. Inputs are also considered elastic if they originate from incorporated processes[11] that have outputs produced in a fixed ratio and this output represents more than 10 % of the economic value of the output.

If elastic input materials originate from an incorporated process[11], the GHG emissions for this input must be determined based on the actual data of the production process. The GHG emission calculation of the input must include the total emissions resulting from the production of this input. The emissions from the extraction of primary energy sources for the production of the input material must be taken into account in this calculation. However, the emissions resulting from the combustion of the input fuel do not have to be included in the calculation, as these are calculated by the last interface for the final fuel.

Where elastic inputs come from unincorporated processes, the values listed in Part B of the Annex to Delegated Regulation (EU) 2023/1185 must be used. Any changes to these values by the European Commission take effect in the scheme immediately after publication. If an input is not in one of the tables listed in Part B of the Annex, the emission factor must be taken from one of the following sources (in the order below):

1: Current version of the JRC-WTW report

2: ECOINVENT database

3: Official sources (e.g. IPCC, IEA, governments)

4: Sources such as the E3 and GEMIS database

5: Peer-reviewed publications

7.5 Emissions from existing use or fate (e_{ex-use})

The emissions from existing use or fate take into account those emissions that are avoided by capturing and incorporating CO_2 equivalents into the fuel. Since these quantities would be emitted into the atmosphere due to the existing use or fate without capture and incorporation, they represent an emission credit and are therefore included in the calculation of total emissions E with a negative sign (already included in formula 2).

Credit for the avoidance of CO_2 emissions is only possible if the CO_2 originates from one of the following sources, has not been deliberately produced and has not already been credited in another scheme:

- the CO_2 has been captured from an activity listed under Annex I of Directive 2003/87/EC[12] and has been taken into account upstream in an effective carbon pricing system. (only permitted until 2036; if the CO_2 stems from a source other than the combustion of fuels for electricity generation, it may be used until 2041[13]), or
- the CO_2 has been captured directly from the air, or
- the captured CO_2 stems from the production or the combustion of biofuels, bioliquids or biomass fuels complying with the sustainability and greenhouse gas saving criteria and the CO_2 capture did not receive credits for emission savings from CO_2 capture and replacement, set out in Annex V and VI of Directive (EU) 2018/2001, or

[12] Directive 2003/87/EC Annex I

[13] Biomass fuels that meet the requirements under bullet three are exempt from this requirement.

- the captured CO_2 is of biogenic origin and stems from a process which is out of the scope of the sustainability and greenhouse gas saving criteria set out in Directive (EU) 2018/2001[14]
- the captured CO_2 stems from the combustion of RFNBO or RCF complying with the greenhouse gas emissions savings criteria, set out in Article 25(2) and Article 28(5) of Directive (EU) 2018/2001 and Delegated Regulation (EU) 2023/1185, or
- the captured CO_2 stems from a geological source of CO_2 and the CO_2 was previously released naturally.

CO_2 is considered to be taken into account upstream in an effective carbon pricing system, if the activity listed under Annex I of Directive 2003/87/EC falls under a carbon pricing system that has been positively assed by the European Commission and the point of origin of the CO_2 can prove that allowances for the amount of CO_2 have been cancelled. The list of positively assessed carbon pricing systems can be found below or in the Annex to the document "*Q&A for the certification if RFNBOs and RCF*" published on the voluntary schemes homepage[15] of the European Commission.

According to the above-mentioned document, the following systems can be considered to fulfil the requirement of upstream accounting in an effective carbon pricing system:

- EU ETS which applies in 30 States of the European Economic Area: the EU-27 Member States and in three EFTA States Iceland, Liechtenstein and Norway
- SWISS ETS
- UK ETS

Any changes to the list of effective carbon pricing systems in the document "*Q&A for the certification if RFNBOs and RCF*" by the European Commission take effect in the scheme immediately after publication.

The criteria that a carbon pricing system must fulfil in order to be considered effective by the European Commission are provided in Chapter 12.2.

[14] If the CO_2 source is located in a third country and the economic operator does not want to export the biofuel, bioliquid or biomass fuel to the EU, this does not justify the conclusion that the activity falls out-side the scope of Directive (EU) 2018/2001.

[15] voluntary schemes homepage

Requests to assess carbon pricing systems of specific countries regarding their compliance with the Delegated Regulation (EU) 2023/1185, can be addressed at the Commission by the relevant competent authorities. The same applies to carbon pricing systems on sub-national levels.

In the case of CO_2 that would have been released directly into the atmosphere, for absolute emission savings under e_{ex_use}, credit of one CO_2 equivalent can be granted for each CO_2 equivalent incorporated into the fuel.

For the fuel producer to be allowed to credit the avoided CO_2 emissions through incorporation into the fuel, the requirements set out in section 3.3 must be fulfilled.

If the fuel producer produced a RCF using

- liquid or solid waste streams of non-renewable origin that are not suitable for material recovery in accordance with Article 4 of Directive 2008/98/EC or
- waste processing gas and exhaust gas of non-renewable origin which is produced as an unavoidable and unintentional consequence of the production process in industrial installations,

the existing use or fate is to be determined on the basis of the practice that the point of origin has employed to dispose of the material stream in the previous three calendar years. If the point of origin has exclusively sent the material stream to a waste incineration plant for thermal treatment during the previous three calendar years, the emission savings (e_{ex-use}) can be calculated on the basis of the expected incineration ratio. Accordingly, for each mole of carbon incorporated into the fuel, only 1 mol - X of the carbon can be credited as avoided CO_2eq emissions, with X standing for the proportion of carbon that would not have been converted into greenhouse gas.

If the usual practice has been to dispose of the material streams in a landfill site, then only the avoided GHG emissions that would have resulted from storage in landfill (e.g. methane emissions) can be credited as avoided emissions. It is not permissible to assume that the entire material stream is converted into CO_2 equivalents.

7.6 Emissions from the use of electricity (e_i or e_p)

The GHG emissions that relate to the supply of electricity must be included in different formula elements of formula 2 depending on the function in the process to be certified. For example, electricity used to electrolyse water is considered an (elastic) input because it makes energy available for fuel production and must therefore be included in e_i. Electricity that, for example, is used to operate pumps or infrastructure, must, in contrast, be included in e_p. Only the electricity considered an input for fuel production must comply with the criteria for electricity set forth in Article 27(3) of Directive (EU) 2018/2001 if the electricity is used for the production of RFNBOs (e.g. electrolysis).

Whenever electricity is used, be it in the form of an input or for operating infrastructure, the respective GHG emissions must be taken into account even if the resulting output cannot be classified as an RFNBO. This means that if electricity is taken from the grid to produce hydrogen but does not fully qualify as renewable under Directive (EU) 2018/2001, the GHG emissions must be taken into account accordingly. Electricity that qualifies as fully renewable according to this document can be attributed an emission value of 0 gCO_2eq/MJ.

If electricity is used that is taken from the electricity grid and cannot be considered fully renewable, the specific emission intensity for the electricity used must be determined. One of the three following alternative methods is to be applied during each calendar year to attribute greenhouse gas emission intensities to the electricity taken from the grid[16]:

7.6.1 Determining the emission intensity based on the full production load hours

Where the number of full production load hours is equal to or lower than the number of hours in which the marginal price of electricity in the bidding zone was set by installations producing renewable electricity or nuclear power plants in the current calendar year, a greenhouse gas emissions intensity of 0 gCO_2eq/MJ can be used. To this end, the fuel producer must be able to show the corresponding documentation on the full production load hours and the number of hours in which the marginal price was set by the above-mentioned power plants from a suitable source.

[16] When a fuel producer decides on a calculation method, this method must be applied for the entire calendar year. The methodology can only be changed at the beginning of the new calendar year.

Where this number of full load hours exceeds this number of hours in which the marginal price was set by the previously mentioned power plants, an emission intensity of 183 gCO_2eq/MJ must be used for the additional hours.

