Gold Standard for the Global Goals

Climate Security & Sustainable Development

METHODOLOGY

METHODOLOGY FOR MARINE FUELS AND BIO BUNKERS

SDG 13

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SUMMARY

This methodology presents a standardised approach to measure, certify and verify greenhouse gas (GHG) emissions reductions for activities involving use of blended biofuels with fossil bunkers in sea vessels (as bunker fuels). The counterfactual baseline scenario looks at GHG emissions from conventional fossil fuel traditionally used to power sea vessels.

The typical project activity for this methodology – biofuel bunkering in sea vessels - includes all supply chain processes (from waste oil collection to loading the blended biofuel onto a vessel), measuring emissions from the entire supply chain of the biofuel and comparing these against the GHG emissions from the fossil fuel options for shipping transport.

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1| Introduction

1.1.1 | The following table describes the key information for the application of the methodology.

Table 1. Key information

Typical mitigation activity (project) type	Activities that involve the production and use of blended biofuel for marine transport, where the biofuel is produced from Used Cooking Oil (UCO). * The terms 'Mitigation Activity', 'Activity' and 'Project' refer to project activity and are used interchangeably.
Activity requirement	NA
Mitigation activity (project) type	Transportation: Displacement of more-carbon-intensive fossil fuel for combustion in vehicles/transportation applications by use of biofuel
Sectoral scope	Sectoral scope): SS 05 and 07
Applicable GS4GG products	☒ GSVERs ☒ Certified impact statement
Geographical applicability	Global
Applicable activity (project) scale	☒ Micro scale ☒ Small scale ☐ Large scale A mitigation activity can claim emission reductions less than or equal to - 10,000 tCO_2 eq per year for Micro scale activity - 60,000 tCO_2 eq per year for Small scale activity
Mitigation type	☒ Emission reduction ☐ Emission removal
Project activity start date	The start date is the date of implementation of the first blending to the sea vessels under the project
Crediting period start date	The start date of crediting period is the date of start of operation (start of blending of 1st sea vessel as part of mitigation activity) or a maximum of two years prior to the date of Project Design Certification, whichever occurs later.
Crediting period length	Fifteen years (maximum); the mitigation activity follows five-year renewal cycle per latest version of GS4GG requirements for renewal of crediting period. If any legal mandate comes into force during the crediting period, the mitigation activity can be credited only until the date the legal requirements take effect. Refer to full methodology, other limitations for crediting period may apply.

2| Definition

2.1.1 | In addition to terms and definition listed in GS4GG Glossary, the following definitions apply for the purposes of this methodology:

Table 2. Terms and Definitions

Term	Definition
Allocation factor (AF)	The energy content of the main product relative to the summation of the energy content of main product and the by-products and co-products, if applicable.
Biofuels	Biofuels are fuels derived from biologically renewable resources, which include plant-based sugars, oils, terpenes, and animal fat waste amongst other waste-derived oils. They are often used as alternatives to non-renewable fossil fuels.
Blended Biofuel	Blend of fossil fuel and biofuels
Bunker Delivery Note (BDN)	It is the standard document required by Annex VI of MARPOL, which contains information on bunker fuel delivery including name of receiving vessel, port, date, data of supplier, quantity and characteristics of the bunker fuel. Bunker suppliers are to provide the BDN and the note is to be retained on the vessel for a period of three years after the fuel has been delivered.
Carbon Intensity Indicator (CII) rating	It is a measure of how efficiently a ship transports goods or passengers. CII is an annual operational energy efficiency indicator determined as grams of CO_2 emitted per cargo-carrying capacity and nautical mile. Ships are given annual ratings ranging from A to E (with A being the most efficient and E the least efficient) depending on their CII score. The CII rating is used to determine the annual reduction factor needed to improve the ship's operational carbon intensity. From 1 January 2023 it is mandatory for all ships to calculate their attained Energy Efficiency Existing Ship Index (EEXI) to measure their energy efficiency.
Double Counting	Refer to GHG Emissions Reductions & Sequestration Product Requirements for the definitions.
Energy Efficiency Operational Indicator (EEOI)	The EEOI is defined as the ratio of mass of CO_2 emitted per unit of transport work. EEOI is used as monitoring indicator i.e., representative value of the energy efficiency of the ship operation over a consistent period which represents the overall trading pattern of the vessel. More information on EEOI calculation can be found in Guidelines for voluntary use of the Ship Energy Efficiency Operational Indicator.
Feedstock factor (FF)	The conversion rate or yield of 1 ton of biofuel from 1 ton of dry feedstock. It is expressed as a ratio or a percentage.
Fossil fuel comparator	Biofuels are assessed by comparing their lifecycle GHG emissions to a 'fossil fuel comparator', which is based on the average GHG intensity of fossil fuels in the EU transportation. Unconventional oil-based

	fuels, such as extra heavy oil, kerosene oil, light tight oil, deep sea oil, and synthetic products, increase in the total fuel supply, the fossil fuel comparator should be adjusted frequently.
Heavy Fuel Oil (HFO)	It is a category of fuels of a tar-like consistency. It is also known as bunker fuel and is the predominant fuel source for marine vessel transportation. HFO usually contains several different compounds, which make emissions upon combustion more polluting when compared with other fuel oils. A key differentiating factor amongst heavy fuel oils is their sulphur oxides content. According to the ISO 8217 the maximum sulphur oxide content shall not exceed 3.5%.
International Maritime Organisation (IMO)	United Nations specialised agency with the responsibility for the safety and security of shipping and the prevention of marine and atmospheric pollution by ships.
MARPOL	The International Convention for the Prevention of Pollution from Ships is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes.
RED – II	Renewable Energy Directive based on the EU directive 2018/2001 (recast) on the promotion of the use of energy from renewable sources. On 14th July 2021, the European Commission proposed the revision of the RED II under the "Fit for 55" package of legislative proposals in view to achieve climate neutrality in the EU by 2050, including the intermediate target of an at least 55% net reduction in GHG by 2030.
Second Generation Biofuels	SGB is produced from residual and waste products from industry, households and non-food biomass. These include used cooking oil (UCO), corn stover, wheat straw, forestry residue, municipal solid waste, switchgrass and miscanthus.
Traceability and Sustainability Declaration	The checklist to identify, track and trace elements for raw materials and intermediate products as it moves along the supply chain.
Tonne nautical mile (TNM)	TNM is a measure of freight transportation output. A transportation output of 1 tonne-mile is achieved when a tonne of cargo is moved 1 nautical mile (1.853 km).
UCO methyl ester (UCOME)	It is a second-generation biofuel made from the esterification of Used Cooking Oil (UCO).

3| Scope, applicability and entry into force

3.1 | Scope

3.1.1 | This methodology applies to projects involving biofuel production to be used within the maritime industry across all sea vessel types. Biofuel bunkering only includes UCO methyl ester (UCOME) that is blended in vessels[1].

3.2 | Applicability

3.2.1 | This methodology is applicable to projects that consume biofuel above and beyond IMO's mandates to decarbonise the shipping sector.

3.2.2 | If IMO's requirements for any vessel class included in the project become more stringent during the project's crediting period, it shall be taken into account and the baseline shall be adjusted to ensure that vessels that are using biofuel bunkers are doing so above and beyond the IMO mandate.

3.2.3 | The biofuel used in project activity shall be produced from used cooking oil (UCO) only. If the biofuel in the project facility is only partly produced from the Used Cooking Oil (UCO), any volumes of biofuel that are also produced in the project facility from other feedstock sources shall not be included in the quantity of biofuel for which GHG emission reductions are claimed.

3.2.4 | Only the biofuel that has been loaded on to the vessel and blended with fossil fuels shall be eligible for crediting. This ensures that the blended fossil fuel shall be used for maritime bunkering. A bunkering delivery note (BDN) shall be requested to measure the amount of biofuel in the blend as well as to ensure that the blended biofuel was used in bunkering only.

3.2.5 | The biofuels used for blending shall be compliant with the international standards (Refer to Paragraph 5.4.7) or national regulations (if exists).

3.2.6 | The vessels category eligible to be included under an eligible project based on their Carbon Intensity Indicator (CII) rating is as given in Table 3 below. The categorisation of the vessel shall be monitored during the entire crediting period.

[1] The Gold Standard encourages the methodology developers to propose a revision to the methodology to include other types of biofuels to encourage decarbonisation in the maritime sector.

Table 3. Applicability of vessels based on their latest CII rating

Vessel category as per the latest CII rating	Applicability under methodology
Category A Category B Category C	a. Eligible for issuance of GHGs emission reduction, for the biofuel blending above and beyond the minimum required for them to maintain a Class C status. b. Vessels shall present evidence to demonstrate that the biofuel blending is above the minimum threshold to maintain their "C" status. c. Biofuel bunkering for decarbonisation efforts to reach the minimum threshold shall not be counted towards emission reductions claims.
Category D	Not eligible
Category E	Not eligible

3.2.7 | The projects are not eligible under this methodology:

a. if the activity receives incentives from national and/or subnational schemes, whether financial or in any other forms for blending biofuels unless the project developer can demonstrate that these incentives are insufficient to overcome the financial barriers, or

b. if carbon credits of any form are issued to any feedstocks, intermediary, or final biofuel prior to blending with fossil fuels and loaded on to the sea vessel.

3.2.8 | The emission reductions calculated under this methodology shall correspond only to ship movement in international waters such that they are not attributable to any host country.

3.3 | Safeguards

3.3.1 | The project developer shall demonstrate that double counting of emission reductions will not occur, e.g. via a contractual agreement with shipowners, unique identification of ships etc. The steps undertaken to avoid double counting shall be documented in the project design document and monitored as necessary.

3.3.2 | Any activity involved in this methodology shall not undermine or conflict with any international, national, sub-national or local regulations. Such regulations shall be applicable to all the supply chain components happening within the jurisdiction of any country (refer to Table 5 below for the categories of supply chain components). The project design document shall present:

a. a summary of existing the national, regional and local regulatory framework relevant for the proposed activity.

b. monitoring plan at the activity level to ensure that any activity is surplus to regulations during the crediting period (refer to Paragraph 5.3.1 |

3.4 | Entry into Force

3.4.1 | The methodology comes into force on its publication date.

