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Sustainability criteria for the production of biofuels and bioliquids for energy applications — Principles, criteria, indicators and verifiers

Part 4: Calculation methods of the greenhouse gas emission balance using a life cycle analysis approach

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Nachhaltigkeitskriterien für die Herstellung von Biokraftstoffen und flüssigen Biobrennstoffen für Energieanwendungen - Grundsätze, Kriterien, Indikatoren und Prüfer - Teil 4: Berechnungsmethoden der Treibhausgasemissionsbilanz unter Verwendung einer Ökobilanz

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Management Centre: Avenue Marnix 17, B-1000 Brussels

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Foreword

This document (EN 16214-4:2013) has been prepared by Technical Committee CEN/TC 383 “Sustainably produced biomass for energy applications”, the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2013, and conflicting national standards shall be withdrawn at the latest by July 2013.

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Introduction

Directive 2009/28/EC [1] of the European Commission on the promotion of the use of energy from renewable sources, referred to as the Renewable Energy Directive (RED), incorporates an advanced binding sustainability scheme for biofuels and bioliquids for the European market. The RED contains binding sustainability criteria to greenhouse gas savings, land with high biodiversity value, land with high carbon stock and agro-environmental practices. Several articles in the RED present requirements to European Member States and to economic operators in Europe. Non-EU countries may have different requirements and criteria on, for instance, the GHG emission reduction set-off.

The sustainability criteria for biofuels are also mandated in Directive 98/70/EC [2] relating to the quality of petrol and diesel fuels, via the amending Directive 2009/30/EC [3] (as regards the specification of petrol, diesel and gasoil and introducing a mechanism to monitor and reduce greenhouse gas emissions). Directive 98/70/EC is referred to as the Fuels Quality Directive (FQD).

In May 2009, the European Commission requested CEN to initiate work on standards on:

- the implementation, by economic operators, of the mass balance method of custody chain management;
- the provision, by economic operators, of evidence that the production of raw material has not interfered with nature protection purposes, that the harvesting of raw material is necessary to preserve grassland's grassland status, and that the cultivation and harvesting of raw material does not involve drainage of previously undrained soil;
- the auditing, by Member States and by voluntary schemes of information submitted by economic operators;

Both the EC and CEN agreed that these may play a role in the implementation of the EU biofuel and bioliquid sustainability scheme. In the Communication from the Commission on the practical implementation of the EU biofuels and bioliquids sustainability scheme and on counting rules for biofuels (2010/C 160/02, [4]), awareness of the CEN work is indicated.

It is widely accepted that sustainability at large encompasses environmental, social and economic aspects. The European Directives make mandatory the compliance of several sustainability criteria for biofuels and bioliquids. This European Standard has been developed with the aim to assist EU Member States and economic operators with the implementation of EU biofuel and bioliquids sustainability requirements mandated by the European Directives. This European Standard is limited to certain aspects relevant for a sustainability assessment of biomass produced for energy applications. Therefore compliance with this standard or parts thereof alone does not substantiate claims of the biomass being produced sustainably.

Where applicable, the parts of this standard contain at the end an annex that informs the user of the link between the requirements in the European Directive and the requirements in the CEN Standard.

1 Scope

This European Standard specifies a detailed methodology that will allow any economic operator in a biofuel or bioliquid chain to calculate the actual GHG emissions associated with its operations in a standardised and transparent manner, taking all materially relevant aspects into account. It includes all steps of the chain from biomass production to the end transport and distribution operations.

The methodology strictly follows the principles and rules stipulated in the RED and particularly its Annex V, the EC decision dated 10 June 2010 "Guideline for calculation of land carbon stocks" for the purpose of Annex V to Directive 2009/28/EC (2010/335/EU) [5] as well as any additional interpretation of the legislative text published by the EU Commission. Where appropriate these rules are clarified, explained and further elaborated. In the context of accounting for heat and electricity consumption and surpluses reference is also made to Directive 2004/8/EC [6] on "the promotion of cogeneration based on a useful heat demand in the internal energy market" and the associated EU Commission decision of 21/12/2006 "establishing harmonised efficiency reference values for separate production of electricity and heat" [7].

The main purpose of this standard is to specify a methodology to estimate GHG emissions at each step of the biofuel/bioliquid production and transport chain. The specific way in which these emissions have to be combined to establish the overall GHG balance of a biofuel or bioliquid depends on the chain of custody system in use and is not per se within the scope of this part 4 of the EN 16214 standard. Part 2 of the standard, addresses these issues in detail also in accordance with the stipulations of the RED. Nevertheless, Clause 6 of this part of the standard includes general indications and guidelines on how to integrate the different parts of the chain.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 16214-1:2012, *Sustainably produced biomass for energy applications — Principles, criteria, indicators and verifiers for biofuels and bioliquids — Part 1: Terminology*

prEN 16214-2, *Sustainably produced biomass for energy applications — Principles, criteria, indicators and verifiers for biofuels and bioliquids — Part 2: Conformity assessment including chain of custody and mass balance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16214-1:2012 apply.

4 Common elements

4.1 General

A number of elements are relevant to several steps of the biofuel/bioliquid production and transport chain. They are described in this clause to which reference is made in subsequent clauses as appropriate.

4.2 Greenhouse gases and CO_2 equivalence

The general definition of a greenhouse gas is given in Part 1 of this standard. Total GHG emissions are expressed in CO_2 equivalent (CO_{2eq}) calculated as:

$$Mass(CO_{2eq}) = mass(CO_2) + GWP_{CH4} \text{ x } mass(CH_4) + GWP_{N2O} \text{ x } mass(N_2O) \quad (1)$$

where

GWP_{CH4} and GWP_{N2O} are the Global Warming Potentials of CH_4 and N_2O respectively, as defined in the RED. Current values to be used are given in Annex A.

4.3 Data quality and sources

Estimating the GHG emissions associated with an activity requires numerical data, often from a variety of sources. This typically involves data generated by an economic operator (such as quantities of material or energy used or produced) and data acquired from external sources (such as the GHG balance of material or energy used or produced).

Data generated by the economic operator shall be supported by appropriate records so that they can be audited and verified.

Data associated with imported material and energy streams will often be obtained from the supplier. Care shall be taken that such data is fit for purpose, well documented and transparent.

Literature data shall be fit-for-purpose and obtained from well documented, transparent and publicly available sources. In particular it should be as recent as possible and, where relevant, be applicable to the geographical area where the activity takes place.

Generally, data is used for calculations covering a certain period of time as stipulated by the chain of custody scheme (see Clause 6). This may correspond to the production of a product consignment or, for continuous operations, to a given period of time. For data such as physical properties (e.g. heating value, carbon content etc.) the value used shall be close to the weighted average during the period i.e. the variability of such data within the time period shall be taken into account.

4.4 Units and symbols

This standard does not specify the units to be used by economic operators to perform calculations and express results. Different trades associated with different steps of biofuel/bioliquid production and transport chain commonly use specific units which are widely accepted and understood within that community and such units may be used.

The only mandated unit is for the overall GHG balance of the biofuel/bioliquid that shall be expressed in g CO_{2eq} / MJ of the biofuel/bioliquid.

However, units used within a calculation algorithm shall in all cases be clearly stated and be mutually consistent. Table 1 gives the recommended units and symbols.

Table 1 — Recommended units and symbols

Item	Symbol	Recommended unit	Symbol
Land area	A	Hectare	ha
Material quantity (mass)	Q_m	Metric tonne, kilogram	t, kg
Material quantity (volume)	Q_v	Cubic metre, Litre	m^3, l
Energy	ε	Mega- or Giga-Joule	MJ, GJ
Specific Energy	ε_s	Mega- or Giga-Joule per unit of the item to which the energy is attached	MJ, GJ / unit
GHG emissions	C	Gram/Kilogram/Tonne CO_{2eq}	g/kg/t CO_{2eq}
GHG emissions per unit of land area	Cl	Gram/Kilogram/Tonne CO_{2eq} per hectare	g/kg/t CO_{2eq}/ha
GHG specific emissions or emission factor	F	Any combination of GHG emissions per unit mass, volume of energy	g/kg/t CO_{2eq} / unit
Lower heating value	LHV	Megajoule/ kilogram or Gigajoule/tonne	MJ/kg, GJ/t
Distance (land)	D	Kilometre	km
Distance (sea)	D	Nautical mile	nM

4.5 Common basis for GHG emission terms

In Annex V of the RED, the total GHG emissions from the use of a biofuel/bioliquid E, expressed per MJ of the biofuel/bioliquid, is expressed by the following formula:

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr} - e_{ee} \quad (2)$$

where

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

e_l are the annualised emissions from carbon stock changes caused by land-use change;

e_p are the emissions from processing;

e_{td} are the emissions from transport and distribution;

e_u are the emissions from the fuel in use which shall be taken to be zero for biofuels and bioliquids

e_{sca} are the emission saving from soil carbon accumulation via improved agricultural management;

e_{ccs} are the emission saving from carbon capture and geological storage;

e_{ccr} are the emission saving from carbon capture and replacement; and

e_{ee} are the emission saving from excess electricity from cogeneration.

"*e*"- terms are emissions incurred at various steps of the chain (see also Clause 5). This formulation implies that all "*e*" terms are expressed per unit of the biofuel/bioliquid (e.g. in g CO_{2eq} / MJ). In practice the GHG emissions associated with each individual step of the biofuel/bioliquid production and transport chain cannot be immediately expressed per unit of the biofuel/bioliquid inasmuch as the exact fate of the product from this particular step is not known at the point of production. In this standard the GHG emissions associated with each step are therefore expressed per unit of the product of that step. This may be volume, mass or energy based. For clarity the symbol C is used for emissions expressed in mass of CO_{2eq} and the symbol F for specific emissions (or emission factor) per unit of a certain product.

Within each subsequent step, the GHG emissions associated with the feedstock to that step are combined with emissions from activities within that step taking proper account of yields and allocation rules are applied (see 4.8) to calculate the combined emissions associated with the product of that step. The precise way in which this is done depends on the chain of custody system in place (see further details in Clause 6).

Individual "*e*" values as expressed in the RED can only be calculated a posteriori when the complete chain has been established.

Such calculations may be carried out for information but are not necessary to establish the GHG balance of biofuels and bioliquids.