7.6.2 Determining the emission intensity based on the marginal unit generating electricity

If provided by the national transmission system operator, the emission intensity of the marginal unit generating electricity in the bidding zone can be used. It must be ensured that the temporal correlation between electricity and RFNBO production is maintained, i.e. that the fuel production took place in the same one-hour period as the marginal unit was producing.

7.6.3 Determining the emission intensity based on the method set out in Part C of Annex to Delegated Regulation (EU) 2023/1185

The GHG emission intensity of electricity taken from the grid must be determined at the level of countries or at the level of bidding zones. The greenhouse gas emission intensity of electricity may be determined at the level of bidding zones only if the required data are publicly available and up to date.

If an emission factor is listed in Table A of the Annex Part C to the Delegated Regulation (EU) 2023/1185 it must be used. If Table A does not list an emission factor for grid electricity, the emission factor can be taken from Annex IX of the Implementing Regulation (EU) 2022/996 or it must be calculated in line with the method described below.

To calculate the emission intensity of electricity taken from the electricity grid, expressed in gCO_2eq/kWh, all potential primary energy sources for electricity generation, type of plant, conversion efficiencies and own electricity consumption in the power plant (e.g. coal to electricity) and the amount of electricity consumed in the power plants for the purpose of power plant operation must be taken into account.

GHG emissions must be calculated in gCO_2eq only. This means that methane (CH_4) and nitrous oxide (N_2O) emissions must be converted to CO_2 equivalents based on the individual Global Warming Potential of the greenhouse gas (Table 1). This can be done by simply multiplying the amount of greenhouse gas emitted from the process by the relevant Global Warming Potential.

Table 1: Emission potential of different greenhouse gases[17]

Greenhouse gas	Global Warming Potential
CO_2	1
CH_4	28
N_2O	265

In the case of fuels used to generate electricity, a distinction must be made between biological and fossil origin. CO_2 emissions from biomass fuels (e.g. combustion of biomethane), provided that proof of certification under REDcert-EU or another certification scheme officially recognised by the European Commission can be provided, do not have to be accounted for. However, CH_4 and N_2O emissions resulting from the use of biomass fuels as well as GHG emissions from the cultivation, collection, processing and transport of the biomass fuels must be accounted for.

All upstream GHG emissions resulting from the use of fossil fuels must be accounted for. Peat and the components of waste materials that are from fossil origins must be treated as fossil fuels. In addition, upstream GHG emissions resulting from the processes required to make the fuel ready to supply for power production (extraction, refining, transport, etc.) must be included in the calculation.

For the calculation of the GHG emissions from fuel combustion, the default values for stationary combustion plants listed in Part C of the Annex to Delegated Regulation (EU) 2023/1185 shall be used.

The emission factor is considered to be equal to zero in the calculation of the share of electricity originating from renewable sources (wind, solar, hydro and geothermal). The reason is that emissions from the construction, decommissioning and disposal of the plants are not included. This is independent of whether the plant produces electricity from renewable or conventional raw materials. Emissions from construction, decommissioning and disposal are not to be included in the calculation of GHG emissions.

To calculate the GHG emission intensity of the electricity taken from the grid (c_i), the GHG emission intensity of the gross electricity production of the electricity supplied to the grid

[17] If these values are updated by the European Commission, they take effect in the scheme immediately after publication.

(e_{gross_prod}) must first be determined using formula 7 as well as the net electricity production (E_{net}) according to formula 8.

The calculation of the emission intensity of gross electricity generation in electricity only plants is based on the emission intensities specific to the fuel type and how much is consumed for the production of the amount of electricity generated.

In the case of Combined Heat and Power (CHP), the fuels used for heat produced in CHP is counted by considering alternative heat production with average overall efficiencies of 85 %, while the rest is attributed to electricity generation.

For nuclear power plants, the conversion efficiency from nuclear heat is assumed to be 33 % or data provided by Eurostat or a similar, accredited source.

$$e_{gross\text{-}prod} = \sum_i (c_{i\text{-}ups} + c_{i\text{-}comb}) \cdot B_i \qquad \text{formula 7}$$

$e_{gross\text{-}prod}$	CO_2 equivalent emissions [gCO_2eq]
$c_{i\text{-}ups}$	Upstream CO_2 equivalent emission factors [gCO_2eq/MJ]
$c_{i\text{-}comb}$	CO_2 equivalent emission factors from fuels combustion [gCO_2eq/MJ]
B_i	Fuel consumption for electricity generation [MJ]

$$E_{net} = E_{gross} - E_{own} - E_{pumps} \qquad \text{formula 8}$$

E_{net}	Net electricity production [MJ]
E_{gross}	Gross electricity production [MJ]
E_{own}	Own internal electricity consumption in power plant [MJ]
E_{pumps}	Electricity for pumping [MJ]

The GHG emission factor of the electricity taken from the grid can now be determined by means of the quotient of the values derived (formula 9).

$$c_i = \frac{e_{gross\text{-}prod}}{E_{net}} \qquad \text{formula 9}$$

c_i	Emission factor of the electricity taken from the grid in [gCO_2eq/MJ]

Data from meaningful literature is permitted to determine GHG emission intensity. Data on electricity production and fuel consumption can be found in data and statistics from the International Energy Agency (e.g. USA). If the electricity is sourced in an EU member state, Eurostat data are more detailed and must be used instead.

If the GHG emission intensity is determined at the level of the bidding zones, data from official national statistics of the same level of detail as the IEA data must be used.

The fuel consumption data must include data at the highest level of detail available from national statistics, i.e. fuel consumption figures must be available at least for the following fuel types: solid fossil fuels, manufactured gases, peat and peat products, oil shale and oil sands, oil and petroleum products, natural gas, renewables and biofuels, non-renewable waste and nuclear. The renewables and biofuels category includes biofuels, renewable municipal waste, hydro, ocean, geothermal, wind, solar and heat pumps.

The Annex to Delegated Regulation (EU) 2023/1185 provides binding default values for determining GHG emission intensity. Any changes to these values by the European Commission take effect in the scheme immediately after publication.

7.7 Emissions from processing (e_p)

Emissions from processing include direct GHG atmospheric emissions from the processing itself, from waste treatment and leakages, and from the production of chemicals or other products used for processing (formula 10).

$$e_p = \frac{M_{electricity} \cdot c_{electricity} + M_{waste} \cdot c_{waste} + e_{direct} + \sum_i e_{i,other}}{M_{fuel}} \quad \text{formula 10}$$

where

$$e_{i,other} = M_i \cdot c_i \quad \text{formula 11}$$

e_p	Emissions from processing in the calculation period in [gCO_2eq/MJ]
$M_{electricity}$	Quantity of electricity used in the calculation period in [MJ]
$c_{electricity}$	Emission factor of electricity used in [gCO_2eq/MJ]
M_{waste}	Amount of waste produced in the calculation period [t]
c_{waste}	Emission factor of waste treatment [gCO_2eq/t]
e_{direct}	Direct GHG emissions in the calculation period from the process [gCO_2eq]
$e_{i,other}$	Emissions from other processes relevant to processing or from the process of capture and permanent geological storage of CO_2 [gCO_2eq]
M_{fuel}	Total quantity of the fuel produced in the calculation period in [MJ]

Fuel producers must take into account all processes relevant to processing that have not already been included as inputs in e_i in the calculation of emissions from processing (e.g. electricity consumption to operate the plant, cooling, waste treatment). To this end, all processes required for processing as well as the corresponding emission factors must be documented. In addition, direct GHG emissions (for example process exhaust gas) must be included in the calculation. Emissions from processing must be measured directly or based on the technical specifications of the processing plant.

7.8 Emissions from fuel combustion during end use (e_u)

Unlike biofuels, the methodology for calculating the total emissions from the use of the fuel does not stipulate across-the-board that the GHG emissions from the combustion of RFNBOs or RCFs during end use are to equal zero. However, hydrogen used as a fuel is a special case, as it does not cause any direct GHG emissions when converted with oxygen.

