Requirements for the co-processing of raw materials and fuels from biomass, renewable and fossil sources

Note on the status of this document:

This reference document is an integral part of the 2BS voluntary scheme developed by the 2BS Association.

This update aims to comply with the current Revised Renewable Energy Directive EU/2018/2001 (RED III).[1]

[1] *Consolidated version of the Directive: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02018L2001-20240716*

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Implementing regulation 2022/996

This procedure incorporates the following provisions of:

- art. 23 of the European Commission's Implementing Regulation**s** (EU) 2022/996 adopted on 14 June 2022 on "***Specific rules for co-processing"*** as detailed in
- the *EU Commission's Implementing Regulation 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***".
    - Co-processing typically refers to an oil refinery unit processing biomass feedstock together with fossil feedstock and transforming them into final fuels.
    - However, this methodology may be also applied in other cases of installations treating
        - bioliquids and fossil oil or
        - in installation co-processing wastes of bio and non-bio-origin.

    The biomass feedstock may, for instance, be lipid-based material, such as vegetable oil, crude tall oil or pyrolysis oil, and the fossil feedstock typically originates from crude oil.

    The final fuels produced from such a feedstock mix are usually diesel fuel, jet fuel, heating oil, marine fuel, gasoline, gasoline components and sometimes propane gas, a constituent of Liquefied Petroleum Gas, while minor fractions of other products can also be present. Crucially, such co-processed fuels contain a share of biofuels and biogas.

    The case of a production unit that uses biomethane as a feedstock withdrawn from the interconnected infrastructure, which is certified and traced through the mass-balancing system of the interconnected gas infrastructure, is not considered a type of co-processing in the meaning of this delegated regulation.

These procedure requirements must be implemented no later than 18 months, i.e., on 1 January 2024, for existing operational units claiming compliance with the methodology to determine the share of biofuel and biogas for transport, produced from biomass being processed with fossil fuels in a common process.

Requirements of sections 3, 4, 5, 6, and 7 of this procedure are split into:

- The audit standards 2BS-STD-01 (eligibility and collection of biomasses) and 2BS-STD-02 (processing and trade of raw materials and final fuels)
- The procedures:
    - 2BS-PRO-02 (Certification process)
    - 2BS-PRO-03 (GHG Methodology)
    - 2BS-PRO-04 (Wastes & residues)
    - 2BS-PRO-05 – (Biogas & Biomethane)

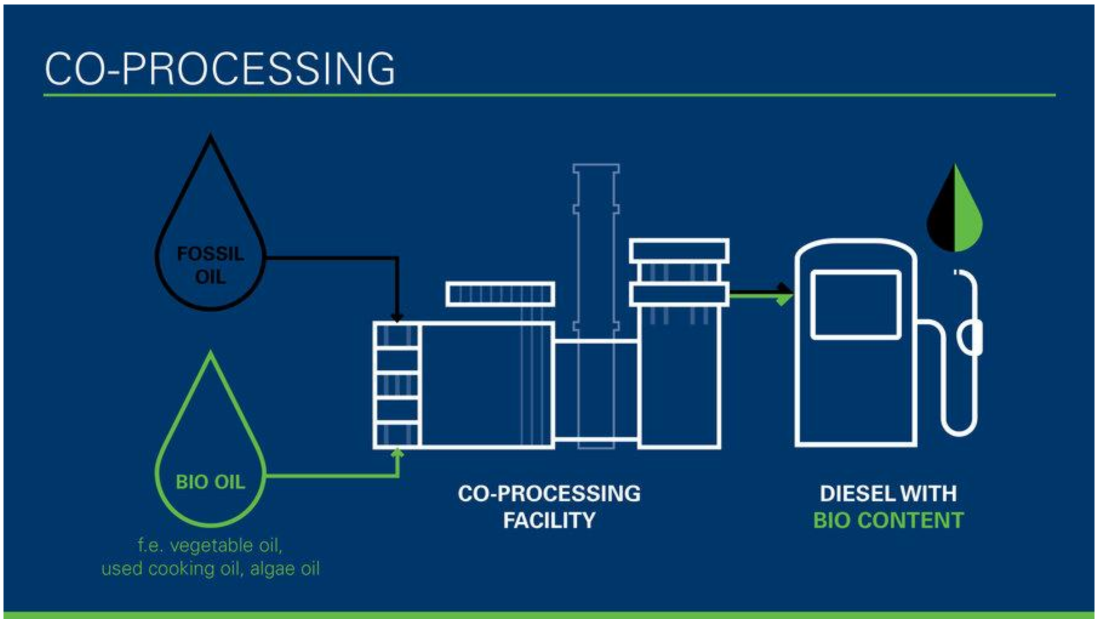
Traceability of changes in this procedure[2]

Date	Section	Paragraph	Deleted text	Added text	Change of version

[2] *After its initial validation by the EC*

1. Introduction

The term "coprocessing" typically refers to an oil refinery unit where biomass materials are processed alongside fossil-based materials to transform them into fuels and final products containing a portion of biogenic content. These final products can be in liquid, gaseous, or solid form.



This methodology is not limited to oil refineries but can also be applied in other facilities handling bioliquids and fossil oils or in plants engaged in co-treating waste of both biological and non-biological origins. Such processes result in the production of Recycled Carbon raw materials and Renewable Fuels of Non-Biological Origin. **Please note that this procedure applies only to the typical co-processing of biogenic feedstocks. RCF and RFNBO are mentioned in relation to this process, but additional methodology is required to address these two types of fuels.**

Biomass materials utilized in coprocessing can encompass a wide range of inputs, including raw materials, by-products, waste, and process residues. Examples include vegetable oils, agricultural by-products, used cooking oil (UCO), animal fat, raw tall oil, and pyrolysis oil. Fossil raw materials typically stem from crude oil refining.