4.6 Completeness and system boundaries

In order to determine which data is required for the estimation of the GHG associated with a certain activity, the economic operator shall define the boundaries of the system under consideration. A number of material and energy streams will enter the system directly controlled by the economic operator. Each of these streams will itself have a production and transport chain involving other streams and so on.

In all cases the principle of completeness shall be followed, i.e. all emissions associated with all inputs into the economic operator's core system shall be taken into account. This may be done by using overall figures from other sources in which case the boundaries are set narrowly around the economic operator's system. Alternatively all or part of the production and transport chain of some of the input streams may be included thereby expanding the boundaries of the economic operator's system. To account for the inherent variability of agricultural yields and inputs (fertilisers, agrochemicals etc.), multiannual averages may be used.

The extent to which such production and transport chain are included within the boundary is a matter of judgement by the economic operator. A guiding element shall be the materiality of the contribution of a certain input to the overall GHG balance of the desired product and the completeness and quality of the overall figures from the other sources. Where such contribution is small, additional specific calculations are unlikely to be justified and use of a generic literature data may be appropriate.

Some processes involve use of very small amounts of input material such as process chemicals (e.g. anti-foam agents, corrosion inhibitors, water treatment chemicals etc.). The impact of such inputs on the total GHG footprint of the product is generally negligible and, in agreement with the verifiers, may be ignored. As guidance in this respect it is recommended that the contribution of such inputs be ignored if their combined value is unlikely to affect the GHG savings value of the biofuel/bioliquid rounded to the nearest percentage point.

In line with the RED, GHG emissions generated during manufacturing or maintenance of equipment such as farm machinery, process plants and transport vectors or by the people operating them shall not be taken into account.

4.7 GHG emissions from energy use

4.7.1 General

Each step of the chain will consume energy, either imported or internally generated from a portion of the feedstock or as a result of the conversion process.

Energy may be imported in the form of:

— Fuel e.g. coal, oil, diesel, gasoline, natural gas, biomass (including in some cases the biofuel feedstock), biofuel or bioliquids;

- Electricity from the local grid system or from a third party;
- Heat (commonly as steam) from a nearby source.

Associated GHG emissions include CO_2 emissions from combustion of fossil carbon as well as any venting of methane and nitrous oxide to the atmosphere occurring during either the combustion process or in other steps of the chain.

This aspect shall be taken into account for every step of the biofuel/bioliquid production. It shall account for the imported energy for the use of all machinery and other relevant equipment.

The conversion steps may also produce surplus energy in the form of either heat (steam) or electricity which can be exported.

This clause describes the rules to be applied to calculate the GHG emissions associated with these energy streams and integrate them into the total emissions associated with a step of the chain.

4.7.2 Energy import

4.7.2.1 General relationship between GHG emissions and energy use

For a given accounting period, the generic relationship between GHG emissions and energy use is as follows:

$$C_x = \varepsilon_x \times F_{ex} \quad (3)$$

where

C_x is the mass of GHG emitted (expressed as CO_{2eq}) during the accounting period as a result of the energy consumed;

ε_x is the amount of energy consumed within the accounting period;

F_{ex} is the GHG emission factor associated with the production, transport and end use of the particular energy form consumed (mass CO_{2eq}/unit energy), including venting of methane and nitrous oxide and relevant to the accounting period.

When carrying out the calculation to determine the value of C_x, care shall be taken to ensure that input values of ε_x and F_{ex} are expressed in consistent units.

4.7.2.2 Imported fuel

For fossil fuels consumption is mostly expressed in mass (solid or liquid fuels) or volume terms (liquid fuels, natural gas) and occasionally directly in energy terms (natural gas). Emission factors F_{ex} for fossil fuels will normally be available from the fuel supplier.

Where biofuels or bioliquids are used as fuel, their emission factor shall be determined using the methodology laid out in this standard.

Where other forms of biomass or biomass-derived products are used as fuel, their emission factor shall be based on an analysis of their production and transport chain. For the purpose of this calculation CO_2 emissions from the combustion of biomass-based fuels shall be taken as zero. Relevant emission factors will normally be available from the fuel supplier.

For the calculation of the GHG emission factor of the fuel, CO_2 emissions associated with end use of the fuel shall be those that would be produced by its complete combustion. For fuels that are fully or partly of biomass origin, combustion emissions from the fraction of carbon from biomass origin shall be deemed to be zero. Any significant emission of nitrous oxide or methane during the combustion process shall be taken into account.

The specific case of imported fuel used in a cogeneration scheme is considered in 4.7.3.

Where the import is expressed as the quantity of fuel consumed (Q_x) in either mass (Q_{mx}) or volumetric (Q_{vx}) units the emission factor may be expressed as F_{qx} on the same basis in mass of CO_2 per unit of mass or volume of the fuel. F_{qx} is related to F_{ex} by the following formula:

$$F_{qx} = F_{ex} \times LHV_x \qquad (4)$$

where

LHV_x is the lower heating value of the fuel in units of energy / unit of mass or volume.

C_x may then be expressed as:

$$C_x = Q_x \times F_{qx} = Q_x \times F_{ex} \times LHV_x \qquad (5)$$

NOTE Where both Q_x and F_{qx} are directly available, LHV_x is not required.

Although it is not per se required for the GHG calculation, the related energy consumption ε_x may be calculated separately as:

$$\varepsilon_x = LHV_x \times Q_x \qquad (6)$$

Typical LHVs of various fuels are listed in Annex III of the RED while emissions associated with biofuels as fuel to a process can be derived from the typical values in Annex V of the RED. Emission factors and LHVs for other fuels may be obtained from the applicable Member State guidance for calculating the Greenhouse Gas balance of biofuels. Where no Member State guidance is available this data shall be obtained from a verifiable source. In most cases, the fuel supplier should be able to supply this data.

Values of ε_x or Q_x can be obtained from either plant or accounting/invoicing records.

4.7.2.3 Imported heat

Heat may be imported in the form of steam or via a hot fluid system. The emission factor shall be based on an analysis of the heat production facility. This will normally be provided by the heat supplier.

4.7.2.4 Imported electricity

If the biofuel/bioliquid facility is connected to the local grid or imports electricity from a plant connected to the grid, then imported electricity (usually expressed in energy terms ε_{el}) shall be deemed to have been provided by the grid. The associated emission factor F_{eel} shall represent a national or regional (e.g. EU-wide) supply average as published by authoritative bodies such as national statistics agencies.

Where a biofuel/bioliquid facility imports electricity from a plant that is not connected to the grid the actual emission factor of that plant shall be used.

4.7.3 Combined heat and power supply (Cogeneration)

In many cases both heat and electricity will be supplied to a facility from a cogeneration scheme. The following rules are applicable whether or not the cogeneration scheme and the biofuel/bioliquid facility have a common ownership and/or operation.

Where the entirety of the heat produced by the cogeneration plant is consumed by the biofuel/bioliquid facility, the GHG emission calculation shall be based on the total fuel consumption of the cogeneration plant.

Where the cogeneration plant also supplies heat to other customers, the fuel consumption of the cogeneration plant shall be apportioned according to the relative heat consumption of each customer.

If the ratio of electricity to heat consumption of the biofuel/bioliquid facility is higher than that produced by the cogeneration plant, the extra electricity required by the biofuel/bioliquid facility shall be deemed to have been obtained from the local grid.

If the ratio of electricity to heat consumption of the biofuel/bioliquid plant is lower than that produced by the cogeneration plant, the size of the cogeneration plant shall be assumed to be the minimum necessary for supplying the heat needed to produce the biofuel/bioliquid. The biofuel/bioliquid facility shall therefore be allocated an electricity surplus calculated as:

$$P_s = P_{Cogen} \times (H_b / H_{Cogen}) - P_b \qquad (7)$$

where

P_s is the electricity surplus allocated to the biofuel/bioliquid facility;

P_{Cogen} is the total electricity production of the cogeneration plant;

P_b is the electricity consumption of the biofuel/bioliquid facility;

H_b is the heat consumption of the biofuel/bioliquid facility;

H_{Cogen} is the total heat production of the cogeneration plant.

For the purpose of the GHG emissions calculation this electricity surplus shall generate a credit equal to the emissions that would be generated by producing the same amount of electricity in a state-of-the-art plant without cogeneration using the same fuel as the actual cogeneration plant. For the purpose of this calculation efficiency values should be taken from Annex I of EU Commission decision 2007/74/EC [7]. The emission factor of the fuel to the cogeneration plant will generally be available from the fuel supplier.

The above rule does not apply when the cogeneration plant is fuelled by a co-product from the biofuel/bioliquid facility. In that case the surplus electricity itself shall be considered a co-product and shall be taken into account in the allocation process (see 4.7.5 and 4.8).

NOTE When heat or electricity surplus is produced in non-cogeneration schemes, 4.7.5 applies.

4.7.4 Energy generation from own feedstock or internal streams

The energy required for a step of the biofuel/bioliquid chain may be generated by a portion of the feedstock or a stream generated during processing/conversion of that feedstock (e.g. a residue). Inasmuch as these streams are from biomass origin, the CO_2 emissions associated with their combustion are deemed to be zero. However any associated methane and/or nitrous oxide emissions shall be taken into account.

Where a portion of the feedstock is used as fuel, emissions related to production and transport of the total amount of feedstock used shall be taken into account in the chain calculation.

4.7.5 Exported heat or electricity (no cogeneration cases)

A step of the biofuel/bioliquid chain may produce excess heat that is exported and used by a third party. No credit shall be allocated to this excess heat.

However where the surplus heat is clearly produced for meeting the demand of other parties by combusting a fuel in excess of the requirement of the biofuel/bioliquid facility, the portion of the fuel used for generating the surplus heat shall not be considered as an input into the chain. Unless the surplus heat is produced from a demonstrably separate facility that amount of fuel shall be deemed to have the quality of the average fuel used in all heat generation facilities used in the facility.

A step of the biofuel/bioliquid chain may produce excess electricity that is exported either to the local grid or to a third party.

Where such surplus electricity is produced in a cogeneration plant using a fuel other than a co-product of that step the rules described in 4.7.3 apply.

In all other cases this excess electricity shall be considered as a co-product and taken into account accordingly in the allocation process (see 4.8).

