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A. Introduction & scope

A.1 The principles and criteria in this instruction document are for voluntary certification of Greenhouse gas (GHG) emissions, as an extension to the existing GGL normative framework. The GGL Foundation will evaluate these principles and criteria periodically, and thus reserves the right to make changes as it considers appropriate. OBJ

A.2 With the GHG calculation methodology of this document, the fossil greenhouse gases coming from fossil fuels used for producing biomass are calculated. Comparing these against a reference value for the fossil fuel mix for the energy grid that the biomass is to replace, in order to decrease the amount of fossil GHG, the balance needs to be negative and below the reference value.

A.3 The aim of this document is to provide lean, simple, accurate and open GHG calculations with clear references to all the values used and the source of these values. The next participant in the supply chain shall use the previous and partial GHG calculations as their inputs.

A.4 All GGL standards and supporting documents are considered normative unless stated otherwise.

A.5 Unless stated otherwise, the calculation is done with data collected over a year. Reporting shall include an explanation and source reference.

B. Green Gold Label GHG

B.1 This Instruction is designed to comply with the Japanese market requirements in compliance with the METI (Ministry of Economy, Trade and Industry) FIT (Feed-in Tariff) and FIP (Feed-in Premium) scheme.

B.2 GGL distinguishes Disaggregated default values and Actual values for GHG emissions, of which either can be used subject to conditions below. For the following parameters it is obligatory to be based on Actual values only:

E_p (emissions from processing), and
Etd (emissions from transport and distribution).

Note 1 - E_p and Et_d are as described in section D of this document.

Note 2 – Notwithstanding the above, Eu (emissions from the fuel in use) are to be included in all GHG calculations as well.

B.3 When actual values are used, certification bodies need to certify emissions according to ISO 14065.

Principle 1: Disaggregated default values

1.1 Disaggregated default values and default values may only be used if actual values are unavailable and cannot be attained with maximum effort. If the actual transport distances and/or configuration of the production unit do not enable a choice of the right default value, the most conservative value shall be taken, meaning for example the value for a configuration using a natural gas boiler.

1.2 When applying the default values, it is necessary to check whether each category is applicable.

1.3 The default values in this document also provide life cycle GHG default values by process. Such disaggregated default values can be utilized for actual calculation. When no specific data are available, (disaggregated) default values in the Annex may be used under specific circumstances.

1.4 When disaggregated default value are used then the delivery notes (i.e. transaction certificates and raw material statements) must not include

the specific greenhouse gas data, but only state “Use of disaggregated default value” or similar.

Principle 2: Actual values

2.1 Actual values can only be calculated when all relevant information is available and transmitted through the chain of custody.

2.2 Actual values need to be certified by certification bodies according to ISO 14065.

2.3 Actual values of emissions from transport can only be determined if emissions of all transport steps are recorded and transmitted through the chain of custody. Actual values of emissions from processing can only be determined if emissions of all processing steps are recorded and transmitted through the chain of custody.

2.3 If at any point of the chain of custody emissions have occurred and are not recorded, so that the calculation of an actual value is no longer feasible for operators downstream in the chain of custody, this must be clearly indicated in the delivery notes.

2.4 Information on actual GHG emissions must be provided for all relevant elements of the GHG emission calculation formula. ‘Relevant’ refers in this context to elements for which reporting is obligatory. All elements for which actual values should be used instead of disaggregated default values and all elements related to emission savings (if applicable).

2.5 Adjustment of actual GHG emissions values throughout the chain of custody are subject to the following:

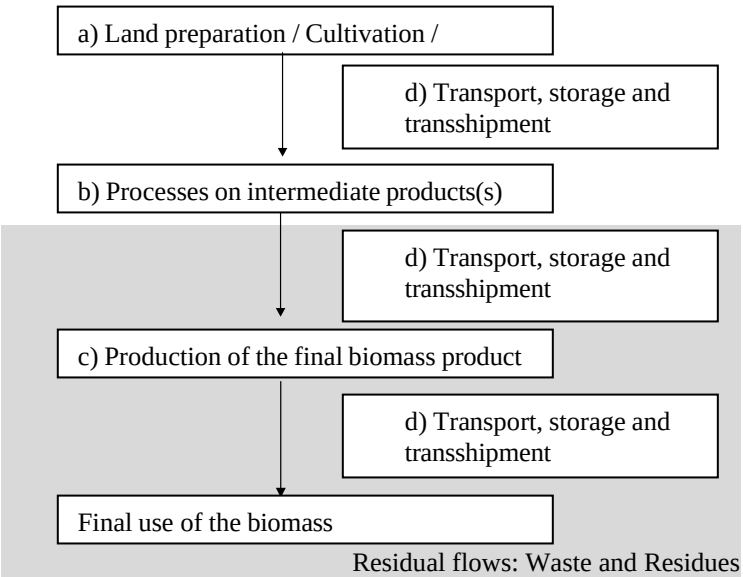
2.5.1 GHG emissions need to be transmitted through the chain of custody via GGL transaction certificates and calculated as per section D.