The final fuels derived from the blend of fossil and biomass materials may consist of various components such as gaseous substances (e.g., propane), light distillates like naphtha/petrol, medium distillates including kerosene (including for aviation fuels) and diesel (both for traction and heating), heavy fuels (also for maritime applications), and even solid components like coke, which is a product of carbonizing heavy fractions.

The term "coprocessing" specifically denotes a process wherein the resultant fuels contain a portion derived from biogenic sources, such as biofuels, bioliquids, and biogas. This distinction is crucial for the term's applicability.

Coprocessing is characterized by the simultaneous treatment of biomass-derived materials alongside conventional fossil-based inputs within refinery processes. This integrated approach, where both biogenic and fossil resources are processed together, is what distinguishes coprocessing from other methods.

Certainly, here are some examples of coprocessing in various refinery and chemical processes:

- **Hydrodesulfurization (HDS) Units**: Used cooking oil can be coprocessed with gasoil in HDS units, which are used for desulphurization of middle distillates. This process helps in reducing the sulfur content in the final product, improving its environmental properties.

- **Catalytic Cracking Units (FCC)**: Agricultural byproducts can be coprocessed with heavy gasoil fractions in FCC units. These units utilize catalysts to break down heavy hydrocarbons into lighter fractions, thereby increasing the yield of valuable products such as gasoline and diesel.

- **Primary Distillation Units**: Coprocessing can also occur in primary distillation units, where crude oil is separated into various fractions based on their boiling points. Here, coprocessing may involve blending biomass-derived materials with conventional fossil fuels during the distillation process.

- **Recycled Carbon Raw Materials and Renewable Fuels of Non-Biological Origin**: These materials can be coprocessed with conventional fossil fuels in refinery and chemical facilities. For instance, fractions of pyrolysis oil obtained from waste plastic can be upgraded in a refinery or chemical facility and mixed with conventional materials to produce recycled carbon transport fuels.

- **Hydrogenation/Hydrotreating Units**: Hydrogen produced using renewable energy sources can be coprocessed with conventional hydrogen in hydrogenation or hydrotreating units. These units are used for various purposes such as desulphurization, hydrogenation of unsaturated hydrocarbons, and production of clean fuels.

These examples illustrate the versatility of coprocessing across different refinery and chemical processes, highlighting its role in integrating renewable and non-biological resources to produce sustainable fuels and chemicals.

The provided text outlines the procedural guidelines for ensuring compliance with sustainability requirements for biofuels and recycled carbon fuels produced within a co-processing unit, following Revised Renewable Energy Directive EU/2018/2001 (RED III) and the Commission's Implementing Regulation 2023/1640 of 5 June 2023. Here's a breakdown of the key points:

- **Purpose and Overview**: The text details the methodology necessary to determine the bio-share of renewable fuels, recycled carbon fuels, and renewable fuels of non-biological origin for transportation, all originating from co-processing activities.

- **Compliance with Sustainability Standards**: Economic operators must adhere to specific criteria and steps to ensure that biofuels and recycled carbon fuels meet sustainability standards mandated by relevant directives and regulations.

- **Raw Material Compliance**: Raw materials used must comply with current 2BS Standards and Procedures.

- **Challenges in Measurement**: There may be difficulties in distinguishing between recycled fossil carbon and 'virgin/new' fossil carbon, and accurately measuring the biomass content in each product due to limitations in measurement methods.

- **Test Method Flexibility**: Economic operators are allowed to use a common harmonized test method based on radiocarbon or their own test methods. However, periodic verification using the radiocarbon method is required for operators using a different primary method.

- **Conversion Factors**: Methodologies for determining conversion factors for biomass, fossil, and recycled carbon raw materials, as well as renewable fuels of non-biological origin, are described. These factors determine the quantity of each product produced from a specific quantity of raw material.

- **Regulatory Considerations**: National co-processing regulations may differ from or present additional requirements to the outlined procedure.

- **Further Resources**: Additional details on greenhouse gas emissions, wastes and residues, and verification procedures can be found in specified documents (2BS-PRO-03, 2BS-PRO-04, 2BS-PRO-02).

Overall, the text provides comprehensive guidance for economic operators involved in co-processing activities, ensuring adherence to sustainability standards and regulatory requirements.

2. Scope

The procedure outlined applies to **processing plants or sites where a combination of biomass, recycled materials, and renewable materials of non-biological origin undergo simultaneous chemical transformation alongside conventional or virgin fossil materials**.

These processes are geared towards producing various types of **transport fuels**, encompassing:

- diesel,

- gasoline,
- aviation kerosene,
- naphtha,
- liquefied or compressed gases,
- bioliquids, and
- other relevant products.

3. Raw material requirements

The procedure mandates that biomass sourced from agricultural and forestry operations must adhere to all requirements stipulated within the 2BS voluntary scheme. This entails compliance with the following standards and procedures:

- 2BS-STD-01: Ensures **eligibility of raw materials**, agricultural biomass, and wastes & residues.
- 2BS-STD-02: Governs the **trade of raw mate**rials and fuels, as well as processing standards.
- 2BS-STD-03: Covers the **collection** and processing **of forestry biomass**.
- 2BS-PRO-04: Outlines procedures for fuels produced from **wastes & residues**.
- 2BS-PRO-03: Provides methodology for calculating greenhouse gas emissions and savings.
- 2BS-PRO-05: Establishes procedures for biogas & biomethane.

Furthermore, consignments of biomass must be accompanied by the requisite 2BS documentation to ensure compliance.

It's important to note that raw materials failing to meet 2BS requirements are ineligible for inclusion in the production of biofuels, bioliquids, biomass fuels, or recycled carbon fuels.

This underscores the significance of adhering to the stringent standards set forth by the 2BS voluntary scheme in ensuring the sustainability and integrity of biomass-derived products.

4. Chain of custody requirements

<u>**To determine the share of biogenic carbon**</u> **in effluents from biomass coprocessing plants**, economic operators have the flexibility to develop and utilize a test method that aligns with their company's characteristics, the specific process configuration of their plants, and the mix of materials being treated.