For RFNBO and RCF whose combustion is associated with the emission of greenhouse gases (CO_2, CH_4 or N_2O), the emissions from fuel combustion during their final use must be determined by the last interface on the basis of the total fuel combustion. The Annex to Delegated Regulation (EU) 2023/1185 lists in Part B the emission factors for complete combustion of selected fuel types that can be used as equivalent for the RFNBO or RCF, where applicable. If the emission factor of the fuel is not listed in the table, a scientific source or a scientifically recognised database (e.g. ecoinvent database) can be used. Alternatively, the complete combustion of fuels can be considered on the basis of stoichiometry and the GHG emissions calculated.

If the production process results in a by-product alongside the fuel or the fuel fraction, then the GHG emissions generated up to the point in the value chain first need to be allocated (section 7.12). After that, the total emissions resulting from the use of the fuel must be calculated as follows:

$$E = E_{fuel,ex\text{-}e_u} + \frac{e_u}{M_{fuel}}$$ formula 12

E	Total emissions from the use of the fuel in [gCO_2eq/MJ]
$\mathbf{E_{fuel,\ ex\text{-}e_u}}$	Emissions up to the point of product allocation [gCO_2eq/MJ]
$\mathbf{e_u}$	Emissions from combusting the fuel in its end-use [gCO_2eq]
$\mathbf{M_{fuel}}$	Total quantity of the fuel produced in the calculation period in [MJ]

If a process results in two or more fuels and by-products, then the GHG emissions generated up to the point in the value chain first need to be allocated in accordance with section 7.12. After the allocation, the total emissions resulting from the use of the fuels must be calculated specifically for each fuel by adding the fuel-specific emissions from combusting the fuel. This is demonstrated in the following using the example of fuel a (formula 13).

$$E_a = E_{fuel,ex\text{-}e_u} + \frac{e_{u,a}}{M_{fuel,a}}$$ formula 13

$\mathbf{E_a}$	Total emissions from the use of fuel a in [gCO_2eq/MJ]
$\mathbf{E_{fuel,\ ex\text{-}e_u}}$	Emissions up to the point of product allocation [gCO_2eq/MJ]
$\mathbf{e_u}$	Emissions from combusting the fuel in its end-use [gCO_2eq]
$\mathbf{M_{fuel,a}}$	Total quantity of fuel a produced in the calculation period [MJ]

7.9 Emissions from transport and distribution (e_{td})

Emissions from transport and distribution include all emissions generated during the transport of intermediate products and the storage and distribution of finished fuels, including leakages (e.g. CH_4). In addition, all emissions that arise at the point of distribution (e.g. the petrol station) are accounted for in this formula element. Emissions from the supply of inputs are not taken into account here, as these are already included in e_i.

$$e_{td} = \frac{(d_{loaded} \cdot K_{loaded} + d_{empty} \cdot K_{empty}) \cdot c_{operating\ resources}}{M_{fuel}}$$ formula 14

$\mathbf{e_{td}}$	Emissions from transport and distribution in the calculation period in [gCO_2eq/MJ]
$\mathbf{d_{loaded/empty}}$	Transport distance when vehicle is loaded or empty in [km]
$\mathbf{K_{loaded/empty}}$	Fuel consumption of the means of transport when loaded or empty in [L/km]
$\mathbf{c_{operating\ resources}}$	Emission factor of the operating resources (fuel) [gCO_2eq/L]
$\mathbf{M_{fuel}}$	Total quantity of the fuel produced in the calculation period [MJ]

Alternatively, formula 15 can be used to calculate the transport emissions:

$$e_{td} = \frac{(m_{transported}) \cdot d_{transport} \cdot c_{means\ of\ transport}}{M_{fuel}} \qquad \text{formula 15}$$

$\mathbf{e_{td}}$	Emissions from transport and distribution in the calculation period in [gCO_2eq/MJ]
$\mathbf{m_{transported}}$	Transported mass in the calculation period in [t]
$\mathbf{d_{transport}}$	Transport distance over which the fuel was transported in [km]
$\mathbf{c_{means\ of\ transport}}$	Emission factor of the specific means of transport [$gCO_2eq/t \cdot km$].
$\mathbf{M_{fuel}}$	Total quantity of the fuel produced in the calculation period [MJ]

In addition to the data to be documented for the calculation of transport emissions, the chosen means of transport must also be documented. Suitable emission factors can be found in Annex IX of Implementing Regulation (EU) 2022/996 and the Annex to Delegated Regulation (EU) 2023/1185. Alternatively, a scientifically accepted database or source can be used. However, if an item is covered in one of the legal acts, good reasons must be given for the use of alternative values.

7.10 Emissions savings from the capture and permanent geological storage of carbon dioxide in (e_{CCS})

Where a process for making renewable liquid and gaseous transport fuels of non-biological origin or recycled carbon fuels produces carbon emissions that are permanently stored in accordance with Directive 2009/31/EC on the geological storage of carbon dioxide, this may be credited to the products of the process as a reduction in emissions under e_{ccs}. Emissions arising due to the process of capture and geological storage, including transport and direct gas slip of CO_2, also need to be accounted for under e_p.

The calculation of emission savings from CO_2 capture and permanent geological storage must be directly linked to the respective calculation period. Since the process emissions from capture and geological storage are already taken into account in the e_p, only the clearly verifiable permanently stored quantity of CO_2 must be divided by the quantity of fuel produced in the calculation period to determine the emission reduction (formula 16).

$$e_{ccs} = \frac{M_{CO_2}}{M_{fuel}} \qquad \text{formula 16}$$

$\mathbf{e_{ccs}}$	Emissions savings from the capture and permanent geological storage of carbon dioxide [gCO_2eq/MJ]
$\mathbf{M_{CO_2}}$	Total amount of permanently stored CO_2 in [gCO_2eq]
$\mathbf{M_{fuel}}$	Total quantity of the fuel produced in the calculation period [MJ]

7.11 Dealing with upstream emissions

As described in this chapter, economic operators must determine the total emissions from the use of the fuel. While the production of the RFNBO or RCF may be carried out by one economic operator, it is also possible that multiple economic operators may be part of the RFNBO or RCF value chain. In order for the last interface to calculate actual GHG emissions, the emissions resulting from the processes of the upstream economic operators must be passed on along the value chain (see section 8.1).

Upstream GHG emissions associated with the incoming feedstock must be transformed using the so-called fuel feedstock factor. This factor describes the ratio of feedstock required to produce 1 MJ of fuel (formula 17). By applying this factor, the upstream emissions are transformed from $gCO_2eq/kg_{feedstock}$ or $gCO_2eq/MJ_{feedstock}$ to gCO_2eq/MJ_{fuel}.

$$ff_{fuel} = \frac{M_{feedstock}}{1\ MJ_{fuel}} \quad \text{formula 17}$$

$\mathbf{ff_{fuel}}$	Fuel feedstock factor
$\mathbf{M_{feedstock}}$	Quantity of feedstock required to produce 1 MJ of fuel [kg or MJ]
$\mathbf{1\ MJ_{fuel}}$	Quantity of fuel produced

If, for example, a fuel producer produces RFNBO-CH_4 via catalytic methanisation and receives the RFNBO-H_2 from an upstream fuel producer, the emissions associated with the production of the hydrogen need to be adjusted using the fuel feedstock factor.

Assuming a case in which the emissions associated with the hydrogen production is 5 $gCO_2eq/MJ_{hydrogen}$ and the fuel feedstock factor would be 1.2 $MJ_{hydrogen}/MJ_{methane}$, the emission from the elastic input hydrogen that would need to be considered, is 6 $gCO_2eq/MJ_{methane}$

7.12 Processes with multiple outputs and allocation rules

If the total amount of fuel resulting from a process consists of a mixture of RFNBO, RCF and other fuel types, the same GHG emission intensity must be assumed for all fuels resulting from the process. The exception to this rule is the case of co-processing where RFNBOs and RCFs only partially replace a conventional input (e.g. of fossil origin) or biomass in a process (see section 7.13). In this process, the GHG emissions from fuel production are allocated proportionally to the respective fuel type based on the energy of the inputs.