2.5.2 At each step of the chain of custody it must be verified whether the emission estimate needs to be adjusted:

- Additional emissions from transport and/or processing have to be added to E_p and/or E_{td} respectively;
- Energy losses occurred during processing or if relevant transportation or storage have to be taken into account using a “feedstock factor”;
- Whenever a processing step yields co-products, emissions need to be allocated using an “allocation factor’ following the rules set out in the GHG emission calculation methodology;

- At the last processing step the emission estimate shall be calculated in the unit gCO_2 eq/MJ according to section D.

Figure 1 below gives an indicative overview of the applicable scope for the GHG methodology if this document.



Collection of data is divided into 4 grouped processes or process blocks that are labelled a) through d). The applicable building blocks for GHG emissions relating to GGL-category 5 Biogenic residues and (secondary) waste have been shaded for clarity.

C. GHG emission savings

C.1 The following values for GHG emission saving in this document apply for installations producing electricity, heating or cooling using biomass fuels under the assumption of an energy mix from 180g Co2/MJ electricity in 2030. This is the applicable baseline.

C.2 The GHG reduction requirement is set at 50% reduction to be achieved for fuels used until FY 2029 and 70% reduction to be achieved for fuels used in FY2030 and beyond.

C.3 For power plants approved under FIT in FY2021 applies a voluntary reporting on GHG reduction. For power plants approved under FIT in FY2022 it is required to demonstrate a GHG reduction of 50% in FY 2029 and in FY 2030 of 70%. For power plants under FIT approval after

2030 the GHG reduction requirement may be 70%, which is to be revisited around 2025.
For clarity Figure 2 summarizes:

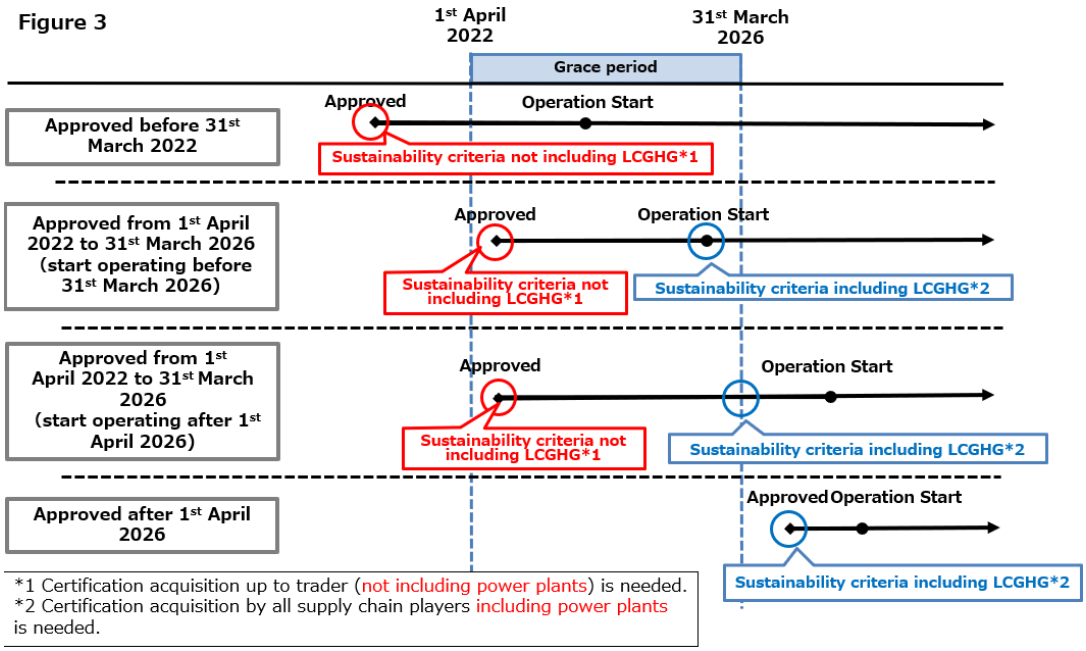
Figure 2		GHG reduction requirement ratio	
		- FY2029	FY2030-
FIT approval date	- FY2021	Voluntary reporting	
	FY2022-	-50%	-70%
	FY2030-	-	-70%