The main test methods are detailed later in the text, and operators can designate the entire refinery, bioliquids, and fossil oils processing plant, or waste-based input coprocessing plant as **appropriate system boundaries**, irrespective of the chosen test method.

For coprocessing certification, blending of co-processed fuels with other fuels is considered to occur outside the system boundaries, and **the radiocarbon** (^{14}C) **method is applied before blending**.

When reporting co-processing outputs in terms of biogenic quotas, operators must provide information on the accuracy and precision of the test method used and disclose any inaccuracies in flow measurements and calorific value values utilized in the main test method.

In most cases, operators apply the same verification method across different processing units within the same refinery, bioliquids, and fossil oils processing plant, or coprocessing plant utilizing waste as input.

However, if units are not interconnected and no flows exist between them, operators may employ different test methods.

In the case of coprocessing plants using waste as input, both this methodology and the radiocarbon (^{14}C) verification method can only be applied if reliable and representative samples can be collected at the input level to determine the biogenic content accurately.

Operators must ensure that the detection limit of their chosen test method is capable of effectively measuring the expected share of biofuels or biogas in the process. Additionally, if operators communicate co-treatment results using a primary test method other than radiocarbon (^{14}C), they must periodically apply the latter to outputs to verify system functionality and the accuracy of results obtained from the primary method.

The radiocarbon verification (^{14}C) **method is mandatory** for all outputs where biogenic carbon content is claimed.[3]

Economic operators involved in co-processing activities are **required to accurately document** all incoming quantities and types of biomasses, recycled carbon raw materials, and fuels, as well as renewable fuels from non-biological sources entering the co-processing site. Similarly, they must document all outgoing quantities and types of biofuels, biogas, recycled carbon fuels, and renewable fuels of non-biological origin.

To accurately account for the conversion of raw materials into final products, specific conversion factors must be determined for each biomass, recycled carbon, and renewable material. These factors should be tailored to the process and site where the processing unit is located, unless national reference yield values are used.

In cases where multiple products are generated from the process, a distinct conversion factor must be established for each product derived from each raw material. For instance, if the raw material consists

[3] *In the case of economic operators treating municipal solid waste, this method can also apply to the determination of the biomass fraction of waste used to produce energy as an alternative to using default values. When using default values, these should be primarily based on:*

a. Official statistical data from government bodies when available.
b. If no official statistical data from government bodies are available, statistical data published by independent bodies may be used.
c. If these values are not available, the numbers may be based on scientifically peer-reviewed work with the precondition that data lies within the commonly accepted data range.

of a blend of used cooking oil and fossil diesel, separate conversion factors should be determined for converting used cooking oil into biodiesel, bio-propane, and any other resulting products. Additionally, some biomass, recycled carbon, or renewable content must be attributed to all products, including carbon monoxide, carbon dioxide, and water, with justification provided for the quantities allocated to each product.

A free allocation of biomass, recycled carbon, or renewable content to products **is prohibited** unless specified otherwise by further communications from the European Commission or national governments.

In certain cases, **conversion factors may be specified in national legislation**. For example, in Italy, reference conversion factors for different vegetable oils to HVO in a diesel hydro-desulfurization plant are provided. It's important to note that nationally set conversion factors[4] always take precedence for operators and facilities in the respective country.

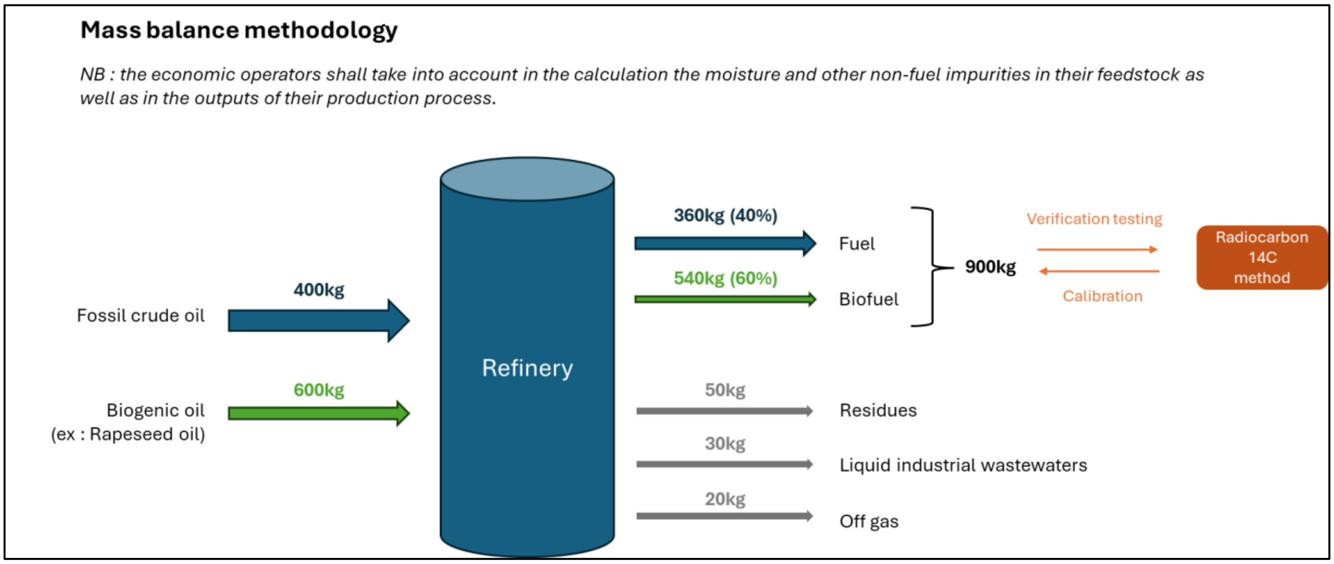
In order to determine the share of biogas or biofuel produced by co-processing, the economic operators shall define the whole refinery as system boundaries and use a method based on mass or energy balance, yield methods, or radiocarbon ^{14}C testing of the outputs.