4.7.6 Overall GHG balance from energy use and export

The net GHG emissions associated with energy usage and export shall be calculated as follows:

$$C_n = C_{if} + C_{ih} + C_{ieg} + C_{int} - C_{ex} \tag{8}$$

where

C_{if} is the emissions from fuel import (4.7.2.2), including cogeneration fuel (4.7.3);

C_{ih} is the emissions from heat import (4.7.2.3);

C_{ieg} is the emissions from grid electricity import (4.7.2.4);

C_{int} is the emissions from combustion of own feedstock or internal stream (4.7.4);

C_{ex} is the emissions from exported cogeneration electricity (4.7.3).

4.8 Allocation rules

The products from a step in the production and transport chain are classified into the biofuel/bioliquid itself or an intermediate product, co-products, residues and wastes (see definitions in EN 16214-1).

The total GHG emissions incurred in all upstream steps of the chain and up to the point where co-products are separated, are allocated between the biofuel/bioliquid or intermediate and the co-products. Wastes and residues do not share the burden of allocation i.e. none of the GHG emissions incurred up to the point at which they are collected are allocated to them. The conditions under which excess electricity produced on site and exported is deemed to be a co-product are set out in 4.7.5.

The emission inventory for the allocation shall include all operations that need to be carried out in order to dispose of all wastes and residues which, therefore, leave the system without a GHG burden. Accordingly when a waste or residue is used for the production of biofuels or bioliquids the GHG emissions are deemed to be zero up to the point of collection as defined in EN 16214-1. If the waste or residue is subsequently used as feedstock for biofuels/bioliquid production all emissions incurred past that point shall be allocated to that waste or residue.

As a result the identification of the biofuel/bioliquid or intermediate product related to the chain and the classification of an output product as a co-product, a residue or a waste is crucial to the outcome and shall be done in strict accordance with the definitions given in EN 16214-1.

GHG emissions are allocated between the biofuel/bioliquid or intermediate and the co-products on the basis of their respective energy content as measured by their Lower Heating Value (LHV). The GHG emissions burden allocated to co-product *i* is therefore:

$$Ci = Ct \times Qi \times LHVi \, / \sum \left(Qj \times LHVj \right) \tag{9}$$

where

Ct is the total GHG emissions incurred through the chain up to the point where the co-products are separated;

Qi is the quantity of product *i* produced;

LHVi is the lower heating value of product *i*;

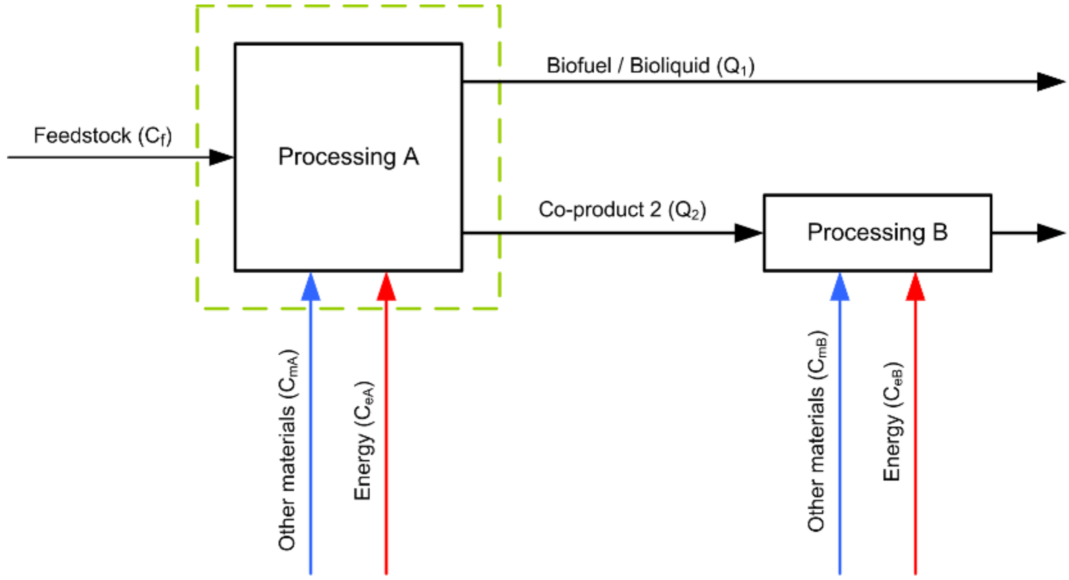
Qj is the quantity of product *j* produced;

LHVj is the lower heating value of product *j*.

The GHG emission factor allocated to product *i* is then:

$$Fi = Ci / Qi \text{ (kg } CO_{2eq}\text{/t or /m}^3\text{) or } Ci / Qi / LHVi \text{ (kg } CO_{2eq}\text{/GJ)} \quad (10)$$

GHG emissions incurred downstream of the point where the co-products are separated shall be wholly charged to the biofuel/bioliquid or intermediate or to the particular co-product for which they are incurred (e.g. for drying). This is illustrated in Figure 1.



Total GHG emissions associated with all inputs into processing A: $C_{tA} = C_f + C_{mA} + C_{eA}$

GHG emissions allocation to Biofuel/Bioliquid: $C_1 = C_{tA} * Q_1 * LHV_1 / (Q_1 * LHV_1 + Q_2 * LHV_2)$

GHG emissions allocation to Co-product: $C_{2A} = C_{tA} * Q_2 * LHV_2 / (Q_1 * LHV_1 + Q_2 * LHV_2)$

Total GHG emissions associated with all inputs into processing B: $C_{tb} = C_{mb} + C_{eB}$

Total GHG emissions charged to the Co-product: $C_2 = C_{2A} + C_{tB}$

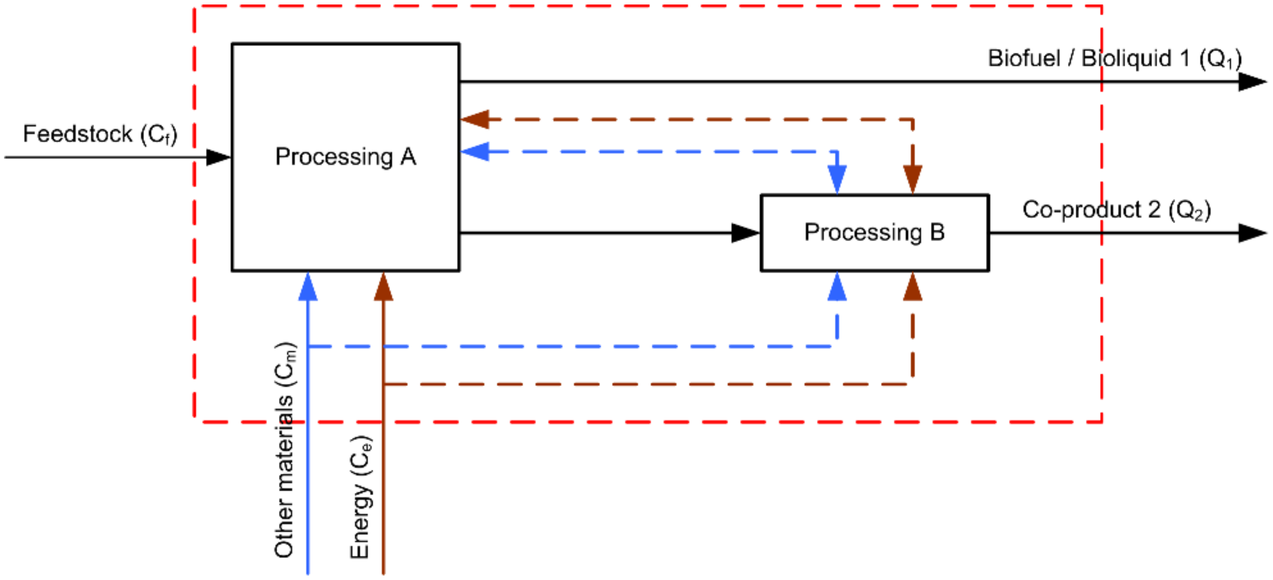
Where LHV_1 is the lower heating value of the Biofuel/Bioliquid and LHV_2 that of the Co-product.

$C_{tB} = C_2 + C_{mB} + C_{eB}$

Where *LHVi* is the lower heating value of product *i*.

Figure 1 — Allocation between biofuel/bioliquid or intermediate and co-products without feedback loops

An exception to this rule is where further processing of some of these products is interdependent through energy or material feedback loops. In this case emissions from downstream processing shall be included in the allocation process up to the point where such feedback loops do not occur anymore. This is illustrated in Figure 2.



Total GHG emissions associated with all inputs:	$C_t = C_f + C_m + C_e$
GHG emissions allocation to Biofuel/Bioliquid:	$C_1 = C_t * Q_1 * LHV_1 / (Q_1 * LHV_1 + Q_2 * LHV_2)$
GHG emissions allocation to Co-product:	$C_2 = C_t * Q_2 * LHV_2 / (Q_1 * LHV_1 + Q_2 * LHV_2)$

Figure 2 — Allocation between biofuel/bioliquid or intermediate and co-products with feedback loops

In Figure 1, the inputs to processing steps A and B are clearly separated and allocation occurs at the point at which the co-product is physically separated. Where different co-products are produced and separated at different stages of the process, a separate calculation and allocation shall be carried out for each sub-step leading to the production of a new co-product.

In Figure 2, there are energy and material feedbacks between processing step A and B so that the energy inputs into each processing step are not clearly identifiable. The allocation boundary is extended to include processing step B.

The LHV value shall be that pertaining to the actual product at the point at which it is separated from the other products and in the physical state in which it is produced taking into account its water content (see definition of LHV in EN 16214-1).

Products with high water content may have a very low or even negative heating value (i.e. the amount of heat required to dry them is higher than the heat that can be released by burning the dry matter). Negative heating values shall be considered to be zero i.e. no negative allocation is permitted. When a product is assigned a zero LHV, it effectively does not attract any GHG emissions allocation.

Exported electricity produced in a scheme without cogeneration or from a co-product is considered as a co-product. In this case the term ($Q_i * LHV_i$) in Formula (9) shall be replaced by the actual electrical energy.

Any material that would have been a co-product and is used directly to generate energy for the process or for export, shall be excluded from the allocation. Emission associated with the use of this material shall however be taken into account in the GHG balance.