4| Normative References:

4.1.1 | This methodology refers to the latest approved versions of the following Clean Development Mechanism (CDM) methodological tool:

a. ACM0017: Production of biofuel (Version 4.0)

5| Baseline Methodology

5.1 | Project Boundary

5.1.1 | The project boundary includes:

a. The physical and geographical site of the initial collection of UCO for biofuels production;

b. Transportation of UCO to biofuel production facilities;

c. Processing site of raw material to biofuel;

d. Site of physical blending of biofuels;

e. Transportation of the biofuel into the port for loading, unloading, blending tank and the ship's engine;

f. The vessel on which the biofuel is consumed.

5.2 | Emission sources included in the project boundary

5.2.1 | The following table summarised the emission sources included or excluded from project boundary.

Table 4: Emission sources included in or excluded from the project boundary

Scenario	Source	Gas	Included	Justification/Explanation
Baseline scenario	Upstream, midstream and downstream GHG emissions of fossil fuels that are used in maritime bunkering	CO_2	Yes	Major source of emission
		CH_4	Yes	Significant source of emission
		N_2O	Yes	Significant source of emission
Project scenario	Emissions from the initial collection of waste-based feedstock for biofuels	CO_2	Yes	Small amount of electrical energy may be required
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Midstream GHG emissions associated with the processing of waste-based feedstock into biofuels	CO_2	Yes	Small amount of fuel energy may be required
		CH_4	Yes	Significant source of emissions in some cases

		N_2O	Yes	Significant source of emissions in some cases
	Downstream GHG emissions associated with transporting the biofuel from the processing facility on to the maritime vessel for bunkering	CO_2	Yes	Limited fuel energy may be required
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification

5.3 | Demonstration of Additionality

5.3.1 | All activities, regardless of their scale, shall demonstrate regulatory surplus. It means showing that the proposed activity is not directly mandated by law or triggered by any legal requirements, such as legally binding agreements, covenants, consent decrees, or contracts with government agencies or private parties. If a legal mandate comes into effect during the crediting period, the project can only claim credits until the day the legal requirements become effective.

5.3.2 | The project developer shall demonstrate additionality by conforming to additionality requirements of one of the options below:

a. CDM Tool 01 - Tool for the Demonstration and Assessment of Additionality;

b. CDM Tool 21 – Demonstration of additionality of small-scale project activities; (applicable to small or micro scale projects only)

5.4 | Baseline scenario

5.4.1 | The project developer shall identify realistic and credible alternatives to the project activity, following the approach outlined in Step 1 of the latest version of CDM Tool 01. This includes defining alternatives to the following elements of the project activity and demonstrating consistency with mandatory laws and regulations.

a. Production of fuels: what would have happened at the production level in the absence of the proposed project activity?

b. Consumption: which fuel would have been consumed in the absence of the proposed project activity?

c. Feedstock: what would have happened to the UCO used as input for production of biofuel in the absence of the proposed project activity

5.4.2 | In case the baseline analysis is not fully conclusive, the project developer shall select the baseline scenario alternative with least emissions among the alternatives that are the most economically attractive according to the investment analysis and the sensitivity analysis.

5.4.3 | The methodology requires a dynamic baseline assessment approach. During a given crediting period, the baseline scenario must be continuously monitored and conservatively selected for each monitoring period. The baseline shall be

updated as needed, such as when revised guidelines, rules, or regulations are mandated and come into force.

5.4.4 | The baseline scenario is defined as the most prevalent fuel or fuel mix used for marine transport that is relevant to the project activity vessel (e.g., Ship category).

a. If applicable, the blending baseline scenario shall be determined when the project activity takes place and is based off the presence of any direct or indirect government driven biofuel incentives (for examples subsidies or taxes exemptions) provided to the biofuel across the project boundary including but not limited to feedstock collection, blending of biofuels and transferring the blended biofuel into the sea vessel.

b. Baselines for each project scenario shall be determined by considering the most recent government initiatives, IMO mandates for decarbonisation and the most commonly used marine fuel. The percentage of biofuel blended and utilised in the project activity shall be compared against the applicable baseline scenario. Eligibility shall be determined based on the additional percentage of biofuel blended in the project scenario relative to the baseline. If the level of biofuel blending in a project scenario is the same as or lower than the baseline scenario, the project activity is not eligible for crediting.

c. The baseline for marine vessel bunkering applies when the IMO has mandated the use of biofuels or other measures to help the vessel to decarbonise. Any vessel equivalent to or below reaching category C is considered baseline. For example, if a vessel moves from category D to category A after one year of decarbonising the project shall only consider emission reductions associated with the move from C to A. The emissions reductions corresponding to the jump from category D to C are ignored as the baseline emission for such a vessel shall be assumed corresponding to category D. However, if the IMO mandates changes during a given crediting period, the baseline shall be adjusted accordingly from the date the new mandate is implemented. It is not expected that the IMO mandates will be relaxed. If such a scenario occurs, the project shall follow the most stringent mandates.

5.4.5 | To ensure conservativeness, the project shall apply a lower value of the default GHG emission factor as provided by regulatory entities such as the EU (e.g., fossil fuel comparator for transport), IPCC, or the actual emission factor as verified and used to meet the IMO compliance, where applicable.

5.4.6 | As per IMO's interim guidance as part of MEPC.1/Circ. 905, and applicable for biofuels certified by an international certification scheme, a default value for the baseline emission factor (GHG emissions of the fossil fuel comparator for transport) of 94g CO_2eq/MJ may be applied.

5.4.7 | The aforementioned default values apply to any project activity that involves displacing fossil fuels not covered by IMO's Guidelines on Life Cycle GHG

Intensity of Marine Fuels (LCA Guidelines). The project developer shall continuously monitor IMO's LCA guidelines to ensure that the most relevant emission factors are being considered.

5.4.8 | The blended proportion of biofuel with fossil fuels in project vessels shall be compliant with the most up to date international regulations at the time of blending, for example Annex VI of MARPOL and MEPC.1/Circ.795/Rev.6.

5.4.9 | The fuel efficiency of the vessel:

a. For the baseline scenario, it shall be determined based on the past 12 months of shipowner's bunker consumption for that vessel, adjusted for speed, load, and other relevant factors affecting fuel consumption. For example - prior year CII ratings can be a good starting point to calculate the baseline fuel efficiency of the vessel.

b. For project scenario with the introduction of biofuels, it shall be measured (after adjusting for changes in calorific value due to the introduction of biofuels) to ensure that there is no ship engine degradation from using biofuels. The fuel efficiency shall be compared to baseline scenario and shall be assessed on annual basis or once during the monitoring period, whichever is more frequent.

5.4.10 |The project developer shall demonstrate that without the project activity the used UCO would have been disposed off as per the local laws and regulations of the respective jurisdiction of the points of origin. To confirm the likely baseline use of the used UCO, the following information shall be provided:

a. Prevalent local laws and regulations for disposal of UCO.

b. If regulations for the disposal of UCO are not prevalent, the closest substitute (from the waste supply chain) shall be assessed. The project developer shall propose the closest substitute to demonstrate that the UCO shall be disposed off instead of being used for other purpose.

5.5 | Selection and justification of the baseline scenarios

5.5.1 | The selection and justification of the baseline scenario, as highlighted in the section 5.4 above, shall depend on the most up to date information with regards to industry wide practices as highlighted by the IMO.

5.5.2 | The sea vessel owners shall provide information on the most common types of fossil bunkers to further define the standard industry-wide practices, in the case that fossil bunkers differ from region to region or more likely, for different types of vessels and different shipping routes.

5.6 | Project scenario

5.6.1 | The project scenario is the loading of blended biofuel bunker onto a sea vessel for the purpose of marine transport. Emissions reductions associated with the biofuel use are calculated by comparing the GHGs reduction metric of the biofuel as compared to the corresponding baseline scenario.

5.6.2 | Emissions reductions from biofuel use shall be calculated off the difference between the project activity and the baseline scenario.

5.6.3 | Depending upon the initiatives pursued by the IMO to help the maritime sector decarbonise, the project scenarios shall be updated.

5.7 | Emission reductions quantification

5.7.1 | GHG emissions are calculated for entire supply chain, i.e., Collection Upstream, Processing, Blending Logistics & Transportation Downstream, to the final marine vessel.

5.7.2 | The GHG emissions associated with biofuels are divided into eight categories, reflecting the emissions from each aspect of biofuel production, blending, and the logistics supply chain. Each component of the supply chain is assessed separately for GHG emissions, and the total is calculated by summing these values. The supply chain component is segmented as A, B, C, D, E, F, G and H and detailed GHG calculations are shown below for each of these segments.

5.7.3 | Feedstock factor (FF) is applied when GHG are expressed in the term of raw material, as it needs to be expressed in terms of outgoing material. The FF is defined as the conversion rate or yield of biofuel from 1 ton of dry feedstock. It is expressed as a ratio or a percentage.

$$FF = \frac{q_b}{q_f} \qquad \textit{Eq. 1}$$

Where:

FF	=	Feedstock factor is conversion rate or yield of biofuel from 1 ton of dry feedstock
q_b	=	Quantity of biofuel blended in the project activity tons)
q_f	=	Quantity of feedstock (tons) required to produce

5.7.4 | Allocation Factors (AF) are applied to co-products are produced. The assumption here is that the by-products are processing waste and have no other use. Therefore, all GHG savings from the biofuel conversion are attributed only to the final biofuel, not to any intermediate or by products that are produced. The AF is defined as the energy content of the main product compared to the summation of the energy content of main product, by-product and co-product, if applicable.

$$AF = \frac{LHV_b}{LHV_b + LHV_{bp}} \qquad \textit{Eq. 2}$$

Where:

AF	=	Allocation Factor is energy content of the main product (biofuel) relative to the energy content of all products (biofuel, by-products and co-products, if applicable) produced in the biofuel production process
LHV_b	=	Lower Heating Value of the biofuel (MJ/dry kg)

LHV_{bp} = Lower Heating Value of the by-products (MJ/dry Kg)

5.7.5 | GHG from all elements of supply chain shall be adjusted with Feedstock Factor and Allocation Factor as provided in Table 6: Updated equation.