In the case of mass balance, energy balance or yield methods, a ^{14}C radiocarbon testing of all outputs must be conducted to corroborate the correctness of the method as well as its results.
Economic operators shall thoroughly document the inputs of biogenic feedstock during the common process, as well as the fraction of biofuels/biogas outputs from them.

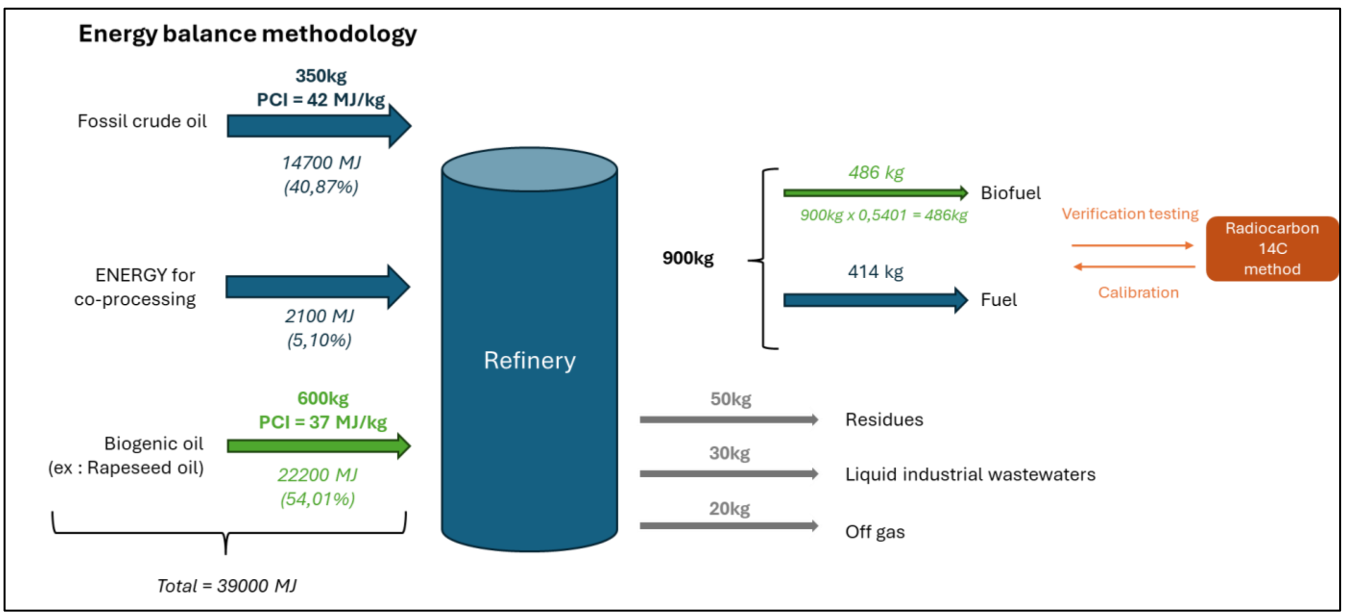
To calculate overall or **product-specific conversion factors**, **four main approaches** can be utilized:

1. **Mass balance method**: This method involves tracking the mass of inputs and outputs throughout the process. The bio-content of all outputs is proportional to the bio-content of all inputs. The share of biogenic material identified by the radiocarbon 14C testing results is allocated to each output. (No free allocation possible).

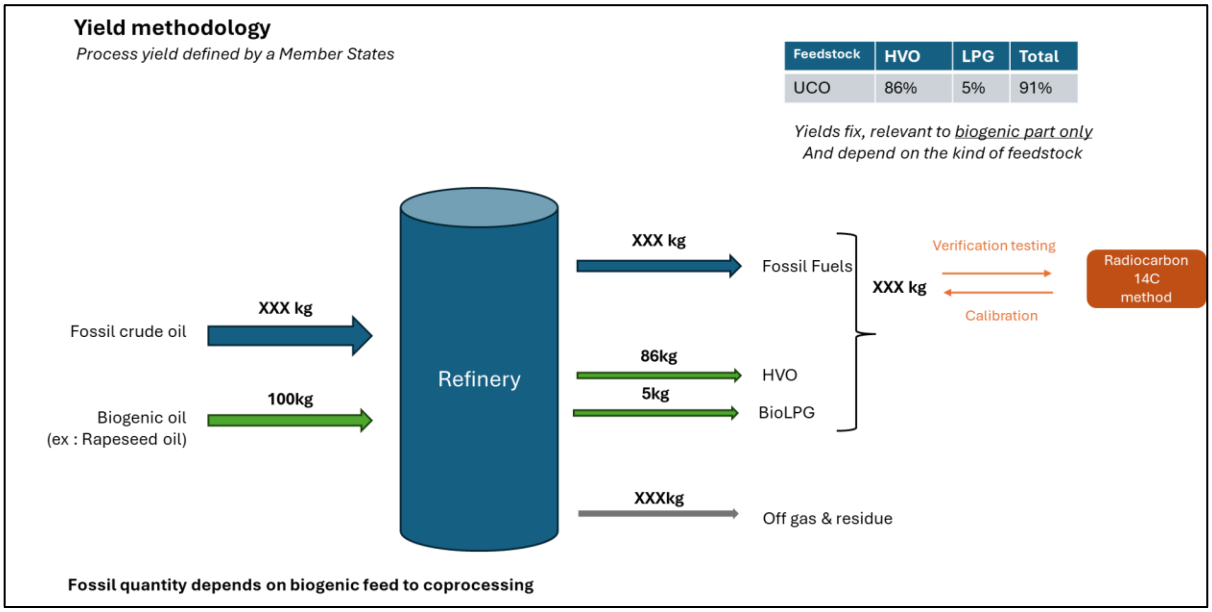
[4] *E.g. rapeseed oil to HVO in a diesel desulfurization plant is set at 86.4% and to bio propane it is set at 5%.*



2. **Energy content method**: This approach assesses the energy content of inputs and outputs to calculate the conversion factor. The Energy share of biogenic content in all outputs to be determined as being equal to the energy share of the biogenic content at the input.