If the total amount of fuel resulting from a process consists of a mixture of RFNBO, RCF or other fuel types, the share or RFNBO must be determined according to formula 18 and the share of RCF according to formula 19.

To determine the share of RFNBO in a fuel mixture of different fuel types, the fuel producer must divide the relevant renewable energy input into the process by the total relevant energy inputs into the process (formula 18).

$$S_{RFNBO} = \frac{\varepsilon_{RFNBO,relevant}}{\varepsilon_{total}} \cdot 100\% \qquad \text{formula 18}$$

S_{RFNBO}	Part of the output that qualifies as RFNBO
$\varepsilon_{RFNBO,relevant}$	Relevant input of renewable energy in [MJ]
ε_{total}	Total relevant energy input of the process in [MJ]

To determine the share of RCF in a fuel mixture of different fuel types, the fuel producer must divide the relevant energy input qualifying as a source for the production of RCF into the process by the total relevant energy inputs into the process (formula 19).

$$S_{RCF} = \frac{\varepsilon_{RCF,relevant}}{\varepsilon_{total}} \cdot 100\% \qquad \text{formula 19}$$

$\mathbf{S_{RCF}}$	Part of the output that qualifies as RCF
$\boldsymbol{\varepsilon_{RCF,relevant}}$	Relevant RCF energy input [MJ]
$\boldsymbol{\varepsilon_{total}}$	Total relevant energy input of the process in [MJ].

The relevant energy for material inputs is the lower heating value of the material input that enters into the molecular structure of the fuel. For material inputs containing water, the lower heating value is taken to be the lower heating value of the dry part of the material input (i.e. not taking into account the energy needed to evaporate the water). RFNBO or RCF used for the production of conventional (fossil-based) fuels do not have to be taken into account.

For electricity inputs that are used to enhance the heating value of the fuel or intermediate products, the relevant energy input is the energy of the electricity.

For industrial off-gases, the relevant energy input of the off-gas is to be determined on the basis of its lower heating value. If the off-gas is of non-renewable origin and contains hydrogen, its energy input must be taken into account in formula 19.

In the case of heat that is used to enhance the heating value of the fuel or intermediate product, the relevant energy input is the useful energy in the heat that is used to synthesize the fuel (useful heat). Useful heat is determined by multiplying the total heat energy added to the process for the purpose of enhancing the heating value of the fuel of intermediate product multiplied by the Carnot efficiency, as defined in Annex V, part C, point (1)(b) of Directive (EU) 2018/2001.

The shares determined according to formula 18 and formula 19 must be applied to each output that is considered a fuel (material with a heating value).

If, for example, a fuel producer uses solid waste streams of non-renewable origin in a gasification process to produce a syngas and adds RFNBO-H_2 in the downstream Fischer-Tropsch process, all fuels from this process have the same GHG emission expressed in gCO_2eq/MJ.

To determine what share of the fuel from this process can be classified as RCF and which share as RFNBO, the following (simplified) calculation must be performed:

$$S_{RCF} = \frac{\varepsilon_{syngas}}{\varepsilon_{syngas} + \varepsilon_{RFNBO\text{-}H_2}} \cdot 100\% \qquad S_{RFNBO} = \frac{\varepsilon_{RFNBO\text{-}H_2}}{\varepsilon_{syngas} + \varepsilon_{RFNBO\text{-}H_2}} \cdot 100\%$$

An additional example for determining the share of RFNBO-H_2 and non-RFNBO-H_2 in the case of the use of partially renewable electricity is provided in the annex to this document.

Where a process yields several co-products of which only selected fractions are suitable for use as fuel, GHG emissions must be allocated to the resulting co-products. Co-products might be, for example, substances that have no heating value, but can be used for material applications in the chemical industry (commonly referred to as chemicals), but also the heat, electricity or mechanical energy exported from the plant.

$$E_{fuel,\ ex\text{-}e_u} = \frac{\alpha_{fuel} \cdot E_{ex\text{-}e_u}}{M_{fuel\ fraction}} \qquad \text{formula 20}$$

$\mathbf{E_{fuel,\ ex\text{-}e_u}}$	Emissions up to the point of product allocation [gCO_2eq/MJ]
$\mathbf{\alpha_{fuel}}$	Allocation factor of the fuel fraction
$\mathbf{M_{fuel\ fraction}}$	Total quantity of fuels produced in the calculation period [MJ]
$\mathbf{E_{ex\text{-}e_u}}$	Total emissions up to the point of allocation excluding e_u in [gCO_2eq]

The following rules apply to allocation:

- GHG emissions must be allocated at the end of the process that produces the co-products. The emissions allocated must include the emissions from the process itself, as well as the emissions attributed to inputs to the process as well as all upstream GHG emissions.

- The emissions to be allocated are e_i plus any fractions of e_p, e_{td} and e_{ccs} that take place up to and including the process step at which the co-products are produced. If an input into the process is itself a co-product of another upstream process, the emissions up to the other upstream process must be allocated first to establish the emissions to be attributed to the use of this input.
- If a co-product is then further processed, these GHG emissions from the downstream process can only be attributed to the respective co-product.
- Where the process allows the ratio of the co-products produced to be changed, the allocation is done based on physical causality by determining the effect of increasing the ratio of the co-product. For this purpose, the share of the co-product is increased, while it is assumed that the output of the remaining products remains constant. The GHG emissions resulting from the change in the product ratio must be allocated to the co-product.
- Where the ratio of the products is fixed and the co-products are all fuels, electricity or heat, the GHG emissions are allocated based on the share of the energy content of the product in the total energy output of the process (formula 21). Where GHG emissions are allocated to heat from the process, only the useful part of the heat may be considered, as defined in paragraph 16 of Directive (EU) 2018/2001 Annex V, part C.

$$a_{\varepsilon,fuel} = \frac{\varepsilon_{fuel}}{\varepsilon_{total}} = \frac{\sum_n M_{fuel,n} \cdot LHV_{fuel,n}}{\sum_n M_{fuel,n} \cdot LHV_{fuel,n} + \sum_n M_{energy,n}} \qquad \text{formula 21}$$

$\mathbf{a_{\varepsilon,fuel}}$	Allocation factor based on the energy content of the fuel and the total energy output
$\mathbf{\varepsilon_{fuel}}$	Energy content of the fuel or products that are considered fuel in [MJ]
$\mathbf{\varepsilon_{total}}$	Energy content of the total process output (total energy output) in [MJ]
$\mathbf{M_{fuel,n}}$	Total quantity of fuel n produced in the calculation period [kg]
$\mathbf{LHV_{fuel,n}}$	Lower heating value of the respective fuel [MJ/kg]
$\mathbf{M_{energy}}$	Amount of useful energy exported from the process (e.g. heat) in [MJ]

- Where the ratio of the products is fixed and some co-products are materials with no energy content, the allocation is done by the economic value of the co-products. For this purpose, the share of the fuel in the total economic value of all co-products must be determined (formula 22). The economic value of a product is the average factory-gate value of the products over the last three years. If such data is not available, because it is, for example, a new installation, the economic value must be estimated from commodity prices minus the cost of transport and storage.

$$a_{v,fuel} = \frac{v_{fuel}}{v_{total}} = \frac{M_{fuel} \cdot EV_{fuel}}{M_{fuel} \cdot EV_{fuel} + M_{co\text{-}product} \cdot EV_{co\text{-}product}} \qquad \text{formula 22}$$

$\mathbf{a_{v,fuel}}$	Allocation factor based on the economic value of the fuel and the total economic value of the output
$\mathbf{v_{fuel}}$	Economic value of the fuel or products that are considered fuel in [€ or $]
$\mathbf{v_{total}}$	Economic value of the total process output (total economic value) in [€ or $]
$\mathbf{M_{fuel}}$	Total quantity of fuels produced in the calculation period [kg]
$\mathbf{M_{co\text{-}product}}$	Total quantity of the co-product produced in the calculation period [kg]
EV	Economic value of the respective component [€/kg or $/kg]

7.13 Co-processing: determining the GHG emissions

If a RFNBO or RCF is used in a process to partially replace a conventional input, the requirements on co-processing apply and the emissions need to be calculated on the basis of all relevant energy inputs required in stoichiometric terms for the conversion of the RFNBO/RCF input.

