Department for Transport

RTFO Guidance for Renewable Fuels of Non-Biological Origin

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Contents

1. Introduction

Guidance Scope

1.1 This document contains supplementary guidance specific to Renewable Fuels of Non-Biological Origin (RFNBOs), explaining how RFNBOs are defined and treated under the RTFO and how additionality can be demonstrated in the context of renewable electricity used as an energy input. This guidance should be read in conjunction with the wider guidance of the RTFO scheme.

1.2 Queries or comments should be directed to the Department for Transport's (DfT's) RTFO Unit at rtfo-compliance@dft.gov.uk.

Definition of RFNBOs

1.3 RFNBOs are renewable liquid or gaseous transport fuels for which none of the energy content of the fuel comes from biological sources. These fuels are considered renewable where the energy content of the fuel comes from renewable energy sources[1] but excluding bioenergy. This means that RFNBOs could be made using electricity and/or heat from wind, solar, aerothermal, geothermal or water (including hydrothermal sources, waves and tides). RFNBOs cannot be derived from bioenergy sources and therefore would not be able to be derived from biomass, landfill gas, sewage treatment plant gas or biogases. As the available energy source of RFNBOs comes from electricity or heat, the input raw materials must contain no usable energy. In practice this means that RFNBOs must be made from either water and/or carbon dioxide (CO_2).

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

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

petrol, kerosene and diesel. It can also be reacted with nitrogen through the Haber process to produce renewable ammonia.

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

1.6 If the CO_2 is generated from fossil energy sources specifically for the purposes of producing transport fuel, this CO_2 must be accounted for as fossil CO_2 emissions in the reported carbon intensity of the RFNBO (see paragraph 3.13). Upstream supply-chain emissions associated with extracting, refining and transporting the fossil energy source must also be accounted for.

1.7 Where non-waste biogenic CO_2 is used to produce a RFNBO, the biomass used to produce the biogenic CO_2 is considered to be a feedstock. This feedstock must not have been generated specifically for the purpose of converting it into a fuel for use in transport. This means that:

- the biomass source must be a waste or residue and must meet the relevant sustainability criteria as set out in Chapters 7 and 9 of the RTFO Compliance Guidance – for example, forestry residues must meet the forest criteria
- any and all supply-chain emissions associated with the cultivation, collection, extraction and transport of the biomass source must be accounted for in the carbon intensity of the RFNBO

1.8 When a fuel is produced without biological feedstocks using a mixture of renewable (non-bioenergy) energy and non-renewable (and/or bioenergy[2]) energy, the resulting fuel is a part RFNBO, part non-RFNBO. Chapter 2 explains how to determine the renewable portion of a RFNBO.

Eligibility for RTFCs

1.9 The renewable portion of a RFNBO which meets the sustainability criteria is eligible for Renewable Transport Fuel Certificates (RTFCs). To apply for RTFCs, suppliers must also meet the wider requirements of the RTFO such as the submission of fuel volumes, carbon and sustainability information, chain of custody requirements and having supplied fuel for use in relevant transport modes in the UK. Suppliers should refer to the RTFO Compliance Guidance for more information.

1.10 Any fuel rewarded under the RTFO must meet the requirements with regards to multiple incentives, outlined in Chapter 6 of the RTFO Compliance Guidance.

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[2] Biomass-derived electricity cannot be used to generate a RFNBO, as the energy content of a RFNBO has to come from non-bioenergy sources. Biomass-derived electricity used in a hydrogen electrolyser therefore generates a hydrogen fuel that is not a fossil fuel, not a biofuel and not a RFNBO. Similarly, nuclear fission-derived electricity cannot be used to generate a RFNBO, as nuclear power is not listed as a renewable energy source, so again, the resulting fuel would neither be a fossil fuel, nor a biofuel, nor a RFNBO.

However, it is permissible for the electricity used in production to have received support, such as through contract for difference (CfD).

1.11 To meet the sustainability criteria, a RFNBO must achieve a 65% greenhouse gas (GHG) emission saving over the whole life-cycle relative to the fossil fuel baseline of 94 gCO_2eq/MJ. This is equivalent to a carbon intensity of 32.9 gCO_2eq/MJ. GHG emissions must be calculated in line with the methodology set out in Chapter 3.

