GHG EMISSIONS & SUSTAINABILITY

CERTIFHY EU RFNBO VOLUNTARY SCHEME

Version number	**1.5**
Date of Issue:	**31.10.2024**

Contents

1. Status of this document

This document, 'GHG Emissions & Sustainability', is part of the CertifHy EU RFNBO Voluntary Scheme.

All CertifHy EU RFNBO Voluntary Scheme documents in their latest applicable version are valid and must be considered for the scope of application. In the event of conflict between the text of this document and the CertifHy EU RFNBO Voluntary Scheme "Scheme Document", the "Scheme Document" shall always take precedence.

Change History

Version	Date	Description
1.0	28.02.2023	Version 1.0
1.1	10.07.2023	Version 1.1: Adjustments following the publication of an updated version of the Assessment Protocol for Voluntary Schemes for RFNBOs
1.2	15.01.2024	Version 1.2: Adjustments taking up the guidance document "Q&A implementation of hydrogen delegated acts" of the European Commission of 26.07.2023
1.3	02.05.2024	Version 1.3: Adjustments taking up the guidance document "Q&A implementation of hydrogen delegated acts" of the European Commission of 14.03.2024 and feedback from DG ENER
1.4	25.07.2024	Version 1.4: - Further guidance on each component of the GHG emissions calculation - Further guidance on allocation of emissions for co-processing - Formatting and referencing amendments
1.5	31.10.2024	Version 1.5: - Update to RED reference and editorial adjustments - Introduction of materiality threshold - Update of Chapter 4.14 – Allocation

2. Purpose of this document

The Purpose of this document, “GHG Emissions & Sustainability”, is to lay down the requirements of the CertifHy EU RFNBO Voluntary Scheme as they pertain to the methodology, rules and guidelines for calculating and verifying the GHG emissions and GHG emissions reductions that can be attributed to a given volume of RFNBO, in addition to verifying that the requirements related to the electricity input used for RFNBO production have been met.

These requirements apply to the production of RFNBOs via electrolysis and analogously for less common production pathways. They shall apply regardless of whether the RFNBO is produced inside or outside the territory of the European Union.

3. Scope and Normative References

The CertifHy EU RFNBO Voluntary Scheme requirements set forth in this document apply to all relevant elements of the supply chain, from renewable electricity production to the distribution of the final product, and to all intermediate products used for the production of conventional fuels, as applicable. This includes all relevant intermediate steps and supply chain elements related to the materials, fuels or energies consumed in the full supply chain.

The rules set out in this document apply regardless of whether the RFNBO is produced inside or outside the territory of the European Union.

The legal basis for the provisions laid down in this document consists of:

- the Revised Directive EU/2018/2001[1];
- the Commission Delegated Regulation 2023/1184 of 10.02.2023[2] supplementing Revised Directive EU/2018/2001 of the European Parliament and of the Council by establishing a Union methodology setting out detailed rules for the production of renewable fuels of non-biological origin, in the following referred to as CDR 1184,
- the Commission Delegated Regulation 2023/1185 of 10.02.2023[3] supplementing Revised Directive EU/2018/2001 of the European Parliament and of the Council by establishing a minimum threshold for greenhouse gas emissions savings from the use of recycled carbon fuels and by specifying a methodology for assessing greenhouse gas emissions savings from renewable fuels of non-biological origin and from recycled carbon fuels, in the following referred to as CDR 1184.

The following further elements of the regulatory environment are relevant to this document:

- Internal Electricity Market Directive[4]
- Internal Electricity Market Regulation[5]
- Capacity allocation and congestion management Commission Regulation[6]

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[1] Revised Directive EU/2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast); OJ L 328, 21.12.2018, p. 82; modifications by Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652

[2] Commission Delegated Regulation of 10 February 2023, OJ L 157/11, 20.06.2023; in the following referred to as CDR 1184

[3] Commission Delegated Regulation of 10 February 2023 including its Annex, OJ 157/20, 20.06.2023; in the following referred to as CDR 1185

[4] Directive 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (recast); OJ L 158, 14.6.2019, p. 125

[5] Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast); OJ L 158, 14.6.2019, p. 54

[6] Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management; OJ L 197, 25.7.2015, p. 24

- Emissions Trading Directive[7]

Relevant terms used in this CertifHy EU RFNBO Voluntary Scheme document are defined in the legal texts listed above.

The European Commission has published the guidance document "Q&A implementation of hydrogen delegated acts"[8]..

The latest version of the document at the time of adoption of this CertifHy scheme document is the version of 14 March 2024.

The Commission defines the following disclaimer:

> *"This report summarises the outcome of those meetings and does not create any enforceable right or expectation. The binding interpretation of EU legislation is the exclusive competence of the Court of Justice of the European Union. The views expressed in this document are without prejudice to the position that the Commission might take before the Court of Justice.*
>
> *Neither the European Commission nor any person acting on behalf of the European Commission is responsible for the use which might be made of the following information."*

For illustration purposes only, Figure 1 provides an overview of the scope of the two Commission Delegated Regulations, as well as the applicable electricity supply cases and major requirements. Commission Delegated Regulation of 10 February 2023, OJ L 157/11, 20.06.2023, in the following referred to as CDR 1184, defines requirements for Sustainability (see chapter 7). Commission Delegated Regulation of 10 February 2023 including its Annex, OJ 157/20, 20.06.2023, in the following referred to as CDR 1185, with its Annex defines the methodology for calculating GHG emissions and GHG reductions (see chapters 4, 5, 6).

Detailed requirements are included in the subsequent chapters of this document:

Topic	Sub-topic	Chapter
Grid mix	Grid mix (≤90% renewable share)	Chapter 7
	Grid mix >90% renewable share	Chapter 7.3.1
Direct connection		Chapter 7.2

[7] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC; OJ L 275, 25.10.2003, p. 32

[8] Available at https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/voluntary-schemes_en

Topic	Sub-topic	Chapter
Grid connection	In general	Chapter 7.3
PPA	Specific PPA requirements	Chapter 7.3.4
	Additionality and no support	Chapter 7.3.5
	Temporal correlation	Chapter 7.3.6
	Geographic correlation	Chapter 7.3.7
Imbalance settlement		Chapter 7.3.3
Exceptions	Low carbon electricity grid <18 gCO2eq/MJel	Chapter 7.3.2
	Electricity price ≤ EUR 20/MWh or < 0.36 times the price of an emission allowance	Chapter 7.3.6
Combining electricity supply options		Chapter 7.3.8
Avoidance of double counting	Use of Guarantees of Origin (GO) or similar certificates in third countries	Chapter 7.3.1, 7.3.4, 7.3.5
Detailed data requirements	List of data and documents	Annex C: Data requirements for initial audits

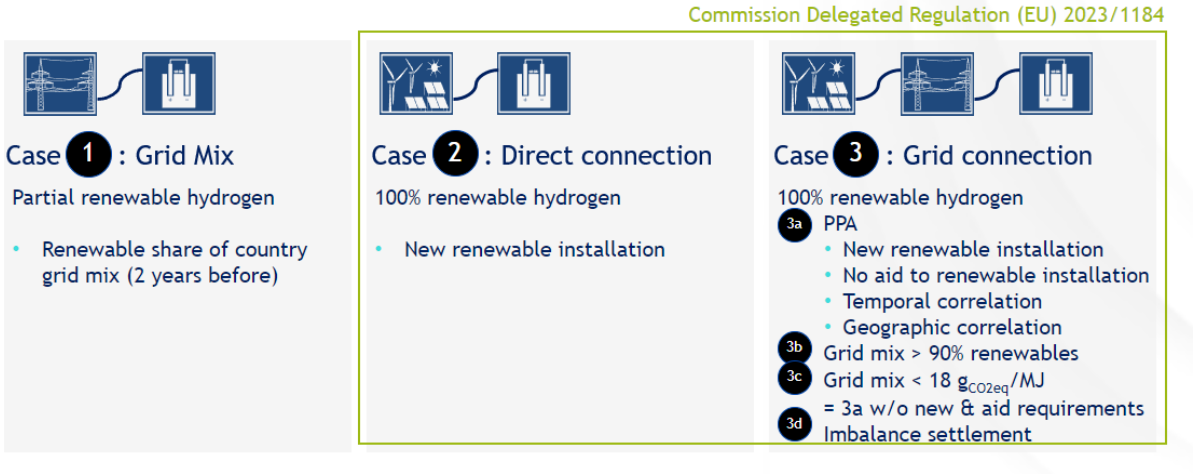

Figure 1: Overview of the scope of the two Commission Delegated Regulations as well as applicable electricity supply cases and major requirements

4. GHG emissions savings requirement and calculation methodology

This chapter defines the provisions related to the required GHG emissions savings of RFNBOs and to the calculation of GHG emissions.

4.1 GHG emissions savings requirement

According to Article 29a (1) of the Revised Directive EU/2018/2001 for RFNBOs, the GHG emissions savings from the use of RFNBOs shall be at least 70%.

Application of the 70% reduction requirement to the fossil fuel comparator (see chapter 4.8 below) results in a threshold for GHG emissions of 28.2 g_{CO2eq}/MJ – the emissions, as calculated according to the provisions of this document, must be below this threshold in order for fuels to be deemed -compliant with Revised Directive EU/2018/2001.

4.2 GHG emissions calculation

CDR 1185 defines the methodology for assessing GHG emissions and GHG emissions savings from RFNBOs.

GHG emissions from the production and use of RFNBOs shall be calculated as follows:

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

where:

E = total emissions from the use of the fuel (g_{CO2eq}/MJ_{fuel})

$e_i = e_{i\ elastic} + e_{i\ rigid} - e_{ex\text{-}use}$: emissions from supply of inputs (g_{CO2eq}/MJ_{fuel})

$e_{i\ elastic}$ = emissions from elastic inputs (g_{CO2eq}/MJ_{fuel})

$e_{i\ rigid}$ = emissions from rigid inputs (g_{CO2eq}/MJ_{fuel})

$e_{ex\text{-}use}$ = emissions from inputs' existing use or fate (g_{CO2eq}/MJ_{fuel})

e_p = emissions from processing (g_{CO2eq}/MJ_{fuel})

e_{td} = emissions from transport and distribution (g_{CO2eq}/MJ_{fuel})

e_u = emissions from combusting the fuel in its end-use (g_{CO2eq}/MJ_{fuel})

e_{ccs} = emission savings from carbon capture and geological storage (g_{CO2eq}/MJ_{fuel})

All energy values shall be based on the lower heating value[9].

Emissions from the manufacture of machinery and equipment shall not be taken into account.

The GHG emissions intensity of RFNBOs shall be determined by dividing the total emissions of the process covering each element of the formula by the total amount of fuel stemming from the process, and shall be expressed in terms of grams of CO_2 equivalent per MJ of fuel (g_{CO2eq}/MJ_{fuel}). If a fuel is composed of a mix of RFNBOs and other fuels, all (fuel) types shall be considered to have the same emissions intensity.

While the previous paragraph establishes that, in the case of the production of a mix of fuels (RFNBOs and other fuels), all (fuel) types shall be considered to have the same emissions intensity, this provision (based on CDR 1185) only applies when defining the emissions intensity of RFNBOs. Hence, this rule only serves the purpose of allocating the appropriate share of emissions to RFNBOs. The correct methodology to determine the emissions intensity of biofuels for the purposes set out in Revised Directive EU/2018/2001 Article 29 is set out in Revised Directive EU/2018/2001 Article 31 and the related Annexes. The exception to this rule is the case of co-processing, wherein RFNBOs are only partially replacing a conventional input in a process.

The processing of mixed biogenic and non-biogenic non-recyclable waste into fuels is not considered co-processing, as co-processing only covers cases wherein RFNBOs are replacing a conventional input in a process. As no replacement takes place in this case, the rules for co-processing do not apply and the entire output from the process is considered to have the same emissions intensity.

Further provisions on co-processing are provided in Annex A: Implementation of co-processing for RFNBOs.

- In such a situation, the energetic value of inputs between the part of the process that is based on the conventional input; and
- the part of the process that is based on RFNBOs, assuming that the process parts are otherwise identical

shall be distinguished on a proportional basis in the GHG emissions intensity calculation.

An analogous distinction between processes shall be applied where RFNBOs are processed together with biomass.

The GHG emissions intensity may be calculated as an average of the entire fuel production occurring during a period of, at most, one calendar month, though shorter time intervals are allowed. Where electricity qualifying as fully renewable according to the methodology set out in Revised Directive EU/2018/2001 is used as an input that enhances the heating value of the fuel or intermediate products, the time interval shall be in line with the temporal correlation requirements defined in chapter 7.3.6.

[9] Values regarding the energy content of fuels, as set out in the Revised Directive EU/2018/2001in Annex III, shall be used. For the determination of the energy content of fuels not included in Annex III, the relevant European Standards Organisation (ESO) standards shall be used in order to determine the heating values of fuels. Where no ESO standard has been adopted for that purpose, the relevant International Organization for Standardisation (ISO) standards shall be used.

Accordingly, the emissions intensity of renewable hydrogen produced via electrolysis according to chapter 7.3.6 must be determined on an hourly basis as of January 2030 (or sooner, if a Member State decides to mandate hourly correlation earlier for RFNBO production in its territory).