Figure 1 shows a process in which four different inputs – inputs A, B, C and D – are processed together to produce fuels A, B and C. If a fuel producer replaces 50 % of input D with the RFNBO equivalent, as in the example, the total relevant energy input into the process is reduced to the amount stoichiometrically required for the conversion of the RFNBO. Consequently, only 50 % of inputs A, B and C is needed.

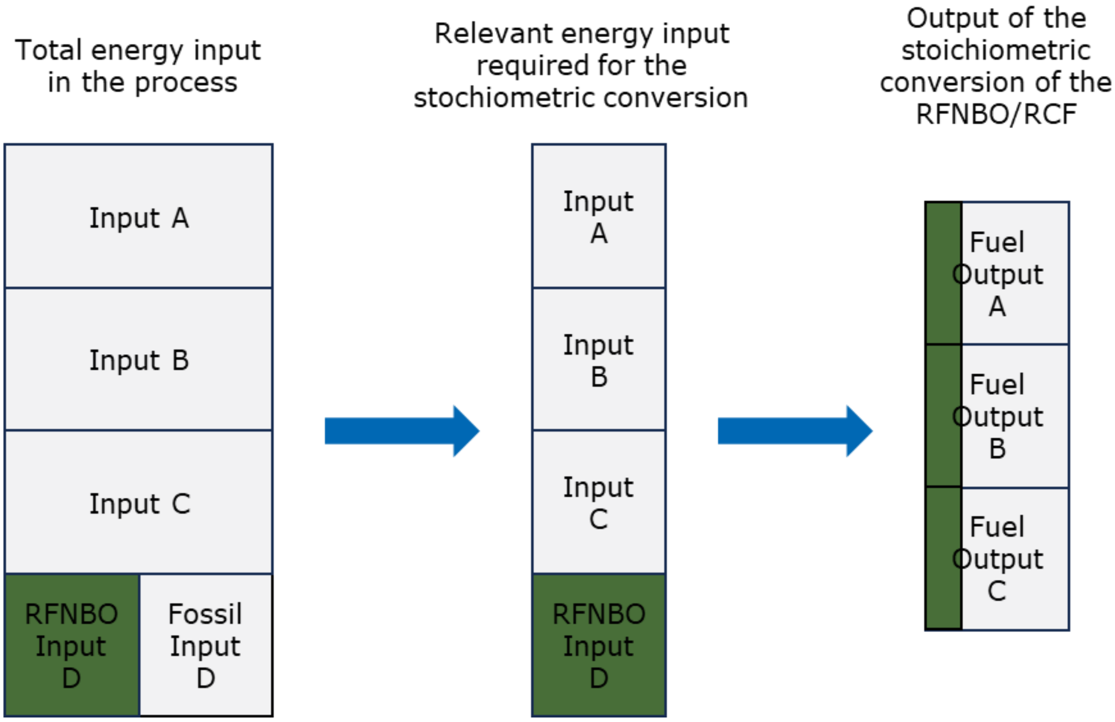

Figure 1: A depiction of the treatment of co-processes.

In the case of a co-process, the total emissions from the use of the fuel must be calculated in accordance with formula 23. The emissions of all the fuel types resulting from the process must be assumed to be the same. The emissions from the supply of inputs (e_i) must therefore be taken into account on the basis of the corresponding energy share of the input to the process. Only the emissions from fuel combustion during end use must thereafter be added on a fuel specific basis (section7.8).

If the co-process results in one or more fuels and by-products, then the rules for allocation must be followed (section 7.12).

$$E_{fuel} = \sum_n S_n \cdot e_{i,n} + e_p + e_{td} + e_u - e_{ccs}$$ formula 23

where:

$$S_n = \frac{\varepsilon_{n,in}}{\varepsilon_{educts}}$$ formula 24

$\mathbf{E_{fuel}}$	Total emissions from the use of the fuel in [gCO_2eq/MJ]
$\mathbf{S_n}$	Relevant energy share of the input
$\mathbf{\varepsilon_{n,in}}$	Relevant energy input by the input n [MJ]
$\mathbf{\varepsilon_{educts}}$	Total relevant energy input of the process for the stoichiometric conversion of the RFNBO/RCF input in [MJ].
$\mathbf{e_{i.n}}$	Total relevant energy input of the process in [MJ].
$\mathbf{e_p}$	Emissions from processing in [gCO_2eq/MJ]
$\mathbf{e_{td}}$	Emissions from transport and distribution in [gCO_2eq/MJ]
$\mathbf{e_u}$	Emissions from combusting the fuel in its end-use [gCO_2eq/MJ]
$\mathbf{e_{ccs}}$	Emission savings from carbon capture and geological storage in [gCO_2eq/MJ]

7.14 Determining the GHG savings potential by the last interface

The GHG savings potential of the RFNBO or RCF must be calculated according to formula 25 using the fossil fuel comparator specified in Delegated Regulation (EU) 2023/1185.

$$\Delta E = \frac{E_F - E}{E_F} \cdot 100\ \%$$ formula 25

$\mathbf{\Delta E}$	GHG savings potential of the RFNBO or RCF in %
$\mathbf{E}$	Total emissions from the use of the fuel in [gCO_2eq/MJ]
$\mathbf{E_F}$	Total emissions from the fossil fuel comparator (94 gCO_2eq/MJ)

8 Mass balancing requirements

The requirements for mass balancing in the REDcert-EU scheme can be found in the document "Scheme principles for mass balancing". They must also be fulfilled in the context of RFNBO and RCF certification.

8.1 Sustainability characteristics to be documented

Information on the sustainability characteristics of the relevant energy input, intermediate product and final 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 during each phase. Sustainability characteristics transferred from one company 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 phase (if applicable) and passed on to the next phase:

- name of voluntary scheme and certificate number
- proof of sustainability number
- fuel type
- country of fuel production
- GHG emissions data (including E, $E_{fuel,ex\text{-}e_u}$ and the relevant formula elements)
- 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

8.2 Tracing information to be documented

To be able to trace a consignment 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) and energy of the consignment

8.3 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.

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

As the methodology for determining the total emissions from the use of the fuel allows averaging GHG emissions for values that have been calculated for individual time intervals up to a period of one month, as long as the individual values meet the minimum savings threshold of 70 %, a single PoS can be issued for the total amount of fuel whose emissions have been averaged over this period.

9 Electricity-fuel balance

While all economic operators must introduce a mass balance system in accordance with the REDcert-EU "Scheme principles for mass balancing", fuel producers that use partly and/or fully renewable electricity as relevant energy input must additionally introduce a documentation system that represents an electricity-fuel balance for the RFNBO production step. This balance must be kept in accordance with the requirements on temporal correlation (section 4.4)[18].

[18] Therefore, a negative balance is not allowed at any time.

This requires documentation of the following electricity and fuel quantities:

- the amount of electricity sourced from the grid that does not count as fully renewable (partly renewable) as well as the proportion of renewable electricity
- the amount of electricity that counts as fully renewable because it has been obtained from a direct connection to an installation generating renewable electricity
- the amount of electricity that counts as fully renewable because it was sourced in a bidding zone where the average proportion of renewable electricity is greater than 90%
- the amount of electricity that counts as fully renewable as it meets the conditions from the section "Power purchase agreement and electricity emission intensity < 18 gCO_2eq/MJ".
- the amount of electricity that counts as fully renewable because it meets the requirements set out in the sections "Additionality condition", "Temporal correlation conditions" and "Geographic correlation conditions"
- the amount of electricity that counts as fully renewable as it meets the conditions in the section "Electricity consumption during an imbalance settlement period"
- the amount of fuel that meets the requirements for the production of RFNBO as well as the amount of fuel that does not meet the requirements for the production of RFNBO (called non-RFNBO)

In addition, fuel producers must document the amount of renewable electricity generated by installations producing renewable electricity. This applies regardless of whether the installations are directly connected to an electrolyser and regardless of whether the renewable electricity is used for the production of the RFNBO or for other purposes.