3. **Incremental (Differential) yield change method based on mass**: This method focuses on changes in yield or efficiency based on mass measurements.



4. **Yield balance based in experimental conversion factors**: This method focuses on the relationship between the bio-input and bio-output by using conversion factors determined during several batches of feedstock at known co-processing conditions.

5. **Output ^{14}C analyses**: Economic operators shall apply the Accelerator Mass Spectrometry (AMS) method. If the bio-share is expected to be at least 1 volume %, they may alternatively apply **Liquid Scintillation Counting (LSC)** method, if the sample is suitable for this testing method, especially regarding particles present in clear liquids .
   For biomass coprocessing, this method involves analysing outputs using techniques described in:
   - ASTM D6866 - *Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis*
   - EN 16640 - *Bio-based products - Determination of the bio-based carbon content of products using the radiocarbon method*
   - ISO 16620-2 : *Plastics - Biobased content - Part 2: Determination of biobased carbon content*
   - EN 15440 - *Solid recovered fuels - Methods for the determination of biomass content*
   - CEN/TS 16137 - *Plastics - Determination of biobased carbon content*

Testing may be conducted by either operators or accredited laboratories. For a list of accredited laboratories, please refer to accreditation bodies that apply to your country such as COFRAC (France), UKAS (United Kingdom), DAkkS (Germany), Accredia (Italy) and ANAB (United States).

Experimental measurements conducted on a pilot plant using individual components or model systems related to the co-processing facility **are permissible in the initial certification process**. However, they are subject to verification and supplementation with field evidence obtained during the actual coprocessing phase in plants.

The first three methods mentioned above are detailed as references for the present 2BS certification Procedure in the EU Commission's Implementing Regulation 2023/1640 of 5 June 2023, specifically in articles 2, 3, and 4, respectively[5].

Economic operators are permitted to employ yield-based methods as the primary methods **only if** the system is maintained under the reference operating conditions, they have defined, which includes ensuring the quality of the co-processed materials. If a yield-based method is used, economic operators must apply the radiocarbon (^{14}C) method as a control method to verify the efficiency (performance) factor, at least whenever they alter the reference operating conditions. This requirement is by Article 6 of Regulation 2023/1640, which governs specific provisions regarding the application of the radiocarbon method (^{14}C).

If the production system co-processes renewable hydrogen of biological origin, economic operators shall document the origin of the hydrogen, as well as demonstrate that the hydrogen entering the (hydro)processing unit or another co-processing unit was not accounted as renewable energy elsewhere (to avoid double counting), that it has been incorporated into the final biofuel and not simply used to remove impurities. For further technical certification provisions, reference is to Art. 5 of the EU Commission's Implementing Regulation 2023/1640.

If the radiocarbon (^{14}C) test method, when used as a second method to verify the biogenic content of an output, shows a **deviation of more than 1 %** in absolute terms from the result of the main method used by the economic operator, only the values of the radiocarbon method (^{14}C) are considered valid.
In the initial year of implementing this methodology, economic operators are **permitted to deviate by up to 3% instead of the usual 1% in absolute terms**, as they refine and perfect their testing methods.
Additionally, it is incumbent upon economic operators to scrutinize the primary test methods to rectify any systemic errors that may contribute to deviations. **If deemed necessary, they should calibrate the method itself to align with the prescribed standards**. This ensures that any discrepancies are identified and rectified promptly to maintain accuracy and compliance with sustainability requirements.

The application frequency of the **primary test method** and the **radiocarbon (^{14}C) test method** if used as a secondary method, is established taking into account the complexity and variability of the fundamental co-processing parameters, **to ensure that at all times the biogenic content assertions reflect the expected biogenic content**.

Economic operators calculate the biogenic share at least for each co-processed batch. Unless a method is applied that can identify the operating conditions relating to the carbon content in the output for each lot or batch, **the radiocarbon (^{14}C) method applies whenever a change occurs in the composition of the raw materials higher than 5 % compared to the reference conditions concerning**:

[5] *and also described in a European Commission publication that explains the methodology for implementation of each option, https://energy.ec.europa.eu/index_en*

- the share of biogenic inputs or
- the quantity of hydrogen and catalyst in the total mass, the process parameters relating to the absolute process temperature [K], to the absolute process pressure [Pa] or
- the composition of the product.

An elemental analysis of carbon, oxygen, and nitrogen and an analysis of water and solids contents are provided as a basis for evaluating the composition parameters of the product. (For example, in common industrial practice, CHN analysis according to ASTM D5291 are conducted. As well as density test. The oxygen content could be calculated by difference).

In any case, the radiocarbon (^{14}C) method is applied at least once every 4 months.

The <u>methodology</u> used for determining the conversion factors and hence the quantities of renewable fuels, recycled carbon fuels, and renewable fuels of non-biological origin for transport, which result from co-processing **must be clearly stated and described**. The methodology shall not be changed after that unless authorized by the auditor.

For the obligations relating to registrations, process control, audits, and communication of deviations, this procedure refers to art. 7 of the EU Commission's Implementing Regulation 2023/1640 of 5 June 2023 and for the points below reported.

Economic operators:

- **for at least two years**, retain the **samples** associated with biogenic coprocessing **quota claims** and the recording of measurement data and calculations.
- **provide certification bodies** and auditors with **full access** to such samples, records, and tests and
- **also make available the detailed description of the main test method used**, including the indication of the accuracy and precision, also verified through the radiocarbon method (^{14}C) as well as the procedure for its application.