Where relevant, GHG emissions intensity values calculated for individual time intervals may be used to calculate an average GHG emissions intensity for a period of up to one month, provided that the individual values calculated for each time period meet the minimum savings threshold of 70%.

To reduce the efforts of identifying minor contributions to the overall emissions, a materiality threshold of emissions may be applied. The materiality threshold is defined at 5% in relation to the threshold for GHG emissions of 28.2 g_{CO2eq}/MJ, meaning that up to 5% of the threshold value for GHG emissions can be conservatively estimated without the need for exact calculation.

4.3 Elastic versus rigid inputs

When determining emissions from the supply of inputs, a distinction must be made between elastic inputs and rigid inputs. Rigid inputs are those for which the supply cannot be expanded to meet extra demand. Thus, all outputs produced in a fixed ratio by an incorporated process[10] , and which represent less than 10% of the economic value of the output, are considered rigid. Waste heat from incorporated processes, for example, might fall into the category of a rigid input. If it represents 10% or more of the economic value, however, it shall be treated as elastic. In principle, elastic inputs are those for which the supply can be increased to meet extra demand. Petroleum products from refineries are considered elastic inputs because refineries can change the ratio of their products. Other elastic inputs include electricity, natural gas, and CO_2. In case of doubt, an input should be treated as elastic.

4.3.1 GHG emissions of elastic inputs

The GHG emissions of elastic inputs that are obtained from an incorporated process shall be determined based on data retrieved from their actual production process. This shall include all emissions arising due to their production over the whole supply chain (including emissions arising from the extraction of the primary energy required to make the input, the processing of the input and transportation of the input). Combustion emissions related to the carbon content of fuel inputs shall not be included[11].

However, GHG emissions from the elastic inputs that are not obtained from an incorporated process shall be determined based on the values included in Chapter 5. If the input is not included in the list, information about the emissions intensity

[10] Incorporated processes include processes that take place in the same industrial complex, or that supply the input via a dedicated supply infrastructure, or that supply more than half of the energy of all inputs to the production of the RFNBO.

[11] If carbon intensities are taken from the table in chapter 5, combustion emissions shall not be considered. This is because combustion emissions are counted in processing or in the combustion emissions of the final fuel.

may be drawn from the latest version of the JEC-WTW report[12], the ECOINVENT database[13], official sources such as the IPCC[14], IEA[15] or government, other reviewed sources such as the E3[16] and GEMIS[17] database and peer reviewed publications.

4.3.2 GHG emissions of rigid inputs

Emissions from rigid inputs shall include the emissions resulting from the diversion of those inputs from a previous or alternative use. These emissions shall take into account the loss of production of electricity, heat or products that were previously generated using the input, as well as any emissions arising from additional treatment of the input and its transport. The following rule shall apply:

> Emissions attributed to the supply of rigid inputs shall be determined by multiplying the lost production of electricity, heat or other products by the relevant emission factor. In case of lost electricity production, the emission factors to consider are for grid electricity generation in the country where the displacement occurred determined according to the appropriate methodology set out in Chapters 4.10 or 4.11. In case of diverted material, the emissions to be attributed to the replacement material are calculated as for material inputs in this methodology. For the first 20 years following the start of RFNBO production, the loss of production of electricity, heat and material shall be determined based on the average amount of electricity and heat that was produced from the rigid input over the last three (3) years before the start of production of RFNBO. After 20 years of production, the loss of production of electricity, heat or other products shall be determined based on the minimum energy performance standards assumed in pertinent best available technology (BAT) conclusions. Where the process is not covered by a BAT, the estimation of lost production shall be based on a comparable process applying state-of-the-art technology.

4.4 Processing emissions

Emissions from processing, e_p, shall include emissions from the processing itself, in addition to the emissions from onsite water treatment, compression, loading/unloading, purification and from the onsite production of chemicals or products used in processing, etc. Every processing unit in the supply chain must guarantee that all GHG emissions from processing and from process-specific inputs are included in the emissions calculation.

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[12] The current version as of 27 September 2022 can be found here: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC121213/jec_wtw_v5_121213_final.pdf

[13] https://ecoinvent.org/

[14] https://www.ipcc.ch/

[15] https://www.iea.org/

[16] http://e3database.com/

[17] https://iinas.org/downloads/gemis-downloads/

Emissions from processing need to be allocated to main products and co-products, as described in Chapter 4.14 "Allocation" above.

Data always needs to be gathered for the whole process. At minimum, the following data for the calculation of GHG emissions must be gathered, where applicable. All input values must be gathered for the same time period.

Water treatment (where applicable):

- Raw water (sea water) intake (m^3/h) at rated capacity operation;
- Power consumption (kWh/h) and other energy consumption (kWh/h); and
- Fresh water output (m^3/h)

Loading/unloading (where applicable):

- Specific loading/unloading power consumption per kg of fuel

Processing:

- All inputs (kg or other appropriate unit), separately per hour of operation at rated capacity;
- Energy consumption, separately for each form of energy consumed of operation at rated capacity; and
- All outputs (kg or other appropriate unit), separately per hour of operation at rated capacity

Where the operation is not at rated capacity, all inputs, energy consumptions and outputs should be provided at actual capacity, including an indication of actual capacity.

Compression:

- Power consumption per kg of output

Emissions from processing shall include direct atmospheric emissions from the processing itself, from waste treatment and from leakages.

For other emissions to be included in e_p, equivalent data need to be provided.

Alternatively, equivalent data may be provided to allow for the calculation e_p at the same level of precision and reliability.

4.5 Transport and distribution emissions

Emissions from transport and distribution (e_{td}) can only be accurately determined if all transportation steps are recorded and communicated throughout the entire chain of custody. Each recipient of input RFNBO must be able to determine the upstream transport emissions (e_{td}). Additionally, the final Economic Operator before the final consumption of the fuel must calculate the downstream transport and distribution emissions to the final consumption and include them in his or her emissions calculation. For the calculation of e_{td} , the following information must be provided. All input values must be gathered for the same time period:

- Transport distance loaded/empty, respectively (if the empty return ways are attributable to the certified company they must be taken into account. If the return way is not empty and accountable to another company, which can be proven by relevant documentation, return ways can be excluded for transport calculations)
- Mode of transport (e.g. diesel truck, pipeline, ship), type of transport vessel and transport capacity
- Fuel type and consumption of the transport vessel per distance travelled; and
- Amount of product transported.

For other modes of transport and distribution, equivalent data must be provided.

Alternatively, equivalent data may be provided that allows for the calculation of e_{td} at the same level of precision and reliability.

For road transport by truck, the following data would be required (or equivalent):

- Type of RFNBO transported
- Type of fuel consumed by the truck
- Fuel consumption per ton of RFNBO transported (l/t/100km)
- Truck capacity (t of RFNBO)
- Transport distance (km); and
- Total quantity of RFNBO transported

For ship transport, the following data would be required (or equivalent):

- Type of RFNBO transported
- Type of fuel consumed by the vessel
- Cruise speed (knots)
- Fuel consumption per distance travelled (t or kWh per km or per nautical mile)
- Transport distance (km or nautical miles)
- Where applicable: RFNBO losses (%/day); and
- Total quantity of RFNBO unloaded at the port of destination

For hydrogen transport through an H_2 grid/pipeline:

- Type of energy consumed for H2 transport in the grid/pipeline; and
- Energy consumption of H2 transport in the grid/pipeline (kWh or MJ)

In general, the H_2 grid/pipeline operator should provide the relevant data.

Emissions from transport and distribution shall include emissions from the storage and distribution of the finished fuels. Emissions attributed to inputs e_i shall include emissions from their associated transport and storage.

GHG emissions from upstream transport of inputs or downstream transport of the products e_{td} can be calculated based on the following formula:

$$e_{td}\left[\frac{gCO_{2eq}}{MJ}\right] = \frac{V_{\#} * \left(d_{loaded}[km] * C_{loaded}\left[\frac{l}{km}\right] + d_{empty}\left[\frac{l}{km}\right] * C_{unloaded}\left[\frac{l}{km}\right]\right) * EF_{fuel}\left[\frac{gCO_{2eq}}{l}\right]}{energy\ content\ of\ transported\ substance\ [MJ]}$$

Where

$V_{\#}$	number of transport vessels needed to transport the quantity of substance
d_{loaded}	distance travelled by loaded vessels [km]
$d_{unloaded}$	return distance travelled by empty vessels [km]
C_{loaded}	fuel consumption in loaded operation [l/km]
$C_{unloaded}$	fuel consumption in unloaded return operation [l/km]
EF_{fuel}	emission factor of the fuel [kg_{CO2eq}/l]

To determine how often a transport vessel was used for a given amount of transported substances, $V_{\#}$ must be calculated. This value is found by dividing the total transported products by the loading capacity of the transport vessel used. For instance, if ten (10) tons of substance are transported using trucks with a capacity of one (1) ton each, ten (10) trucks ($V_{\#} = 10$) would be required. The total fuel consumption for both loaded and empty trips (if applicable) is then multiplied by the number of times the transport vessel is used and the emission factor (EF_{fuel}) of the fuel.

In case there are losses of the substance during transport or distribution, these need to be taken into account by defining the amount of transported substance as the substance reaching the recipient after transport.

The provisions on mass balancing defined in the CertifHy EU RFNBO Voluntary Scheme document "Traceability & Chain of Custody" need to be complied with.

A supplier is responsible for providing information about the transport and distribution emissions of a given consignment to the next Economic Operator (recipient) in the value chain when the change of ownership of that consignment occurs *after* its transport and distribution. The recipient of the consignment must have access to all relevant GHG values and information to be audited on their upstream transport and distribution emissions.

For the calculation of the GHG emissions associated with transport, distribution and storage of RFNBOs, in case of mixtures of compliant RFNBOs with non-compliant products, the GHG emissions associated with the RFNBO should be attributed according to the share of RFNBOs in the mixture.

4.6 Emissions from combusting the fuel in its end use

Emissions from combustion of the fuel refer to the total combustion emissions of the fuel in use (CO_2, CH_4, N_2O). Greenhouse Gases other than CO_2 shall be converted to CO_{2eq} by multiplying their Global Warming Potential (GWP)

relative to CO_2 over the 100-year time horizon as set out in Annex V, part C, point 4 to Revised Directive EU/2018/2001.

Emissions from combustion include all sources of CO_2, including biogenic sources. However, the use of CO_2 may allow for the claiming of a credit under $e_{ex\text{-}use}$, which may fully compensate the emissions due to fuel in use. The provisions set out in Section 4.13 apply for this purpose.

To determine the emissions of fuel in use (e_u), the values for the combustion emissions set out in the first table in Chapter 5 shall be used.

4.7 CCS

Where a process for making RFNBOs 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 storage operation (including transport of the carbon dioxide) shall also be taken into account under e_p.

4.8 GHG emissions savings calculation

For all RFNBOs, the total emissions from the fossil fuel comparator shall be 94 g_{CO2eq}/MJ.

GHG emissions savings from RFNBOs shall be calculated as follows:

Savings = $(E_F – E) / E_F$

where:

E = total emissions from the use of RFNBO

E_F = total emissions from the fossil fuel comparator.

4.9 RFNBO share calculation

If the output of a process does not fully qualify as RFNBO, notably where the relevant energy input is not fully renewable, their respective shares in the total output shall be determined as follows:

- The fraction of RFNBO shall be determined by dividing the relevant renewable energy input into the process by the total relevant energy inputs into the process.
- The share of RFNBO is calculated at each step of the supply chain where the heating value of the fuel is increased. At stages of the supply chain where the heating value of the fuel remains unchanged, only additional emissions are added,where relevant. This shall also be applied if the processing steps take place in the same facility.

- The relevant energy for material inputs is the lower heating value of the material input that enters into the molecular structure of the fuel[18].
- For fuels used as input to generate heat that enhances the heating value of the produced fuel, the relevant energy is the lower heating value of these fuels.
- For electricity inputs that are used to enhance the heating value of the fuel or intermediate products, the relevant energy is the energy of the electricity.

Figure 2 shows the determination of inputs using the production of ammonia as an example.