5.7.6 | The total supply chain emissions shall then be compared with the fossil bunker fuel GHG emission to determine emission reductions.

a. The ratio of blending shall be stated, and the emission of the blended volume shall be segregated for the biofuel portion and the fossil portion. Only the biofuel portion of the emission shall be added onto the emission from upstream and processing, downstream, after the blending operations.

b. Every element of the supply chain shall report associated GHG emissions through a documented declaration. The project developer shall sum all the individual GHG emissions, including downstream transport emission up to the blending facility.

Table 5: Categories of supply chain components

Category	Description	Shortform
A	Collection, transportation of raw material from points of origin	$e_{td\_upstream}$
B	Transportation of raw material to the biofuel conversion Facility	$e_{td\_downstream1}$
C	Processing of raw material to biofuel	$e_{processing}$
D	Transportation of UCOME to port	$e_{td\_downstream2}$
E	Sea vessel transportation of UCOME from loading port to destination (unloading) port	$e_{td\_downstream3ship}$
F	Unloading of UCOME from destination port / terminal for blending	$e_{td\_downstream4pipeline}$
G	Loading of blended bunker fuel from blending tank to berth	$e_{td\_downstream5pipeline}$
H	Sea vessel transportation of blended UCOME bunker fuel from berth to ship or sea vessel	$e_{td\_downstream6final}$

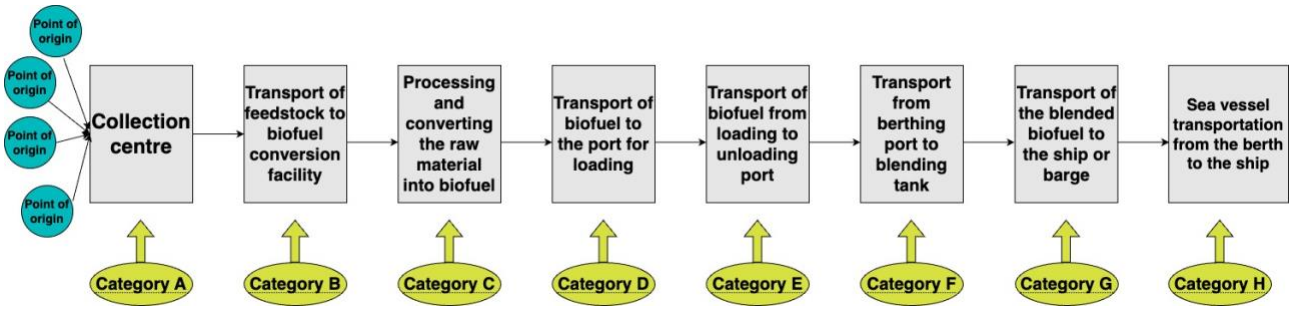

Figure 1: Diagrammatic representation of the categories of supply chain components

Category A

5.7.7 | Category A refers to the collection and transportation of the raw material/ feedstock (used cooking oils) from Points of Origin (PoO) to the collection center. This methodology requires to establish the PoO for the raw material, which shall eventually be processed into the biofuel. The focus shall be on a reverse hub and spoke model, where PoOs are the spokes that feed into the hub, which is the collection center of UCO.

5.7.8 | All GHG emissions and emission factors are calculated and indicated in the Traceability and Sustainability Declaration Documents shall be validated and verified the VVB the suppliers of the raw material & the final marine biofuel.

5.7.9 | The project developer shall report the PoO of the used cooking oils (e.g., hotels, restaurants etc.).

a. If the process of collecting waste oil from the PoO involves collection centre before supplying it for processing, the project developer shall calculate the GHG emissions associated with collection of waste-oils and transportation to a larger collection center as well.

b. The project developer shall report the locations for the multiple PoOs and GHGs emissions shall be calculated associated with the transportation of the raw material from the PoOs to a bigger collection center.

5.7.10 |The average percentage of moisture and impurities shall be considered based on lab results of raw materials from the collection center. For calculating this average percentage, data for a minimum of 12 months or from the start date shall be used.

5.7.11 |The GHG emission calculations are as follows:

$$e_{td\_upstream} = \frac{(d_{ups\_l} * K_l + d_{ups\_e} * K_e) * EF_{fuel}}{(1 - m_f) * q_f} \qquad \textit{Eq. 3}$$

Where:

$e_{td\_upstream}$ = Emissions from Category A ($kgCO_2e$/dry ton)

d_{ups_l} & d_{ups_e} = total distance (km) for the loaded and empty journeys respectively for Category A

K_l & K_e	=	diesel/fossil fuel consumption of truck (litres/km) for the loaded and empty journeys respectively for Category A
EF_{fuel}	=	fossil fuel emission factor ($kgCO_2e$/litre) for the fuel used (default value of 3.14 $kgCO_2e$/litre may be applied)
m_f	=	moisture content of the feedstock (%)
q_f	=	Quantity of feedstock (wet ton) required to produce q_b

5.7.12 |The moisture content (m) for any item 'n' can be calculated as follows:

$$m_n = \frac{q_{n,d}}{q_{n,w}} * 100 \qquad \textit{Eq. 4}$$

Where:

m_n	=	The moisture content (%) of item 'n' for which we are calculating the moisture content. It could be feedstock or biofuels.
$q_{n,d}$	=	the total quantity of item 'n' produced (dry tons)
$q_{n,w}$	=	the total quantity of item 'n' produced (wet tons)

The GHG emissions calculated for each route is reviewed and the highest GHG emissions is used for the entire batch of stock collected from the PoOs.

Category B

5.7.13 |Category B refers to the GHG emissions associated with transporting the feedstock from the collection center to the biofuel conversion facility. It includes but not limited to the fuel consumption of trucks involved in transport, analysing truck load capacity, number of trucks used for transportation and the distance from the collection centers to the biofuel conversion facility.

5.7.14 |The weighted average percentage of moisture and impurities shall be established based on lab results at the receiving point.

5.7.15 |The transport emission per ton of biofuel transported is calculated as follows:

$$e_{td\_downstream1} = \frac{(d_{downs1\_l} * K_l + d_{downs1\_e} * K_e) * EF_{fuel}}{(1 - m_b) * q_b} \qquad \textit{Eq. 5}$$

Where:

$e_{td\_downstream1}$	=	Emissions from Category B ($kgCO_2e$/dry ton)
d_{downs1_l} & d_{downs1_e}	=	total distance (km) for the loaded and empty journeys respectively for Category B
K_l & K_e	=	diesel/fossil fuel consumption of truck in (litres/km) for the loaded and empty journeys respectively for Category B
EF_{fuel}	=	fossil fuel emission factor ($kgCO_2e$/litre) for the fuel used (default value of 3.14 $kgCO_2e$/litre may be applied)
m_b	=	moisture content of the biofuel (%)
q_b	=	Quantity of biofuel (wet ton) blended in the project activity

5.7.16 |Conversion to dry tons is calculated as per Eq 4.

Category C

5.7.17 |The category C refers to emissions associated with processing and converting the raw material into the biofuel and looks at production data throughout the crediting period, mainly feedstock throughput rate, by-products produced, additional catalysts used in processing and amount of final product produced.

a. In situations where the monitoring period is less than 12 months, there shall be a review process within 6 months to update the interim values calculated.

b. The project developer shall ensure that any by-product (e.g., glycerol) is not disposed of or left to decay but it should be either incinerated or used as raw material for industrial consumption or sold.

5.7.18 |The electricity, natural gas and other energy requirements in processing the raw material into the biofuel shall also be monitored. The developer may use default factors provided by reputed organisations if justified. The quantity of consumables used in the production process, for example – methanol, citric acid, bleaching earth, and phosphoric acid – shall also be taken into account for GHG emissions quantification.

5.7.19 |Emissions from wastewater shall be taken into account as and when applicable, and the default values associated with emissions may be applied if justified as conservative.

5.7.20 |The emissions calculations for the biodiesel plant are as follows:

$$EM_{elecon} = electricity \times EF_{REM} \times (1 + TDL) \qquad \textit{Eq. 6}$$

Where:

EM_{elecon}	=	Emissions from electricity consumption for the entire biofuel production facility ($kgCO_2e$/year). The electricity consumption shall be determined from the electricity bill or other similar records.
electricity	=	Electricity consumption for the entire biofuel production facility (kWh/year)
EF_{REM}	=	Emission Factor of the Regional Electricity ($kgCO_2e$/kWh). Default value for the emission factor for the regional electricity mix for example JEC Well-to-Tank report v5, 2020[2] and Biograce v 4d, 2014[3] may be applied, if justified as conservative. The developer shall use the latest available values at the time of verification.

[2] https://publications.jrc.ec.europa.eu/repository/handle/JRC119036

[3] https://www.biograce.net/content/ghgcalculationtools/standardvalues

TDL = average technical transmission and distribution losses (%) for transmitting electricity to a source as per CDM Tool 05.

The emissions from heat production are calculated as follows:

$$EM_{hepro} = q_{fuelcon} \times EF_{fuel} \quad \textit{Eq. 7}$$

Where:

EM_{hepro} = Emissions from heat production ($kgCO_2e$/year)

$q_{fuelcon}$ = Quantity of fuel consumed (kg/year) for heat production at the biofuel production facility. Fuel consumption shall be calculated based on data from the meter reading

EF_{fuel} = Emission factor for fuel ($kgCO_2e$/kg) used for heat production. The latest default Emission Factor for fuel provided by the reputed organisation for example European Commission: Standard values for emission factors, v 1.0. 2015[4] may be used, if justified as conservative.

5.7.21 |The emissions from further inputs are calculated as follows:

$$EM_{inputs} = q_{inputs} \times EF_{inputs} \quad \textit{Eq. 8}$$

Where:

EM_{inputs} = Emissions from inputs ($kgCO_2e$/year)

q_{inputs} = Quantity of inputs (kg/year) required for biofuel production at the facility. The inputs will be determined from the biodiesel facility's production report

EF_{inputs} = Emission factors for inputs ($kgCO_2e$/kg) under consideration in q_{inputs}. For the emission factors associated with additional inputs may be sourced from Biograce v 4d, 2014[5] and European Commission: Standard values for emission factors, v 1.0. 2015[6], if justified as conservative.