Furthermore, **concerning the application of the mass balance system**, Economic operators:

- To avoid the risk of deviations and facilitate an ex-post audit of claims relating to coprocessing and the biogenic share of their fuels, apply a global mass balance system indicating the biogenic share of inputs and outputs.

- They carry out the mass balance calculation in parallel with the main test method to check and compare the results of both methods of assessing the biogenic share in the final fuels produced;

- When blending coprocessing outputs with other fuels within the refinery or other coprocessing facilities, use a mass balance system that allows batches of fuels derived from fossil fuel-treated biomass to be blended with other fuels in a common process while providing adequate information on the characteristics and sizes of the batches under Article 30 of Revised Renewable Energy Directive EU/2018/2001.

The conversion factors shall be used to carry out the mass balance accounting as described in the audit standard 2BS-STD-02.

A separate mass balance shall be kept for each type of biomass, recycled carbon, and renewable hydrogen (or other renewable fuel of non-biological origin) material. **Materials in one product group may be included in the same mass balance** as described in 2BS-STD-02. However, **separate mass balances shall be kept for different product groups** such that the application of the mass balance system respects the rules set out in Articles 26 and 27 of the Revised Renewable Energy Directive EU/2018/2001 (RED III) for determining the contribution of biofuels, bioliquids, and biomass fuels towards the targets for renewable energy**.**

The mass balance is administered at the level of a container, processing or logistical facility, transmission and distribution infrastructure, or site.

A refinery or chemicals processing facility is classified as a site. Therefore, if there is more than one processing unit that produces intermediate products or final bioliquids, biofuels, recycled carbon fuels, or renewable fuels of non-biological origin on the site, each product group-specific mass balance can encompass all facilities processing the same type or category of feedstock, providing that all facilities are owned by the same legal entity.

Any discrepancies detected by auditors from Certification Bodies regarding the proportions of biofuels or biogas in the fuel market by economic operators are classified as "**major non-compliance**". These are promptly reported to voluntary systems or other certification systems responsible for verifying that biomass-derived fuel conforms to sustainability and greenhouse gas emission reduction criteria outlined in Articles 29(2) to (7) and (10) of the Revised Renewable Energy Directive EU/2018/2001.

Regarding monitoring and enforcement responsibilities concerning claims of sustainable biogenic quotas made by economic operators, this procedure defers to the provisions stipulated in Article 7 of the EU Commission's Implementing Regulation 2023/1640 of 5 June 2023.

5. GHG emissions and calculation methodology

This passage outlines the procedures and considerations for calculating greenhouse gas (GHG) emissions in co-processing facilities dealing with biomass, waste carbon fuel, or renewable fuel.

The calculation of actual greenhouse gas (GHG) emission values for biofuels, bioliquids, and biomass fuels under the Renewable Energy Directive II (RED III) involves a detailed and specific process that follows the methodology laid out in Annex V of Revised Renewable Energy Directive EU/2018/2001 (RED III).

Calculation of GHG emissions for biogenic inputs

The calculation must consider the emissions related to all stages of the production chain, including those related to the upstream emissions of biogenic inputs, the emissions related to the co-processing process itself, the emissions related to the production of reagents and other inputs, such as hydrogen if used during the co-processing process. The emissions related to the transport of the produced fuel as well as their distribution until the service station shall be considered. The use of default disaggregated values is allowed by the Revised Renewable Energy Directive EU/2018/2001 (RED III) for certain factors of the emissions formula.

Following the methodology described in Annex V part C of the Revised Renewable Energy Directive EU/2018/2001 (RED III), the emissions of specific co-processed liquid fuel E [gCO_2eq/MJ] is as follows:

$$E_{\text{co-processed biofuel}} = E_{\text{upstream}} + E_{\text{extra reagents}} + E_{\text{processing}} + E_{td} + E_u + e_{ccr} + e_{ccs}$$

Where,

- E_{upstream} is the upstream emissions of biogenic feedstock, i.e. biocrudes or lipids,
- $E_{\text{extra reagents}}$ is the emissions related to the production of reagents used during the co-processing specifically for the conversion of biogenic feedstock into fuel, e.g. hydrogen for deoxygenation.
- $E_{\text{processing}}$ is the share of the whole refinery emissions from co-processing that was attributed to the biogenic feedstock. Note that the energy allocation must be done to all useful multiple outputs. CO_2 emissions from biogenic origin should not be counted.
- E_{td} are the emissions due to transport and distribution of the produced biofuel.
- E_u are the emissions from the fuel use.
- e_{ccs} are emission savings from CO_2 capture and geological storage; and
- e_{ccr} are emission savings from CO_2 capture and replacement.

Upstream emissions related to the biogenic feedstock (E_{upstream}, $E_{\text{extra reagents}}$**)**

The emissions E_{upstream} are defined as follows:

$$E_{\text{upstream}} = E_{\text{ec-bio}} + E_{\text{l-bio}} + E_{\text{p-bio}} + E_{\text{td-bio}} + e_{sca} + e_{ccr} + e_{ccs}$$

Where,

- $E_{\text{ec-bio}}$ are the emissions due to the extraction and culture of biogenic feedstock. This factor is to be considered only if applicable, when the biogenic feedstock is a product or a co-product.
- $E_{\text{l-bio}}$ are the emissions due to the land use change. These must be considered only if the biogenic feedstock production caused carbon stock changes due to land-use change.

- $E_{p\text{-}bio}$ are the emissions due to processing and production of the biogenic feedstock before entering the refinery system boundaries, if applicable.
- $E_{td\text{-}bio}$ are the emissions due to the transportation and distribution of the biogenic feedstock.
- e_{ccs} are emission savings from CO_2 capture and geological storage
- e_{ccr} are emission savings from CO_2 capture and replacement.
- e_{sca} emission savings from soil carbon accumulation via improved agricultural management

If the biogenic feedstock is classified as waste or residue, the emissions $E_{ec\text{-}bio}$, $E_{l\text{-}bio}$, $E_{p\text{-}bio}$ are considered zero at the point of origin. However, the emissions due to their further treatment and/or transportation $E_{p\text{-}bio}$ and $E_{td\text{-}bio}$ shall be considered.