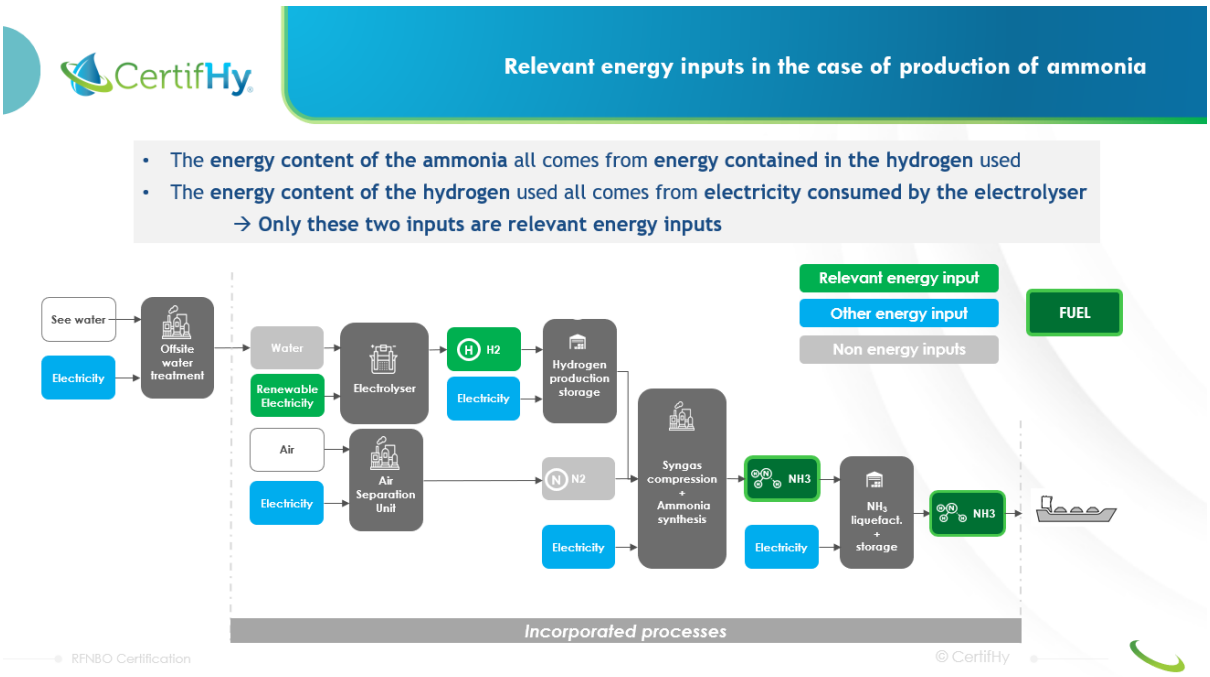

Figure 2: Example of relevant energy inputs in a case of ammonia production

For industrial off-gases, it is the energy of the off-gas based on the lower heating value. In case of heat that is used to enhance the heating value of the fuel or intermediate product, the relevant energy is the useful energy in the heat that is used to synthesise the fuel. Useful heat is the total heat energy multiplied by the Carnot efficiency, as defined in Annex V, part C, point (1)(b) of Revised Directive EU/2018/2001. Other inputs are only taken into account when determining the emissions intensity of the fuel.

Electricity or other forms of energy that are not used to enhance the heating value of the products or intermediate products are not required to be renewable. This applies to hydrogen production, to other processing steps and generally to all steps in the supply chain.

[18] 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 used as intermediate products for the production of conventional fuels are not considered.

The GHG emissions associated with such energy consumption shall taken into account in the calculation of the GHG emissions intensity and the GHG emissions savings achieved by the RFNBO.

Where the use of electricity and/or heat for the reconversion of RFNBOs such as ammonia, methanol, methane or others into hydrogen (and possibly co-products) does not increase the heating value of the (co-)products, the share of RFNBO is not affected. To establish whether the electricity and heat used in a process are adding to the heating value of the fuel, the heating value of the RFNBO entering the process and qualifying as an RFNBO shall be compared to the heating value of the (co-)products yielded by the process. If the heating value of the hydrogen (and the co-products, where applicable) yielded from the process exceeds the heating value of the RFNBO input, the heating value is increased. Accordingly, the electricity and heat areadding to the heating value of the fuel, and therefore must be considered relevant energy.

4.10 GHG emissions of renewable electricity

Where electricity is used for the production of RFNBOs, either directly or for the production of intermediate products, electricity qualifying as fully renewable according to Article 27(6) of Revised Directive EU/2018/2001 shall be attributed zero GHG emissions.

Electricity used for the production of RFNBO includes electricity that adds to the heating value of the fuel and electricity that is used to power equipment required for the production or further processing of RFNBOs. Electricity used for the production of materials with no energy content or inputs that do not qualify as RFNBOs cannot be considered fully renewable unless they are located in the same industrial complex as the RFNBO production. Accordingly, the provisions of Chapter 4.11 apply to the attribution of the emissions intensity of such electricity.

4.11 GHG emissions of grid electricity

One of the three following methods shall be applied during each calendar year to attribute GHG emissions values to the electricity taken from the grid that does not qualify as fully renewable according to Article 27(6) of Revised Directive EU/2018/2001 and that is used to produce RFNBOs:

(a) GHG emissions values shall be attributed according to Chapter 6. This is without prejudice to the assessment under State aid rules; or

(b) GHG emissions values shall be attributed according to the number of full load hours the installation producing RFNBOs is operating. Where the number of full load hours is equal to or lower than the number of hours for which the marginal price of electricity was set by installations producing renewable electricity or nuclear power plants in the preceding calendar year for which reliable data are available, grid electricity used in the production process of RFNBOs shall be attributed a GHG value of zero g_{CO2eq}/MJ. Where this number of full load hours is exceeded, grid electricity used in the production process of RFNBOs shall be attributed a GHG emissions value of 183 g_{CO2eq}/MJ; or

(c) the GHG emissions value of the marginal unit generating electricity at the time of the production of the RFNBO in the bidding zone may be used if this information is publicly available from the national transmission system operator.

If the method set out in point (b) is used, it shall also be applied to electricity that is used to produce RFNBOs and qualifies as fully renewable according to Article 27(3) of Revised Directive EU/2018/2001.

Option (b) can only be applied in jurisdictions where a liberalised electricity market with free access for all electricity producers is implemented, where a transparent market-based pricing mechanism is available and where pricing data is made publicly available by a reliable source that is independent of its own market interests.

4.12 Supply chain elements

The supplier of each input, excluding those where the values are taken from Chapter 5, shall calculate the emissions intensity[19] of the input following the procedures in this document and report the value to the next production step or final fuel producer. The same rule applies to the suppliers of inputs farther back in the supply chain. After hydrogen production, the emissions information for an RFNBO is forwarded through the supply chain by using a "Proof of Sustainability'" (see the CertifHy EU RFNBO Voluntary Scheme document "Traceability & Chain of Custody"). The provisions of the latter document need to be complied with, as well as all other provisions of the CertifHy EU RFNBO Voluntary Scheme.

Provisions regarding who covers which transport and distribution emissions and how these are forwarded through the supply chain are included in section 4.5.

The GHG emissions methodology applies to each processing step.

The final Economic Operator in the fuel supply chain before the final consumption of the fuel must include the emissions from the combustion of the fuel in its end use. Together with the emissions reported to it through the proofs of sustainability, the upstream and downstream emissions of transport and distribution, as well as its own processing emissions (and where relevant, emissions of inputs and emission savings from carbon capture and geological storage), the final Economic Operator calculates the total emissions from the production and use of the fuel.

Where renewable electricity is supplied via the electric grid based on PPA(s) (see Chapter 7.3.4), the hydrogen producer shall provide the data to the Certification Body from an independent reliable source, such as the grid operator or the electricity market regulator. If this is not possible, the producer needs to provide a certificate for the electricity production data on an hourly basis from an independent third party according to a standard recognised by the CertifHy EU RFNBO Voluntary Scheme. The list of recognised standards is available from the CertifHy Scheme Operator upon request.

[19] Where carbon intensities are taken from the tables in chapter 5, combustion emissions shall not be considered. This is because combustion emissions are counted in processing or in the combustion emissions of the final fuel.

4.13 GHG emissions from existing use or fate, including of sources of CO_2

Emissions from existing use or fate include all emissions in the existing use or fate of the input that are avoided when the input is used for fuel production.

In the case of waste used for fuel production which would otherwise be sent to a landfill, all emissions that occur in the landfill, including non-CO_2 emissions due to methane leakage, may be considered. The fossil carbon incorporated in the composition of the fuel cannot be considered, however, as landfill waste is not combusted.

These emissions shall include the CO_2 equivalent of the carbon incorporated in the chemical composition of the fuel that was or would have otherwise been emitted as CO_2 into the atmosphere. This includes CO_2 that was captured and incorporated into the fuel, provided that at least one of the following conditions is fulfilled:

(a) the CO_2 has been captured from an activity listed under Annex I of Directive 2003/87/EC[20] and has been taken into account upstream in an effective carbon pricing system and is incorporated into the chemical composition of the fuel before 2036. This date shall be extended to 2041 in other cases than CO_2 stemming from the combustion of fuels for electricity generation; or;

(b) the CO_2 has been captured from the air, or;

(c) the captured CO_2 stems from the production or the combustion of biofuels, bioliquids or biomass fuels complying with the sustainability and GHG emissions 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 Revised Directive EU/2018/2001, or;

(d) the captured CO_2 stems from the combustion of RFNBOs or recycled carbon fuels complying with the GHG emissions saving criteria, set out in Article 25(2) and Article 28(5) of Revised Directive EU/2018/2001 and CDR 1185; or

(e) the captured CO_2 stems from a geological source of CO_2 and the CO_2 was previously released naturally.

Provisions for what constitutes an "effective carbon pricing system" are provided in Annex B.

Installations that incinerate municipal waste are currently not covered in Directive 2003/87/EC (Emissions Trading System). Fossil-based CO_2 from the incineration of municipal waste therefore cannot automatically be considered as avoided emissions in the EU. However, CO_2 from these installations can be considered avoided emissions in cases where a Member State, in its application of Directive 2003/87/EC, covers such emissions under the Emissions Trading System and the CO2 is incorporated in the chemical composition of the fuel before 2036.

[20] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC; OJ L 275, 25.10.2003, p. 32

Biogenic CO_2, including the biogenic share of CO_2 arising from the incineration of municipal waste, constitutes an eligible carbon source, provided that the sustainability and GHG emissions savings criteria are met. Compliance with these criteria may be assumed if the installation producing the CO_2 is exempt from demonstrating compliance with the sustainability criteria, (e.g. if the installation has a rated thermal input below the applicable threshold).

Biogenic CO_2 stemming from processes which are out of the scope of the sustainability and GHG emissions saving criteria of Revised Directive EU/2018/2001 are also eligible.

In the case of a CO_2 stream that includes both fossil-based and biogenic CO_2 , the rules of the mass balance system shall be applied. Accordingly, it is possible to consider all CO_2 taken from the stream biogenic, provided that the amount of biogenic CO_2 taken from the stream does not exceed the amount of biogenic CO_2 included in the mixture. The appropriate period of time for achieving the mass balance is three (3)months[21].

Captured CO_2 stemming from a fuel that is deliberately combusted for the specific purpose of producing the CO_2 and CO_2, the capture of which has received an emissions credit under other provisions of the law, shall not be included.

All sources of CO_2 can be used. However, some CO_2 sources make it challenging to achieve the 70% GHG savings threshold:

- CO_2 from sources listed under a) to e) above thus have a factor $e_{ex\text{-}use}$ of 1 kg_{CO2eq}/kg_{CO2}. CO_2 from other sources has a factor $e_{ex\text{-}use}$ of 0 kg_{CO2eq}/kg_{CO2}.
- Captured CO_2 stemming from a fuel that is deliberately combusted for the specific purpose of producing the CO_2 has a factor $e_{ex\text{-}use}$ of 0 kg_{CO2eq}/kg_{CO2}.

In a situation where biomass is burned for electricity production, the CO_2 captured from this process for fuel processing is not considered "deliberately combusted for the specific purpose of producing the CO_2" if an economically meaningful use of the energy stemming from the combustion takes place. Economically meaningful uses of the energy would comprise, for instance, cases where the energy is sold or required for the operation of own production facilities including the RFNBO plant.

CO_2, the capture of which has received an emissions credit under other provisions of law, has a factor $e_{ex\text{-}use}$ of 0 kg_{CO2eq}/kg_{CO2}.

Emissions associated with the inputs, such as electricity and heat and consumable materials used in the capture process of CO_2, shall be included in the calculation of emissions attributed to inputs.

[21] See also CertifHy Voluntary Scheme document Traceability & Chain of Custody, notably chapter 5.1.

4.14 Allocation

Where a process yields multiple co-products, such as fuels or chemicals, as well as energy co-products such as heat, electricity or mechanical energy exported from the plant, greenhouse gas emissions shall be allocated to these co-products by applying the following approaches in the following manner:

(a) The allocation shall be conducted at the end of the process that produces the co-products. The emissions allocated shall include the emissions from the process itself, as well as the emissions attributed to inputs to the process.

(b) The emissions to be allocated shall be 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 process, the allocation at the other process shall be done first to establish the emissions to be attributed to the input (see Figure 4 and case (e) below).

(c) If any installation inside the project boundary treats only one of the project's co-products, then the emissions from that installation shall be allocated entirely to that co-product.

(d) Where the process allows to change the ratio of the co-products produced, the allocation shall be done based on physical causality by determining the effect on the process' emissions of incrementing the output of just one co-product whilst keeping the other outputs constant. Where the ratio of the products is fixed and the co-products are all fuels, electricity or heat, the allocation shall be done by energy content. If allocation concerns exported heat on the basis of the energy content, only the useful part of the heat may be considered, as defined in point 16 of Revised Directive EU /2018/2001 Annex V, part C. Figure 3 below illustrates how emissions should be allocated in this case.

$$\text{Allocation factor of the RFNBO} = \frac{\text{Energy content of RFNBO}}{\text{Sum of energy content of RFNBO + Product B}}$$

(e) Figure 4 below shows how to allocate emissions in case not all process steps of a processing are relevant to all co-products. Emissions of process steps are only allocated to those co-products of the overall process that are relevant to them.