The fuel producer must ensure that the amount of electricity and the amount of fuel is measured using suitable calibrated metering systems. In addition, the fuel producer must ensure that the producer of the renewable electricity provides the information on the amount of electricity fed into the grid, which is made available to the fuel producer in accordance with the renewables power purchase agreement, at the intervals required to fulfil the temporal correlation.

If the fuel producer concluded one or more renewables power purchase agreements with economic operators that generate renewable electricity, the amount of electricity received must be assigned to the corresponding installation generating renewable electricity specified in the associated power purchase agreement.

If the fuel producer uses a storage asset that is charged in accordance with the requirements on temporal correlation, the fuel producer must introduce an individual electricity balance for that storage asset. Once the electricity is stored in the storage asset and the compliance with the temporal correlation has been demonstrated, the electricity can be used flexibly to produce RFNBO. However, the electricity drawn from the storage asset must then also be documented in the electricity-fuel balance.

Assuming a fuel producer sources electricity from an installation generating renewable electricity and is additionally connected to the electricity grid to ensure constant electricity supply, the documentation must contain at least the information given in the example.

Time period 01. January – 31. January				
Type of electricity	**Amount [Mwh]**	**Amount [MJ]**	**Amount of H_2 [MJ]***	**Type of fuel**
Partially renewable (grid contention) 80 % share renewable	80	0.288×10^6	0.187×10^6	RFNBO
	20	0.072×10^6	$0{,}047 \times 10^6$	non-RFNBO
Fully renewable (direct connection)	1000	3.60×10^6	2.34×10^6	RFNBO
Total amount of RFNBO [MJ]	2.527×10^6			
Total amount of non-RFNBO [MJ]	$0{,}047 \times 10^6$	*assumed conversion factor 1.54 $MJ/MJ_{hydrogen}$		

If the electricity produced must be consumed within the same one-hour period, the information must be documented per hour.

The categorisation whether the fuel can be classified as RFNBO or non-RFNBO in this example is based on the electricity type. Please bear in mind that the RFNBO must also fulfil the requirement on the minimum GHG emission savings.

The table shown is merely an example and therefore not a mandatory type of documentation. Fuel producers can create their own documentation structure, provided that the required information is included.

Fuel producers must provide the auditor with their electricity-fuel balance in advance of the planned audit.

10 Requirements for neutral inspections

The requirements for neutral inspection in the REDcert-EU scheme can be found in the document "Scheme principles for neutral inspections". They must also be applied in the context of RFNBO and RCF certification.

Apart from the requirements set out in this document, auditors shall use the "*Q&A for the certification if RFNBOs and RCF*" published on the voluntary schemes homepage[19] of the European Commission as guidance. When the guidance in the Q&A document is updated, auditors must familiarise themselves with the updates and take the new guidance into account when conducting audits.

10.1 Scope of certification

The scope of certification for fuel producers can vary depending on their organisation structure, but in general each fuel producer requires a single certification. A distinction must be made between fuel producers engaged in only a specific activity (e.g. electrolysis) and fuel producers which combine two or more processes and so constitute compound systems (e.g. electrolysis, CO_2 source and fuel production all in one site).

In the event of a compound system, a distinction must be made between one joint legal entity and a number of separate legal entities. If the installations within a compound system are separate legal entities, the scope of certification must be chosen for each legal entity, i.e. in accordance with the activity in which the legal entity in question is engaged. If the installations within the compound system exist as one legal entity, that compound system can be considered as a whole. However, the fuel producer must set up a mass balance system that satisfies the requirements in the document "Scheme principles for mass balancing" for each installation, calculate the GHG emissions individually for each installation and in line with the requirements described in this document, and provide proof of scheme compliance for each installation.

The certificate that constitutes proof of scheme compliance and specifies the scope of certification is issued (for the specific activity or the compound system) following a positive decision by the certification body.

[19] voluntary schemes homepage

10.2 Certification of points of origin

Points of origin may be certified by means of either individual certification or group certification. Following the successful completion of the certification process for individual certification, the point of origin receives a separate certificate. Certification must be conducted in line with the scheme principles for neutral inspections.

Without an individual certificate, the point of origin is obliged, to prove its compliance with the requirements set out in section 3.3 and must consent to periodic inspections by a REDcert-recognised certification body by means of a signed self-declaration. If a fuel producer sources material streams from only one point of origin, which has transmitted a signed self-declaration for the specific material stream, that point of origin may be included in the fuel producer’s certification process. If a fuel producer sources material streams from more than one point of origin, the certification process for that group of points of origin can pursue the group-certification approach, provided the fuel producer assumes the role of group manager (as described in the scheme principles for neutral inspections). Group certification must be conducted in line with the scheme principles for neutral inspections.

10.3 Qualification of auditors

In addition to the requirements placed on auditors in section 7 of the scheme principles for neutral inspections, the following requirements in particular must be satisfied by auditors conducting inspections in the area of recycled carbon fuels and/or renewable liquid and gaseous transport fuels of non-biological origin:

- a minimum of two years’ experience in fuel life-cycle assessment
- experience in auditing GHG emission calculations in accordance with the methodology set out in Annexes V and VI to Directive (EU) 2018/2001
- knowledge of the requirements of Delegated Regulation (EU) 2023/1184 and Delegated Regulation (EU) 2023/1185
- experience in ecology, natural science, engineering, energy management or a related field

11 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 mass balancing	
3	Scheme principles for neutral inspections	
4	Scheme principles for integrity management	
5	Interphase-specific checklists	
6	Definitions in the REDcert-EU scheme	

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.

12 Annex

12.1 Relevant legislation

Directive (EU) 2018/2001	Link
Directive (EU) 2023/2413	Link
Delegated Regulation (EU) 2023/1184	Link
Delegated Regulation (EU) 2023/1185	Link
Implementing Regulation (EU) 2022/996	Link
Directive 2008/98/EC	Link

12.2 Criteria effective carbon pricing system

Accounting upstream in an effective carbon pricing system means that the emissions are subject to a carbon price when the RFNBOs or RCF is first produced. For example, when emissions from an industrial process are subject to carbon pricing when captured and used to produce an RFNBO or RCF (e.g., e-kerosene). By contrast, downstream accounting means carbon pricing is only applied where the emissions are finally released into the atmosphere from the RFNBO or RCF (e.g. when the e-kerosene is used in aviation).

As concerns what is an *effective carbon pricing system* according to the "*Q&A for the certification if RFNBOs and RCF*", the system must meet minimum criteria ensuring effective enforcement, so each tonne emitted is paid for:

- have a robust monitoring, reporting and verification (MRV) process
- be binding on its participants
- be stable
- apply the carbon price at least on the whole sector producing RFNBO or RCF
- ensure stringent enforcement
- be government-led.

In addition, the design features of the system need to ensure that the carbon price is effective in achieving its purpose of leading to emission reductions in line with climate neutrality:

- in the case of an emission trading system (ETS): with an absolute and ultimately declining cap aligned with the climate neutrality target of the country for achieving the country's Paris-aligned nationally determined (NDC).
- in the case of a tax: with an increasing trajectory aligned with the climate neutrality target of the country for achieving the country's Paris-aligned NDC.
- for both an ETS and a tax: without design features which render the cap or tax ineffective.