5.7.22 |Emissions from wastewater are calculated as follows:

$$EM_{ww} = q_{ww} * EF_{ww} \quad \textit{Eq. 9}$$

Where:

EM_{ww} = Emissions from wastewater ($kgCO_2e$/year) produced at the biofuel production facility

[4] https://energy.ec.europa.eu/system/files/2015-10/Standard%2520values%2520v.1.0_0.xlsx

[5] https://www.biograce.net/content/ghgcalculationtools/standardvalues

[6] https://energy.ec.europa.eu/system/files/2015-10/Standard%2520values%2520v.1.0_0.xlsx

q_{ww} = Quantity of wastewater (litres/year) produced at the biofuel production at the facility. The volume of wastewater will be determined from the production report

EF_{ww} = Emission factors for wastewater ($kgCO_2e$/litre) under consideration in q_{ww} . Emission factor associated with wastewater may be sourced from Ecoinvent v. 3.7, 2020[7].

5.7.23 | Finally, adding all the emissions from the processing unit of the biodiesel plant yields the following:

$$e_{processing} = \frac{\Sigma(EM_{elecon}, EM_{hepro}, EM_{inputs}, EM_{ww})}{yield_{mp}} \quad \text{Eq. 10}$$

Note: It is in category C where the Feedstock Factor (yield of biofuel from 1 ton of dry feedstock) and the Allocation Factor (Energy in Biofuel / (Energy in Biofuel + Energy in co-products)) shall be calculated.

Where:

$yield_{mp}$ = Total quantity of the main product (biofuel) produced at the biofuel production facility (kg/year)

5.7.24 | The biofuels processing unit summates all the emissions (after converting to per unit final biofuel material using the feedstock & allocation factor as provided in Table 6: Updated equation) and includes the emissions for processing, before passing it onto the next element in the supply chain i.e., the blending operations. The processing unit shall get the GHG values approved by an internationally accredited certifying body for this methodology.

5.7.25 | All GHG values are approved by the certifying bodies as per internationally set requirements – for example in compliance with RED-II[8]. The calculated GHG values for the various levels of supply chains, must be certified by an external qualified GHG expert auditor with sufficient technical capacity, representing a certifying body or holding a recognised qualification.

Category D

5.7.26 | This category D refers to emissions associated with transporting the biofuel to the port of loading. This methodology considers truck load capacity, number of trucks used as well as diesel consumption. The average percentage

[7] https://ecoinvent.org/the-ecoinvent-database/data-releases/ecoinvent-3-7/

[8] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC

moisture and impurities is established based on the lab results at the biofuel facility.

5.7.27 |Similar to Category B, CO_2 emissions per dry ton are calculated as follows:

$$e_{td\_downstream2} = \frac{(d_{downs2\_l} * K_l + d_{downs2\_e} * K_e) * EF_{fuel}}{(1 - m_b) * q_b} \quad \textit{Eq. 11}$$

Where:

$e_{td\_downstream2}$	=	Total emissions from Category D ($kgCO_2e$/dry ton)
d_{downs2_l} & d_{downs2_e}	=	total distance (km) for the loaded and empty journeys respectively for Category D
K_l & K_e	=	diesel/fossil fuel consumption of truck (litres/km) for the loaded and empty journeys respectively for Category D
EF_{fuel}	=	fossil fuel emission factor ($kgCO_2e$/litre) for the fuel used (default value of 3.14 $kgCO_2eq$/liter)
m_b	=	moisture content of the biofuel (%)
q_b	=	Quantity of biofuel blended (wet ton) in the project activity

5.7.28 |The moisture calculation in the denominator of Eq 11 is used to convert the CO_2 emissions from the biofuel into a dry ton for consistency. The moisture content of the biofuel shall be measured throughout the following categories to adjust for any changes in moisture content and emission calculations in dry tons.

Category E

5.7.29 |This category refers to maritime emissions from transporting the biofuel from the loading to the unloading port. This analyses the quantity of the biofuel in the sea vessel (as per the Bill of Lading) with percentage of moisture & impurities as per the Quality & Quantity Surveyor's Report.

5.7.30 |The distances shall be determined as per the sea distance in km. This distance can be calculated using tools such as https://sea-distances.org. The CO_2 emissions per dry ton are calculated as follows:

$$e_{td\_downstream3ship} = \frac{d_{downs3\_l} * EF_{tmode} * \%_{downs3b}}{(1 - m_b)} \quad \textit{Eq. 12}$$

Where:

$e_{td\_downstream3ship}$	=	Emissions from Category E ($kgCO_2e$/dry ton)
d_{downs3_l}	=	total distance (km) from the port of loading to unloading
EF_{tmode}	=	fossil fuel emission factor for tmode ($kgCO_2e$/ton-km).

The tanker vessel has emissions of roughly 0.0108 $kgCO_2e$ / ton-km as calculated from Biograce v 4d, 2014[9], may be used, if justified conservative

m_b = moisture content of the biofuel(%)

$\%_{downs3b}$ = Ratio of weight of biofuel to the total weight of cargo being carried by the transport mode under Category E of the supply chain (%)

Category F

5.7.31 |This category at the pipeline distance from the berthing port to the blending tank where the biofuel is blended with fossil fuels. There is an emission factor associated with pipeline use, to account for energy used to transport via pipeline. The formula to calculate the CO_2 emissions per dry ton is as follows:

$$e_{td\_downstream4pipeline} = \frac{d_{downs4\_l} * EF_{pipeline} * \%_{downs4b}}{(1-m_b)} \quad \textit{Eq. 13}$$

Where:

$e_{td\_downstream4pipeline}$ = Emissions from Category F ($kgCO_2e$/dry ton)

d_{downs4_l} = Transport distance / pipeline length (km) from the berthing port to the blending tank where the biofuel will be blended before it is used for bunkering

$EF_{pipeline}$ = Emission factor for pipeline transport ($kgCO_2e$/ton-km). The default emission factor is 0.0020 $kgCO_{2eq}$ / ton-km as per Biograce v 4d, 2014[10] may be applied, if justified as conservative.

m_b = moisture content of the biofuel (%)

$\%_{downs4b}$ = Ratio of weight of biofuel to the total weight of cargo or product being carried by the transport mode under Category F of the supply chain (%).

Category G

5.7.32 |This category tracks the blended biofuel that will be loaded on to the ship or the barge, using the pipeline distance from the blending tank to the berth. Similar calculations as part F except the need to account for the fact that a biofuel blend is being transported. The formula to calculate the CO_2 emissions per dry ton is the same as the one in Category F and is as follows:

$$e_{td\_downstream5pipeline} = \frac{d_{downs5\_l} * EF_{pipeline} * \%_{downs5b}}{(1-m_b)} \quad \textit{Eq. 14}$$

[9] https://www.biograce.net/content/ghgcalculationtools/standardvalues

[10] https://www.biograce.net/content/ghgcalculationtools/standardvalues

Where:

$e_{td\_downstream5pipeline}$	=	Emissions from Category G ($kgCO_2e$/dry ton)
d_{downs5_l}	=	Transport distance or length of the pipeline (km) from the blending tank to barge for the biofuel
$EF_{pipeline}$	=	Emission factor for pipeline transport ($kgCO_2e$/ton-km). The default emission factor as 0.0020 $kgCO_2e$/ton-km as per Biograce v 4d, 2014[11] may be applied, if justified as conservative.
m_b	=	moisture content of the biofuel (%)
$\%_{downs5b}$	=	Ratio of weight of biofuel to the total weight of cargo or product being carried by the transport mode under Category G of the supply chain (%)

Category H

5.7.33 |The final part involves the sea vessel transportation of the blended biofuel from the berth to the ship or the sea vessel and looks at the quantity of biofuel in the blended fuel to be loaded onto the ship or barge. The sea distance shall be in km from the terminal to the sea vessel where the blended bunker fuel is loaded for use.

5.7.34 |The formula to calculate CO_2 emissions per dry ton is identical to Category E and is as follows:

$$e_{td\_downstream6final} = \frac{d_{downs6\_l} * EF_{pipeline} * \%_{downs6b}}{(1-m_b)} \qquad \textit{Eq. 15}$$

Where:

$e_{td\_downstream6final}$	=	Emissions from Category H ($kgCO_2e$/dry ton)
D_{downs6_l}	=	Transport distance or length of the pipeline (km) from the barge to the ship where the blended biofuel is eventually used as a bunkering fuel.
$EF_{pipeline}$	=	Emission factor for pipeline transport ($kgCO_2e$/ton-km). The default emission factor is 0.0020 $kgCO_2e$/ton-km as per Biograce v 4d, 2014[12] may be applied, if justified as conservative.
m_b	=	moisture content of the biofuel (%)
$\%_{downs6b}$	=	Ratio of weight of biofuel to the total weight of cargo or product being carried by the transport mode under Category H of the supply chain (%)

[11] https://www.biograce.net/content/ghgcalculationtools/standardvalues

[12] https://www.biograce.net/content/ghgcalculationtools/standardvalues

5.7.35 |Total biodiesel emissions add parts A to H (after accounting for the feedstock conversion factor and energy content in parts A and B, since this methodology deals with the feedstock). The summation is divided by the lower heating value to get a gCO_{2eq}/MJ metric (called φ), which is compared with fossil fuels.

5.7.36 |The total GHG emissions are calculated for biofuels as follows:

$$\mu = \sum \alpha, \beta, \xi, \phi, \psi, \theta, \pi, \lambda \qquad \textit{Eq. 16}$$

5.7.37 |The following equation converts μ from $kgCO_2eq$/dry ton of biofuel to gCO_2eq/MJ:

$$\boldsymbol{\varphi} = \frac{\mu}{LHV_{biofuel}} \qquad \textit{Eq. 17}$$

Where the Lower Heating Value for the biofuel (at 0% water, unless otherwise stated) is based off the European Commission: Standard values for emission factors, v 1.0. 2015[13] document.