4.9 GHG emissions from transport

In biofuels/bioliquids chains transportation is mainly related to:

— Biomass transportation from the field to a processing plant;

— Intermediate biomass product transportation from a process plant to another;

— Biofuel/bioliquid transport to blending and distribution.

Any of these transportation steps may include ship, barge, truck, train or (for liquids and gases) pipeline. Each of these transportation means will use one or several fuels (or electricity). For each transportation mean, the GHG emission factor per unit of material transported (F_t) shall be calculated as follows:

$$F_t = \sum \left(F_f i \times Qs_t i \right) \times D_t \tag{11}$$

where

$F_f i$ is the GHG emission factor for production transport and use of fuel i expressed in CO_{2eq} per unit of fuel (mass, volume or energy);

$Qs_t i$ is the specific consumption of fuel i per unit of distance covered and per unit of product transported (mass, volume or energy). Where applicable, this term shall include empty back-haul consumption except where it can be proven that the transportation mean is used for a different purpose on the return trip;

D_t is the one-way distance covered by the transportation mean.

The GHG emissions C_{bt} from a transportation mean of a quantity of biomass/intermediate Q_{bx} is calculated as

$$C_{bt} = Q_{bx} * F_t \tag{12}$$

Small losses (either physical or accounting) may be incurred as a result of transportation operations. These shall be taken into account by basing the final specific GHG emission figure on the amount of product actually delivered.

In the case of blended fuels (e.g. fossil fuel and biofuel mixtures) $F_f i$ shall be consistent with the composition of the blend.

Electricity shall be deemed to have been supplied from the grid as defined in 4.7.2.4.

4.10 GHG emissions from machinery use

4.10.1 General

Various types of machinery, either mobile or stationary, are used in various steps of a biofuel/bioliquid production and transport chain, particularly in agriculture and forestry and for biomass preparation. GHG emissions from such equipment are essentially related to energy consumption as either diesel fuel or electricity. Emissions related to other consumables are generally negligible. In some specific applications this may not be the case (e.g. lubricants in certain cases) and these additional emissions shall be taken into account using a similar calculation methodology.

4.10.2 Agricultural and forestry machinery

Energy consumption for agricultural and forestry machinery is normally expressed per unit of land area and per year. The GHG emissions from machinery in mass of CO_{2eq} per unit of land area and per year are calculated as

$$CI_{mm} = Q_{mmf} \times F_f \qquad (13)$$

where

Q_{mmf} is the fuel consumption of the machinery, expressed in mass, volume or energy terms per unit of land area and per year,

F_f is the GHG emission factor for production transport and use of the fuel in mass of CO_{2eq} per unit of fuel (mass, volume or energy).

For reporting purposes the corresponding emission factor expressed in mass of CO_{2eq} per unit of net biomass produced may also be calculated as

$$F_{mm} = CI_{mm} / Y_{bp} \qquad (14)$$

where

Y_{bp} is the net biomass yield expressed as the quantity of biomass (mass or volume), net of any losses or retained seeding material, per unit of land area and per year.

4.10.3 Other mobile or stationary machinery

Emissions from other mobile or stationary machinery may be related to handling or preparation of biomass or other intermediate material (cranes, forklift trucks, elevators, etc.). The emissions from machinery in mass of CO_{2eq} per unit of product handled are calculated as

$$C_m = Q_{mf} \times F_f \qquad (15)$$

where

Q_{mf} is the quantity of fuel consumed by the machinery over a period of time, expressed in mass, volume or energy terms,

F_f is the GHG emission factor for production transport and use of the fuel in mass of CO_{2eq} per unit of fuel (mass, volume or energy),

The emission factor for the machinery is therefore:

$$F_m = Q_{mf} \times F_f / Q_p \qquad (16)$$

where

Q_p is the quantity of product handled over the same period of time expressed in mass or volume.

4.11 GHG emissions from chemicals

Chemicals may be used in various steps of the biofuel/bioliquid production and transport chain, process chemicals (additives, catalysts, etc.), reagents in conversion processes, etc.

NOTE Fertilisers and agrochemicals are dealt with separately in 5.3.3 as their use is expressed per unit of land area.

Associated GHG emissions shall take into account production and supply. Where chemicals contain fossil carbon and become mixed with the biofuel/bioliquid or intermediate, CO_2 emissions that would be generated by the combustion of that fossil carbon shall be added (to be consistent with the assumption that the biofuel/bioliquid only contains carbon of biomass origin). For a given operating period, GHG emissions associated with such chemicals shall be calculated as:

$$C_{chem}i = Q_{chem}i \times (F_{chem}i + F_{fc}i) \tag{17}$$

$$C_{chem} = \sum C_{chem}i \tag{18}$$

where

- $Q_{chem}i$ is the quantity of chemical i consumed, in mass, volume or energy terms;
- $F_{chem}i$ is the GHG emission factor of chemical i, as mass of CO_{2eq} per unit of chemical i;
- $F_{fc}i$ is the CO_2 emissions associated with combustion of the fossil carbon contained in chemical i, per unit of chemical i;
- $C_{chem}i$ is GHG the emissions associated with the quantity of chemical i consumed, in mass of CO_{2eq};
- C_{chem} is the total GHG emissions associated with all chemicals consumed, in mass of CO_{2eq}.

Emissions factors shall be either supplied by the supplier of the substance or obtained from a reputable and verifiable source.

Many chemicals may be used in small quantities; the associated emissions will be very small and may not need to be included (see 4.6).

5 Biofuels and bioliquids production and transport chain

5.1 Main steps

This clause describes the main steps of a generic biofuel or bioliquid production and transport chain and sets them out in a way that defines the outline of this standard. This is illustrated in Figure 3.

The chain generally starts with a plot of land where biomass is produced and ends where the biofuel or bioliquid is released for consumption. A specific chain may only include a subset of these steps.

LAND USE AND LAND USE CHANGE covers all activities related to preparation of the land prior to cultivation. In cases where land use change occurred (according to the definition in EN 16214-1) the GHG impact of this change shall also be taken into account in this step.

BIOMASS PRODUCTION covers all activities related to biomass cultivation, in either an agricultural, forestry or other environment, from plant seeding to harvesting. It includes the impact of all inputs such as seeding material, fertilisers, agrochemicals, energy etc. It also includes the GHG impact of nitrous oxide and methane emitted during biomass production.

In addition to crops and forestry products, waste and residues from various sources may be used as feedstock for biofuel / bioliquid manufacture. For these alternative feedstocks the land use and biomass production steps do not apply.

BIOMASS PREPARATION covers all activities related to the treatment of the biomass such as drying, chipping etc. In some cases wastes and residues may require such treatment beyond their point of collection for the specific purpose of using them as a feedstock for biofuel / bioliquid manufacture.

BIOMASS / INTERMEDIATE HANDLING AND STORAGE covers all activities related to collection, storage and transport of the biomass or intermediates to the premises of the next economic operator where the material is to be converted. It may also include wastes and residues collection.

BIOMASS / INTERMEDIATE CONVERSION covers all activities required to convert the biomass into a biofuel / bioliquid via intermediate products (such as vegetable oil) as the case may be. It includes process energy, as well as the emissions associated with production and supply of reagents and process chemicals. It also takes into account any GHG emissions associated with the chemical or biological reactions occurring during the conversion steps. Conversion can involve one or several steps, be carried out in the same or in different locations, by the same or different economic operators. In such cases, intermediate products also need to be stored and transported.

BIOFUEL / BIOLIQUID TRANSPORT covers all activities related to transportation of the biofuel/bioliquid to the blender and distribution of the final fuel. The relevant generic methodology for transport steps is described in 4.9.

The GHG emissions associated with the biofuel/bioliquid production and transport chain is the sum of all GHG emissions incurred at each step of the chain. The following elements, covering all GHG emissions generated for making the biofuel/bioliquid available to its customer are addressed in Annex V of the RED and are also covered by this standard:

1) Emissions from the extraction or cultivation of raw materials;

2) Annualised emissions from carbon stock changes caused by land-use change;

3) Emission saving from soil carbon accumulation via improved agricultural management;

4) Emissions from processing;

5) Emission saving from excess electricity from cogeneration:

6) Emissions from transport and distribution;

7) Emission saving from carbon capture and geological storage;

8) Emission saving from carbon capture and replacement;

Emissions from the fuel in use are considered to be zero.

Not included in either the RED or this standard are emissions generated during manufacturing or maintenance of equipment such as farm machinery, process plants and transport vectors or by the people operating them.

For fuels containing carbon originating from biomass the CO_2 emissions released by combustion of that carbon are deemed to be zero as they are compensated by the CO_2 absorbed by the plants during biomass production. The way to correctly account for fossil inputs and/or co-processing of biomass and fossil feedstocks during biofuel/bioliquid production is described in 5.6.