1.12 RFNBOs are not required to meet the land criteria. This means that the following sustainability data is not required:

- whether the fuel met a voluntary scheme that covers the land criteria (though voluntary schemes that cover, for example, the GHG calculation or the chain of custody may be relevant)
- the land use on 1 January 2008

1.13 Should a consignment of RFNBO fail to meet the sustainability criteria then this volume will not be eligible for RTFCs. Moreover, this volume of unsustainable fuel will be added to the supplier's fuel supply from which its obligation is calculated, provided the supplier exceeds the reporting threshold (see the RTFO Compliance Guidance).

1.14 Under the RTFO, consignments of fuel must be reported on an individual feedstock basis (see the RTFO Compliance Guidance). For RFNBOs, the feedstock should be reported as the energy source (e.g. wind power or geothermal energy). Where a mix of non-bioenergy renewable electricity sources have been used in the production of a consignment of RFNBO, it is permissible to report the feedstock as “Renewable electricity mix (non-bioenergy)”. Care must be taken to ensure that the bioenergy is not counted within this mix.

1.15 In line with the treatment of other fuels under the RTFO, suppliers must, on request by the Administrator, be able to provide evidence of a complete chain of custody for a given consignment of fuel from feedstock up to the assessment point. This chain of custody must follow the principles of mass balance. Suppliers can meet this requirement by reporting through a recognised voluntary scheme or by setting up their own chain of custody. More information is provided in the RTFO Compliance Guidance.

1.16 RFNBOs can be classified as development fuels and be eligible for double reward of development RTFCs (dRTFCs) if they meet the criteria set out in Chapter 4 of the RTFO Compliance Guidance.

1.17 Some RFNBOs are eligible for specific reward reflecting their energy content. Specific multipliers and RTFC reward rates are outlined in Chapters 1 and 6 of the RTFO Compliance Guidance.

2. Determining the portion of the fuel that is a RFNBO

General conditions

2.1 RFNBOs are generally made using renewable electricity as the energy source. The proportion of the fuel that is considered renewable depends on the electricity it is derived from and whether it meets the criteria for additionality[3] or regionalisation[4] described in this Chapter (paragraphs 2.14 & 2.16). These scenarios are summarised in Table 1 and a flow diagram is provided in Figure 1.

2.2 If a fuel is made using heat rather than electricity and not all of the heat is from non-bioenergy renewable sources, the amount of eligible RFNBO produced should be calculated as follows:

$$\text{MJ of RFNBO} = \frac{\text{MJ of renewable (non-bioenergy) inputs}}{\text{MJ of all energy inputs}} \times \text{MJ of fuel produced}$$

2.3 The default position where a fuel is made using electricity is that the RFNBO portion of the fuel is equal to the proportion of supply from non-biomass renewable sources in the national grid they are drawing electricity from (Scenario 1, Table 1). This should be calculated using either:

- annual grid averages from the relevant competent authority[5] for the most recent available full year

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

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

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

- real-time figures for each 30-minute period, where this data, and the corresponding whole life-cycle carbon intensity (see paragraphs 3.17 & 3.19), is available from a reliable and authoritative sources[6] (also see paragraph 2.4)

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

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

2.4 Where real-time figures are used, it is permissible to calculate the renewability over periods of continuous production longer than 30 minutes (up to a maximum of 12 months). This average should be weighted based on the electricity consumed in each 30-minute period within the period chosen. The period used should exactly match the period used for determining the weighted average carbon intensity of the electricity consumed (see paragraph 3.16).

2.5 There are three exceptions to the default position set out in paragraph 2.3:

- if a production site is connected to an electricity grid that meets the criteria for regionalisation (paragraph 2.14) then the RFNBO portion of the fuel produced at that site is calculated in the same way as described in paragraph 2.3 but for the regional rather than national grid (Scenario 2, Table 1)
- if the renewable electricity meets the criteria for additionality (paragraph 2.16) then it can be considered additional renewable electricity and the RFNBO portion of the fuel should be calculated as described in paragraph 2.8 (Scenario 3, Table 1)
- if the renewable electricity is not from new generation capacity (paragraph 2.19[7]) but otherwise meets the criteria for additionality (paragraph 2.16) and associated evidence requirements (Table 2) then it can be considered 100% renewable and the RFNBO portion of the fuel should be calculated as described in paragraph 2.8 (Scenario 4, Table 1)[8]

2.6 It is also permitted to produce a consignment of RFNBO using a portion of electricity which meets the criteria for additionality (Scenario 3, Table 1) and a portion of electricity not from new generation capacity but which otherwise meets the criteria for additionality (Scenario 4, Table 1). This mix of Scenario 3 and Scenario 4 is labelled Scenario 5 in Table 1. To make use of this scenario, the following conditions apply:

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[6] The RTFO Administrator is not currently aware of any robust data sources that provide the necessary real-time data on both the share of non-bioenergy renewables as well as the whole life-cycle carbon intensity taking into account direct generation, well-to-tank and transmission and distribution emissions (see paragraph 3.17). The RTFO Administrator will keep this position under review as new data sources emerge.