[13] https://energy.ec.europa.eu/system/files/2015-10/Standard%2520values%2520v.1.0_0.xlsx

Table 6: Updated equations (accounting for dry ton of CO_2e emissions)

Category	Description	Updated Equation
A	Collection, Transportation of Raw Material from Points of Origin	$\boldsymbol{\alpha} = e_{td\_upstream} \div FF * AF$
B	Transportation of Raw Material to the Biofuel conversion Facility	$\boldsymbol{\beta} = e_{td\_downstream1} \div FF * AF$
C	Processing of Raw Material to Biofuel	$\boldsymbol{\xi} = e_{processing} * AF$
D	Transportation of UCOME to Port	$\boldsymbol{\phi} = e_{td\_downstream2}$
E	Sea Vessel Transportation of UCOME from Loading Port to Destination (Unloading) Port	$\boldsymbol{\psi} = e_{td\_downstream3ship}$
F	Unloading of UCOME from Destination Port / terminal for Blending	$\boldsymbol{\theta} = e_{td\_downstream4pipeline}$
G	Loading of Blended Bunker Fuel from Blending Tank to Berth	$\boldsymbol{\pi} = e_{td\_downstream5pipeline}$
H	Sea Vessel Transportation of Blended UCOME Bunker Fuel from Berth to Ship or Sea Vessel	$\boldsymbol{\lambda} = e_{td\_downstream6final}$
	Total GHG emissions in $kgCO_{2eq}$/dry ton of biofuel	$\boldsymbol{\mu} = \sum \alpha, \beta, \xi, \phi, \psi, \theta, \pi, \lambda$
	Total GHG emissions in gCO_{2eq}/MJ of biofuel	$\boldsymbol{\varphi} = \frac{\mu}{lower\ heating\ value_{biofuel}}$

To calculate the GHG savings benchmark, $\boldsymbol{\varphi}$ is compared to the fossil fuel reference according to the formula below:

$$GHG_{SP\%} = \frac{(GHG_{FFCT} - \boldsymbol{\varphi})}{GHG_{FFCT}} * 100 \qquad Eq.\ 18$$

Where:

$GHG_{SP\%}$ = GHG savings potential of the biofuel relative to the fossil fuel comparator for transport (%)

GHG_{FFCT} = refers to the GHG emissions of the fossil fuel comparator for transport (gCO_2e/MJ)

$\boldsymbol{\varphi}$ = Total GHG emissions of biofuel (gCO_2e/MJ). The default emission values GHG_{FFCT} is: 94 gCO_{2eq} / MJ[14]

[14] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC

5.7.38 |The net emission reduction per ton of biofuel used can be calculated based on the following formula:

$$GHG_{SP} = GHG_{FFCT} - \boldsymbol{\varphi} \qquad Eq.\ 19$$

Where:

GHG_{SP}	=	GHG savings potential of the biofuel relative to the fossil fuel comparator for transport (gCO_2e/MJ)
GHG_{FFCT}	=	refers to the GHG emissions of the fossil fuel comparator for transport (gCO_2e/MJ)
$\boldsymbol{\varphi}$	=	Total GHG emissions of biofuel (gCO_2e/MJ)

5.7.39 |The above equation is then converted into the absolute emissions reduction (ER) per year based on the following equation and the quantity of biofuel blended in a year over the crediting period:

$$AVER\left[\frac{tCO2e}{yr}\right] =$$

$$GHG_{SP} * LHV_b * (1 - m_b) * q_b * \%_{biofuelconsumed} * \%_{biofuelother} * (1 - R) * (1 - V)$$

Eq 20

Where:

AVER	=	Absolute Voluntary Emissions Reductions delivered by the project (tCO_2e/year)
GHG_{SP}	=	GHG savings potential of the biofuel relative to the fossil fuel comparator for transport (gCO_2e/MJ)
LHV_b	=	Lower Heating Value of the biofuel (MJ/g)
m_b	=	Moisture content of the biofuel (%)
q_b	=	Quantity of biofuel utilised in the project activity (wet ton/year)
$\%_{biofuelconsumed}$	=	Amount of biofuel in the blended bunkering fuel that was consumed during the crediting period as reported by the project proponent (%). We assume that the % of biofuel consumed in the blended bunkering fuel will be the same as the % of the blended bunkering fuel consumed by the ship over the crediting period, which will be determined by the project developer with supporting data from the shipowner.
$\%_{biofueother}$	=	percentage of biofuel that are also produced in the project facility but from other feedstock sources rather than UCO (%)
R	=	the percentage of the project activity that falls within the baseline maritime biofuel penetration rate for the regulating country or for the shipping route (%). The baseline will be determined by the project proponent in compliance with

Step 1 of Tool 01 of CDM that is used to demonstrate additionality.

V	=	the percentage of the project activity that falls within the baseline biofuel bunkering rate for the specific vessel above and beyond baselines calculated in R (%). The baselines will be determined based on the vessels prior year CII rating and will be adjusted for any mandated decarbonisation measures the shipowner must adopt.

5.8 | Leakage Emissions

5.8.1 | The project activities in this scenario already have leakage emissions accounted for in transport (truck, sea vessel and pipeline) and processing within the default CO_{2eq} emissions values.

5.8.2 | Carbon leakage emissions for second generation biofuels (specifically UCO) shall be assumed to be zero owing to the waste/residual nature of the feedstocks used to make second generation biofuels.

5.9 | General Requirements for data and information sources

5.9.1 | Emissions associated with feedstock sourcing, processing and transport up until the blended biofuel is used in the vessel shall be monitored. To summarise the monitoring at various stages of the supply chain will be as follows:

Table 7: Monitoring and data sources

Stage	Function	Monitoring
A	Collection, Transportation of Raw Material from Points of Origin	Weighted average percentage of moisture and impurities in the feedstock is established based on lab results at the receiving point
B	Transportation of Raw Material to the Biofuel conversion Facility	
C	Processing of Raw Material to Biofuel	Based on a production period of biofuel of up to 12 months and based on the production report from the facility
D	Transportation of UCOME to Port	Average percentage of moisture and impurities in the biofuel is established based on lab results at the receiving point
E	Sea Vessel Transportation of UCOME from Loading Port to Destination (Unloading) Port	Percentage of moisture & impurities in the biofuel as per Quality & Quantity surveyor's report, amount of biofuel will be verified by the bill of lading.
F	Unloading of UCOME from Destination Port / terminal for Blending	
G	Loading of Blended Bunker Fuel from Blending Tank to Berth	Percentage of moisture & impurities in the biofuel as per Terminal Operator's report
H	Sea Vessel Transportation of Blended UCOME Bunker Fuel from Berth to Ship or Sea Vessel	

5.10 | Data and parameters not monitored

5.10.1 | As a guideline for the parameters highlighted below, the default methodological values shall be sourced from latest published data, which includes the emission factors (EF), with which the respective input data are multiplied, and lower heating values.

Parameter ID	**MFBB 1**
Data/Parameter:	K_l & K_e
Data unit:	liters / km
Description:	Diesel/fossil fuel consumption of truck
Source of data:	Default values for K_{loaded} and K_{empty}:

Market	**Payload (kg)**	**K_{loaded} (litre/km)**	**K_{empty} (litre/km)**
Brasil	19,500	0.398	0.282
China	25,000	0.416	0.270
Europe	19,300	0.336	0.238
India	27,230	0.548	0.261

	<table><tr><td>US</td><td>17,237</td><td>0.404</td><td>0.296</td></tr></table> Default values sourced from the International Council on Clean Transportation (ICCT)[15].
Measurement procedure if any	-
Any comment:	Other default value may also be used however a justification of the appropriateness of the value and source of information shall be provided.

Parameter ID	**MFBB 2**
Data/Parameter:	EF_{fuel}
Data unit:	$kgCO_2eq$/liter or $kgCO_2eq$/MJ or $kgCO_2eq$/ton-km
Description:	Life cycle emissions associated with diesel consumption
Source of data:	<table><tr><th>Fuel/mode</th><th>Values used</th></tr><tr><td>Barge tanker (for Europe)</td><td>0.043458 $kgCO_2eq$/ton-km</td></tr><tr><td>Barge tanker (for rest of the world)</td><td>0.04435 $kgCO_2eq$/ton-km</td></tr><tr><td>Diesel</td><td>3.14 $kgCO_2eq$/liter</td></tr><tr><td>Freight, lorry (for Europe)</td><td>0.13098 $kgCO_2eq$/ton-km</td></tr><tr><td>Freight, lorry (for the rest of the world)</td><td>0.1367 $kgCO_2eq$/ton-km</td></tr><tr><td>Freight train (for Europe w/o Switzerland)</td><td>0.045569 $kgCO_2eq$/ton-km</td></tr><tr><td>Freight train (for the rest of the world)</td><td>0.048276 $kgCO_2eq$/ton-km</td></tr><tr><td>Heavy Fuel Oil</td><td>3.42 $kgCO_2eq$/litre or 0.085 $kgCO_2eq$/MJ</td></tr><tr><td>Heavy Fuel Oil for maritime transport</td><td>0.087 $kgCO_2eq$/MJ</td></tr></table> Values sourced and calculated from European Commission:

[15] https://www.globalfueleconomy.org/media/404893/gfei-wp14.pdf

	Standard values for emission factors, v 1.0. 2015[16].
Measurement procedure if any	-
Any comment:	Other default value may also be used however a justification of the appropriateness of the value and source of information shall be provided.

Parameter ID	**MFBB 3**
Data/Parameter:	LHV_b & LHV_{bp}
Data unit:	MJ/kg
Description:	Lower calorific values of Biofuel and by-products
Source of data:	<table><tr><th>Fuel</th><th>Values used</th></tr><tr><td>Crude and refined vegetable oil</td><td>37 MJ/kg</td></tr><tr><td>Waste vegetable / animal oil</td><td>37.1 MJ/kg</td></tr><tr><td>Palm oil</td><td>37 MJ/kg</td></tr><tr><td>Palm kernel meal</td><td>17 MJ/kg</td></tr><tr><td>Crude Glycerin (Glycerol)</td><td>16 MJ/kg</td></tr></table> Values sourced from European Commission: Standard values for emission factors, v 1.0. 2015[17].
Measurement procedure if any	-
Any comment:	Other default value may also be used however a justification of the appropriateness of the value and source of information shall be provided.