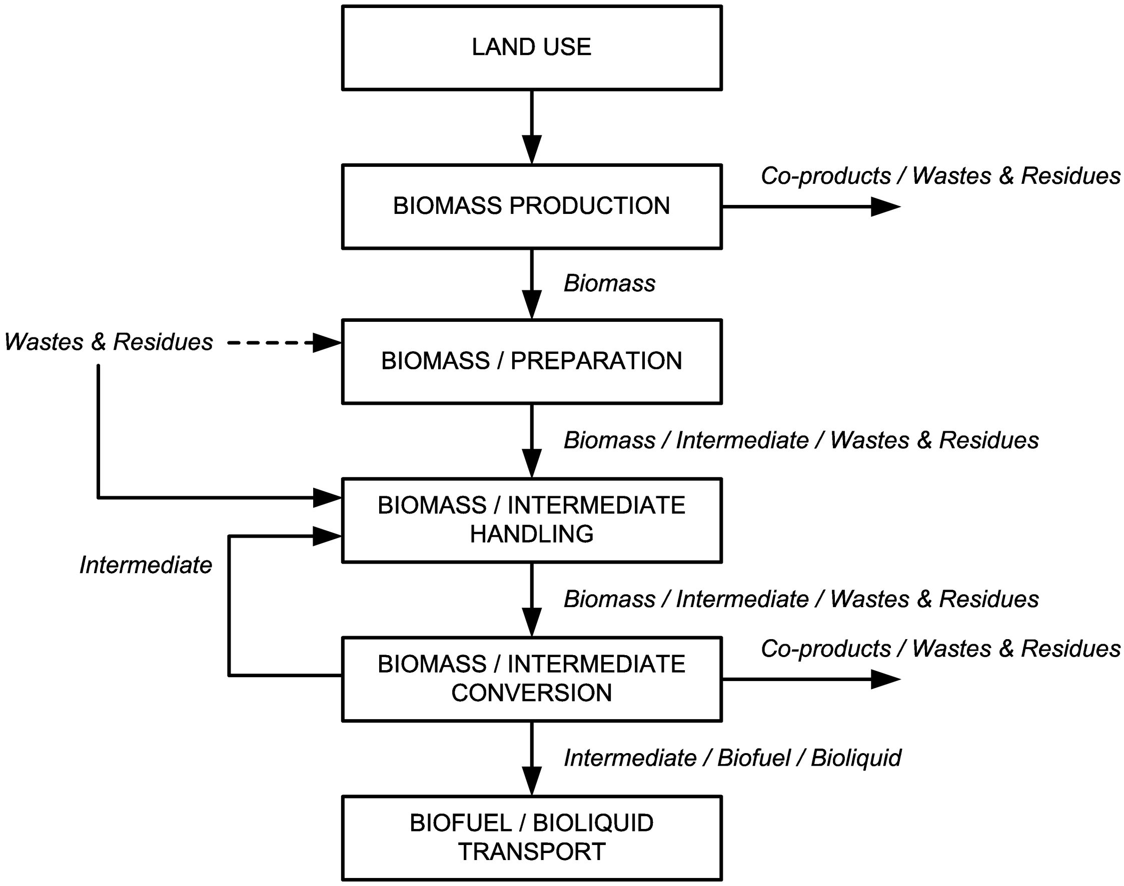


Figure 3 — Generic biofuel/bioliquid production and transport chain

NOTE The steps shown in Figure 3 are more detailed than the three generic steps provided in the RED for the disaggregated default values (see 6.2):

- “Land use”, “Biomass production” and “Biomass preparation” are included into the generic “Cultivation” step;
- “Biomass/Intermediate conversion” is included in the “Processing” step;
- “Biofuel/Bioliquid transport” is included in the “Transport and distribution” step;
- With regards to “Biomass/intermediate handling and storage” any transportation step should be regarded as part of “Transport and distribution”. Other elements may be included either into “Cultivation” or “Processing” to the extent that they occur at the biomass producer or at the processing plant.

Annex V part C sub 3 of the RED opens the option to take into account differences between fuels in useful work done i.e. the efficiency with which the fuel is used. This is intended to be brought in as a correction to the percentage savings of the biofuel compared to the fossil fuel comparator. How this may be evaluated and implemented is not part of this standard which focuses on the production and transport chain (in line with the boundaries of the chain of custody scheme).

GHG emissions changes arising from blending or formulation of biofuels and fossil fuels may be significant but are not taken into account in this standard at this stage.

5.2 Land use and land use change

5.2.1 Changes in soil carbon stock due to direct land use change

Land use has a direct impact on the amount of carbon stored both in the soil and aboveground. This clause deals with emissions caused by the change of use of the land where the biomass is grown. Emissions related to “indirect land use change” (ILUC) are not included in Annex V of the RED and therefore not considered in this standard.

For the calculation of carbon stock the reference land use shall be the land use in 2008 or 20 years before the raw material was obtained, whichever was the latest (RED Annex V part C sub 7).

The total mass of soil carbon stock per unit land area shall be expressed as:

$$CS = SOC + C_{veg} \quad (19)$$

where

SOC is the soil organic carbon content (in mass per unit land area),

C_{veg} is the above and below ground vegetation carbon stock (in mass per unit land area).

Soil Organic Carbon (SOC) can change as a result of a number of factors notably change in the use of the land and, for a given land use, changes in agricultural management. Changes in SOC and/or aboveground carbon stock will result in one-off CO_2 emissions to or absorption from the atmosphere. The dependency of *SOC* on these factors is generally expressed as:

$$SOC = SOC_{ref} \times f_{lu} \times f_{mg} \times f_{i} \quad (20)$$

where

SOC_{ref} is the reference soil organic carbon in mass per unit land area;

f_{lu} is the stock change factor for land-use systems or sub-system for a particular land-use (dimensionless);

f_{mg} is the stock change factor for agricultural management (dimensionless);

f_{i} is the stock change factor for input of organic matter (dimensionless).

The factors are specific to a certain land use, management and organic restitution regime and determine the level of SOC that land will reach under these conditions, as compared to the reference level.

For SOC_{ref}, f_{lu}, f_{mg} and f_{i} and C_{veg}, the requirements of EC decision 2010/335/EU [5] should be followed.

The total GHG emissions associated with all changes are:

$$CI_{cst} = (CS_{R} - CS_{A}) \times 3{,}664^{1)} \quad (21)$$

where

CI_{cst} is the total one-off emissions resulting from carbon stock change including both soil and vegetation cover, in mass of CO_2 per unit land area,

CS_{R} is the carbon stock per unit land area associated with the original land state (measured as mass of carbon per unit area, including both soil and vegetation cover). The reference land use shall be the land use in January 2008 or 20 years before the raw material was obtained, whichever was the latest,

CS_{A} is the carbon stock per unit area associated with the new land state (measured as mass of carbon per unit land area, including both soil and vegetation cover).

1) The quotient obtained by dividing the molecular mass of CO_2 (44,010 g/mol) by the molecular mass of carbon (12,011 g/mol) is equal to 3,664.

Although these emissions occur over a period of time, they only occur once given an original and a modified land state. They are therefore annualised over a 20 years period by taking 1/20th of the total one time emissions as the annual figure.

$$CI_{cs} = CI_{cst} / 20 \quad (22)$$

where

CI_{cs} is the annualised emissions resulting from carbon stock change including both soil and vegetation cover (below and above ground), in mass of CO_2 per unit land area.

This emission term shall then disappear after 20 years of cultivation of the land under the same conditions.

Economic operators may also present their own calculations based on actual data. In this case the annualisation shall be done over the actual period during which the changes have been recorded.

5.2.2 Improved agricultural management

Even without land use change, soil organic carbon can also be increased by improving agricultural management practices such as the "organic restitution regime" (input of organic matter). Such improvements shall be taken into account and calculated using the methodology laid out in 5.2.1 with regards to increases in the f_{mg} and f_i factors.

5.2.3 Burning

Burning of vegetation or dead organic matter as part of the land use change process may result in emissions of CH_4 and N_2O from incomplete combustion. The resulting GHG emissions shall be calculated according to the formulation given in 5.3.6 and converted into annual emissions as 1/20th of the total emissions. This emission term will then only apply for the first 20 years of cultivation of the land under the same conditions.

5.2.4 Degraded land bonus

Annex V part C sub 7 of the RED foresees a bonus of 29 g CO_2/MJ of biofuel when the biomass has been grown on degraded land. Because this bonus is expressed in terms of the biofuel/bioliquid, it can only be applied at the end of the chain on the basis of evidence of land origin carried through the chain of custody system (see Clause 6).

5.3 Biomass production

5.3.1 General

GHG emissions from biomass production (CI_{bp}) are often conveniently expressed per unit of land area and per year. They include those from:

a) Production and use of agricultural / forestry inputs such as:

   1) seed or planting materials (CI_{seed});

   2) agro-chemicals including fertilisers (CI_{chem});

   3) irrigation (CI_{irr});

b) So-called field emissions (methane and mostly nitrous oxide) occurring during the cultivation cycle as a result of land management (CI_{field});

c) Pre and post harvest burning of vegetation (CI_{burn}).

Mobile farm machinery is used during most of the planting, growing and harvesting operations and is normally taken into account as a single term (CI_{mm}) based on energy consumption per unit land (see 4.10).

The total GHG emissions from biomass production per unit and land area and per year (CI_{bp}) are the sum of all the above terms which are further elaborated below.

$$CI_{bp} = CI_{seed} + CI_{chem} + CI_{irr} + CI_{field} + CI_{burn} + CI_{mm} \quad (23)$$

Article 19 of the RED requires EU Member States to establish “a list of those areas on their territory classified as level 2 in the nomenclature of territorial units for statistics (NUTS) or as a more disaggregated NUTS level in accordance with Regulation (EC) No 1059/2003 of the European Parliament and of the Council of 26 May 2003 on the establishment of a common classification of territorial units for statistics (NUTS) where the typical greenhouse gas emissions from cultivation of agricultural raw materials can be expected to be lower than or equal to the emissions reported under the heading “Disaggregated default values for cultivation” in part D of Annex V to this Directive, accompanied by a description of the method and data used to establish that list”.

As part of that process, many EU Member States will produce estimated values for the various NUTS areas. As an alternative to the calculation described in this clause, these values may be used as actual values for biomass production for crops grown in the EU.

5.3.2 Seeding material

GHG emissions from seeding material include those incurred for production, storage and transport of seeds. This is in most cases very small. Application is included in the generic farm machinery term CI_{mm}.

Where seeding material is obtained from own production, the amount of biomass retained as seeding material shall be subtracted from the total biomass production to calculate the net biomass production.

5.3.3 Fertilisers and agro-chemicals

Fertilisers include both organic and chemical fertilisers. Agro-chemicals include pesticides and all other agricultural inputs produced by chemical plants. Related GHG emissions stem from production and transport of these materials as well as field emissions related to fertiliser use (see 5.3.4). Application is included in the generic farm machinery term CI_{mm}.

GHG emissions from production and transport of fertilisers and agrochemicals can be calculated as:

$$CI_{chem} = Q_{chem} \times F_{chem}, \quad (24)$$

where

$CI_{chem.}$ is the GHG emissions caused by fertiliser and agro-chemical production and transport to the farm, expressed per unit of land area;

Q_{chem} is the quantity of fertiliser or agro-chemical applied per unit of land area, usually expressed in mass;

F_{chem} is the GHG intensity (emission factor) of fertiliser or agro-chemical production and transport expressed in mass of CO_{2eq} per unit of fertiliser or agro-chemical (usually mass).

Organic fertilisers that are classified as a residue or a waste have zero emissions at the point of collection. Any GHG emissions from transport shall, however, be taken into account following the methodology laid out in 4.9.

Actual fertilisers and agrochemicals transport emissions may be difficult to assess and use of average or typical values may be considered.