The allocation of emissions to co-products will be done based on the allocation factor, which reflects the relation of the total energy content of each co-product to the overall energy content of all products. The following formula must be applied when calculating emissions of co-products:

$$\text{Allocation factor of the intermediate product} = \frac{\text{Energy content of intermediate product}}{\text{Energy content of intermediate product + Product B}}$$

Where not all process steps are relevant to all co-products (see Figure 4), allocation takes place at the relevant process step. Only processing (e_p), transport and distribution (e_{td}) and CCS (e_{CCS}) emissions up to and including the relevant processing step are included in the allocation. In the example of Figure 4, allocation takes place after process step 1 between the intermediate product and product B. The processing emissions (and possibly transport and distribution and CCS emissions) of processing step 2 are fully assigned to the RFNBO.

Where a cogeneration unit – providing heat and/or electricity to a fuel production process for which emissions are being calculated – produces excess electricity and/or excess useful heat, the greenhouse gas 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:

$$C_h = \frac{Th - T0}{Th}$$

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 that 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 that calculation, the following definitions apply:

(i) "cogeneration" shall mean the simultaneous generation in one process of thermal energy and electrical and/or mechanical energy;

(ii) "useful heat" shall mean heat generated to satisfy an economical justifiable demand for heat, for heating or cooling purposes; (c)

(iii) "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.

(f) where the ratio of the products is fixed and some co-products are materials with no energy content, the allocation shall be done by the economic value of the co-products. The economic value considered shall be the average factory-gate value of the products over the last three years. If such data is not available, the value shall be estimated from commodity prices minus the cost of transport and storage[22]. Figure 3 below illustrates how emissions should be allocated in this case. Figure 4 below shows how to allocate emissions in case not all process steps of a processing are relevant to all co-products. Emissions of process steps are only allocated to those co-products of the overall process that are relevant to them.

[22] Note that it is the relative values of the co-products that matters, so general inflation is not an issue.

The allocation of emissions to co-products will be done based on the allocation factor, which reflects the relation of the economic value of each co-product to the overall economic value of all products. The following formula must be applied when calculating emissions of co-products:

Allocation factor of the RFNBO = economic value RFNBO / sum of economic value of RFNBO and of Product B

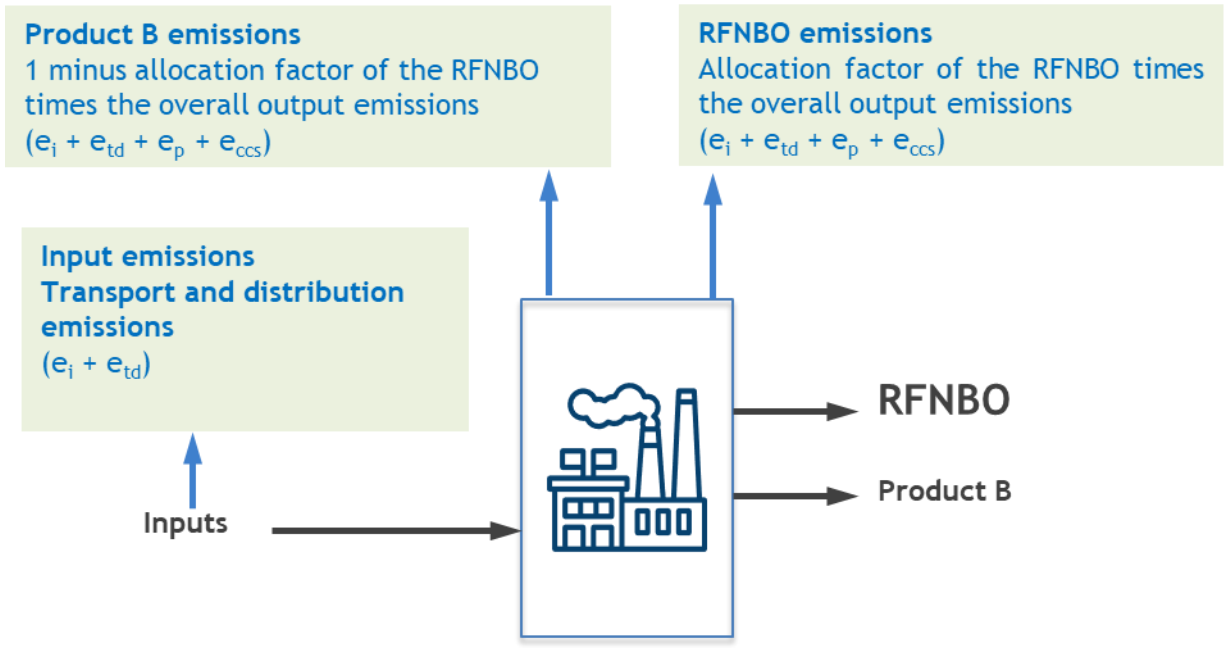

Figure 3: Allocation rule where the ratio of the products is fixed and the co-products are all fuels, electricity or heat (case (e) above) or some co-products are materials with no energy content (case (f) above)

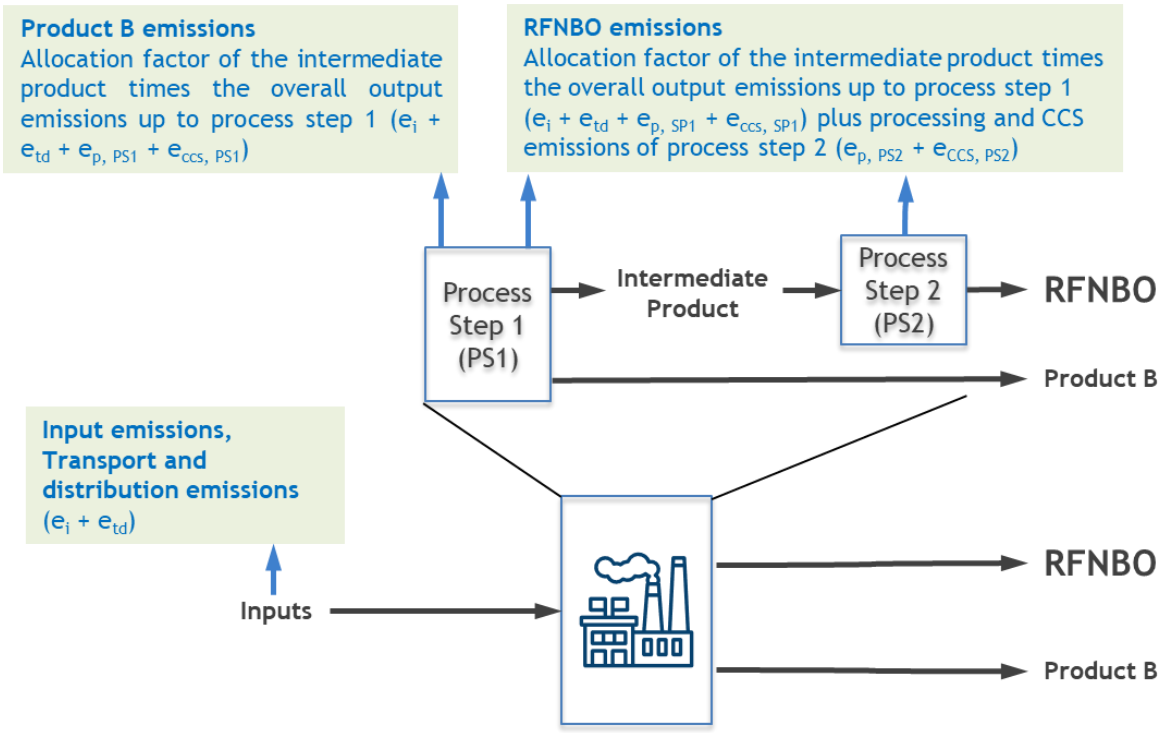

Figure 4: Allocation rule where not all process steps are relevant to all co-products (case (e) and case (b) above in relation to fractions of e_p, e_{td} and e_{CCS})

All products with an energy content should be considered fuels.

If a process yields RFNBOs and other fuels and materials with no energy content, a first allocation shall be done based on the economic value of the co-products, as set out above under point (f). For energy products, the allocation rule set out in Chapter 4.2 and Annex A shall apply. An example of a process that yields fuels and materials without any energy content is a chlor-alkali electrolysis process that produces chlorine and soda as materials with no energy content and hydrogen as fuel. The hydrogen stemming from the process could qualify as an RFNBO if all relevant requirements of this CertifHy EU RFNBO Voluntary Scheme document are fulfilled. Each co-product would include the same share of RFNBOs and other fuels in line with Article 30(2) of Revised Directive EU/2018/2001 (see chapter 4.2 and Annex A).

Emissions from an electrolyser facility shall be allocated between hydrogen and oxygen based on economic allocation if the oxygen is used in other processes or otherwise valorised, and the oxygen is not released to the atmosphere. The economic value shall be the average factory-gate value of the products over the last three (3) years. If the hydrogen is composed of products that are attributed with the same emissions intensity, then an average price (weighted arithmetic average) may be applied.

Figure 5 serves to further illustrate the GHG emissions intensity of RFNBO production from the co-processing of different types of inputs.

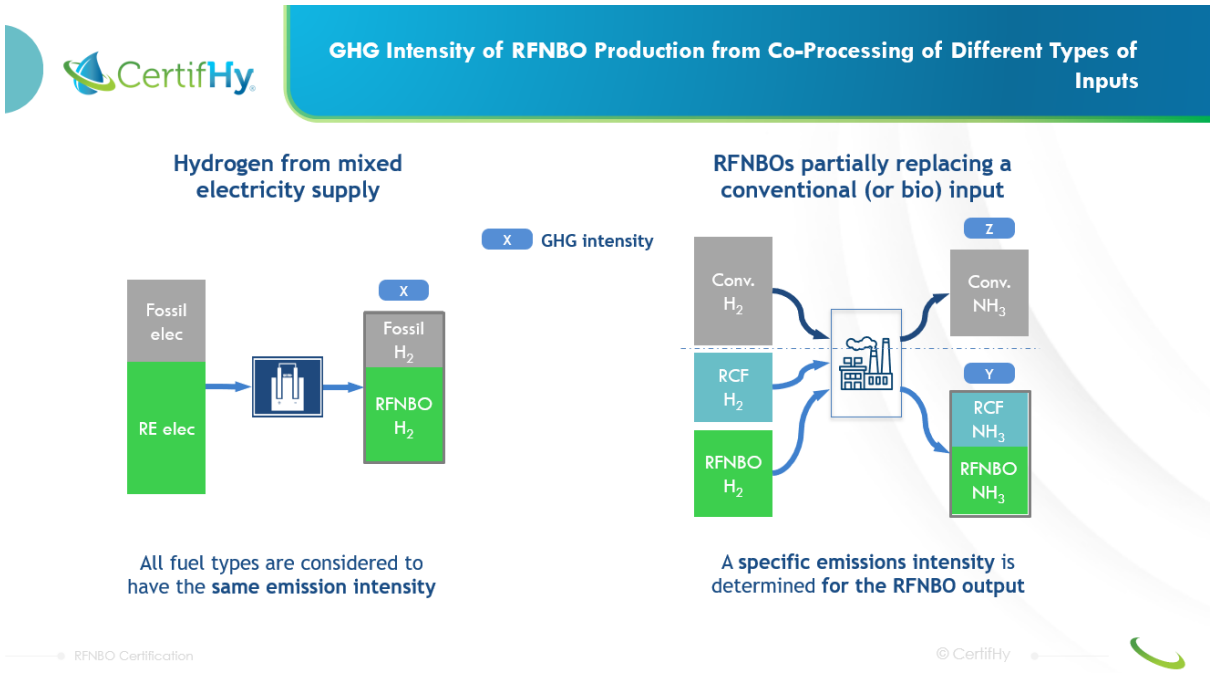

Figure 5: GHG intensity of RFNBO production from co-processing of different types of inputs

5. "Standard Values" for Greenhouse Gas Emission Intensities of Elastic Inputs

The following data are set out in part B of the Annex to CDR 1185.

The GHG intensities of inputs other than electricity are shown in the tables below:

	Total emissions g_{CO2eq}/MJ	*Upstream emissions* g_{CO2eq}/MJ	*Combustion emissions* g_{CO2eq}/MJ
Natural gas	66.0	9.7	56.2
Diesel	95.1	21.9	73.2
Gasoline	93.3	19.9	73.4
Heavy fuel oil	94.2	13.6	80.6
Methanol	97.1	28.2	68.9
Hard coal	112.3	16.2	96.1
Lignite	116.7	1.7	115.0

	Total emissions g_{CO2eq}/kg
Ammonia	2351.3
Calcium chloride ($CaCl_2$)	38.8
Cyclohexane	723.0
Hydrochloric acid (HCl)	1061.1
Lubricants	947.0
Magnesium sulphate ($MgSO_4$)	191.8
Nitrogen	56.4
Phosphoric acid (H_3PO_4)	3124.7
Potassium hydroxide (KOH)	419.1
Pure CaO for processes	1193.2
Sodium carbonate (Na_2CO_3)	1245.1
Sodium chloride (NaCl)	13.3
Sodium hydroxide (NaOH)	529.7

Sodium methoxide ($Na(CH_3O)$)	2425.5
SO_2	53.3
Sulphuric acid (H2SO4)	217.5
Urea	1846.6

Any changes to the standard values, as set out in part B of the Annex to CDR 1185, or grid emission factors, as set out in part C of the Annex to CDR 1185, will be implemented in the CertifHy EU RFNBO Voluntary Scheme with immediate effect. This applies to all relevant CertifHy EU RFNBO Voluntary Scheme documents and the Auditor Checklist.