12.3 Examples

12.3.1 Use of fully renewable and partially renewable electricity

Fuel producers may combine different options to source renewable electricity provided the way electricity is sourced is fully documented in line with the requirements set out in section 9 of this document. This also applies for electricity sourced during the same time interval. For each way of sourcing electricity, the dedicated rules apply. However, electricity always counts either as fully renewable or as partially renewable.

Figure 2 shows an example of an electrolyser that sources fully renewable electricity via a direct line and partially renewable electricity from the grid. For such a setup, two options for running the electrolyser are possible. Option 1 is the batch production, in which dedicated RFNBO-H_2 is produced using fully renewable electricity. Only when the installation generating renewable electricity is not producing, the fuel producer sources electricity from the grid. Option 2 is the combination of fully renewable electricity with partially renewable electricity and therefore, no dedicated production of RFNBO-H_2 is performed.

Independent of whether option 1 or option 2 is applied, if the electrolyser is fed with 50 % electricity that counts as fully renewable and 50 % electricity that is only 40 % renewable, 70 % of the total hydrogen produced will be renewable (RFNBO-H_2). The remaining 30 % cannot be made renewable by applying the rules of the Delegated Regulation (EU) 2023/1184 (non-RFNBO-H_2). The remaining 30 % may count as low carbon hydrogen under the forthcoming certification framework planned in the hydrogen and gas markets decarbonisation package.

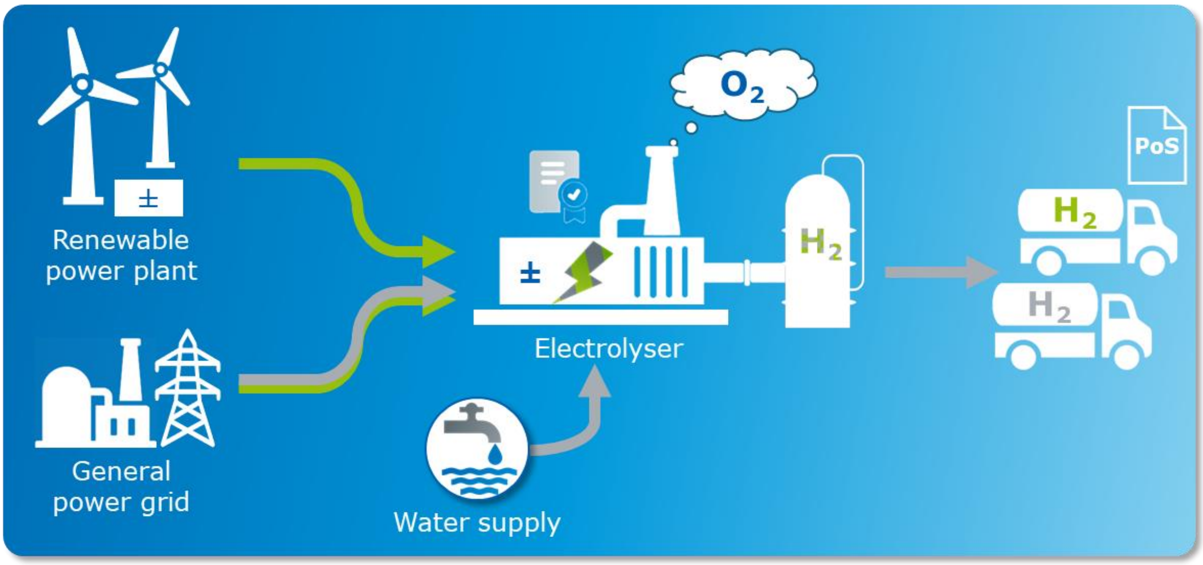

Figure 2: Example of an electrolyser producing hydrogen using either fully renewable electricity or partially renewable electricity.

When determining the GHG emissions, the option for the production chosen by the fuel producer is important. The calculation for both options is shown below.

Option 1: Assuming a case in which the fuel producer produced 130 MJ RFNBO-H_2 using 200 MJ fully renewable electricity and 130 MJ hydrogen using 200 MJ partially renewable electricity with a renewable share of 40 %. It can be demonstrated that no "mixing" of the different electricity types took place during hydrogen production and that hydrogen was therefore produced in definable batches. Furthermore, it is assumed that the fuel producer operates in a bidding zone where the emission factor for electricity is reported to be 10 gCO_2eq/MJ. The water is supplied directly from a regional water pipeline and is deionised before it is fed into the electrolyser. It is assumed that the energy required for the water upgrading facility is directly connected to the installation generating renewable electricity. Hence, the emission factor $e_{i,water}$ is assumed to be zero. The emissions from processing (e_p) come to 1.2 gCO_2eq/MJ, and the emissions from transport and distribution (e_{td}) amount to 0.5 gCO_2eq/MJ.

The fuel fractions produced using fully renewable electricity and those produced using partially renewable electricity need to be considered separately from one another.

For RFNBO-H_2 produced using fully renewable electricity, an emission factor of zero can be assumed for the electricity used. Therefore, the total emissions from the use of the fuel (E) and the greenhouse gas emission savings (ΔE) are calculated as follows:

$$E = e_i + e_p + e_{td} + e_u - e_{ccs}$$

$$E = 0\ \frac{gCO_2eq}{MJ} + 1.2\ \frac{gCO_2eq}{MJ} + 0.5\ \frac{gCO_2eq}{MJ} + 0\ \frac{gCO_2eq}{MJ} - 0\ \frac{gCO_2eq}{MJ} = 1.7\ \frac{gCO_2eq}{MJ}$$

$$\Delta E = \frac{94\ \frac{gCO_2eq}{MJ} - 1.7\ \frac{gCO_2eq}{MJ}}{94\ \frac{gCO_2eq}{MJ}} = 0.98 \rightarrow 98\ \%$$

The use of the hydrogen produced using fully renewable electricity leads to a GHG emission reduction of 98 %.

For RFNBO-H_2 produced using partially renewable electricity, the emissions in respect of the electricity used to enhance the heating value need to be taken into account in accordance with the method chosen (section 7.6).

Therefore, the total emissions from the use of the fuel (E) and the greenhouse gas emission savings (ΔE) are calculated as follows:

$$E = e_i + e_p + e_{td} + e_u - e_{ccs}$$

$$e_i = e_{elastic} + e_{rigid} - e_{ex\text{-}use}$$

$$e_i = \frac{10\ \frac{gCO_2eq}{MJ} \cdot 200\ MJ}{130\ MJ} + 0\ \frac{gCO_2eq}{MJ} - 0\ \frac{gCO_2eq}{MJ} = 15.4\ \frac{gCO_2eq}{MJ}$$

$$E = (15.4 + 1.2 + 0.5 + 0 - 0)\ \frac{gCO_2eq}{MJ} = 17.1\ \frac{gCO_2eq}{MJ}$$

$$\Delta E = \frac{94\ \frac{gCO_2eq}{MJ} - 17.1\ \frac{gCO_2eq}{MJ}}{94\ \frac{gCO_2eq}{MJ}} = 0.82 \rightarrow 82\ \%$$

The use of the hydrogen produced using partially renewable electricity leads to a GHG emission reduction of 82 %. However, because of the use of partially renewable electricity with a renewable share of 40 %, only 40 % (S_{RFNBO} = 0.4) – i.e. only 52 MJ – can be sold as RFNBO-H_2.

Option 2: Assuming the same conditions as described for option 1, but in this example the fuel producer has produced 130 MJ hydrogen using 100 MJ fully renewable electricity and 100 MJ partially renewable electricity that is fed into the electrolyse at the same time. Therefore, no batch production was performed.

As set out in section 7.12, if the total amount of fuel resulting from a process consists of a mixture of fuels (in this example RFNBO and non-RFNBO), the same GHG emission intensity must be assumed for all fuels resulting from the process. Therefore, a separate consideration of the fuels produced is not possible.