In the case of co-products, the allocated emissions at the moment of their production along with the emissions related to their further treatment and/or transport until the co-processing plant shall be considered.

In case hydrogen and/or other reagents are used during the co-processing process, the emissions related to their production and transport shall also be considered, by using emission factors following the instructions detailed in 2BS-PRO-03 ($E_{extra\ reagents}$).

Allocation of emissions from the Co-Processing step to the biogenic fraction ($E_{processing}$)

When evaluating emissions from co-processing, both biogenic (renewable) and fossil feedstocks are used together, thus, it’s essential to differentiate their contributions. In this manner, the energy and inputs required specifically for converting the biogenic feedstock into fuel will be determined, taking into account that it involves additional steps like deoxygenation, unlike fossil feedstocks. Therefore, a virtual split of bio vs fossil conversion pathways is performed and the main approach to calculate the actual GHG emissions values consists of these four steps:

1. **Benchmark**: a baseline scenario, where the process is run entirely on fossil feedstock is analyzed, and its emissions and inputs (energy, reagents, catalysts) are recorded.

2. **Co-processing:** another scenario is recorded covering both possibles cases, when biogenic feedstock replaces a fraction of fossil fuel, and when it adds an additional quantity of biogenic feedstock to the process. Its emissions and inputs (energy, reagents, catalysts) are recorded as well.

3. **Comparison:** the baseline scenario is compared with the fossil/biogenic co-processing scenario to determine all additional inputs (energy, reagents, catalysts) associated specifically with the biogenic feedstock (e.g. hydrogen for deoxygenation, extra heat, extra electricity). These additional energy and inputs are attributed to the biogenic fraction. Concerning emissions, however, all the additional emissions from the process (biogenic material leading to heat and CO_2) are considered biogenic. Note that the biogenic CO_2 emissions during co-processing shall be excluded from the calculation.

4. **Inputs share attribution:** for all the replaced fossil feedstock by biogenic feedstock, a share of all inputs (i.e. the overall refinery emissions: energy, reagents, catalysts) from the baseline scenario is attributed proportionally to the biogenic feedstock, based on its respective fraction.

Finally, the total GHG emissions are the sum of the extra-CO2 emissions linked to the specific conversion of biogenic feedstock and the biogenic share of the total refinery emissions based on the biogenic input percentage.

N.B. This virtual split bio vs fossil conversion path concerns only the biogenic feedstocks and **does not apply** to recycled carbon fuels (RCFs), renewable fuels from nonbiological origin (RFNBOs), low-carbon fuels, nor fossil fuels co-processed fuels.

An illustrating example of the calculation method is shown below:

Benchmark: A refinery plant processes 100,000 tons of fossil feedstock annually, consumes 50,000 MWh for this process and reports the overall refinery GHG emissions to be 150,000 tons of CO2eq.

Co-processing: The refinery plant processes 100,000 tons of feedstock, from which 70,000 tons of fossil fuel, and 30,000 tons of biogenic feedstock. The energy consumption was 70,000 MWh and reports the overall refinery GHG emissions to be 170,000 tons of CO2eq, from which 5,000 tons of CO2eq correspond to CO2 emissions from **biogenic origin** formed during the process itself (**which are not to be counted**)

Comparison:

170,000 tons of CO2eq – 5,000 tons of CO2eq $_{\text{(biogenic origin)}}$ = **165,000 tons of CO2eq**
165,000 tons of CO2eq are the CO2eq emissions excluding the emissions from biogenic origin

165,000 tons of CO2eq – 150,000 tons of CO2eq$_{\text{(baseline)}}$ = **15,000 tons of CO2eq**
15,000 tons of CO2eq are the additional emissions needed to convert biogenic feedstock.

Inputs share attribution:
30,000 tons of biogenic feedstock ÷ 100,000 tons of feedstock × 100 = 30%.
30% is the fraction of the biogenic input.

30% × 150,000 tons of CO2eq$_{\text{(baseline)}}$ = **45,000 CO2eq**
+ extra CO2 after comparison benchmark/scenario= 45+15=60 CO2
In conclusion:

$E_{processing}$ = **45,000 CO2eq** + **15,000 tons of CO2eq** = **<u>60,000 tons of CO2eq</u>**

In conclusion, 60,000 tons of CO2eq shall be allocated to the produced biofuel.

Note: These values are purely illustrative to exemplify the calculation process, they do not intend to reflect the order of magnitude nor any ratio of real values from co-processing plants.

For the factors Etd and Eu disaggregated values from Annex V in the Revised Renewable Energy Directive EU/2018/2001 (RED III) may be used. The e_{ccr} and e_{ccs} may only be considered where all the requirements set out in the delegated act 2022/996 are met.

- **Calculation Standards**: GHG emissions calculations must adhere to the standards specified in 2BS-PRO-03 and the RED III Annex VI.

- **Commissioning Date**: The date of commissioning of the plant, used to determine GHG savings thresholds, is defined as the earliest date when the facility started commercial-scale production using biomass, waste carbon fuel, or renewable fuel of non-biological origin.

- **Allocation of GHG Emissions**: If the facility produces multiple types of biomass, recycled carbon, or renewable products, GHG emissions must be divided among them based on their energy content, determined by their lower heating value.

- **Exclusion of Certain Emissions**: GHG emissions cannot be assigned to certain solid, liquid, or gaseous waste and residues produced during co-processing, such as carbon dioxide, water, and carbon pitch. However, methane, ethane, carbon monoxide, and similar compounds are considered coproducts, and GHG emissions are allocated to them unless specified otherwise in EU or national legislation. This is because these compounds can be readily utilized onsite for heat and power generation.