6. GHG Emission Intensity of Electricity

The GHG emissions intensity of electricity shall be determined at the level of countries or at the level of bidding zones. The GHG emissions intensity of electricity may be determined at the level of bidding zones only if the required data is publicly available. The calculation the carbon intensity of electricity, expressed as gCO_{2eq}/kWh electricity, shall consider all potential primary energy sources for electricity generation, type of plant, conversion efficiencies and own electricity consumption in the power plant.

The calculation shall consider all carbon equivalent emissions associated with the combustion and supply of the fuels used for electricity production. This depends on the amount of different fuels used in the electricity production facilities, the emission factors from fuel combustion and the upstream fuel emission factors.

Greenhouse Gases other than CO_2 shall be converted to CO_{2eq} by multiplying their Global Warming Potential (GWP) relative to CO_2 over the 100-year time horizon as set out in Annex V, part C, point 4 to Revised Directive EU/2018/2001. Because of their biogenic origin, CO_2 emissions from the combustion of biomass fuels are not accounted for, but emissions of CH_4 and N_2O shall be accounted for.

Hydrogen leakages should be treated as an energy loss (leading to a proportional increase of the emission intensity). The global warming potential of emitted hydrogen should be considered as soon as such a value is added in Annex V of Revised Directive EU/2018/2001 .

For the calculation of the GHG emissions from the combustion of fuels, the IPCC default emission factors for stationary combustion in the energy industries shall be used (IPCC 2006). The upstream emissions shall include emissions from all the processes and phases required to make the fuel ready to supply the power production. They result from the extraction, refining and transportation of the fuel used for electricity production.

In addition, all the upstream emissions from the cultivation, harvesting, collection, processing and transport of biomass shall be considered. Peat and the components of waste materials that have fossil origins shall be treated as fossil fuels.

The fuels used for gross electricity production in electricity-only plants are determined based on the electricity production and the efficiency of conversion to electricity. In the case of Combined Heat and Power (CHP), the fuels used for heat produced in CHP shall be counted by considering alternative heat production with average overall efficiencies of 85%.Tthe rest shall be attributed to electricity generation.

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

No fuels are associated with electricity production from renewables that include hydro, solar, wind and geothermal. The emissions from the construction and decommissioning and waste management of electricity producing facilities are not considered. Thus, the carbon equivalent emissions associated with the renewable electricity (wind, solar, hydro and geothermal) production are considered to be equal to zero.

The CO_2 equivalent emissions from gross electricity production shall include upstream emissions from JEC WTW v5[23] listed in Table 3 and the default emission factors for stationary combustion from IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006) listed in Tables 1 and 2. The upstream emissions for supplying the fuel used shall be calculated applying the JEC WTW v5 upstream emission factors[23].

The calculation of the carbon intensity of electricity shall be done following the formula:

$$e_{gross\_prod} = \sum_{i=1}^{k} (c_{i-ups} + c_{i-comb}) * B_i$$

where: e_{gross_prod} – CO_2 equivalent emissions $[gCO_{2eq}]$

c_{i-ups} – upstream CO_2 equivalent emission factors $[\frac{\mathrm{gCO2eq}}{\mathrm{MJ}}]$

c_{i-comb} – CO_2 equivalent emission factors from fuels combustion $[\frac{\mathrm{gCO2eq}}{\mathrm{MJ}}]$

B_i – fuel consumption for electricity generation $[MJ]$

i=1⋯k –fuels used for electricity production

The amount of net electricity production is determined by the gross electricity production, own electricity consumption in the power plant and the electricity losses in pump storage.

$$E_{net} = E_{gross} - E_{own} - E_{pump}$$

where: E_{net} – net electricity production $[MJ]$

E_{gross} – gross electricity production $[MJ]$

E_{own} – own internal electricity consumption in power plant $[MJ]$

E_{pump} – electricity for pumping $[MJ]$

The carbon intensity of net produced electricity shall be the total gross GHG emitted for producing or using the net electricity:

$$CI = \frac{\mathrm{egross_{prod}}}{\mathrm{Enet}}$$

Where: CI – CO_2 equivalent emissions from electricity production $[\frac{\mathrm{gCO2eq}}{\mathrm{MJ}}]$

[23] Prussi et al., 2020: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC121213/jec_wtw_v5_121213_final.pdf

6.1 Electricity production and fuel consumption data

Data on electricity production and fuel consumption shall be sourced from IEA Data and statistics that provides data on energy balances and electricity produced using various fuels, e.g. from IEA website, Data and Statistic section ("Energy Statistics Data Browser")[24].

For EU Member States, Eurostat data are more detailed and can be used instead. Where the GHG emissions intensity is established at the level of bidding zones, data from official national statistics of the same level of detail as the IEA data shall be used.

Where bidding zones are not identical to countries, data from official national statistics must be used. This data must have been derived in accordance with the methodology applied for determining the RES-E share in the SHARES tool[25].

Fuel consumption data shall include available data at the highest level of detail available from national statistics: 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. Renewables and biofuels include biofuels, renewable municipal waste, hydro, ocean, geothermal, wind, solar and heat pumps.

[24] Example: https://www.iea.org/data-and-statistics/data-tools/energy-statistics-data-browser?country=GERMANY&energy=Coal&year=202

[25] https://ec.europa.eu/eurostat/web/energy/database/additional-data

6.2 Input data from literature sources

The following data are set out in part C of the Annex to CDR 1185.

Table 1 Default emissions factors for stationary combustion [g/MJ fuel on a net calorific value]. Note: values have to be multiplied with GWP factor set out in Annex V, part C, point 4 to Revised Directive EU/2018/2001.

Fuel	*CO_2*	*CH_4*	*N_2O*
Solid fossil fuels			
Anthracite	98.3	0.001	0.0015
Coking coal	94.6	0.001	0.0015
Other bituminous coal	94.6	0.001	0.0015
Sub-bituminous coal	96.1	0.001	0.0015
Lignite	101	0.001	0.0015
Patent fuel	97.5	0.001	0.0015
Coke oven coke	107	0.001	0.0015
Gas coke	107	0.001	0.0001
Coal tar	80.7	0.001	0.0015
Brown coal briquettes	97.5	0.001	0.0015
Manufactured gases			
Gas works gas	44.4	0.001	0.0001
Coke oven gas	44.4	0.001	0.0001
Blast furnace gas	260	0.001	0.0001
Other recovered gases	182	0.001	0.0001
Peat and peat products	106	0.001	0.0015
Oil shale and oil sands	73.3	0.003	0.0006
Oil and petroleum products			
Crude oil	73.3	0.003	0.0006
Natural gas liquids	64.2	0.003	0.0006
Refinery feedstocks	73.3	0.003	0.0006
Additives and oxygenates	73.3	0.003	0.0006
Other hydrocarbons	73.3	0.003	0.0006
Refinery gas	57.6	0.001	0.0001
Ethane	61.6	0.001	0.0001
Liquefied petroleum gases	63.1	0.001	0.0001
Motor gasoline	69.3	0.003	0.0006
Aviation gasoline	70	0.003	0.0006
Gasoline-type jet fuel	70	0.003	0.0006
Kerosene-type jet fuel	71.5	0.003	0.0006
Other kerosene	71.5	0.003	0.0006
Naphtha	73.3	0.003	0.0006
Gas oil and diesel oil	74.1	0.003	0.0006
Fuel oil	77.4	0.003	0.0006

White spirit and SBP	73.3	0.003	0.0006
Lubricants	73.3	0.003	0.0006
Bitumen	80.7	0.003	0.0006
Petroleum coke	97.5	0.003	0.0006
Paraffin waxes	73.3	0.003	0.0006
Other oil products	73.3	0.003	0.0006
Natural gas	56.1	0.001	0.0001
Waste			
Industrial waste (non-renewable)	143	0.03	0.004
Non-renewable municipal waste	91.7	0.03	0.004

Source: IPCC, 2006; cited from CDR 1185

Table 2 Default emissions factors for stationary combustion of fuels of biomass origin [g/MJ fuel on a net calorific value]

Fuel	***CO_2***	***CH_4***	***N_2O***
Primary solid biofuels	0	0.03	0.004
Charcoal	0	0.2	0.004
Biogases	0	0.001	0.0001
Renewable municipal waste	0	0.03	0.004
Pure biogasoline	0	0.003	0.0006
Blended biogasoline	0	0.003	0.0006
Pure biodiesels	0	0.003	0.0006
Blended biodiesels	0	0.003	0.0006
Pure bio jet kerosene	0	0.003	0.0006
Blended bio jet kerosene	0	0.003	0.0006
Other liquid biofuels	0	0.003	0.0006

Source: IPCC, 2006; cited from CDR 1185

Table 3. Fuel upstream emission factors [g CO_{2eq}/MJ fuel on a net calorific value]

Fuel	***Emission factor***
Hard coal	15.9
Brown coal	1.7
Peat	0
Coal gases	0
Petroleum Products	11.6
Natural gas	12.7
Solid biofuels	0.7
Liquid biofuels	46.8
Industrial Waste	0
Municipal waste	0
Biogases	13.7
Nuclear	1.2

Source: JEC WTW v5; cited from CDR 1185

Table A includes the values for the GHG emission intensity of electricity at country level in the European Union. If the GHG emission intensity of electricity is determined at country level, these values shall be used for electricity sourced in the European Union until more recent data becomes available to determine the emission intensity of electricity.

The objective of the Commission is to update these data annually. Data will be made available on the website of the European Commission.

Table A: Emission intensity of electricity in the European Union 2020

Country code	***Country***	***Emission intensity of generated electricity (g_{CO2eq}/MJ)***
AT	Austria	39.7
BE	Belgium	56.7
BG	Bulgaria	119.2
CY	Cyprus	206.6
CZ	Czechia	132.5
DE	Germany	99.3
DK	Denmark	27.1
EE	Estonia	139.8
EL	Greece	125.2
ES	Spain	54.1
FI	Finland	22.9
FR	France	19.6
HR	Croatia	55.4
HU	Hungary	72.9
IE	Ireland	89.4
IT	Italy	92.3
LV	Latvia	39.4
LT	Lithuania	57.7
LU	Luxembourg	52.0
MT	Malta	133.9
NL	Netherlands	99.9
PL	Poland	196.5
PT	Portugal	61.6
RO	Romania	86.1
SK	Slovakia	45.6
SI	Slovenia	70.1
SE	Sweden	4.1

Source: CDR 1185 based on JRC, 2022

7. Sustainability

This chapter defines the provisions related to the electricity used to produce RFNBOs.

If the output of a process does not fully qualify as RFNBO, the RFNBO share in the total output shall be determined according to the provisions in Chapter 4.9 above.

The requirements on GOs defined in this chapter also apply in cases where this document and CDR 1184 do not require the conclusion of a renewables PPA.

7.1 Case 1: Grid mix

Article 27(3), fourth subparagraph, of Revised Directive EU/2018/2001 defines that, where electricity is used for the production of RFNBOs, either directly or for the production of intermediate products, the average share of electricity from renewable sources in the country of production, as measured two years before the year in question, shall be used to determine the share of renewable energy.

The average share of electricity from renewable sources in the country of production shall be determined by dividing the gross final consumption of electricity from renewable sources in the country of production calculated by analogy to the rules set out in Article 7(2) of Revised Directive EU/2018/2001 by the gross electricity production from all energy sources as defined in Annex B to Regulation (EC) 1099/2008, except from water previously pumped uphill, plus imports minus exports of electricity to the country.

Guarantees of Origin (GOs) according to Revised Directive EU/2018/2001 Art. 19 for renewable electricity need to be cancelled for RFNBO production in EU Member States and EFTA States. The renewable electricity GOs for the direct line need to comply with the general requirements laid out in Article 19 of Revised Directive EU/2018/2001. In Member States where GOs cannot be issued for self-consumption, no GOs are required.

Similarly, in third countries where a certification system similar to the definition in Revised Directive EU/2018/2001 Art. 19 for renewable electricity exists, the relevant certificates need to be cancelled for RFNBO production.

The electricity GOs or certificates in third countries shall be issued for installations located in the same country as the electrolyser.

All provisions related to electricity GOs or certificates in third countries detailed in Chapter 7.3.5 apply.

7.2 Case 2: Rules for counting electricity obtained from direct connection to an installation generating renewable electricity as fully renewable

For the purpose of demonstrating compliance with the criteria set out in Article 27(3), fifth subparagraph, of Revised Directive EU/2018/2001 for counting electricity obtained from direct connection to an installation generating renewable electricity as fully renewable, the fuel producer shall provide evidence on the following:

(a) the installations generating renewable electricity are connected to the installation producing RFNBO via a direct line, or the renewable electricity production and production of RFNBO take place within the same installation. The physical existence of a direct line must be verified to comply with this requirement and may also be additionally supported by construction plans and / or permitting documentation;

(b) the installations generating renewable electricity came into operation not earlier than 36 months before the installation producing RFNBO; where additional production capacity is added to an existing installation producing RFNBO, the added capacity shall be considered to be part of the existing installation, provided that the capacity is added at the same site and the addition takes place no later than 36 months after the initial installation came into operation. The commissioning date of the installation generating renewable electricity and the installation producing RFNBO must be evidenced by providing and verifying the plants' operational plans, data originating from the bidding zone's TSO or DSO (whichever apply) to verify the first date of electricity injection, data such as commercial contracts and production data supporting the commissioning date of the installation producing RFNBOs; and

(c) the installation producing electricity is not connected to the grid, or the installation producing electricity is connected to the grid but a smart metering system that measures all electricity flows from the grid shows that no electricity has been taken from the grid to produce RFNBO. The correct calibration of the smart metering system must be checked and approved by the Certification Body.