5.3.4 Greenhouse gases field emissions

Field emissions of N_2O and CH_4 due to land management consist of four different contributions:

$$CI_{field} = CI_{f\text{-}N2O,direct} + CI_{f\text{-}N2O,indirect} + CI_{liming + urea} + CI_{CH4,\ flood} \quad (25)$$

where

CI_{field}	is the total emissions caused by fertiliser and other input use during the field cultivation period, expressed in mass of CO_{2eq} per unit of land area;
$CI_{f\ –N2O,\ direct}$	is the direct emissions expressed in mass of CO_{2eq} per unit of land area;
$CI_{f\ –N2O,indirect}$	is the indirect emissions expressed in mass of CO_{2eq} per unit of land area;
$CI_{liming\ +\ ureain}$	is the emission of CO_2 from urea and lime application expressed in mass of CO_{2eq} per unit of land area;
$CI_{CH4,\ flood}$	is the emission of CH_4 from flooded cultures expressed in mass of CO_{2eq} per unit of land area.

All direct and indirect N_2O emissions shall be taken into account. These include (all in kg N·per unit area per year):

— Amount of synthetic nitrogen fertiliser applied;

— Amount of managed animal manure, compost, sewage sludge and other organic nitrogen additions applied to soils;

— Amount of nitrogen in crop residues (above- and below-ground), catch crops and grasses from forage/pasture renewal returned to soils;

— Amount of nitrogen mineralised in mineral soils associated with loss of soil carbon from soil organic matter as a result of changes to land use or management;

— Amount of nitrogen from urine and dung deposited by cattle, pigs and poultry on pasture, range and paddock ;

— Amount of nitrogen from urine and dung deposited by sheep and other animal grazing on pasture, range and paddock.

Calculations shall also include N_2O emissions resulting from management of organic soils, caused by decomposition of the soil, as well as indirect N_2O emissions following (i) volatilisation of NH_3 and NO_x from managed soils and from fossil fuel combustion and biomass burning and (ii) leaching and runoff of nitrogen, mainly as NO_3^-, from managed soils.

All field emissions of N_2O and CH_4 may be calculated in accordance with the IPCC Guidelines [8] or any future update. In the absence of more specific data the economic operator may use the Tier 1 approach as defined in Chapter 11 of the IPCC Guidelines but may also apply a Tier 2 or Tier 3 approach if appropriate data is available.

N_2O and CH_4 emissions shall be converted into CO_2-equivalents according to the procedure laid out in 4.2.

5.3.5 Irrigation

Crop irrigation requires machinery for pumping, storage and spreading of water. The related GHG emissions shall be calculated according to the methodology laid out in 4.10.

5.3.6 Pre and post-harvest burning

Burning of vegetation, dead organic matter or crop residues may result in emissions of CH_4 and N_2O from incomplete combustion. The resulting GHG emissions shall be calculated according to the formulation given in 4.2, Formula (1) as:

$$CI_{burn} = M \times C_f \times (GWP_{CH4} \times G_{ef,\ CH4} + GWP_{N2O} \times G_{ef,\ N2O}) \tag{26}$$

where

- CI_{burn} is the emissions from biomass burning (massCO_{2eq}/ per unit land per year);
- M is the mass of biomass available for combustion, expressed as dry matter per unit land per year, including biomass, ground litter and dead wood;
- C_f is the fraction of available biomass combusted, dimensionless;
- $G_{ef}i$ is the mass of substance *i* produced per unit mass of dry matter burned.

Values for C_f and $G_{ef}i$ for CH_4 and N_2O shall be taken from IPCC guidelines [8] unless specific and verifiable data is available from other sources.

CO_2 emissions from burning biomass material are considered to be zero.

5.4 Biomass preparation

Biomass production covers any post-harvest treatment that may be required for safe and effective storage and transport or for conservation (such as drying, chipping, compacting etc.). This is applicable to both crops and forestry products. It may also apply to wastes and residues used as feedstock for biofuel/bioliquid production at or downstream of their point of collection.

The GHG emissions related to these activities are mostly from stationary machinery (calculated according to the methodology laid out in 4.10.3) and other activities such as drying for which the generic methodology laid out in 4.7 shall be applied.

The preparation step may entail a small biomass loss which shall be taken into account in the calculation of the net quantity of biomass available to the next economic operator and of the associated specific GHG emissions.

5.5 Biomass / intermediate handling and storage

Biomass / intermediate handling covers all activities related to storage and transport of the biomass / intermediate to the premises of the next economic operator where the biomass / intermediate is to be prepared / converted.

Storage requires energy through the use of mobile and stationary machinery (conveyor belts, cranes etc.) and ancillary equipment. Emissions associated with these activities shall be calculated according to the methodology laid out in 4.10.3.

Storage may also lead to a small loss of biomass / intermediate which shall be taken into account in the calculation of the net quantity of biomass / intermediate available to the next economic operator and of the associated specific GHG emissions.

GHG emissions from each mode of transport shall be calculated according to the methodology laid out in 4.9.

5.6 Biomass /intermediate conversion

5.6.1 General

This clause covers all steps required to convert a biomass feedstock (agricultural crop, forestry product or waste/residue) into a biofuel or bioliquid. This may require a single biofuel/bioliquid or intermediate production step or a succession of several steps which may be carried out at a single integrated plant or at separate plants. In the latter case transport of the intermediate products may be required for which the related emissions shall be calculated according to the methodology laid out in 4.9. Figure 4 depicts the inputs and outputs of a generic conversion plant. Inputs include the biomass feedstock itself and any associated reagent required for the conversion reaction (e.g. methanol in the case of biodiesel), process chemicals, fuels and energy (heat and electricity). Outputs include the main product (biofuel/bioliquid or intermediate), any co-product, wastes and residues, surplus energy (heat or electricity).

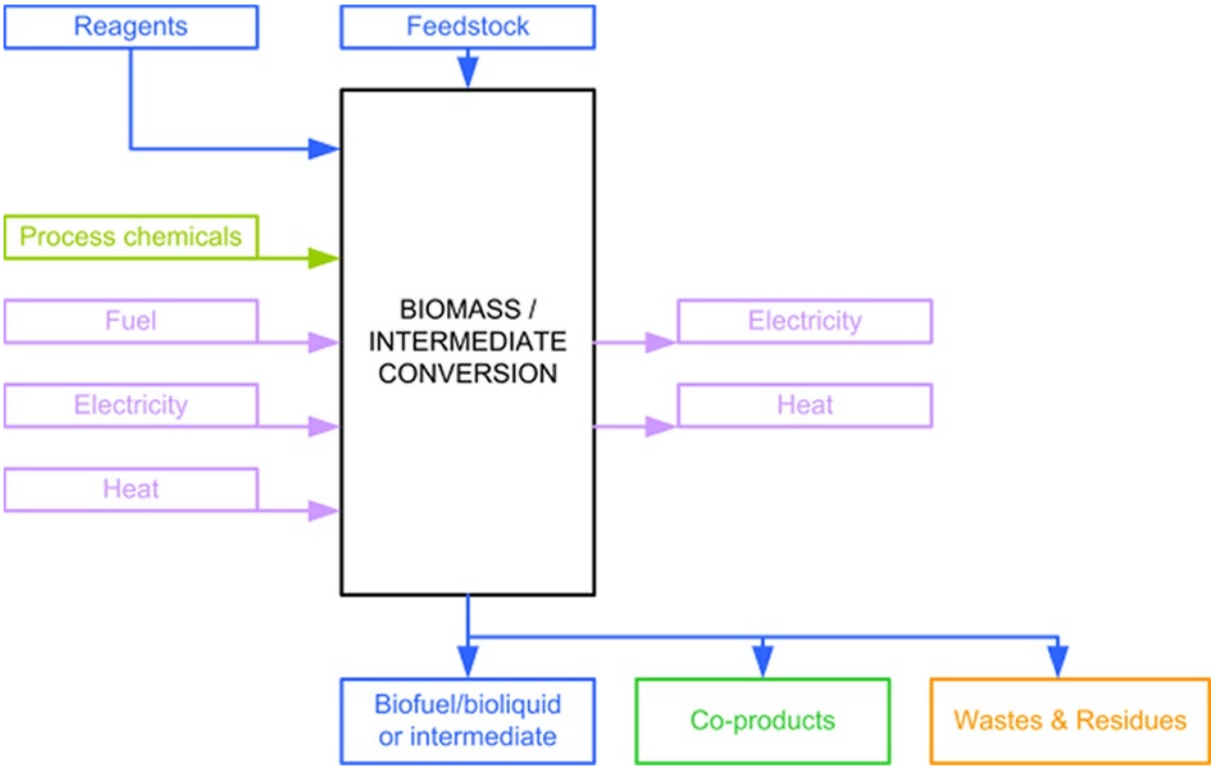


Figure 4 — Generic conversion plant

For a given operating period, the total net GHG emissions associated with the conversion step (C) shall be calculated as the sum of the emissions associated with:

— Production and supply of reagents required for the conversion reaction including their intrinsic fossil carbon content (C_{rea});

— Production and supply of process chemicals (C_{chem});

— Production, supply and combustion of imported fuels (C_{fue});

— Combustion of internally produced fuels (C_{fui});

— Production and supply of imported heat and electricity (C_{en});

— Nitrous oxide and methane from chemical/biological reactions (C_{re})

minus the GHG emissions credits (C_{ex}) associated with exported electricity from cogeneration (see 4.7).

$$C_c = C_{rea} + C_{chem} + C_{fue} + C_{fui} + C_{en} + C_{re} - C_{ex} \quad (27)$$

The GHG emissions inventory shall take into account all inputs related to any processing required for wastes and residues prior to their point of collection.

These total net emissions shall be allocated between the main product (the biofuel/bioliquid or an intermediate) and any co-products in proportion of their energy content according to the methodology laid out in 4.8.

5.6.2 GHG emissions from process chemicals and reagents

GHG emissions from process chemicals and reagents shall be calculated according to the methodology laid out in 4.11. In the case of reagents the emission factor shall take into account transport to the conversion plant.

5.6.3 GHG emissions from fuels

A conversion facility may use a combination of imported (e.g. diesel, coal, natural gas) and self-produced fuels originating from the biomass feedstock (e.g. wood bark).

GHG emissions from imported fuels shall be calculated according to the methodology laid out in 4.7.2.2.