[7] As per paragraph 2.19, new generation capacity in the context includes new, upgraded, life-extended or recommissioned sites.

[8] Note that Scenario 4 cannot be utilised where there is no grid connection.

- the carbon intensity of the electricity used to produce the RFNBO must be calculated based on a weighted average carbon intensity (paragraph 3.18) over the period chosen by the supplier
- the weighted average should be calculated over the one single period of continuous operation and for the same production facility[9]
- the maximum period over which the weighted average can be calculated is 12 months
- the finished fuel must meet the 65% greenhouse gas (GHG) emissions saving requirement (paragraph 1.11)

2.7 The GHG emissions associated with the renewable energy consumed must be taken into account when calculating the overall GHG emissions of the RFNBO following the methodology set out in Chapter 3. The factor to be used for each scenario is set out in Table 1 and is zero for wholly additional renewable electricity. See paragraphs 3.14 & 3.15 for more details.

2.8 Where additionality is demonstrated for all of the electricity consumed and all of that electricity is derived from non-bioenergy renewable sources, the fuel can be considered to be 100% RFNBO. Where some of the electricity input is derived from non-renewable or bioenergy sources, the amount of eligible RFNBO produced should be calculated using the following equation:

$$\text{MJ of RFNBO} = \frac{\text{MJ of renewable (non-bioenergy) inputs}}{\text{MJ of all energy inputs}} \times \text{MJ of fuel produced}$$

2.9 In some situations, the criteria for additionality may only be met for a proportion of the electricity supplied, for example where an electricity production site provides insufficient electricity to the grid to meet the demand from the RFNBO production site (as calculated in paragraph 2.24). In such cases, the RFNBO fuel should be divided into two consignments proportional to the amount of electricity supplied that meets the additionality criteria (Figure 1). The consignment derived from electricity which doesn't meet the additionality criteria should revert to using grid average figures for determining renewability (Scenarios 1 or 2 in Table 1).

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

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

2.12 Renewability can be re-assigned between different consignments of the same chemically identical product made from a part RFNBO, part non-RFNBO process, as

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

for partial biofuels (see Chapter 4 of the RTFO Compliance Guidance). Renewability cannot be assigned between chemically different products.

2.13 Each consignment of each product must be sold with the correct renewability information. For example, any non-renewable portion must not be sold as renewable fuel. See Chapter 10 of the RTFO Compliance Guidance for more details. This information must match any reassignment which has occurred following paragraph 2.12.

Scenario	Description of electricity supply	Methodology for calculating RFNBO portion	GHG intensity of the electricity consumed	Evidence requirements
1	Electricity drawn from a national grid, no additionality or regional grid demonstrated	Proportional to the percentage supply from non-bioenergy renewables in the national grid	Grid average or real-time GHG intensity (national)	Evidence of connection to and electricity supply from the national grid
2	Electricity drawn from a regional grid, no additionality demonstrated	Proportional to the percentage supply from non-bioenergy renewables in the regional grid	Grid average or real-time GHG intensity (regionalised)	Evidence of connection to and electricity supply from the relevant regional grid
3	Electricity that meets the criteria for additionality	Proportional to the renewable (non-bioenergy) electricity used in production (paragraph 2.8)	Zero	Evidence of additionality relevant to the specific case (see paragraph 2.18)
4	Electricity that meets cases B or C in the criteria for additionality (paragraph 2.17) except it is not from new generation capacity (paragraph 2.19)[10]	Proportional to the renewable (non-bioenergy) electricity used in production (paragraph 2.8)	Grid average or real-time GHG intensity (national or regional as appropriate)	Evidence of additionality relevant to the specific case (see paragraph 2.18), excluding paragraph 2.19
5	A mix of electricity sources, a portion meeting scenario 3, and a portion meeting scenario 4 (see paragraph 2.6)	Proportional to the renewable (non-bioenergy) electricity used in production (paragraph 2.8)	A weighted average of the electricity supplied under the two scenarios (see paragraph 3.18)	As per Scenario 3 and Scenario 4

Table 1 Summary of scenarios for producing RFNBOs using electricity and corresponding renewable portions, GHG intensity and evidence requirements. A flow diagram for determining which scenario applies is provided in Figure 1.

[10] Note that Scenario 4 cannot be applied to cases A or D in Table 2.