If the fuel producer also uses electricity from the grid, it may count it as fully renewable if it complies with the rules set out in Chapter 7.3.

An installation shall be considered to be in operation once the physical production of RFNBO or renewable electricity has started (i.e. once the production of fuels including hydrogen or any other RFNBO or renewable electricity has started; see definitions in the CertifHy EU RFNBO Voluntary Scheme document "Definitions" as well as Chapter 7.3.5).

Guarantees of Origin (GOs) according to Revised Directive EU/2018/2001 Art. 19 for renewable electricity need to be cancelled for RFNBO production in EU-Member States and in EFTA States. The renewable electricity GOs for the direct line need to comply with the general requirements in Article 19 of Revised Directive EU/2018/2001. In Member States where GOs cannot be issued for self-consumption, no GOs are required.

Similarly, in third countries where a certification system similar to the definition in Revised Directive EU/2018/2001 Art. 19 for renewable electricity exists, the related certificates need to be cancelled for RFNBO production.

All provisions related to electricity GOs or certificates in third countries detailed in Chapter 7.3.5 apply.

Electricity sourced via a direct connection from an installation that does not meet the requirements for being considered fully renewable would not count as fully renewable, and the rules applying for electricity taken from the grid that does not qualify as fully renewable apply (see Chapter 4.11).

7.3 Case 3: Rules for counting electricity taken from the grid as fully renewable

7.3.1 Grid mix above 90% renewables

Fuel producers may count electricity taken from the grid as fully renewable if the installation producing the RFNBO is located in a bidding zone where the average proportion of renewable electricity exceeded 90% in the previous calendar year and the production of RFNBO does not exceed a maximum number of hours set in relation to the proportion of renewable electricity in the bidding zone.

The average share of electricity from renewable sources in the country of production shall be determined by dividing the gross final consumption of electricity from renewable sources in the country of production calculated by analogy to the rules set out in Article 7(2) of Revised Directive EU/2018/2001 by the gross electricity production from all energy sources as defined in Annex B to Regulation (EC) 1099/2008, except from water previously pumped uphill, plus imports minus exports of electricity to the country.

This maximum number of hours shall be calculated by multiplying the total number of hours in each calendar year by the share of renewable electricity reported for the bidding zone where the renewable RFNBO is produced. The average share of renewable electricity shall be determined by dividing the gross final consumption of electricity from renewable sources in the bidding zone calculated by analogy to the rules set out in Article 7(2) of Revised Directive EU/2018/2001 by the gross electricity production from all energy sources as defined in Annex B to Regulation (EC) 1099/2008, except from water previously pumped uphill, plus imports minus exports of electricity to the bidding zone. Once the average share of renewable electricity exceeds 90% in a calendar year, it shall be continued to be considered to be higher than 90% for the subsequent five calendar years.

The definition of 'bidding zone' for the European Union (see CertifHy EU RFNBO Voluntary Scheme document "Definitions") is to be applied in countries where the European definition of bidding zone can be applied.

With regards to the implementation of the bidding zone concept, recital 3 of CDR 1184 provides further guidance:

"[…] Where reference is made to bidding zone and imbalance settlement period, concepts that exist in the Union but not in all other countries, it is appropriate to allow fuel producers in third countries to rely on equivalent concepts

provided the objective of this Regulation is maintained and the provision is implemented based on the most similar concept existing in the third country concerned. In case of bidding zones such concept could be similar market regulations, the physical characteristics of the electricity grid, notably the level of interconnection or as a last resort the country."

Accordingly, the following approach shall be applied:

- It shall be assessed 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, it shall be assessed 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, and there are no geographically differentiated electricity prices, the whole country may be considered as one bidding zone for the purpose of the implementation of the methodology.
- 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 (see Chapter *7.3.1*), the emission intensity of electricity (see Chapter *7.3.2*) or the price of electricity (see Chapter *7.3.6* and *7.3.7*), the conditions can only be considered as fulfilled if compliance can be demonstrated based on reliable data[26] from official sources[27].

Guarantees of Origin (GOs) according to Revised Directive EU/2018/2001 Art. 19 for renewable electricity need to be cancelled to the benefit of the RFNBO producer in EU-Member States and in EFTA States. The renewable electricity GOs need to comply with the general requirements in Article 19 of Revised Directive EU/2018/2001.

Similarly, in third countries where a certification system similar to the definition in Revised Directive EU/2018/2001 Art. 19 for renewable electricity exists, the related certificates need to be cancelled for RFNBO production.

The electricity GOs or certificates in third countries shall be issued for energy originating from installations located in the same country as the electrolyser.

All provisions related to electricity GOs or certificates in third countries detailed in Chapter *7.3.5* apply.

[26] 'Reliable data' means information that is consistently accurate and trustworthy, with a proven track record of precision and adherence to standards.

[27] 'Official sources' refers to authoritative entities or documents recognized by governing bodies, regulatory authorities, or standards organizations. Information from official sources is validated, authentic, and compliant with regulatory and/or industry standards.

7.3.2 Emission intensity of grid electricity lower than 18 g_{CO2eq}/MJ

Where the conditions set out in Chapter 7.3.1 are not met, fuel producers may count electricity taken from the grid as fully renewable if the installation producing the RFNBO is located in a bidding zone where the emission intensity of electricity is lower than 18 g_{CO2eq}/MJ, provided that the following criteria are met:

(a) the fuel producers have concluded directly, or via intermediaries, 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 this or these installations; and

(b) the conditions on temporal and geographical correlation in accordance with Chapters 7.3.6 and 7.3.7 are met.

The emission intensity of electricity shall be determined following the approach for calculating the average carbon intensity of grid electricity in the methodology for determining the greenhouse gas emissions savings from RFNBO set out in chapters 4, 5, and 6 based on latest available data.

Once the emission intensity of electricity is lower than 18 g_{CO2eq}/MJ in a calendar year, the average emission intensity of electricity shall be continued to be considered to be lower than 18 g_{CO2eq}/MJ for the subsequent five calendar years.

The conditions can only be considered as fulfilled if compliance can be demonstrated based on reliable data from official sources.

7.3.3 Imbalance settlement

Electricity taken from the grid that is used to produce RFNBO may also be counted as fully renewable if the electricity used to produce RFNBO is consumed during an imbalance settlement period during which the fuel producer can demonstrate, based on evidence from the national transmission system operator, that:

(a) power-generating installations using renewable energy sources were redispatched downwards in accordance with Article 13 of Regulation (EU) 2019/943;

(b) the electricity consumed for the production of RFNBO reduced the need for re-dispatching by a corresponding amount.

This requirement must be evidenced by the Economic Operator providing the proof one or several bids inserted by installation producing the RFNBO (or one of its intermediaries) on the manual Frequency Restoration Reserve (mFRR) (or an equivalent mechanism) were selected by the TSO in the corresponding bidding zone and the reason for the bid being selected is identified as "redispatching", "congestion management" or equivalent. The evidence must be a document issued and / or certified by the relevant TSO.

These rules will likely be applied only in exceptional cases and the provision shall be followed strictly.

The above provision can only be applied in jurisdictions where Regulation (EU) 2019/943 applies or where market rules are implemented that allow applying this provision, i.e. that entities adopting the tasks of national transmission system operators as well as rules for re-dispatching are set out.

7.3.4 Power Purchase Agreements

Where the conditions in Chapters 7.3.1, 7.3.2, and 7.3.3 are not met, fuel producers may count electricity taken from the grid through PPAs as fully renewable if it complies with the conditions on additionality, temporal correlation and geographic correlation in accordance with Chapters 7.3.5, 7.3.6, 7.3.7.

Requirements for renewable power purchase agreements (PPA) stem from the definition set out in Revised Directive EU/2018/2001 and in CDR 1184. CDR 1184 allows fuel producers to conclude one or more renewable PPAs directly, or via intermediaries. The renewable PPAs need to clearly identify the installations that produce the amount of renewable electricity that is used to produce the renewable hydrogen. Furthermore, the hydrogen producer can only claim the production of RFNBOs based on a renewable PPA if the electricity supplied under the contract has effectively been produced. Intermediaries referred to in CDR 1184 may be involved by various means and for various purposes, including as a contracting party. For example, intermediaries can represent the electricity producers, but it is important that a direct relationship between the electricity producer and the hydrogen producer is maintained.

In addition, the requirements on cancelling Guarantees of Origin (GO) of renewable electricity as described in chapter 7.3.5, the requirements set out in Article 5 of CDR 1184, and the requirements set out in Article 19 of Revised Directive EU/2018/2001 (referred to in recital 15 of CDR 1184), have to be met.

7.3.5 Additionality and no support

The additionality condition referred to in Chapter 7.3.4 shall be considered complied with if fuel producers produce an amount of renewable electricity in their own installations that is at least equivalent to the amount of electricity claimed as fully renewable, or have concluded directly, or via intermediaries, one or more renewable PPAs with Economic Operators producing renewable electricity in one or more installations for an amount of renewable electricity that is at least equivalent to the amount of electricity that is claimed as fully renewable and the electricity claimed is effectively produced in this or these installations, provided that the following criteria are met:

(a) the installation generating renewable electricity came into operation not earlier than 36 months before the installation producing the RFNBO.

Where an installation generating renewable electricity complied with the requirements set out in the previous sentence under a renewables PPA with a fuel producer that has ended, it shall be considered to have come into operation at the same time as the installation producing the RFNBO under a new renewables PPA. The commissioning date of the installation generating renewable electricity and the installation producing RFNBO shall be evidenced by providing and verifying the plants' operational plans, data originating from the bidding zone's TSO or DSO (whichever apply) to verify the first date of electricity injection, data such as commercial contracts and production data supporting the commissioning date of the installation producing RFNBOs.

Where additional production capacity is added to an existing installation producing RFNBO, the added capacity shall be 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 36 months after the initial installation came into operation.

For installations producing RFNBOs, the condition for adding additional capacity in the previous paragraph shall be complied with in order to consider the different capacity parts as one installation.

Starting production should be considered to include any form of commercial production of hydrogen or other RFNBOs or renewable electricity that is intended to be used or sold and goes beyond a pure testing of the installation.

If the installation is taken into operation step by step (part of the capacity at date 1 and other part(s) of the capacity at (a) later date(s)), then the definition of coming into operation would refer to the first date.

(b) The installation generating renewable electricity has not received support in the form of operating aid or investment aid, excluding 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 RFNBO used for research, testing and demonstration.

The absence of any support received shall be evidenced by providing a description of supporting schemes for renewable electricity in the relevant countries, bidding zones, states or regions along with a list of supported installations in the context of these supporting schemes originating from a public and trusted source (governmental and / or institutional). The installation(s) generating renewable electricity must not be identified in the list of supported installations.

Where no trusted source is available, the absence of support shall be supported by a statement found in the Power Purchase Agreement or self-declaration from the Economic Operator, stating that the installation(s) producing renewable electricity have not received support in the form of operating aid or investment aid.

Where an installation is identified has having received support, the reimbursement of such support shall be evidenced by financial statement.

Operating aid or investment aid could be considered to include any payments received from public authorities for the construction of the installations generating renewable electricity and any benefits received from public authorities for the production of renewable electricity, including feed-in tariffs, feed-in premiums, reductions applying for the production, contracts for difference or any direct payments linked to the production of renewable electricity. Whether e.g., a contract for difference constitutes net support, it should be assessed ex-ante and verified ex-post. For the ex-ante assessment, fuel producers should demonstrate based on 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 should demonstrate that the contracted installations generating renewable electricity did not receive net support.

This provision shall not apply until 1 January 2038 to installations producing RFNBO that come into operation before 1 January 2028. This exemption shall not apply to capacity added after 1 January 2028 for the production of RFNBOs.

Revised Directive EU/2018/2001 defines in Art. 27(3), sixth subparagraph: "Electricity that has been taken from the grid may be counted as fully renewable provided that it is produced exclusively from renewable sources and the renewable properties and other appropriate criteria have been demonstrated, ensuring that the renewable properties of that electricity are claimed only once and only in one end-use sector."

In order to ensure this, Guarantees of Origin (GOs) according to Revised Directive EU/2018/2001 Art. 19 for renewable electricity need to be cancelled for RFNBO production in EU-Member States and in EFTA States. The renewable electricity GOs for the PPA (see Chapter 7.3.4) need to comply with the general requirements in Article 19 of Revised Directive EU/2018/2001.

Similarly, in third countries where a certification system similar to the definition in Revised Directive EU/2018/2001 Art. 19 for renewable electricity exists, the related certificates need to be cancelled for RFNBO production.