These guidelines aim to ensure accurate and standardized measurement and reporting of GHG emissions from co-processing facilities dealing with biomass, waste carbon fuel, or renewable fuel. They also reflect considerations for promoting efficient use of coproducts and compliance with relevant regulatory requirements.

6. Sustainability Declarations

This excerpt outlines requirements for co-processing facilities to transfer sustainability and greenhouse gas emissions-saving characteristics down the supply chain to the next operator. Here's a breakdown of the key points:

1. **Transfer Conditions**: Sustainability and GHG emissions-saving characteristics must be transferred along with the physical material being passed down the supply chain. This ensures that the environmental benefits associated with the product are maintained throughout its lifecycle.

2. **Information Requirements**: When transferring these characteristics, certain information must be included as a minimum:
   - **Country of Origin**: The country of origin of the biomass, recycled carbon, or renewable feedstock used as raw material must be disclosed.
   - **GHG Emissions**: The GHG emissions associated with the product, measured in grams of CO_2 equivalent per unit of mass (dry), must be provided.
   - **Mass of Shipment**: The mass of the shipment being transferred must be specified.

- **Support Information**: Details regarding any financial or other support provided for the production of the consignment should be included. Alternatively, if no support was received, a signed declaration to that effect must be provided.
- **Date of Commissioning**: The date of commissioning of the plant, defined as the earliest date when the biomass, waste carbon fuel, or renewable fuel of non-biological origin raw material was introduced into the co-processing facility for commercial-scale production, must be stated.
- **Product Description**: A clear description of the product, along with a statement indicating that it was produced by co-processing, should be included.

By including this information in the transfer process, co-processing facilities ensure transparency and accountability regarding the environmental characteristics of their products, facilitating informed decision-making throughout the supply chain.

7. Audit and certification requirements.

This section outlines the audit requirements specific to co-processing plants, which are similar to those for other processing facilities but with additional specifications. Here's a breakdown of the key points:

- **Validation of Methodology and Testing**: The auditor must validate the methodology, control testing, and analysis used for determining the quantities of renewable fuels, recycled carbon fuels, and renewable fuels of non-biological origin resulting from co-processing. This ensures the accuracy and reliability of the data used in assessing the environmental impact of the co-processing activities.

- **Treatment of Deviations**: Any changes, errors, or inaccuracies that result in a deviation from the documented methodology, testing, or analysis must be treated as a major non-compliance. This emphasizes the importance of adhering to established procedures and ensuring the integrity of the audit process.

- **Consistency with Industry Standards**: The auditor is responsible for verifying that the methodology, control testing, analysis, and quantities calculated are consistent with industry standards. This ensures that the audit procedures meet recognized norms and benchmarks for accuracy and reliability.

- **Verification of Feedstock and Product Quantities**: The auditor must verify that the quantities of biomass, recycled carbon, and renewable fuels of non-biological origin used as feedstocks, as well as the resulting products, are consistent with industry standards. This verification helps confirm the reliability of data related to the inputs and outputs of the co-processing plant. The auditor will verify the origin of the biogenic feedstock by analyzing the sustainability declaration or the self-declaration, according to whether the co-processing plant gathers already certified biogenic feedstock or gathers biogenic feedstock directly from the points of origin (in case of waste and residues).

Overall, these additional requirements ensure rigorous oversight of co-processing activities, emphasizing the importance of accurate data collection, adherence to established procedures, and compliance with industry standards to assess and mitigate environmental impact effectively.

8. Definitions

All terms have the same meaning as defined in 2BS-PRO-02 and other 2BS voluntary scheme documents.

- '**Biofuels**' means liquid fuel for transport produced from biomass.
- '**Biomass**' means the biodegradable fraction of products, waste and residues from biological origin from agriculture, including vegetal and animal substances, from forestry and related industries, including fisheries and aquaculture, as well as the biodegradable fraction of waste, including industrial and municipal waste of biological origin;
- '**Bioliquids**' means liquid fuel for energy purposes other than for transport, including electricity and heating and cooling, produced from biomass;
- '**Biowaste'** means biowaste as defined in point (4) of Article 3 of Directive 2008/98/EC;
- **'Co-processing'** typically refers to an oil refinery unit processing biomass feedstock together with fossil feedstock and transforming them into final fuels.
- **'Product group'** means raw materials, biofuels, bioliquids, non-gaseous biomass fuels with similar physical and chemical characteristics and similar heating values or gaseous biomass fuels, and LNG with similar chemical characteristics that all are subject to the same rules set out in Articles 7, 26 and 27 of Revised Renewable Energy Directive EU/2018/2001 (RED III)for determining the contribution of biofuels, bioliquids and biomass fuels towards achieving the targets for renewable energy;
- **'Recycled carbon fuels'** means liquid and gaseous fuels that are produced from liquid or solid waste streams of non-renewable origin which are not suitable for material recovery by Article 4 of Directive 2008/98/EC, or from waste processing gas and exhaust gas of non-renewable origin which are produced as an unavoidable and unintentional consequence of the production process in industrial installations.
- **'Renewable fuels of non-biological origin'** means liquid or gaseous fuels that are used in the transport sector other than biofuels or biogas, the energy content of which is derived from renewable sources other than biomass. *
- **'Residue'** means a substance that is not the end product(s) that a production process directly seeks to produce; it is not a primary aim of the production process, and the process has not been deliberately modified to make it;

- **'Site'** means a geographical location, logistical facilities, transmission or distribution infrastructures with precise boundaries within which products can be mixed;

- **'Sustainability and greenhouse gas emissions saving characteristics'** means the set of information describing a consignment of raw material or fuel that is required for demonstrating compliance of that consignment with the sustainability and greenhouse gas emissions saving criteria for biofuels, bioliquids and biomass fuels or the greenhouse gas emission savings requirements applicable for renewable fuels of non-biological origin and recycled carbon fuels;

- **'Waste'** means waste as defined in point (1) of Article 3 of Directive 2008/98/EC, excluding substances that have been intentionally modified or contaminated to meet this definition.