Parameter ID	**MFBB 4**
Data/Parameter:	EF_{REM}
Data unit:	$kgCO_2eq/kWh$
Description:	Emission Factors associated with the regional electricity mix
Source of data:	The Electricity Grid emission factor shall be calculated using the

[16] https://energy.ec.europa.eu/system/files/2015-10/Standard%2520values%2520v.1.0_0.xlsx

[17] https://energy.ec.europa.eu/system/files/2015-10/Standard%2520values%2520v.1.0_0.xlsx

	CDM Tool 05, which incorporates transmission and distribution losses. The tool and default values for this methodology can be downloaded here - https://www.iges.or.jp/en/pub/list-grid-emission-factor/en under the "SummaryEFfromCDM" tab under the Combined Margin EF (Average) as the reference point.
Measurement procedure if any	-
Any comment:	-

Parameter ID	**MFBB 5**
Data/Parameter:	$EF_{natural\ gas}$
Data unit:	$kgCO_2eq/kWh$
Description:	Emission Factors associated with natural gas
Source of data:	0.0676 $kgCO_2eq/kWh$ for Europe mix (4000 km) 0.0662 $kgCO_2eq/kWh$ for Russia (4000 km) The values are based on Based on Biograce v 4d 2014[18], which takes data from the JEC-E3 database.
Measurement procedure if any	-
Any comment:	Other default values, especially for non-European gas, may also be used however a justification of the appropriateness of the value and source of information shall be provided.

Parameter ID	**MFBB 6**
Data/Parameter:	EF_{inputs}
Data unit:	kgCO2e/kg
Description:	Emission Factors associated with inputs in biodiesel production
Source of data:	

Inputs in biodiesel production	**Emission factor**
Methanol	1.98 $kgCO_2e/kg$
Phosphoric Acid	3.01 $kgCO_2e/kg$
Citric Acid	0.96 $kgCO_2e/kg$
Sodium Methylate	4.88 $kgCO_2e/kg$
Hydrochloric Acid	0.75 $kgCO_{2eq}/kg$

[18] https://www.biograce.net/content/ghgcalculationtools/standardvalues

	<table><tr><td>Sodium Hydroxide</td><td>0.47 $kgCO_2e/kg$</td></tr><tr><td>Bleaching Earth</td><td>0.2 $kgCO_2e/kg$</td></tr><tr><td>Nitrogen</td><td>0.43 $kgCO_2e/kg$</td></tr></table> The values are based on Biograce v 4d 2014[19] and the European Commission: Standard Values for emission GHG 205[20], which takes data from the JEC-E3 database.
Measurement procedure if any	-
Any comment:	Other default values may also be used however a justification of the appropriateness of the value and source of information shall be provided.

Parameter ID	**MFBB 7**
Data/Parameter:	EF_{ww}
Data unit:	$kgCO_2e/cbm$
Description:	Emission Factors associated with wastewater
Source of data:	0.547 $kgCO_{2eq}/cbm$ The values are based on Biograce v 4d 2014[21], and the European Commission: Standard Values for emission GHG 205[22], which takes data from the JEC-E3 database.
Measurement procedure if any	-
Any comment:	Other default values may also be used however a justification of the appropriateness of the value and source of information shall be provided.

Parameter ID	**MFBB 8**
Data/Parameter:	EF_{tmode}
Data unit:	$kgCO_2e/ton\text{-}km$
Description:	Emission Factors associated with transport type
Source of data:	For transoceanic tanker the default value is assumed to be 0.0108 $kgCO_{2eq}/ton\text{-}km$

[19] https://www.biograce.net/content/ghgcalculationtools/standardvalues

[20] https://energy.ec.europa.eu/system/files/2015-10/Standard%2520values%2520v.1.0_0.xlsx

[21] https://www.biograce.net/content/ghgcalculationtools/standardvalues

[22] https://energy.ec.europa.eu/system/files/2015-10/Standard%2520values%2520v.1.0_0.xlsx

	The values are calculated from Biograce v 4d, 2014[23]
Measurement procedure if any	-
Any comment:	Other default values may also be used however a justification of the appropriateness of the value and source of information shall be provided.

Parameter ID	**MFBB 9**
Data/Parameter:	$EF_{pipeline}$
Data unit:	$kgCO_2e$/ton-km
Description:	Emission Factors associated with pipelines transporting either oil onshore or natural gas offshore
Source of data:	<table><tr><th>Transportation mode</th><th>Values used</th></tr><tr><td>Pipeline (oil, liquids) onshore</td><td>0.02 $kgCO_2e$/ton-km</td></tr><tr><td>Pipeline natural gas (long distance, offshore) for Europe (RER)</td><td>0.057028 $kgCO_2e$/ton-km</td></tr><tr><td>Pipeline natural gas (long distance, offshore) for the rest of the world (ROW)</td><td>0.10296 $kgCO_2e$/ton-km</td></tr></table> The values for onshore pipeline (oil, liquids) are based on Biograce v 4d, 2014[24] and the values for pipeline natural gas (long distance, offshore) are based off Ecoinvent v. 3.7, 2020: market for transport, pipeline, offshore, long distance, natural gas[25]
Measurement procedure if any	-
Any comment:	Other default values, may also be used however a justification of the appropriateness of the value and source of information shall be provided.

[23] https://www.biograce.net/content/ghgcalculationtools/standardvalues

[24] https://www.biograce.net/content/ghgcalculationtools/standardvalues

[25] https://ecoinvent.org/the-ecoinvent-database/data-releases/ecoinvent-3-7/

Parameter ID	MFBB 10
Data/Parameter:	GHG_{FFCT}
Data unit:	gCO_2e/MJ
Description:	Emission Factors associated with the fossil fuel comparator for transport that the biofuel is displacing
Source of data:	94 gCO_2e/MJ The values are based on the Renewable Energy Directive (RED) – II.
Measurement procedure if any	-
Any comment:	This default values is applicable to any project activity that involves displacing fossil fuels that do not fall under the scope of IMO's Guidelines On Life Cycle GHG Intensity Of Marine Fuels (LCA Guidelines)[26]. The project proponent shall to calculate the CO_2e well-to-wake GHG intensity of the fuel, based off the GHG Equivalence Factors highlighted in Section 6.1 of this methodology. The project proponent shall continuously monitor IMO's LCA guidelines on Marine Fuels to ensure that the most relevant emission factors are being taken into account.

Parameter ID	MFBB 11
Data/Parameter:	Project Technology Description
Data unit:	N/A
Description:	The detailed description of the biofuels processing technology shall include as a minimum: a) Manufacturer/retrofitting entity name b) technology type c) capacity characteristics d) rated thermal efficiency e) biofuel yield ($yield_{mainproduct}$) Any performance certifications from the national standards body or certification body recognised by the national standards body also shall be provided.

26 https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/annex/MEPC%2080/Annex%2014.pdf

Source of data:	Any of the following sources shall be used: a) Manufacturer specifications b) Certifications by a national standards body or an appropriate certification party recognised by a national standard body c) Commercial guarantee d) Technical reports from the installer e) Independent authorised testing body Other sources may be used for this parameter if the developer can justify the appropriateness. Professional opinion or expert opinion is not accepted as a source for this parameter.
Measurement procedure if any	-
Any comment:	For any technical information not available at the time of validation, the validation and verification body (VVB) shall include a FAR (Forward Action Request) in the validation report. Project developer shall provide this information to the verifying VVB before completion of the verification report. No issuance shall be requested for project technologies for which the project technology details are not verified by the verifying VVB prior to completion of the verification report.

Parameter ID	**MFBB 12**
Data/Parameter:	Avoidance of double counting or double claiming among project participants
Data unit:	N/A
Description:	Evidence of avoidance of double counting or double claiming with other parties directly involved with the project or program.
Source of data:	Written assertions with the project developer of the ownership rights and intention of selling the emission reductions resulting from the project activity directed at or signed with all the applicable parties of the following: a) all other project participants; b) project technology producers; and c) retailers of the project technology or the renewable fuel.
Measurement procedure if any	-
Any comment:	If any of the written assertions are not available at the validation, the validating VVB shall include a FAR for verifying VVB. In all cases, the written assertions shall be provided and verified before the first issuance.

Parameter ID	**MFBB 13**

Data/Parameter:	Avoidance of double counting or double claiming with other mitigation actions
Data unit:	N/A
Description:	Analysis of mitigation actions in other voluntary markets or UNFCCC/compliance mechanisms
Source of data:	Using publicly available information from Gold Standard and other voluntary standards, at a minimum Verra and any recognised national or regional standards in the project location, and UNFCCC CDM/future mechanism project & PoA (Program of Activities)/VPA (Voluntary Project Activities) database: a. identify and list any mitigation actions of similar technology, i.e., that provide the same kind of output and use the same kind of equipment or conversion process, operating in overlapping spatial boundaries of the project activity. b. Undertake at the time of design review, VPA inclusion review and at design change review when project/VPA boundary changes after design/inclusion review. If one or more are identified: a. Describe the practices that will be implemented to ensure that the program or project activity quantifies emission reductions only from the technology it has implemented, b. Describe the practices to avoid that the program or project activity implementation displaces technology of other mitigation actions, and c. Design a monitoring approach and method to discount emission reductions in case the program or project activity is found to displace or operate alongside another mitigation action.
Measurement procedure if any	-
Any comment:	-

Parameter ID	**MFBB 14**
Data/Parameter:	Regulatory framework for provision of thermal energy services
Data unit:	N/A
Description:	The project shall not undermine or conflict with any national, sub-national or local regulations or guidance for biofuel production
Source of data:	List and provide a summary of any national, sub-national and local regulations or guidance for the provision of thermal energy

	services/devices of the type the project provides in the project boundary. Describe how the project complies with the regulatory framework.
Measurement procedure if any	-
Any comment:	To ensure that the existing project activity is not covered by a mandated scheme and is a voluntary activity eligible for carbon credits.

Parameter ID	**MFBB 15**
Data/Parameter:	Additionality of Waste Feedstock Use
Data unit:	N/A
Description:	The project developer shall provide information that proves that the current waste to biofuel conversion does not displace a pre-existing energy use for the waste feedstock prior to project intervention.
Source of data:	This includes: a. Prevalent local laws and regulations for disposal of waste feedstock. b. If regulations for the disposal of the specific waste feedstock are not prevalent, the closest substitute (from the waste supply chain) shall be assessed. The project developer shall propose the closest substitute and may write to standards@goldstandard.org for the waste feedstock baseline to be reviewed on a case-by-case basis. Examples of non-energy pre-existing uses for waste feedstock include outright disposal and landfilling.
Measurement procedure if any	-
Any comment:	This ensures that the existing project activity is avoiding carbon emissions and is a voluntary activity eligible for carbon credits.