Only GOs or certificates in third countries that have been issued for the installations covered by the renewables PPAs can be used as evidence. The GOs or certificates in third countries need to carry the same attributes as the physical installation producing the renewable electricity. This includes, but is not limited to:

- The installation unique identifier
- the location of the installation, either postal address where unique, or geographical coordinates
- electrical production capacity of the installation
- the production technology and energy source of the installation
- the date when the installation came into operation
- the production period or date and time of the production (start and end); and
- financial support information (investment support, operational support, etc.).

The associated GOs or certificates in third countries need to be cancelled before the expiry of the validity period to the benefit of the fuel producer and the volume cancelled shall correspond to that claimed under the PPA. The renewable electricity producer shall not sell or transfer the associated GOs or certificates in third countries to any other entity than the operator of the electrolyser under the PPA. These requirements on GOs apply also when renewable electricity is sourced in line with Article 4(1)-(3) of CDR 1184.

Where a Member State decides to immediately cancel the associated electricity GOs, this shall be recognized as proof for avoiding double counting. The adequate cancellation of GOs must be evidenced by the provision of the related cancellation statements, originating by the Issuing Body appointed by a Competent Authority in the relevant bidding zone. When the cancellation statement of GOs cannot be provided for legal reasons (e.g. immediate cancellation decided by Member States, GOs issued on behalf of a Member State for supported production), this must be evidenced by the provisions of the relevant legal texts.

In other countries, the fuel producer shall provide a signed declaration of the producer of the renewable electricity that there is no double selling or double claiming of the renewable attribute and/ or the GHG savings related to this electricity.

7.3.6 Temporal correlation

Until 31 December 2029 the temporal correlation condition referred to in Chapters 7.3.4 and 7.3.7, shall be considered complied with if the RFNBO is produced during the same calendar month as the renewable electricity produced under the renewables PPA or from renewable electricity 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 under the renewables PPA has been produced.

From 1 January 2030, the temporal correlation condition shall be considered complied with if the RFNBO is produced during the same one-hour period as the renewable electricity produced under the renewables PPA or from renewable electricity 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 under the renewables PPA has been produced.

Storage assets are to be considered new if they came into operation not earlier than 36 months before the installation producing RFNBO.

Where a European Union Member State applies the rules set out in this paragraph already from 1 July 2027, for RFNBO produced in their territory, fuel producers shall conform to the rules set out in this paragraph from 1 July 2027 for RFNBO produced in the territory of this Member State, i.e. not for imported RFNBO.

The temporal correlation condition shall always be considered complied with if the RFNBO 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), point (a) of Commission Regulation (EU) 2015/1222[28], is lower or equal to 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[29].

In case the installations generating renewable electricity are not in operation during a period where the conditions defined in the previous paragraph are complied with, the electricity taken from the grid could still be considered as fully renewable if all other relevant criteria set out in this document Chapter 7 are met. This includes criteria on additionality as well as on geographical correlation. As regards the criteria on additionality, it would be sufficient to

[28] Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management (OJ L 197, 25.7.2015, p. 24).

[29] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (OJ L 275, 25.10.2003, p. 32).

demonstrate that a sufficient quantity of renewable electricity was effectively produced by eligible installations under the PPA. It would not matter when this production took place.

For the price of an allowance to emit one tonne of carbon dioxide equivalent, the closing price of the previous trading day for December futures for the ongoing year should be applied.

Possible sources of data include[30]:

- ICE Endex[31]; and
- EEX[32]

The provision in the previous paragraph can only be applied in countries where Regulation (EU) 2015/1222 applies or where a liberalized electricity market exists and similar provisions to Regulation (EU) 2015/1222 are implemented. Where the provision in the previous paragraph makes reference to the price of an allowance to emit one tonne of carbon dioxide equivalent for the purpose of meeting the requirements of Directive 2003/87/EC, this can only be applied in countries where Directive 2003/87/EC applies.

Where electricity price data are required, the conditions can only be considered as fulfilled if compliance can be demonstrated based on reliable electricity price data from official sources.

7.3.7 Geographical correlation

The geographical correlation condition referred to in chapters 7.3.4 and 7.3.6 shall be considered complied with if at least one of the following criteria relating to the location of the electrolyser is fulfilled:

(a) the installation generating renewable electricity under the renewables power purchase agreement is located, or was located at the time when it came into operation, in the same bidding zone as the electrolyser; or

(b) the installation generating renewable electricity is located in an interconnected bidding zone, including in another Member State and electricity prices in the relevant time period on the day-ahead market referred to in Chapter 7.3.6 in the interconnected bidding zone is equal or higher than in the bidding zone where the RFNBO is produced; or

(c) the installation generating renewable electricity under the renewables PPA is located in an offshore bidding zone[33] that is interconnected with the bidding zone where the electrolyser is located.

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[30] CertfiHy gives no warranty (express or implied) and excludes any liability (whether in negligence or otherwise) in connection with the Data provided by the listed sources, including (without limitation) in relation to their availability, suitability, quality, accuracy, timeliness, completeness and or performance.

[31] https://www.ice.com/products/197/EUA-Futures/data?marketId=5474738&span=1

[32] https://www.eex.com/en/market-data/environmentals/futures

[33] The term „offshore bidding zone" is not yet defined legally in Europe. It is used by the European Commission in its „Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: An EU Strategy to harness the potential of offshore renewable energy for a climate neutral future"; Brussels, 19.11.2020; COM(2020) 74 final. The accompanying Commission Staff Working Document, Brussels, 19.11.2020, SWD(2020) 273 final, details the concept of offshore bidding zones.

The location of the installation generating renewable electricity and the location of the installation producing RFNBO shall be evidenced by the provision of their respective geographic coordinates supported by official plans.

Economic Operators located outside of the EU shall support their claim by presenting evidence regarding the definition of bidding zones at their locations according to 7.3.1 of this document.

Where electricity price data are required, the conditions can only be considered as fulfilled if compliance can be demonstrated based on reliable electricity price data from official sources.

When referring to (b) in this chapter (neighbouring bidding zones), the Economic Operator shall use the following guidance:

- For each relevant time interval, the day-ahead prices of the relevant bidding zones. The price data should for each bidding zone must originate from the same source.
- Accepted price data source for bidding zones in EU include: EPEXSPOT[34], Nordpool[35], ENTSO-E[36].
- For bidding zones outside of the EU, the price data must originate from a public, verifiable and trusted source.
- The Economic Operator shall show that the rules set out in (b) from this chapter are verified for each hour.

While interconnected bidding zone are usually adjacent, there may be exceptions e.g., if the bidding zones are connected via a direct line such as a sub-sea cable but otherwise not adjacent.

Offshore bidding zones should be considered as bidding zones that comprise only offshore areas i.e. no land.

Where European Union Member States, without prejudice to Articles 14 and 15 of Regulation (EU) 2019/943, define additional criteria concerning the location of electrolysers and the installation producing renewable electricity to the criteria set out above in order to ensure compatibility of capacity additions with the national planning of the hydrogen and electricity grid, these additional criteria have to complied with for the certification of RFNBO produced in the territory of this Member State, i.e. not for imported RFNBO.

For provisions on “bidding zone”, please see chapter 7.3.1.

7.3.8 Combinations of electricity supply options

The Revised Directive EU/2018/2001 sets out two main pathways to produce RFNBOs: The first approach, set out in the fourth subparagraph of Article 27(3), determines the share of renewable hydrogen based on the share of renewable electricity in the country of production in the year n-2. The second approach set out in the fifth and sixth subparagraphs of Article 27(3), which is further detailed in CDR 1184, allows to produce fully renewable hydrogen via several sub-options.

[34] https://www.epexspot.com/en/market-data

[35] https://data.nordpoolgroup.com/

[36] https://transparency.entsoe.eu/

Fuel producers may combine different pathways and options to source renewable electricity provided the way electricity is sourced is fully documented in line with the requirements set out in Article 8 of CDR 1184. This applies also for electricity sourced during the same time interval. For each way of sourcing electricity, the dedicated rules apply.

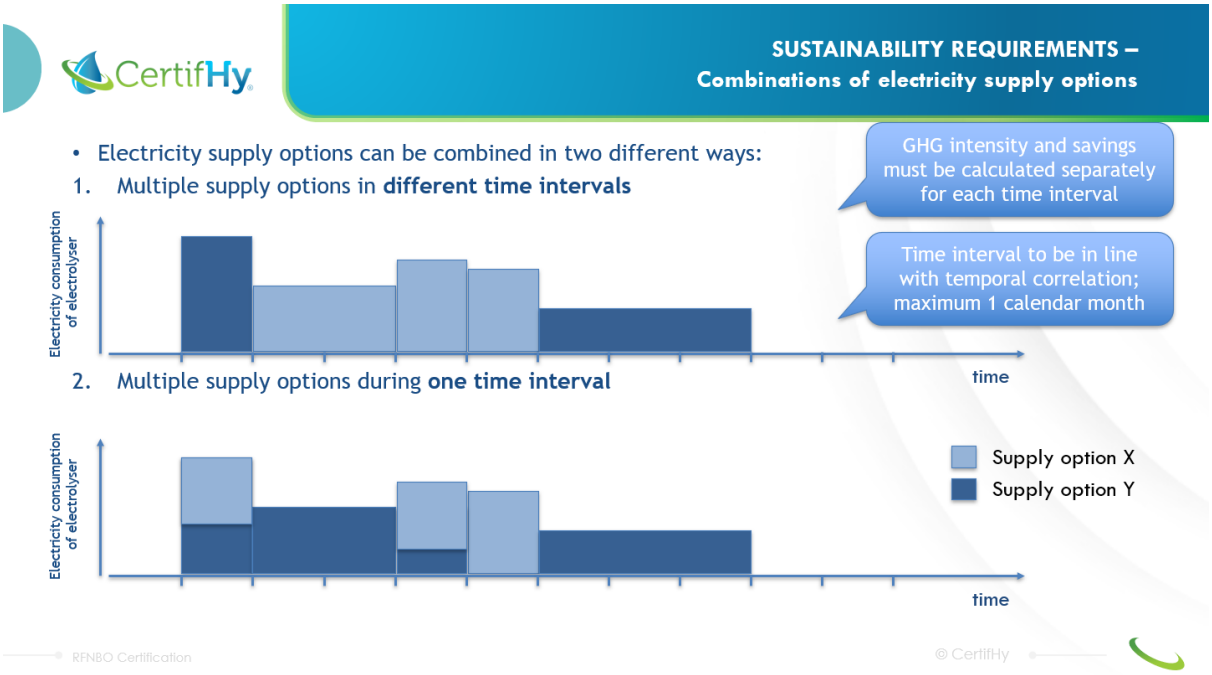

Figure 6: Combinations of electricity supply options

If for instance an 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. The hydrogen produced from the remaining 30% electricity cannot be made renewable by applying the rules of CDR 1184. The hydrogen produced from the remaining 30% electricity may count as low carbon hydrogen under the forthcoming framework under the Hydrogen and Gas Market Decarbonisation Package.

7.4 Common rules

Fuel producers shall provide reliable information demonstrating that all requirements set out in Chapters 7 to 7.3 are complied with, including for each hour as relevant:

(a) the amount of electricity used to produce RFNBO. This information shall be further detailed as follows:
  (i) the amount of electricity sourced from the grid that does not count as fully renewable as well as the proportion of renewable electricity
  (ii) the amount of electricity that counts as fully renewable because it has been obtained from a direct connection to an installation generating renewable electricity as set out in chapter 7.2 (based on CDR 1184 Article 3)

(iii) the amount of electricity sourced from the grid that counts as fully renewable according to the criteria set out in chapter 7.3.1 (based on CDR 1184 Article 4(1))

(iv) the amount of electricity that counts as fully renewable according to the criteria set out in chapter 7.3.2 (based on CDR 1184 Article 4(2)

(v) the amount of electricity that counts as fully renewable according to the criteria set out in chapter 7.3.3 (based on CDR 1184 Article 4(3)

(vi) the amount of electricity that counts as fully renewable in accordance with the criteria set out in s chapter 7.3.4 (based on CDR 1184 Article 4(4)

(b) the amount of renewable electricity generated by the installations generating renewable electricity, regardless of whether they 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; and

(c) the amounts of RFNBOs produced by the fuel producer.

Annex C: *Data requirements for initial audits* provides a list of detailed data requirements.

Annex A: Implementation of co-processing for RFNBOs

RFNBOs may be produced in processes which rely next to renewable hydrogen also on other inputs including fossil fuels, recycled carbon fuels and biomass. This annex explains how the relevant provisions set out in Revised Directive EU/2018/2001 and CDR 1185 and the Q&A guidance document (see chapter 3) shall be implemented to derive the share of RFNBOs in the output of the process as well as the achieved emission savings. Relevant for the implementation are in particular Articles 25(1)(a) and 30 (2) of Revised Directive EU/2018/2001 as well as in chapter 4.2.

Articles 25(2)(a) Revised Directive EU/2018/2001 sets out that RFNBOs are counted towards the targets if they are used as intermediate products for the production of conventional fuels and biofuels. This covers cases where renewable hydrogen is used in refineries e.g., to remove impurities during the hydro treating as well as hydrogen used for the production of HVO and methanol that is used for the production of biodiesel. Given that the hydrogen is already counted, such use of hydrogen is not further considered for the calculation of the share of renewable energy in the output of the process.