GHG emissions from self-produced fuels shall be those from any nitrous oxide and methane produced during combustion. They will in most cases be very small. CO_2 emissions from fuels of biomass origin shall be deemed to be zero. Nitrous oxide and methane shall be converted to CO_{2eq} according to the methodology laid out in 4.2.

5.6.4 GHG emissions from imported heat and electricity

A conversion facility may import energy in the form of heat or electricity. Associated GHG emissions shall be calculated according to the methodology laid out in 4.7.2.3 and 4.7.2.4.

5.6.5 GHG emissions from chemical or biological reactions

The reactions occurring in the chemical or biological conversion process may result in the production of CO_2, nitrous oxide and/or methane.

CO_2 emissions from biomass origin shall be deemed to be zero. Nitrous oxide and methane emissions shall be converted to CO_2eq according to the methodology laid out in 4.2.

All CO_2 emissions from chemical or biological reactions involving products or intermediates which contain fossil carbon from process or other chemicals may be deemed to be zero as long as the methodology laid out in 4.11 has been applied.

5.6.6 Co-processing of bio and fossil feeds

Certain conversion processes may use a combination of biomass and fossil feedstocks. In such cases, the proportion of biological carbon in the total fuel or intermediate product of the conversion step has to be determined and the GHG emissions from the conversion step and subsequent steps apportioned between the bio-based and fossil fractions of the product.

The deemed fraction of bio-based material (β) in the total product shall be calculated as:

$$\beta = \frac{\sum \left(Q_{b,ini} \times LHV_{b,ini} \right)}{\sum \left(Q_{inj} \times LHV_{inj} \right)} \tag{28}$$

where

$Q_{b,in}i$ is the mass of biomass feedstock *i* entering the conversion process;

$LHV_{b,\,in}i$ is the lower heating value of the biomass feedstock *i* entering the coprocessing plant, expressed in energy unit per mass unit;

$Q_{in}j$ is the amount of the input *j* (either biomass or fossil) entering the conversion process, expressed in mass unit;

$LHV_{in}j$ is the lower heating value of the input *j* (either biomass or fossil) expressed in energy unit per mass unit.

The allocation procedure (based on lower heating value) shall to the extent possible be consistent with the nature of each feedstock. Amongst the emission terms defined in 5.6.2 the terms C_{rea}, C_{chem}, C_{fue}, C_e and C_{ex} cannot be directly associated to one particular feedstock. However the emissions produced by internally produced fuels (C_{fui}) and by chemical / biological reactions (C_{re}) can clearly be identified for each feedstock.

Accordingly the deemed GHG emissions associated with the bio-based fraction of the product shall be calculated as:

$$C_{c,bio} = \beta \text{ x } (C_{rea} + C_{chem} + C_{fue} + C_{en} - C_{ex}) + C_{fui,bio} + C_{re,bio} \tag{29}$$

where

$C_{c,bio}$ is the emissions associated with the bio-based part of the biofuel/bioliquid or intermediate produced by the conversion process, in mass of CO_{2eq}, after allocation to any co-product,

$C_{fui,bio}$ is the emissions associated with the combustion of internally produced fuels derived from the biomass,

$C_{re,bio}$ is the emissions associated with chemical / biological reactions of the biomass.

In both of the last two emission terms CO_2 emissions are from biomass origin and shall be deemed to be zero. Nitrous oxide and methane emissions shall be converted to CO_{2eq} according to the methodology laid out in 4.2.

Where the same material is used as both feedstock and imported fuel the respective quantities used shall be clearly identified and accounted for separately.

5.7 Emission credit for carbon capture and storage (CCS) or replacement (CCR)

Where CO_2 produced in a step of the chain is captured and either sequestered in an underground structure or used to substitute CO_2 of fossil origin emitted elsewhere, usually in an industrial or agricultural process, it is effectively not emitted to the atmosphere. In this case a credit may be claimed equal to the mass of CO_2 emissions effectively avoided.

CCS and CCR require energy mostly to capture but also to transport and (in the case of CCS) inject CO_2 underground. Consumption of that energy will in itself cause additional GHG emissions (unless the energy used is renewable or carbon-free). As a result simply capturing the CO_2 originally emitted by a process does not reduce overall emissions by that full amount. In order to effectively avoid the original CO_2 emissions, the additional CO_2 produced by the capture process also needs to be captured (CO_2 emissions from transport and storage should not normally be captured). The credit shall therefore be based on the net CO_2 avoided rather than on the CO_2 captured.

The following definitions apply:

CO_{2ori} is the mass of CO_2 produced by the process without capture

CO_{2cap} is the total mass of CO_2 captured

CO_{2pr} is the total mass of CO_2 produced

CO_{2av} is the net mass of CO_2 “avoided” i.e. not emitted

η_{cap} is the efficiency of the capture process (CO_2 produced / CO_2 captured)

F_{cap} is the GHG emission factor of the capture process, in mass of CO_{2eq} per mass of CO_2 captured

F_{tr} is the GHG emission factor for CO_2 transport, in mass of CO_{2eq} per mass of CO_2 transported

F_{st} is the GHG emission factor for CO_2 storage, in mass of CO_{2eq} per mass of CO_2 stored

CO_2 captured is CO_2 produced by the process without capture plus the extra CO_2 generated by the capture process, times the efficiency of the capture process:

$$CO_{2cap} = (CO_{2ori} + CO_{2cap} \times F_{cap}) \times \eta_{cap} \quad (30)$$

This formula can be solved as long as $F_{cap} \times \eta_{cap}$ is less than 1 (i.e. as long as the capture process produces less CO_2 than it captures) as:

$$CO_{2cap} = CO_{2ori} \times \eta_{cap} / (1 - F_{cap} \times \eta_{cap}) \quad (31)$$

The total CO_2 produced (CO_{2pr}) equals CO_2 captured divided by the capture efficiency and the CO_2 avoided is

$$CO_{2av} = CO_{2ori} – (CO_{2pr} - CO_{2cap}) = CO_{2ori} - CO_{2cap} \times (1-\eta_{cap})/ \eta_{cap} \quad (32)$$

CO_2 emissions from transport and storage operations are proportional to CO_{2cap} and are not usually captured, further reducing CO_{2av}.

The final formula reads:

$$CO_{2av} = CO_{2ori} - CO_{2cap} \times ((1 - \eta_{cap}) / \eta_{cap} - F_{tr} - F_{st})$$

$$= CO_{2ori} \times (1- \eta_{cap} / (1 - F_{cap} \times \eta_{cap}) \times ((1 - \eta_{cap}) / \eta_{cap} - F_{tr} - F_{st})) \quad (33)$$

In the case of CCR F_{st} does not apply and F_{tr} may be compensated by similar emissions incurred when transporting the replaced fossil CO_2.

Claims for the credit shall be documented with evidence of long term geological storage (CCS) or of the source of the CO_2 replaced (CCR).

6 Overall calculation algorithm

6.1 Calculating actual values across the biofuel/bioliquid chain

As described in 4.5, the RED Annex V formulation of the combined emissions across the chain as the sum of “*e*” values expressed per unit of the biofuel/bioliquid cannot be used directly by all individual economic operators. Therefore the methodology described in this standard calculates emissions for each step of the chain expressed per unit of the product of that chain.

All such figures shall be combined in a stepwise manner along the chain taking into account, at each step, the appropriate conversion factors and any allocation between co-products as well as the rules of the applicable chain of custody system as described in prEN 16214-2. In particular, the calculation shall cover a certain period of operation, representative of either the production of a batch or covering a period of time in line with the stipulation of the chain of custody scheme or the requirements of the national authorities.

The generic algorithm for each step, applicable to a given period of operation, is as follows:

a) Emissions from feedstock(s)

$$C_f = \sum Q_f i \times F_f i \tag{34}$$

where

- C_f is the total emissions associated with the feedstocks processed during the period (in mass of CO_{2eq});
- $Q_f i$ is the quantity of feedstock *i* processed during the period (in mass or volume terms);
- $F_f i$ is the average specific emissions of the total of feedstock *i* processed during the period (in mass of CO_{2eq} per mass or volume unit of feedstock).

b) Emissions from operations

C_{op} is the total emissions incurred as a result of the activities during the period in the particular step of the chain, net of any applicable credits.

c) Allocation between biofuel/bioliquid or intermediate and co-products (also refer to 4.8)

Where co-products are produced the total emissions incurred until this point are allocated in proportion of the energy content of the biofuel/bioliquid or intermediate and the co-products. The emissions pertaining to the biofuel/bioliquid or intermediate are calculated as:

$$C_{mp} = \left(C_f + C_{op}\right) \times \left(Q_{mp} \times LHV_{mp}\right) / \sum \left(Q_p i \times LHV_p i\right) \tag{35}$$

where

- C_{mp} is the total emissions pertaining to the total quantity of biofuel/bioliquid or intermediate produced during the period (in mass of CO_{2eq});
- Q_{mp} is the total quantity of biofuel/bioliquid or intermediate produced during the period (in mass or volume terms);
- LHV_{mp} is the lower heating value of the main product;
- $Q_p i$ is the total quantity of either the biofuel/bioliquid or intermediate or co-product *i* produced during the period (in mass or volume terms);
- $LHV_p i$ is the lower heating value of either the biofuel/bioliquid or intermediate or co-product *i*.

The value of C_{op} to be used here shall correspond to all steps up to and including the point of production of the co-products, unless the system includes material or energy feedback loops. In particular if different co-products are produced at different stages of the process, a separate calculation and allocation shall be carried out for each sub-step leading to the production of a new co-product.

The total specific GHG emissions (or emission factor) pertaining to the biofuel/bioliquid or intermediate can then be expressed per unit of the quantity produced as:

$$F_{mp} = C_{mp} / Q_{mp} \quad (36)$$

F_{mp} is the crucial figure that shall be communicated to the next operator in the chain in order for the calculation process to continue.

The algorithm described above uses total quantities and emissions for the period. The calculation may also be done on the basis of specific flows and emissions using conversion factors (e.g. the amount of feedstock required to produce one unit of the main product). However, care should be taken to ensure that such factors are representative of the weighted average operations for the whole period.