C.4 With respect to FIT approval date, operation starting date and sustainability criteria the following applies:

C.4.1 All participants (excluding biomass power plants themselves) in their supply chain for biomass power plants approved under Japan FIT before March 31 2022 only have to conform to existing sustainability requirements. This applies equally for the participants in their supply chain.

C.4.2 All biomass power plants and participants in their supply chain approved under Japan FIT on and after 1 April 2022 have to conform to new sustainability requirements including GHG reduction. A grace period is given until 31 March 2026 which is intended to be used for certification acquisition by all participants in their supply chain including power plants. This grace period is intended to be utilized for (1) the preparation of new criteria (incl. LCGHG reduction by certification schemes and (2) the certification acquisition on new criteria by all participants in the supply chain including power plants. Notwithstanding the grace period, if power plants start operation before 1 April 2026, new sustainability requirements including GHG reduction are applied. For avoidance of doubt Figure 3 summarizes:

Figure 3



D. GHG Calculations

GHG scope and basic calculation formula

D.1 Greenhouse gas emissions (GHG) from the production and use of biomass fuels, shall be calculated either based on disaggregated default values (Section B Principle 1) or actual values for emissions (Section B Principle 2) or a combination of both. These calculations shall be based on a 12-month reporting period.

D.2 The types of GHGs to be calculated are: CO_2 (carbon dioxide), CH_4 (methane) and N_2O (nitrous oxide). The applicable Global Warming

Potential (GWP) shall be for CH4: 25x and for N20: 298x the potential of CO2.

D.3 The basic formula for calculating GHG emissions from the use of fuel (E) is:

$E = e_{ec} + e_p + e_{td} + e_u$

Where:

E = total emissions from the use of the fuel;

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

e_p = emissions from processing;

e_{td} = emissions from transport and distribution; and

e_u = emissions from the fuel in use;

D.4 Greenhouse gas emissions from biomass fuels shall be expressed as follows:

- Greenhouse gas emissions from biomass fuels, E, shall be expressed in terms of grams of CO_2-equivalent per MJ of biomass fuel, g CO_2eq/MJ;
- Greenhouse gas emissions from heating or electricity, produced from biomass fuels, EC, shall be expressed in terms of grams of CO_2-equivalent per MJ of final energy commodity (heat or electricity), g CO_2eq/MJ.
- When heating and cooling are co-generated with electricity, emissions shall be allocated between heat and electricity (as described hereunder), irrespective if the heat is used for actual heating purposes or for cooling.

Boundary and calculation

D.5 Carbon stock changes incl. land use change as far as such is within the limits of GGLS5 Principles 7 through 9, cultivation, processing, transportation and power generation are included in the calculation.

D.6 Emissions from construction of facilities such as power plants and biomass fuel production plants are not considered.

D.7 GHG emissions from CO_2 capture and sequestration and CO_2 capture and alternative use (limited to CO_2 of biomass origin) can be considered as emission reductions if they can be avoided.

D.8 The “LCA guidelines for GHG reduction effects of renewable energy” developed by the Ministry of Environment (Biomass Sustainability Working Group April 2023) may be refered as a reference for determining the amount of activity and setting emission factors.

D.9 Unless defined otherwise waste, secondary biomass and agricultural crop residues as defined in GGL 1c can be considered to have zero lifecycle GHG emissions up to the process of collection of those materials.
For further clarification and instructions, see Annex 2. “Cascading instructions”

Calculation method for each process

D.10 Carbon stock changes, including land use change as far as such is within the limits of GGL-S5 Principles 7 through 9: for carbon stock changes including land use changes, only direct land use changes are to be accounted for at this stage.

D.11 Cultivation (cultivation and collection of raw materials): GHG emissions associated with consumption of fossil fuels, electricity, and heat for cultivation of raw materials, production, procurement, and use of fertilizer and chemical substances inputs, and fermentation and fertilization of organic matter must be included.
If CO_2 generated is captured and sequestered or alternatively used (eligible only if biomass origin CO_2 is captured), it may be deducted from the emissions.