Therefore, the total emissions from the use of the fuels (E) and the greenhouse gas emission savings (ΔE) are calculated as follows:

$$E = e_i + e_p + e_{td} + e_u - e_{ccs}$$

$$e_i = e_{elastic} + e_{rigid} - e_{ex\text{-}use}$$

$$e_i = \frac{(10\ \frac{gCO_2eq}{MJ} \cdot 100\ MJ + 0\ \frac{gCO_2eq}{MJ} \cdot 100\ MJ)}{130\ MJ} + 0\ \frac{gCO_2eq}{MJ} - 0\ \frac{gCO_2eq}{MJ} = 7.7\ \frac{gCO_2eq}{MJ}$$

$$E = (7.7 + 1.2 + 0.5 + 0 - 0)\ \frac{gCO_2eq}{MJ} = 9.4\ \frac{gCO_2eq}{MJ}$$

$$\Delta E = \frac{94\ \frac{gCO_2eq}{MJ} - 9.4\ \frac{gCO_2eq}{MJ}}{94\ \frac{gCO_2eq}{MJ}} = 0.90 \rightarrow 90\ \%$$

The use of the hydrogen produced using the “mix” of partially renewable and fully renewable electricity leads to a GHG emission reduction of 90 %. However, because the overall renewable electricity share is 70 %, only 70 % (S_{RFNBO} = 0.7) – i.e. only 91 MJ – can be sold as RFNBO-H_2.

12.3.2 Producing RFNBO-diesel from methanol and hydrogen

Figure 3 shows a possible production pathway for RFNBO-diesel. In the process methanol is converted to diesel via olefin synthesis (with dimethyl ether as an intermediate step). For this, the fuel producer first performs an olefin synthesis in an external operating site (therefore individual certification) and afterwards the olefin oligomers are hydrogenated using RFNBO-H_2. However, it is assumed that both operating sites are run by the same fuel producer.

For the olefin synthesis, the fuel producer sources RFNBO-methanol from overseas and RFNBO-H_2 from a local certified fuel producer. The methanol demand for the production of diesel is considered to be 1.2 $MJ_{methnaol}/MJ_{diesel}$ and the hydrogen demand is considered to be 0.025 $MJ_{hydrogen}/MJ_{diesel}$.

It is assumed that the emissions from processing are 6 gCO_2eq/MJ and that final fuel is the transported by truck with the following specifications:

Payload	27 t	**Tank**	2 t
Loading	25 t	**Distance**	550 km
Fuel type	Fossil diesel	**EF_{fuel}**	95.1 gCO_2eq/MJ
Efficiency	0.87 MJ/t.km	**LHV_{diesel}**	43.1 MJ/kg

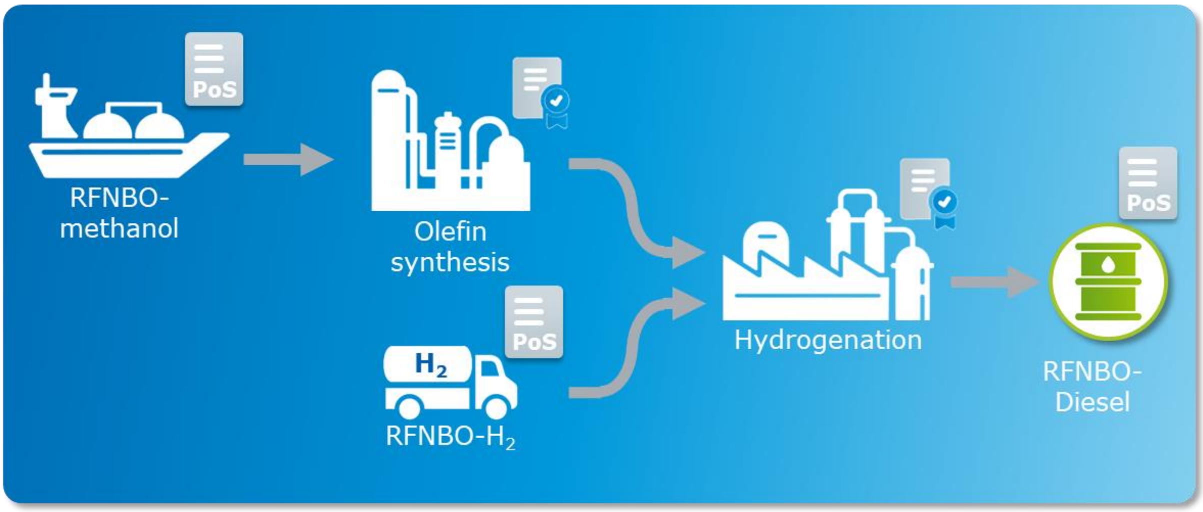

Figure 3: Example of a possible RFNBO-diesel production pathway in which RFNBO-methanol and RFNBO-H_2 are used at the end of the value chain to produce the final fuel.

Calculating emissions from supply of inputs

The upstream emissions reported for methanol and hydrogen must be transformed from $gCO_2eq/MJ_{methanol}$ and $gCO_2eq/MJ_{hydrogen}$ to gCO_2eq/MJ_{diesel} using the fuel feedstock factor (described in section 7.11). As both RFNBO are considered to be the relevant energy inputs to the diesel synthesis, the emissions must be assigned to the formula element $e_{i,elastic}$.

The delivery sheets for the RFNBO-methanol and RFNBO-H_2 provide the following data:

	Methanol [$gCO_2eq/MJ_{methanol}$]	**Hydrogen** [$gCO_2eq/MJ_{hydrogen}$]
E	4.8	1.7
$E_{fuel,ex\text{-}e_u}$	-64.1	1.7
e_i	-72.8	0
e_p	6.0	1.2
e_{td}	2.7	0.5
e_u	68.9	0
e_{ccs}	0	0

The calculation from the supply of inputs must be carried out on the basis of the total emissions from the use of the fuel excluding the formula element e_u ($E_{fuel,ex\text{-}e_u}$).

$$e_{i,elastic} = -64.1 \frac{gCO_2eq}{MJ_{methanol}} \cdot 1.2 \frac{MJ_{methanol}}{MJ_{diesel}} + 1.7 \frac{gCO_2eq}{MJ_{hydrogen}} \cdot 0.025 \frac{MJ_{hdrogen}}{MJ_{diesel}} = -71.3 \frac{gCO_2eq}{MJ_{diesel}}$$

As the emissions from rigid inputs and the emissions from the inputs' existing use or fate are zero, the following applies: $e_i = e_{i,elastic}$

Calculating emissions from transport and distribution of the final fuel

As described in section 7.9 formula 15 can be used to calculate e_{td}. Based on the details given above, the calculation must be carried out as follows:

$$e_{td} = \frac{27\ t \cdot 550\ km \cdot (0.87 \frac{MJ}{t.km} \cdot 95.1 \frac{gCO_2eq}{MJ})}{25\ t \cdot 1000 \frac{kg}{t} \cdot 43.1 \frac{MJ}{kg}} = 1.1 \frac{gCO_2eq}{MJ}$$

Calculating total emissions from the use of the fuel and GHG emission savings

According to the Annex Part B of the Delegated Regulation (EU) 2023/1185, the combustion emissions for diesel are 73.2 gCO_2eq/MJ. Therefore, the the total emissions from the use of the diesel (E) and the greenhouse gas emission savings (ΔE) are calculated as follows:

$$E = e_i + e_p + e_{td} + e_u - e_{ccs}$$

$$E = (-71.3 + 6.0 + 1.1 + 73.2 - 0)\ \frac{gCO_2eq}{MJ} = 9.0\ \frac{gCO_2eq}{MJ}$$

$$\Delta E = \frac{94\ \frac{gCO_2eq}{MJ} - 9.0\ \frac{gCO_2eq}{MJ}}{94\ \frac{gCO_2eq}{MJ}} = 0.90 \rightarrow 90\ \%$$

After the overall production of the final fuel, the use of the diesel leads to a GHG emission reduction of 90 %. Since only RFNBO are used as relevant energy input, 100 % of the diesel can be classified RFNBO-diesel.

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