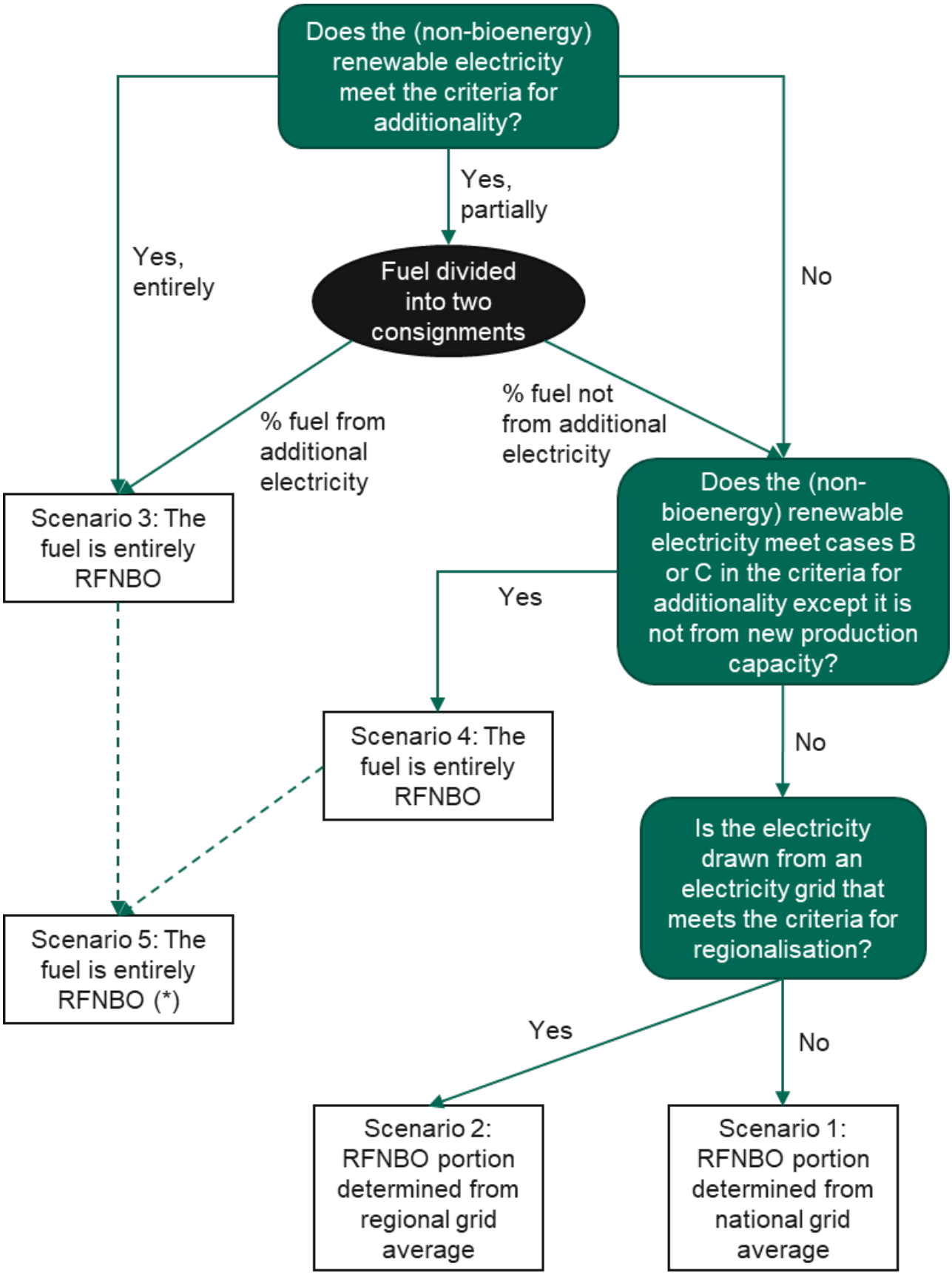

Figure 1 Flow diagram for determining what methodology to use when determining the proportion of a fuel which can be considered a RFNBO. (*) Scenario 5 corresponds to fuel produced from a mix of electricity meeting Scenario 3 and Scenario 4 – see paragraph 2.6.

Criteria for regionalisation

2.14 If the electricity grid a production site is connected to can be reasonably considered under the criteria set out in paragraph 2.15 to be a distinct electricity grid from the relevant national grid, suppliers may use data from that electricity grid rather than the national grid in determining the portion of their fuel which is defined as a RFNBO.