D.12 Processing (pre-processing and conversion): for processing processes, GHG emissions associated with consumption of fossil fuels, electricity, and heat for processing, and manufacturing, procurement, and use of chemical substances must be included.

If CO_2 generated is captured and sequestered or alternatively used (eligible only if biomass origin CO_2 is captured), it may be deducted from the emissions.

D.13 For transportation (raw material and fuel transportation) the following applies:

D.13.1 GHG emissions associated with consumption of fossil fuels, electricity, and heat for transportation and storage of raw materials and consumption of fossil fuels, electricity, and heat for the transportation and storage of fuels must be included.

D.13.2 GHG emissions on return routes shall be taken into account. In particular, for marine transportation, the fuel consumption of the vessel shall be used, taking into account the biomass bulk density.
For the time being, the voyage distance ratio of empty cargo transportation shall be set at 30% for cases where no specific voyage pattern is taken, and in the case of round-trip transportation (round-trip from the same port), the transportation of empty cargo shall be recorded as the transportation distance of biomass fuel, unless it can be confirmed that the return vessel is unloaded.

D.14 Power generation: CO_2 emissions from use of biomass fuels are regarded as zero. Emissions of CH_4 and N_2O shall be included.

Allocation

D.15 The target process/emission activity to be included and the target of allocation shall be specified by biomass type.

D.16 The allocation method shall be the heat quantity proration method.

D.16.1 Where a biomass fuel production process produces, in combination, the fuel for which emissions are being calculated and one or more other products ('co-products'), greenhouse gas emissions shall be divided between the fuel or its intermediate product and the co-products in proportion to their energy content (determined by lower heating value in the case of co-products other than electricity and heat). The greenhouse gas intensity of excess useful heat or excess electricity is the same as the greenhouse gas intensity of heat or electricity delivered to the biomass fuel production process and is determined from calculating the greenhouse gas intensity of all inputs and emissions, including the feedstock and CH_4 and N_2O emissions, to and from the

cogeneration unit, boiler or other apparatus delivering heat or electricity to the biomass fuel production process.

D.16.2 When heating and cooling are co-generated with electricity, emissions shall be allocated between heat and electricity, irrespective if the heat is used for actual heating purposes or for cooling. The following definitions apply:

D.16.2.1 Co-generation shall mean the simultaneous generation in one process of thermal energy and electricity and/or mechanical energy

D.16.2.2 “Useful heat” shall mean heat generated to satisfy an economical justifiable demand for heat, for heating or cooling purposes

D.16.2.3 “Economically justifiable demand” shall mean the demand that does not exceed the needs for heat or cooling and which would otherwise be satisfied at market conditions.

Specific calculation formula – producing electricity, heating and cooling

D.17 Generation efficiency is based on the transmission end efficiency and the calorific value of fuel is based on the lower heating value standard.

D.18 In the case of a combined heat and power plant, the exergy proration of the biomass fuel life cycle GHG before conversion by generation efficiency is performed on the electricity and heat produced to identify

the emissions to be allocated to the electricity portion. Specifically, the following equation is followed:

$$E_{cogen\text{-}bio} = E_{bio} \times \left(\eta_{el} / \left(\eta_{el} + \eta_h \times (T_h - 290) / T_h \right) \right)$$

Where:

$E_{cogen\text{-}bio}$ = Total GHG emissions from biomass fuels before conversion based on generation efficiency (for power generation at combined heat and power plants)

E_{bio} = Total GHG emissions from biomass fuels before conversion based on power generation efficiency

η_{el} = Power generation efficiency in combined heat and power plants (annual power generation divided by annual heat input)

η_h = Thermal efficiency in combined heat and power plants (annual heat supply (excluding on-site consumption including biomass fuel processing, etc.) divided by annual heat input)

T_h = Absolute temperature of the heat supplied in the combined heat and power plant (in degrees Kelvin; K)

Annex 1. Default values for GHG calculations under FIT / FIP for Japanese markets

These values can be found in the document "GGL-1f. Annex - FIT FIP Default GHG values - Biomass Sustainability Working Group - March 2024", written by the Biomass Sustainability Working Group published on the GGL Website (Japanese version; preliminary English version in development by METI).

Future updates of this document will revoke or amend this version as the case may be and published on the GGL Website.