Parameter ID	**MFBB 16**
Data/Parameter:	Avoidance of double counting or double claiming among biofuel blenders and end-users for biofuel bunkering
Data unit:	N/A
Description:	Evidence of avoidance of double counting or double claiming among biofuel blenders and end-users for biofuel bunkering
Source of data:	Evidence of informing / notification of project developer, such as: a. Documentation signed by the biofuel blenders alerting them to the fact that they cannot claim carbon credits or claim

	decarbonisation upon the blending of biofuels, even after it has been sold to an end-user (usually shipowner) for maritime bunkering and that the carbon credits claim remains with the end-user / shipowner. b. The project developer will have documentation restricting them from registering their project under any other voluntary carbon removal scheme for the credits. c. Alternatively, the shipowner can sign a carbon title waiver form, allowing the biofuel blender to receive the carbon credit claim in return for a discount on the blended biofuel. d. No decarbonisation activity in biofuel bunkering associated with this methodology will be considered legitimate without proof of the carbon credit issued.
Measurement procedure if any	-
Any comment:	None

5.10.2 | Data shall be gathered from official sources, like the RED[27]. Should the biofuel blender suggest alternative values it shall be justified. They can be based on Ecoinvent or Biograce or individually calculated or measured (e.g. LHV could be measured through laboratory analyses) as long as the methodology used complies with the methodology set in the RED or the IMO[28] and is verifiable during the audit.

5.10.3 | If not available, other scientifically peer-reviewed literature or official statistical data from government bodies may be used. All data gathered from databases or literature shall be based on the most recent available sources and shall be updated over time. The source and the date of data collection shall be documented. Emission factors chosen or calculated shall also reflect the specific situation and set up. E.g., if an on-site data gathering for individual calculation process-specific input was produced in Europe then the emission factor for this input shall also reflect the European situation.

[27] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC

[28] https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/annex/MEPC%2080/Annex%2014.pdf

6| Uncertainty quantification

6.1.1 | Potential sources of uncertainty, along with the associated Quality Assurance/Quality Control (QA/QC) requirements to minimise them, are summarised in monitoring parameter tables below. The overall uncertainty shall be determined by considering the uncertainties of each element in a calculation.

7| Monitoring methodology

7.1 | Monitoring data and information requirements

7.1.1 | Following data shall be monitored and recorded during the project crediting period:

1. **Biofuel purchase and used:** The end-user of the blended biofuel must maintain an accurate biofuel purchase and use record throughout the crediting period. The record should be backed up electronically. The required data for biofuel blending includes:
    - Quantity purchased of the blended biofuel: this shall be determined by the requisite delivery notes for biofuel bunkering for the vessel or other similar appropriate records.
    - Quantity of blended biofuel used for bunkering: this methodology refers to MPA's (Maritime and Port Authority of Singapore) latest guidelines for biofuel bunkering monitoring[29] at the start of the crediting period.
    - Name, telephone number and address of counterparty from whom the blended biofuel was purchased.
2. **CII rating of the vessel:** The end-user of the blended biofuel must also record its current CII rating for the crediting period.
3. **Ongoing monitoring studies:** Monitoring shall consist of checking a representative sample, once every year (annually) to estimate the GHG savings of the blended biofuel by submitting the required documentation as per the requirements outlined for data/parameters.
4. **Monitoring shore tank to vessel quantities**: Currently, the existing protocol in bunkering involves bringing the fuel for bunkering to a shore tank or a barge from where it is transferred on to a vessel as a bunker fuel. Depending upon the agreements, the bunker fuel delivery trail depends on reconciling the bunkering fuel received by the vessel and the amount delivered from the shore tank / barge. Consequently, the

[29] https://www.mpa.gov.sg/docs/mpalibraries/media-releases/2022/pmc-no-21-of-2022

traceability for biofuel bunkering lies with documentation, bunkering delivery notes (BDN), from the shore tank or barge to the vessel. BDNs issued (basis a third-party surveyor) shall be referred during the crediting period to ensure that the biofuel was used for bunkering purposes only.

7.1.2 | A full Sustainable Marine Fuel Traceability Monitoring Document shall be drafted and the document shall be passed on with added information from one supply chain element to the other. The Traceability and Information Monitoring Document shall contain the following information and data:

a. Purchase date of neat biofuel
b. Name and address of the biofuel producer
c. Fuel Production – date of production, location of production, batch identification number, mass of neat biofuel produced.
d. Fuel type- Type of fuel, Feedstock type, Conversion process
e. Mass of batch purchased
f. Sustainability Documentation
g. GHG emission value
h. Name of any intermediate purchaser & address
i. Name & address of neat biofuel shipper to the blender
j. Fuel Blender – name and address/ location of blending
k. Neat biofuel received at blending operations– date received, mass received, blend ratio of neat fuel, documentation demonstrating blending, mass of neat biofuel claimed as supplied to the ship.

7.1.3 | Relevant parameters shall be monitored and recorded during the crediting period as indicated in section 4.2 below.

7.2 | Data and parameters monitored

Parameter ID	MFBB 17
Data/Parameter:	m_f
Data unit:	Percentage
Description:	Moisture content of the raw material / feedstock at various points of the supply chain that was used to make biofuel used in the project activity
Source of data:	Lab report or market accepted contract specifications
Monitoring frequency:	Annually
QA/QC procedures:	Verified by lab report and subject to audit. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	MFBB 18
Data/Parameter:	m_b
Data unit:	Percentage
Description:	Moisture content of the biofuel at the biofuel conversion facility and

	up to the load port. This will help standardise GHG emissions with transport on a dry ton basis, after taking into account fluctuating moisture readings (if applicable).
Source of data:	Lab report of the biofuel conversion facility
Monitoring frequency:	Annually
QA/QC procedures:	Verified by lab report and subject to audit. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-For Category C and D of supply chain component

Parameter ID	**MFBB 18**
Data/Parameter:	m_b
Data unit:	Percentage
Description:	Moisture content of the biofuel at the load port. This will help standardise GHG emissions with transport on a dry ton basis, after taking into account fluctuating moisture readings (if applicable).
Source of data:	Surveyors' reports at the unloading port
Monitoring frequency:	Annually
QA/QC procedures:	Verified by surveyors' report and subject to audit. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-**– For Category E of supply chain component**

Parameter ID	**MFBB 18**
Data/Parameter:	m_b
Data unit:	Percentage
Description:	Moisture content of the biofuel at the unloading port. This will help standardise GHG emissions with transport on a dry ton basis, after taking into account fluctuating moisture readings (if applicable).
Source of data:	Surveyors' reports at the unloading port
Monitoring frequency:	Annually
QA/QC procedures:	Verified by the surveyors' report and the bill of lading and subject to audit. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-**– For Category F of supply chain component**

Parameter ID	**MFBB 18 –**
Data/Parameter:	m_b
Data unit:	Percentage
Description:	Moisture content of the biofuel at berth. This will help standardise

	GHG emissions with transport on a dry ton basis, after taking into account fluctuating moisture readings (if applicable).
Source of data:	Terminal operator's report and estimations from blended biofuel's moisture content
Monitoring frequency:	Annually
QA/QC procedures:	Verified by terminal operator's report, transport invoices (including bill of lading), bunker delivery notes and subject to audit. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	- **Category G of supply chain component**

Parameter ID	**MFBB 18 –**
Data/Parameter:	m_b
Data unit:	Percentage
Description:	Moisture content of the biofuel at the ship or sea vessel. This will help standardise GHG emissions with transport on a dry ton basis, after taking into account fluctuating moisture readings (if applicable).
Source of data:	Terminal operator's report and estimations from blended biofuel's moisture content
Monitoring frequency:	Annually
QA/QC procedures:	Verified by BDNs and subject to audit. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	- **Category H of supply chain component**

Parameter ID	**MFBB 19**
Data/Parameter:	Points of Origin
Data unit:	N/A
Description:	The raw material generation points from where it is collected before it is brought to a biofuel conversion facility
Source of data:	Feedstock collectors report of raw material origination points
Monitoring frequency:	Annually
QA/QC procedures:	This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 20**
Data/Parameter:	electricity
Data unit:	kWh/year

Description:	Annual electricity consumption associated with production of biofuel
Source of data:	Electricity bill or meter readings from biofuel conversion facility
Monitoring frequency:	Annually
QA/QC procedures:	This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 21**
Data/Parameter:	$q_{FuelCon}$
Data unit:	Kg/year
Description:	Annual fuel consumption for heat production at the biofuel conversion facility
Source of data:	Gas bill or meter readings from biofuel conversion facility
Monitoring frequency:	Annually
QA/QC procedures:	This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 22**
Data/Parameter:	q_{inputs}
Data unit:	Kg/year
Description:	Quantity of inputs including but not limited to methanol, phosphoric acid, citric acid, sodium methylate, hydrochloric acid, sodium hydroxide, bleaching earth and nitrogen used in the biofuel production process annually
Source of data:	Production report from biofuel conversion facility
Monitoring frequency:	Annually
QA/QC procedures:	This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 23**
Data/Parameter:	q_{ww}
Data unit:	Litres/year
Description:	Annual wastewater generated from the production of biofuels
Source of data:	Production report from biofuel conversion facility
Monitoring frequency:	Annually
QA/QC	This is based on the Sustainable Marine Fuel Traceability Monitoring

procedures:	Document.
Any comment:	-

Parameter ID	**MFBB 24**
Data/Parameter:	q_b
Data unit:	Wet ton
Description:	Quantity in tons of blended biofuel loaded into vessels
Source of data:	Bunkering Delivery Notes (BDN) issued by a third-party surveyor
Monitoring frequency:	Annually
QA/QC procedures:	This is based on the Sustainable Marine Fuel Traceability Monitoring Document. The note is to be retained on the vessel for a period of three years after the fuel has been delivered. The percentage of biofuel that are also produced in the project plant but from other feedstock sources besides UCO, shall be discounted in the quantity of blended biofuel.
Any comment:	The actual fuel consumption data is monitored by the ship owner and the project developer collects such data for the monitoring period. The credits are issued on the basis of actual fuel consumption and not on the basis of blended biofuel loaded onto the vessel.