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

a) The relevant competent authority[11] considers and manages the grid in question as a physically separate electricity grid which does not directly reflect national boundaries, as is the case in North America and Northern Ireland.
b) It can be demonstrated that there is no physical connection between the electricity grid that the production site is connected to and the national grid of the country in which the production site it is located.
c) It can be demonstrated that there is a systematic grid congestion which prevents renewable energy generated supplied into a sub-grid from being supplied to the wider national grid.

Criteria for additionality

2.16 The renewable electricity used in RFNBO production is considered to be "additional renewable energy" if the electricity would not have been produced, or would have been wasted, if not consumed by the RFNBO production site. Suppliers can demonstrate that their process is consuming additional renewable energy if they can provide evidence to satisfy one of the criteria listed in paragraph 2.17.

2.17 Renewable electricity meets the criteria for additionality if it meets one of the following cases (subject to also meeting the conditions and evidence requirements outlined in paragraphs 2.18-2.27 and Table 2):

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

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

d) **Curtailment and wastage:** The renewable electricity used is electricity which would have led to curtailment or been wasted if not consumed by the RFNBO production site.[12]
e) **Other:** The supplier can provide evidence relating to a case not specified above that satisfies the Administrator that the renewable electricity is additional.

2.18 The specific conditions and evidence requirements for cases a to d described in paragraph 2.17 are summarised in Table 2 and described in paragraphs 2.19-2.27. The evidence requirements for case E will depend on the specific situation and will be at the discretion of the Administrator.

Case	New generation capacity (Par. 2.19)	Temporal correlation (Par. 2.21)	Purchase agreement (Par. 2.23)	Grid losses (Par. 2.24)	Grid congestion (Par 2.26)
A - Direct line, no grid connection	✓	✗	✗	✗	✗
B - Direct line, grid connection	✓	✗	✗	✗	✗
C - Additional capacity via an electricity grid	✓	✓	✓	✓	✓
D - Curtailment and wastage	✗	✓	✓	✓	✓

Table 2 Summary of conditions and evidence requirements for each case described in paragraph 2.16

2.19 For cases A to C in paragraph 2.17, a supplier must demonstrate that the renewable electricity consumed is from new generation capacity at a new, upgraded, life-extended or recommissioned site. For new, upgraded or recommissioned sites, evidence should be provided to demonstrate that the new generation capacity came online at the same time or after the RFNBO production site started operating. For life-extended sites, it should be demonstrated that the electricity production site would have ceased being able to operate without investment as a result of demand from the RFNBO production site and that this life-extension was completed at the same time or after the RFNBO production site started operating.

2.20 At the discretion of the Administrator, an exception to paragraph 2.19 may be permitted if it can be demonstrated that there was a clear intention before the new generating capacity came online for the renewable electricity generated, or a portion of it, to be consumed by the RFNBO production site. This could be demonstrated through:

- planning permissions or other appropriate documentation that show that the fuel production plant was intended to start operation before or at the same time as the new generation capacity came online but was delayed due to unforeseen circumstances

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

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

2.21 For cases C and D in paragraph 2.17, temporal correlation between electricity generation and electricity consumption must be demonstrated. This can be demonstrated over a settlement period of up to 30 minutes.[13] For each balancing period it must be demonstrated that the amount of renewable electricity consumed by the RFNBO production site was not more than the renewable electricity supplied by the electricity production site(s) exclusively for use by the RFNBO production site.

2.22 For the purposes of demonstrating temporal correlation (paragraph 2.21), it is permissible to use energy storage such as batteries to buffer the electricity supply because the use of electricity by an on-site energy storage asset would be considered electricity consumption by the RFNBO production plant. However, for any electricity stored rather than immediately consumed by an electrolyser, evidence must be provided to demonstrate that this power was stored in the energy storage asset between the time of consumption from the electricity grid to the time of consumption by the electrolyser.

2.23 For cases C and D in paragraph 2.17 a renewables power purchase agreement (PPA), or equivalent contractual mechanism, must be in place between the electricity producer and the RFNBO producer for an amount of electricity equivalent to the amount that is claimed as additional renewable electricity. Both direct/sleeved and portfolio/aggregated PPAs are permitted. Where the same legal entity operates both the electricity and RFNBO production sites a PPA is not required but equivalent documentation must be provided to demonstrate that the claimed renewable electricity was supplied to the grid exclusively for use by the RFNBO production site and was not consumed or sold for use elsewhere.