As a consequence, all renewable hydrogen that is used for the production of conventional transport fuels in oil refineries can be counted towards the objectives of Revised Directive EU/2018/2001 Article 25(1), i.e. before the final fuel is consumed. This implies that the contribution is counted towards the target for renewable energies in transport in the Member State where the renewable fuel is used in the production of the fuel and not where the final fuel is consumed i.e. conventional fuels produced in the refinery will continue to count as fossil fuels. Under the Revised Directive EU/2018/2001 as amended by Directive (EU) 2023/2413 also hydrogen as an intermediate product that is used for the production of biofuels can be counted towards the targets set out in transport. Renewable hydrogen (RFNBOs) used in refineries for other purposes, e.g. for the production of heating oil, is counted towards the industry target.

CDR 1185 sets out a specific rule for calculating the emission intensity of RFNBOs stemming from a process where co-processing is applied (see chapter 4.2). It allows to distinguish in the calculation of the greenhouse gas emissions intensity on a proportional basis of the energetic value of inputs between: (1) the part of the process that is based on the conventional input and (2) the part of the process that is based on RFNBOs assuming that the process parts are otherwise identical.

If for instance a process uses H_2, CO, CO_2 as well as other energy inputs to produce synthetic fuels and the producer intends to replace 20% of the H_2 with H_2 qualifying as RFNBO, it would be possible to determine the emission intensity of the produced synthetic fuels assuming a virtual process which uses only 20% of all inputs mentioned above (20% of each input). In this example, all hydrogen qualifying as RFNBO (which is 20% of the total H_2 input) would be used in the virtual process, and the other 80% of the hydrogen (all non-RFNBO) would be used in the other process which uses 80% of all inputs. Such process would also yield only 20% of the output, but only the energy share of RFNBO hydrogen in the input would be considered an RFNBO. It would be possible to replace in this virtual process more than one input. Not only RFNBOs but also biomass, renewable electricity, renewable heat and CO_2 (including biogenic) could be used for this purpose. While the use of biomass would not add to the share of RFNBOs in the output, they could reduce the emission intensity of the output as the entire output of the virtual process would have the same emission intensity.

$$S_{RFNBO,out} = \frac{E_{RFNBO,in}}{E_{educts}} \quad (1)$$

Where:

$S_{RFNBO,out}$*: energy share of the product that can be counted as RFNBO*

$E_{RFNBO,in}$*: energy content of the RFNBO input only*

E_{educts}*: energy content of all "relevant" inputs (as defined in chapter 4.9).*

For instance, as stated above, if 20% of the energy of the relevant inputs comes from hydrogen that qualifies as renewable, 20% of the output can be claimed as RFNBO. For the share calculated above, it is possible to virtually split the process and determine the emissions for the RFNBO only as follows:

$$Em_{RFNBO} = \Sigma_n s_n \cdot e_{i,n} + e_p + e_{td} + e_u - e_{ccs} \quad (2)$$

Where:

n: each relevant input

s_n*: energy share of the input "n":* $s_n = \frac{E_{n,in}}{E_{educts}}$

$e_{i,n}$*: emissions intensity for the supply of the input "n".*

Inputs qualifying as RFNBO can be attributed to this part of the virtually split process with the upper limit of the energy (or stoichiometric) ratio of the input entering into the output (meaning the energetic share of all inputs has to be respected also for the virtually split part).

CO_2 emissions from fuel combustion have to be counted in the term e_u. If non-fossil carbon enters into the molecule of the output, those emissions might be compensated by the term e_{ex_use} included in e_i for those non-fossil inputs. The share of RFNBOs in the output of the virtual process would be determined as set out in chapter 4.9. In case the process yields more than one output, each type of output would include the same share of RFNBOs and other fuels in line with Article 30(2) of Revised Directive EU/2018/2001 [37]. The ratio of different outputs of the virtual process should not differ from

[37] The described approach applies only for the production of RFNBOs. For determining emission savings and produced amounts of biofuels the relevant provisions in Annex V to Revised Directive EU/2018/2001 and the Commission Delegated Regulation (EU) 2023/1640 of 5 June 2023 on the methodology to determine the share of biofuel and biogas for transport, produced from biomass being processed with fossil fuels in a common process apply.

the share of outputs of the whole process. In accordance with chapter 4.2 it is possible to determine the emission intensity of the output over a period of at most one calendar month.

For illustration purposes only, Figure 7 provides a graphical representation of a process with several inputs; this process may have only one output, or several.

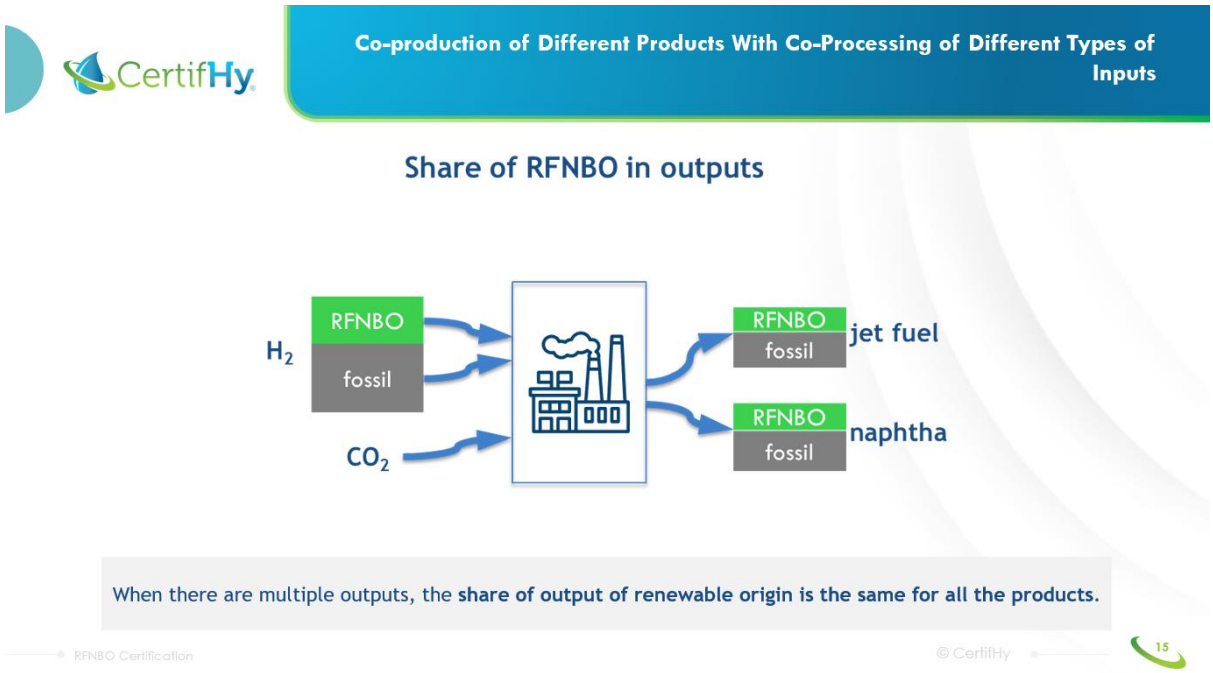

Figure 7: Co-production of different products with co-processing of different types of inputs

Annex B: Criteria for "effective carbon pricing system"

The European Commission has published the guidance document "Q&A implementation of hydrogen delegated acts"[38].

The latest version of the document at the time of adoption of this CertifHy scheme document is the version of 14 March 2024.

Annex B: Criteria for "effective carbon pricing system" includes a list of countries with systems that "can be considered to fulfil the requirement of upstream accounting in an effective carbon pricing system".

The systems covered by this list are recognized by CertifHy.

This list is not exhaustive. Other systems within which RFNBOs are expected to be produced may request to be assessed. Requests to assess the carbon pricing systems of specific countries in regard to the compliance with the delegated acts, can be addressed at the European Commission by the relevant competent authorities. The same applies to carbon pricing systems sub-national level.

The chapter "Criteria effective carbon pricing system" defines the following criteria, which are applied by the European Commission for assessing whether systems are to be considered to fulfil the requirement of upstream accounting in an effective carbon pricing system. In case these criteria are changed, the guidance document "Q&A implementation of hydrogen delegated acts" has precedence over this CertifHy document.

The GHG Methodology sets out that emissions from an input that are avoided when the input is used for fuel production can be deducted from the calculation of the emission intensity of RFNBOs. Such emissions include the CO_2 equivalent of the carbon incorporated in the RFNBO that would have otherwise been emitted as CO_2 into the atmosphere. This includes CO_2 from certain sources that were captured and incorporated into the fuel. One source is the activities listed under Annex I to the ETS Directive (Directive 2003/87/EC), provided that the captured CO_2 has been "taken into account upstream in an effective carbon pricing system" and is incorporated in the chemical composition of the fuel before a certain date.

Accounting upstream in an effective carbon pricing system means that the emissions are subject to a carbon price when the RFNBOs is first produced. For example, when emissions from an industrial process are subject to carbon pricing when captured and used to produce an RFNBO (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 (e.g. when the e-kerosene is used in aviation).

As concerns what is an "effective carbon pricing system" in this context, the system must meet minimum criteria ensuring effective enforcement, so each tonne emitted is paid for:

(i) have a robust monitoring, reporting and verification process;

(ii) be binding on its participants;

[38] Available at https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/voluntary-schemes_en

(iii) be stable;

(iv) apply the carbon price at least on the whole sector producing the RFNBOs;

(v) ensure stringent enforcement;

(vi) 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:

(i) in the case of an emissions trading system (ETS): with an absolute and ultimately declining cap aligned with the climate neutrality target of the country for achieving the country's Nationally Determined Contribution (NDC) aligned with the Paris agreement.

(ii) in the case of a tax: with an increasing trajectory aligned with the climate neutrality target of the country for achieving the country's NDC aligned with the Paris agreement.

(iii) for both an ETS and a tax: without design features which render the cap or tax ineffective.

The following systems can be considered to fulfil the requirement of upstream accounting in an effective carbon pricing system:

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

ii) Swiss ETS

iii) UK ETS

This list is not exhaustive. Other systems within which RFNBOs are expected to be produced may request to be assessed by the European Commission and will be published in the guidance document "Q&A implementation of hydrogen delegated acts".

The criteria applied in this context to assess what is an effective carbon pricing system do not prejudge the recognition of a carbon price paid under the Carbon Border Adjustment Mechanism (CBAM).

Annex C: Data requirements for initial audits

Type	Detailed information	Format[39]	Comments
Qualitative information	Where PPA applies: Signed PPA or signed term-sheet for PPA or tendering/ request for proposal documents for the renewable energy supply, including list of installations providing renewable electricity for the project with unique identification	pdf	Required to assess: • Fitness of Renewable Electricity procurement strategy with EU regulation • Additionality • Avoidance of double counting of renewable electricity attributes
	Description of supporting schemes for renewable electricity in the respective countries, states or regions, list of supported installations, Self-declaration concerning support received by renewable electricity generating installations	ppt/ pdf	
	Description/ Study of the available EAC/ REC[40]-System in the respective country and the commitment to use the EAC/ REC-System as far as it is/ will be available; or Description how the renewable electricity is statistically recorded and published in the respective country with references to legal regulations or national authorities who are responsible for such statistics	ppt/ pdf	
Quantitative information	Evidences for the recent national or regional electricity mix	ppt/ pdf	Required to assess: • Temporal correlation • Geographical correlation • Additionality
	Renewable electricity load profile forecast over a full year	xls	

[39] File formats: ppt – powerpoint (slides), pdf – portable data format; xls – Excel (spread sheet)

[40] EAC – Energy Attribute Certificate; REC – Renewable Energy Certificate

Type	Detailed information	Format[39]	Comments
	Electrolyser consumption profile forecast over a full year	xls	
	Proof of date when hydrogen production installation is planned to come into operation	pdf	

Type	Detailed information	Format	Comments
Qualitative information	Simplified block diagram listing inputs/ process steps & outputs across the value chain	ppt/ pdf	Required for the auditor to: • Clarify the working hypotheses and plant configuration • Understand the relevant inputs to be considered • Make sure the GHG calculation is developed on the good scope
	Description of all inputs: origin/ renewability (if relevant)	ppt/ pdf	
	High level description of downstream (after FOB[41]) activities envisaged	ppt/ pdf	
Quantitative information	Heat & mass balance for all the different process steps	xls	Required for the auditor to: • Check the calculation scope and hypotheses • check consistency • Make sure that the methodology is correctly implemented
	Utilities consumption for all the different process steps (incl. what share of inputs/ outputs will be renewable)	xls	
	Emission factors for all the different inputs (incl. upstream emissions) based on the EU RED methodology or relevant official sources	xls	
	Carbon Footprint (CFP) calculation model detailing the operations performed at each process step and underlying the results	xls	

[41] FOB – free on board

Type	Detailed information	Format	Comments
	Resulting final CFP for each products and/ or plant operating regime and % of GHG emissions reduction compared to the Fossil Fuel Comparator	xls	
	High-level mass balance tool allowing to follow a production batch over time	xls	
	Information above detailed for downstream (after FOB) activities envisaged	xls	

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