Parameter ID	**MFBB 25**
Data/Parameter:	d_{ups_l} & d_{ups_e}
Data unit:	km
Description:	Distance that the raw material is transported from the generation point to the collection and back
Source of data:	Production report, Sustainability Declaration and invoices from raw material collectors
Monitoring frequency:	Annually
QA/QC procedures:	This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 26**
Data/Parameter:	q_f
Data unit:	Wet Tons
Description:	Quantity of feedstock that is converted into biofuel
Source of data:	Sustainability Declaration and invoices from raw material collectors
Monitoring frequency:	Annually

QA/QC procedures:	Cross-verified by production report. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 27**
Data/Parameter:	d_{downs1_l} & d_{downs1_e}
Data unit:	km
Description:	Distance that the raw material is transported from the collection point to biofuel conversion facility and back
Source of data:	Transport and production invoices from raw material collectors and biofuels facility confirming the location of the collection points and the biofuels facility
Monitoring frequency:	Annually
QA/QC procedures:	Cross-verified by the sustainability declaration. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 28**
Data/Parameter:	FF
Data unit:	Ratio or %
Description:	The biofuel conversion feedstock factor – yield of biofuel from 1 ton of dry feedstock.
Source of data:	Sustainability Declaration and invoice from the biofuel conversion facility
Monitoring frequency:	Annually
QA/QC procedures:	Cross-verified by the production report. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 29**
Data/Parameter:	AF
Data unit:	Ratio or %
Description:	The Allocation Factor (AF) is defined as the energy content of the main product as compared to the energy content of main product and the by-product and co-product if applicable
Source of data:	Sustainability Declaration and invoice from the biofuel conversion facility regarding the quantity of biofuel and co products as well as their LHV as determined by the production report from the biofuel facility.
Monitoring	Annually

frequency:	
QA/QC procedures:	This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 30**
Data/Parameter:	d_{downs2_l} & d_{downs2_e}
Data unit:	km
Description:	Transport distance from the biofuel conversion facility to the port of loading and back
Source of data:	Transport invoices to the port of loading, that confirms the location of the port of loading
Monitoring frequency:	Annually
QA/QC procedures:	Verified by the Sustainability Declaration. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 31**
Data/Parameter:	d_{downs3_l}
Data unit:	km
Description:	Distance of the biofuel from the port of loading to unloading
Source of data:	Sustainability Declaration and bill of lading (if applicable) or other transport invoices at the port of unloading to confirm the port of unloading, if applicable.
Monitoring frequency:	Annually.
QA/QC procedures:	Verified by the Sustainability Declaration. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 32**
Data/Parameter:	$\%_{downs3b}$
Data unit:	%
Description:	Ratio of weight of biofuel to the total weight of cargo being carried by the transport mode under Category E of the supply chain expressed in a percentage
Source of data:	Bunkering Delivery Notes (BDN) and transport invoices to confirm the quantity and percentage
Monitoring frequency:	Annually

QA/QC procedures:	Verified by the Sustainability Declaration. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 33**
Data/Parameter:	d_{downs4_l}
Data unit:	km
Description:	Transport distance / pipeline length from the berthing port to the blending tank where the biofuel will be blended before it is used for bunkering
Source of data:	Transport invoices to confirm the location and assess the distance
Monitoring frequency:	Annually
QA/QC procedures:	Verified by the BDNs issued by a third-party surveyor. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 34**
Data/Parameter:	$\%_{downs4b}$
Data unit:	%
Description:	Ratio of weight of biofuel to the total weight of cargo or product being carried by the transport mode under Category F of the supply chain expressed in a percentage
Source of data:	Bunkering Delivery Notes (BDN) and transport invoices to confirm the quantity and percentage
Monitoring frequency:	Annually
QA/QC procedures:	Verified by the BDNs issued by a third-party surveyor. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 35**
Data/Parameter:	d_{downs5_l}
Data unit:	km
Description:	Transport distance or length of the pipeline from the blending tank to barge for the biofuel
Source of data:	Bunkering Delivery Notes (BDN) and transport invoices to confirm the location and assess the distance
Monitoring	Annually

frequency:	
QA/QC procedures:	Verified by the BDNs issued by a third-party surveyor. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 36**
Data/Parameter:	$\%_{downs5b}$
Data unit:	%
Description:	Ratio of weight of biofuel to the total weight of cargo or product being carried by the transport mode under Category G of the supply chain expressed in a percentage
Source of data:	Bunkering Delivery Notes (BDN) and transport invoices to confirm the quantity and percentage
Monitoring frequency:	Annually
QA/QC procedures:	Verified by the BDNs issued by a third-party surveyor. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 37**
Data/Parameter:	d_{downs6_l}
Data unit:	km
Description:	Transport distance or length of the pipeline from the barge to the ship where the blended biofuel is eventually used as a bunkering fuel.
Source of data:	Bunkering Delivery Notes (BDN) and transport invoices to confirm the location and assess the distance
Monitoring frequency:	Annually
QA/QC procedures:	Verified by the BDNs issued by a third-party surveyor. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 38**
Data/Parameter:	$\%_{downs6b}$
Data unit:	%
Description:	Ratio of weight of biofuel to the total weight of cargo or product being carried by the transport mode under Category H of the

	supply chain expressed in a percentage
Source of data:	Bunkering Delivery Notes (BDN) and transport invoices to confirm the location and assess the distance
Monitoring frequency:	Annually
QA/QC procedures:	Verified by the BDNs issued by a third-party surveyor. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 39**
Data/Parameter:	Biofuel Bunker Consumption
Data unit:	Tons
Description:	The consumption of biofuel bunkers by the sea vessel over the monitoring period – assumed to be the same as $q_{biofuel}$
Source of data:	Ship logbooks to determine bunker consumption of the vessel over the monitoring period. Transport invoices to confirm the location and assess the distance
Monitoring frequency:	Annually
QA/QC procedures:	Verified by the bill of lading issued at the destination ports of the vessel over the monitoring period. This will be also verified by ship tracking software and satellite monitoring available online to monitor the shipping routes for the specific vessels.
Any comment:	-

Parameter ID	**MFBB 40**
Data/Parameter:	Energy Efficiency Operational Indicator (EEOI) of vessel with fossil fuel and biofuel
Data unit:	gCO2/TNM
Description:	The EEOI is a monitoring tool that enables operators to measure the fuel efficiency of a ship in operation and to gauge the effect of any changes in operation. More information on its calculation can be found here - https://gmn.imo.org/wp-content/uploads/2017/05/Circ-684-EEOI-Guidelines.pdf
Source of data:	CO_2 Indicator Reporting Sheet as highlighted in https://gmn.imo.org/wp-content/uploads/2017/05/Circ-684-EEOI-Guidelines.pdf from data of the ship's log-book or other official records.
Monitoring frequency:	Annually
QA/QC procedures:	Verified by the BDNs for the amount and type of fuel used and ship's logbooks and ship-tracking software for the distance

	travelled. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 41**
Data/Parameter:	$\%_{biofuel\_consumed}$
Data unit:	%
Description:	This is the % of the pure biofuel ($q_{biofuel}$) produced for bunkering that was consumed during the crediting period. Given that the biofuel is blended with fossil fuel uniformly, this number is assumed to be the same as the % of the total blended bunkering fuel consumed during the crediting period.
Source of data:	Actual fuel consumption during the crediting period can be determined through (but not limited to) BDNs and periodic stocktakes of fuel tanks (based off fuel tank readings) and bunker fuel tank monitoring on board.
Monitoring frequency:	Annually
QA/QC procedures:	Verified by the BDNs for the amount and type of fuel used and ship's logbooks. This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	-

Parameter ID	**MFBB 42**
Data/Parameter:	R
Data unit:	%
Description:	The % of the project activity that falls within the baseline maritime biofuel penetration rate for the regulating country or for the shipping route. The baseline will be determined by the project proponent in compliance with Step 1 of Tool 01 of CDM that is used to demonstrate additionality.
Source of data:	The project developer will determine the biofuel penetration rate baseline based on either: 1. National, international and inter-governmental sources on regulating country's biofuel bunkering penetration rate (to be determined based on where the blended biofuel is loaded on to vessel) 2. Biofuel penetration rate for the specific shipping route where the blended biofuel is consumed by the vessel The project developer will have to take a conservative approach and use the higher of the two baselines based on their analysis

Monitoring frequency:	Annually
QA/QC procedures:	Verified and cross-checked by up-to-date reports on the state of the maritime industry by the IMO and other organisations.
Any comment:	-

Parameter ID	**MFBB 43**
Data/Parameter:	$\%_{biofuel\_other}$
Data unit:	%
Description:	This is the percentage of biofuel that are also produced in the project facility but from other feedstock sources rather than UCO and consumed by the project vessels.
Source of data:	On-site measurements by the project developer
Monitoring frequency:	Annually
QA/QC procedures	Cross check production and consumption data with sales records
Any comment:	

Parameter ID	**MFBB 44**
Data/Parameter:	TDL
Data unit:	%
Description:	This is the average technical transmission and distribution losses for transmitting electricity to a source. Default values: • 20% is assumed if electricity consumption is fully from the grid • 0% is assumed if electricity consumption is fully from captive power plants • Weighted average of the above two proportional to the share of electricity consumed from the grid and captive power plants, if applicable.
Source of data:	Electricity bill for on grid and electric metering for captive power units.
Monitoring frequency:	Annually
QA/QC procedures	This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	

Parameter ID	**MFBB 45**

Data/Parameter:	V
Data unit:	%
Description:	the % of the project activity that falls within the baseline biofuel bunkering rate for the specific vessel above and beyond baselines calculated in R. The baselines will be determined based on the vessels prior year CII rating and will be adjusted for any mandated decarbonisation measures the shipowner must adopt.
Source of data:	Shipowner and IMO[30]
Monitoring frequency:	Annually
QA/QC procedures	This is based on the Sustainable Marine Fuel Traceability Monitoring Document.
Any comment:	

[30] IMO plans to make all vessel's CII ratings public in 2024

8| Application to programme of activites

8.1.1 | This methodology allows the development of a programme of activities as per GS4GG Programme Of Activity Requirements And Procedures.

DOCUMENT HISTORY

Version	Date	Description
1.0	04.09.2024	Initial adoption