2.24 For cases C and D in paragraph 2.17, suppliers must take into account grid technical losses when determining the amount of additional renewable electricity supplied. This means that the corresponding amount of renewable electricity (RE) that needs to be supplied to the grid should be calculated as follows:

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

2.25 For the purposes of paragraph 2.24, suppliers may use a default grid loss factor of 0.1 (i.e. 10%) for UK networks. Alternatively, figures provided by the relevant network operator (or other reliable source) for technical losses may be used.

2.26 For cases C and D in paragraph 2.17, a supplier must be able to demonstrate that there is no systematic grid congestion between the renewable electricity production site(s) and the RFNBO production site.

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[13] Please note that this does not mean that there needs to be one consignment of fuel per 30-minute settlement period. Consignments of fuel simply need to have the exact same sets of 'set of sustainability characteristics' and associated with a particular reporting month or quarter – see Chapter 7 of the RTFO Compliance guidance. Also see paragraph 2.4.

2.27 For cases C and D in paragraph 2.17 where RFNBOs are produced from additional renewable electricity supplied through the electricity grid in a country where a guarantees of origin (GOs) or equivalent system is in place, suppliers must be able to demonstrate evidence of the retirement of any and all certificates associated with the renewable electricity consumed.

3. Greenhouse gas emission methodology for RFNBOs

Overall methodology

3.1 Greenhouse gas (GHG) emissions from the production and use of renewable fuels of non-biological origin (RFNBOs) shall be calculated as follows:

$E = e_{ec} + e_{pp} + e_{td} + e_u - e_{ccs}$

Where:

E = total emissions from the use of the fuel

e_{ec} = emissions from the extraction or collection of raw materials

e_{pp} = emissions from production and processing

e_{td} = emissions from transport and distribution

e_u = emissions from the fuel in use

e_{ccs} = emission saving from carbon capture and storage

3.2 Emissions from the manufacture of machinery and equipment needed for renewable fuel production shall not be taken into account.

3.3 GHG emissions from renewable fuels, E, shall be expressed in terms of grams of CO_2 equivalent per MJ of fuel, gCO_2e/MJ.

3.4 The greenhouse gases taken into account for the purposes of the equation in paragraph 3.1 and shall be CO_2, N_2O and CH_4. For the purpose of calculating CO_2 equivalence, those gases shall be valued as follows:

- CO_2: 1
- N_2O: 298
- CH_4: 25

3.5 GHG emissions savings percentage from RFNBOs shall be calculated as follows:

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

Where:

E_{RF} = total emissions from the RFNBO

E_{FF} = total emissions from fossil fuel comparator for transport

3.6 For the purposes of the calculations referred to in paragraph 3.5, the fossil fuel comparator E_{FF} shall be 94 gCO_2eq/MJ.

Guidance on calculating individual components

3.7 Emissions from the extraction or collection of raw materials, e_{ec}, include emissions:

- from the extraction process itself
- from the collection of raw materials
- from waste and leakages
- from the production of chemicals or products used in extraction or collection of the raw materials (this includes the additional energy and chemicals used in any carbon capture)

3.8 Water, biogenic CO_2, atmospheric CO_2 and naturally occurring/geothermal CO_2 are considered to have zero lifecycle greenhouse gas emissions up to the process of collection of these materials. Where naturally occurring or geothermal CO_2 sources are utilised, evidence must be provided to the Administrator that these emission sources have not been increased by the extraction of the CO_2, or that any additional emissions have been included within the extraction emissions, e_{ec}. Where biogenic CO_2 sources are utilised, evidence should be provided to the Administrator that this CO_2 is not already being used to claim a GHG credit in the original bioenergy supply chain and would otherwise have been emitted to atmosphere[14].

3.9 Suppliers should inform the Administrator if they plan on using naturally occurring, geothermal or biogenic CO_2 sources and the Administrator will define what evidence is required to demonstrate compliance with the criteria in 3.8.

3.10 Waste fossil CO_2 is also considered to have zero lifecycle greenhouse gas emissions up to the point of collection, provided these materials meet the definition of a waste[15], evidence is provided that the carbon in these materials would have otherwise been

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[14] For example, a biofuels producer cannot claim that any biogenic CO_2 used to make a RFNBO constitutes an "emission saving from carbon capture and replacement" within their own biofuel supply chain GHG calculation. This would be an erroneous double claim of GHG savings between biofuel and RFNBO supply chains. Due to their consumption and emission to atmosphere, RFNBOs also do not count as an "emission saving from carbon capture and storage" in the biofuels calculation.

[15] 'Waste' means any substance or object which the holder discards or intends or is required to discard. It excludes substances that have been intentionally modified or contaminated to for the purpose of transforming it into a waste.

emitted to atmosphere, and provided the facility generating these waste materials does not claim a reduction in their emissions due to this use of the waste fossil CO_2.

3.11 If the waste fossil generating facility does wish to claim a reduction in their emissions[16], then these GHG emissions instead need to be assigned to the waste fossil material used to produce the RFNBO and must contribute to e_{ec}, in line with the material's global warming potential (e.g. one tonne of waste fossil CO_2 would be assigned 1 tCO_2e/tonne). Similarly, if the carbon in the material would not otherwise have been emitted to atmosphere (e.g. waste fossil plastic might have sequestered its carbon for centuries in landfill, or as a building insulation material), then the additional greenhouse gas emissions from this avoided sequestration also need to be assigned to the waste fossil material and contribute to e_{ec}.

3.12 If a supplier wishes to carry out either of the practices outlined in paragraph 3.11 they should contact the Administrator for further guidance.

3.13 Emissions from production and processing, e_{pp}, shall include emissions:

- from the production and processing itself
- from waste and leakages
- from the production of chemicals or products used in processing including the CO_2 emissions corresponding to the carbon contents of fossil inputs, whether or not actually combusted in the process[17]

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

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

3.14 Where a RFNBO has been produced using wholly additional renewable electricity (Scenario 3 in Table 1) the GHG emissions associated with the renewable electricity used to produce it can be taken as zero.

3.15 Where a RFNBO has been produced using renewable electricity drawn from an electricity grid and doesn't meet the criteria for additionality outlined in paragraph

[16] For example, from a desire to reduce their costs under the UK's Emission Trading Scheme, or other national taxes on emissions. The waste fossil generating facility cannot claim a GHG savings whilst the RNFBO manufacturer also claims a low carbon fuel is being made, as this would be an erroneous double claim of only one set of GHG savings - since the original fossil carbon is still ultimately ending up in the atmosphere.

[17] This includes non-waste fossil CO_2 used as an input in producing the RFNBO (see paragraph 1.6).

2.16 (Scenarios 1, 2 and 4 in Table 1), the GHG intensity of the production and distribution of that electricity can be calculated as either:

- equal to the average emission intensity of that electricity grid for the most recent available full year which shall be taken to be the national grid average unless the criteria for regionalisation are met (paragraph 2.14), in which case the relevant regional grid average shall be used
- equal to the real-time carbon intensity figures for the given 30-minute periods when the RFNBO was produced, where this data is available from reliable and authoritative sources[18] (also see paragraph 3.16)

In all cases, the figures used should meet the requirements of paragraph 3.17 and match the methodology used to calculate the RFNBO portion of the fuel as described in Chapter 2 and summarised in Table 1. An individual production site must use either annual grid averages **or** real-time figures for fuel supplied within a given obligation year, it is not permitted to switch between the two.

3.16 Where real-time carbon intensity figures are used following paragraph 3.15 (potentially applicable to Scenarios 1, 2 and 4 in Table 1), it is permissible to calculate an average carbon intensity over continuous periods longer than 30 minutes (up to a maximum of 12 months). This average should be weighted based on the electricity consumed in each 30-minute period within the period chosen. The period used should exactly match the period used for determining the renewability of the RFNBO (see paragraph 2.4).

3.17 For the purposes of paragraph 3.15, figures for the grid average GHG emissions should be sourced from reliable and authoritative sources such as government bodies and/or network operators. The figures used should take into account direct (Scope 2) emissions associated with electricity generation and indirect (Scope 3) emissions associated with the extraction, refining and transportation of primary fuels as well as electricity transmission and distribution.

3.18 Where a RFNBO has been produced using some electricity which meets the criteria for additionality (Scenario 3, Table 1) and some electricity not from new generation capacity but which otherwise meets the criteria for additionality (Scenario 4, Table 1) – Scenario 5 in Table 1 – the carbon intensity of the electricity should be calculated based on a weighted average as follows:

$$GHG_{Elec,\ Scen\ 5} = \frac{Electricity_{Scen\ 4} \times GHG_{Elec,\ Scen\ 4}}{Electricity_{Scen\ 3} + Electricity_{Scen\ 4}}$$

Where:

- $GHG_{Elec,Scen\ 5}$ = The weighted average GHG intensity of the electricity used to produce RFNBO in scenario 5 [gCO_2e/MJ]

[18] The RTFO Administrator is not currently aware of any robust data sources that provide the necessary real-time data on both the share of non-bioenergy renewables as well as the whole life-cycle carbon intensity taking into account direct generation, well-to-tank and transmission and distribution emissions (see paragraph 3.17). The RTFO Administrator will keep this position under review as new data sources emerge.

- $GHG_{Elec,\ Scen\ 4}$ = The GHG intensity of the electricity used to produce RFNBO in scenario 4 (see paragraph 3.15) [gCO_2e/MJ]
- $Electricity_{Scen\ 3}$ = The total electricity supplied which meets the conditions for Scenario 3 in Table 1 [MJ]
- $Electricity_{Scen\ 4}$ = The total electricity supplied which meets the conditions for Scenario 4 in Table 1 [MJ]

Please note: For simplicity, the emissions from electricity supplied following scenario 3 are not included in the above equation, as they are taken to be zero (see paragraph 3.14).

3.19 Emissions from transport and distribution, e_{td}, includes emissions from the transport and storage of raw and semi-finished materials, wastes and leakages, and from the storage and distribution of finished materials. Emissions from transport and distribution to be taken into account under e_{ec} shall not be covered by e_{td}.

3.20 Emissions from the fuel in use, e_u, shall be taken to be zero for RFNBOs.

3.21 Emission saving from carbon capture and storage e_{ccs}, that have not already been accounted for in e_{pp}, shall be limited to emissions avoided through the capture and permanent storage of otherwise emitted carbon directly related to the transport, processing and distribution of the fuel.[19] Storage must be demonstrably permanent and stable. Examples may include geological sequestration of CO2, the permanent sequestration of solid carbon through inert underground storgage, or integration into concrete or cement for use in construction. The capture of any CO_2 at the start of the fuel chain, i.e. the collection of raw materials used to manufacture the assessed fuel, cannot be included within this e_{ccs} emission saving – nor can any recycling of captured CO_2 within the fuel chain – as these are not sequestration activities.

Allocation of GHG emissions

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

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

In the case of co-products other than electricity and heat, the energy content of products and co-products should be determined based on LHV (wet) of the feedstock, which can be calculated as follows:

$$LHV_{wet} = LHV_{dry} \times (1 - \%\ \text{water content}) - 2.441 \times \%\ \text{water content}$$

[19] Where carbon is sequestered in a form other than CO_2, an equivalent quantity of CO_2 sequestered should be calculated based on the amount of elemental carbon sequestered. For example, if 1 kg of solid, elemental carbon is captured and sequestered, this would be equivalent to 3.66 kgs of sequestered CO_2.

The GHG intensity of excess useful heat or excess electricity is the same as the GHG intensity of heat or electricity delivered to the RFNBO production process and is determined from calculating the GHG intensity of all inputs and emissions, including the feedstock and CH_4 and N_2O emissions, to and from the cogeneration unit, boiler or other apparatus delivering heat or electricity to the RFNBO production process. In the case of cogeneration of electricity and heat, the calculation is performed following paragraph 3.24.

3.23 For the purposes of the calculation referred to in paragraph 3.22, the emissions to be divided shall be e_{ec} and those fractions of e_{pp}, e_{td} and e_{ccs} that take place up to and including the process step at which a co-product is produced. If any allocation to co-products has taken place at an earlier process step in the life-cycle, the fraction of those emissions assigned in the last such process step to the intermediate fuel product shall be used for those purposes instead of the total of those emissions.

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

In the case of fuels produced in refineries, other than the combination of processing plants with boilers or cogeneration units providing heat and/or electricity to the processing plant, the unit of analysis for the purposes of the calculation referred to in paragraph 3.22 shall be the refinery.

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

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

Where:

T_h = Temperature, measured in absolute temperature (kelvin), of the useful heat at point of delivery.

T_0 = Temperature of surroundings, set at 273.15 kelvin (equal to 0 °C).

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

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

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

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

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

Annex A: Summary of changes (since June 2023 version)

Location	Description
Chapter 2	Mentions of “new production capacity” replaced with “new generation capacity” for consistency.
Chapter 2, footnote 7	Additional footnote clarifying what is included in “new generation capacity”.
Chapter 2, paragraph 2.13	Clarification that paragraph 2.12 still applies.
Chapter 3, paragraph 3.16	Clarification regarding which scenarios in Table 1 3.16 can be applied.
Chapter 3, paragraph 3.21	Amendments to the definition of e_{ccs} to accommodate forms of carbon sequestration other than geological storage of CO_2.
Chapter 3, paragraph 3.22	Addition of “upstream and relevant process step” to clarify which emissions are to be divided between coproducts.