Further specific guidance for each step of the generic chain shown in 5 is given below while Annex B illustrates the build-up of the GHG calculation along the supply chain (refer also to Figure 3).

d) Land use, production of biomass (5.2 and 5.3)

For these initial steps of the chain no feedstock is applicable. The total emissions are the sum of those from land use and cultivation. If co-products are involved, the allocation calculation shall be done at the point at which the co-products are separated.

e) Biomass preparation (5.4)

Biomass preparation may be carried out by the biomass producer or an intermediate operator. Emissions incurred in this step are added to those from land use and production, taking into account any biomass loss during preparation.

f) Handling and transport of biomass (5.5)

Calculation for this step is similar to the above with additional emissions and a possible additional loss.

g) Biomass conversion (5.6)

Biomass may be converted:

1) Either directly to the biofuel/bioliquid;

2) Or through two or more steps first to intermediate products and then to the biofuel/bioliquid.

All steps may be carried by the same economic operator on the same site or by different economic operators and/or on different sites, in which case intermediate transport may be involved.

Each economic operator calculates the combined specific emissions of his product according to the above generic algorithm. A transport term, calculated in accordance with 4.9, is added where appropriate (unless the disaggregated transport default value is used, see 6.2).

6.2 Use of disaggregated default values (DDV) and combining with actual values

The RED foresees the possibility for economic operators to use so-called disaggregated default values (DDVs) to cover the emissions from part of the chain. DDVs listed in Annex V, part D of the RED refers to the following elements of the chain:

- e_{ec}: *cultivation of raw materials*; comprising the biomass production stage, biomass preparation and storage,
- $e_p – e_{ee}$: *processing (including excess electricity)*; comprising all conversion steps,
- e_{td}: *transport and distribution*; comprising all transport processes.

A DDV may only be used for the biofuel/bioliquid for which it is listed in the RED.

DDVs for "cultivation" may be used for feedstocks:

- Cultivated outside the EU.
- Cultivated in the EU in areas where the typical greenhouse gas emissions from cultivation of agricultural raw materials can be expected to be lower than or equal to the DDV. The RED requires EU Member States to publish a list of such areas.
- Classified as waste or residues other than agricultural, aquaculture and fisheries residues.

DDVs for "processing" may only be used for the type of conversion process corresponding to that DDV.

DDVs are expressed in g CO_{2eq} /MJ of the biofuel/bioliquid. Emissions associated with biomass and/or intermediate products are generally expressed per unit of such material and shall not be directly related to the biofuel/bioliquid. Because biomass and/or intermediate products cannot be directly related to the biofuel/bioliquid, a direct combination of calculated actual values (related to physical units of the biomass or intermediate) with disaggregated default values is not possible.

DDVs can only be introduced at the end of the chain and applied to the biofuel/bioliquid.

Accordingly the following method shall be followed:

- An operator claiming use of a DDV shall raise a flag which, together with the quantity of product to which it applies, shall be carried through the biofuel/bioliquid supply chain, according to the applicable chain of custody system, up to the final step of the biofuel/bioliquid production chain (in the same way as other elements of the mandated sustainability information).
- At the end of the chain the flag is converted into the appropriate DDV. The final economic operator shall be able to demonstrate that the biofuel/bioliquid chain is consistent with the DDV used.
- All elements of the chain related to the scope of the DDV are set to zero to avoid double counting.

The DDVs for processing and transport & distribution apply to potentially more than one physical step in the chain (e.g. there is likely to be several transport steps and there may be more the one processing step). When such values are used they shall replace all relevant steps. For instance it is not possible to combine an actual value for a single transport step and the default value for all others.

Annex B further clarifies the calculations.

6.3 Including the degraded land use bonus

According to the RED Annex V part C point 7 and 8 a bonus of 29 g CO_2eq/MJ biofuel/bioliquid (e_B) shall be attributed to the biofuel/bioliquid if the biomass from which it is produced was obtained from restored degraded land. Restoring of degraded land happened at the stage of land use. However the unit of the bonus is related to the biofuel/bioliquid and can be attributed only at the final stage.

This issue shall be addressed in the same way as the DDVs above i.e. by raising a "degraded land" flag that is carried through the chain up to the biofuel/bioliquid and converted into a bonus of 29 g CO_{2eq}/MJ applied to the biofuel/bioliquid.

Annex A
(normative)

Global Warming Potentials

The following Global Warming Potentials, as specified in Annex V of the RED shall be used in the context of this standard:

— Methane (CH_4): 23

— Nitrous oxide (N_2O): 296

Annex B
(informative)

Overall chain calculations

The generic calculations shown below adequately represent the most common chains. Some chains are more complex and may require additional steps. This is most likely to be the case in the conversion step particularly in relation to co-products.

Any credits from CCS or CCR should be subtracted from the relevant emission term before calculating the overall GHG emission factor of the biofuel/bioliquid.

Table B.1 *(1 of 3)*

Chain step	Subclause	Reference	Emission term	Factor	Unit	DDV alternative	Economic operator
Land use and land use change	5.2	Year (a) Hectare (ha)	Carbon stock: Cl_{cs} Degraded land		kg CO_{2eq}/ha/a Flag	Cultivation	Biomass producer
Biomass production	5.3		Cl_{bp}	Yield: Y_{bp}	kg CO_{2eq}/ha/a t biomass/ha/a		
Biomass preparation	5.4		F_{bpr}	Loss: L_{bpr} Corr. Yield: Y_{bpr}=Y_{bp}*(1-L_{bpr})	Fraction t ex farm biomass/ha/a kg CO_{2eq}/t ex farm biomass		
Total “ex farm biomass”		Biomass consignment	F_{bx} = (Cl_{cs} + $Cl_{b,p}$) / Y_{bpr} + F_{bpr}		kg CO_{2eq} / t ex farm biomass		
Biomass handling and storage	5.5		Storage F_b	Storage/transport loss: L_{bst} Corr. Factor (1-L_{bst})	Fraction t del / t ex farm biomass kg CO_{2eq}/t del biomass	DDVc flag	Biomass handler
			Transport F_{bt}		kg CO_{2eq}/t del biomass	Transport & distribution DDVt flag	
Total “delivered biomass”			F_{bd} = F_{bx} / (1-L_{bst}) + F_{bs} + F_{bt}		kg CO_{2eq}/t del biomass		

“continued”

Table B.1 *(2 of 3)*

Chain step	Subclause	Reference	Emission term	Factor	Unit	DDV alternative	Economic operator
BIOMASS CONVERSION	5.6/6.1	Biomass consignment processing window	Emissions from feedstock $C_{bd} = F_{bd} * B$ Emissions from operations C_{bdop} $C_{bdc} = C_{bd} + C_{bdop}$	Biomass consignment: B	t biomass kg CO_{2eq} kg CO_{2eq} kg CO_{2eq}	Processing DDVp	Intermediate producer
Allocation	6.1			Intermediate and co-products $Q_{p\boldsymbol{i}}$ $LHV_{p\boldsymbol{i}}$	t GJ/t		
Total " ex works" Intermediate		Intermediate consignment	$F_{ipx} = C_{bdc} * LHV_{ip} / S(Q_{p\boldsymbol{i}} * LHV_{p\boldsymbol{i}})$		kg CO_{2eq}/t ex works intermediate	DDVp flag	
Intermediate transport	4.9		F_{ipt}	Transport loss: L_{ipt}	Fraction	Transport & distribution DDVt	
Total " delivered" Intermediate			$F_{ipd} = F_{ipx} *(1-L_{ipt}) + F_{ipt}$		kg CO_{2eq}/t del intermediate	DDVt flag	

"continued"

Table B.1 *(3 of 3)*

Chain step	Subclause	Reference	Emission term	Factor	Unit	DDV alternative	Economic operator
INTERMEDIATE CONVERSION	5.6/6.1	Intermediate consignment processing window	Emissions from feedstock $C_{ipd} = F_{bipd} * I$ Emissions from operations C_{ipdop} $C_{ipdc} = C_{ipd} + C_{ipdop}$	Intermediate consignment: I	t intermediate kg CO_{2eq} kg CO_{2eq} kg CO_{2eq}	Processing DDVp	Biofuel/bioliquid producer
Allocation	6.1			Intermediate and co-products $Q_p i$ $LHV_p i$	t GJ/t		
Total " ex works" Biofuel/bioliquid		Biofuel/bioliquid consignment	$F_{bfx} = C_{ipdc} * LHV_{bf} / S(Q_p i * \mathrm{LHV}_p i)$		kg CO_{2eq}/t ex works biofuel/bioliquid	DDVp flag	
Biofuel/bioliquid Transport and dsitribution	4.9		F_{bft}	Transport loss: L_{bf}	Fraction		Biofuel/bioliquid blender
Total " delivered" biofuel/bioliquid			$F_{bfd} = F_{bfx} *(1-L_{bft}) + F_{bft}$		kg CO_{2eq}/t del biofuel/bioliquid		
Total reportable biofuel/bioliquid GHG balance			$\mathbf{F_{bfdE} = F_{bfd} / LHV_{bf}}$ **If degraded land flag raised, subtract 29**		**g CO_{2eq}/MJ del biofuel/bioliquid**		

Table B.2 — Combining actual and disaggregated default values (DDV)

DDV flag raised	Calculation changes
CuHGltivation (DDVc)	$F_{bx} = 0$ $\boldsymbol{F_{bfdE} = F_{bfd} / LHV_{bf} + DDVc}$ **If degraded land flag raised, subtract 29**
Processing (DDVp)	Shall apply to all processing steps $C_{bdop} = C_{ipop} = 0$ $\boldsymbol{F_{bfdE} = F_{bfd} / LHV_{bf} + DDVp}$ **If degraded land flag raised, subtract 29**
Transport & distribution (DDVt)	Shall apply to all transport steps $F_{bt} = F_{ipt} = F_{bft} = 0$ $\boldsymbol{F_{bfdE} = F_{bfd} / LHV_{bf} + DDVt}$ **If degraded land flag raised, subtract 29**

Annex C
(informative)

A-deviations

A-deviation: National deviation due to regulations, the alteration of which is for the time being outside the competence of the CEN-CENELEC member.

This European Standard does not fall under any Directive of the EU in the sense that it has been mandated. However, both the EC and CEN agreed that this European Standard may play a role in the implementation of the EU biofuel and bioliquid sustainability scheme. In the relevant CEN countries these A-deviations are valid instead of the provisions of the European Standard until they have been removed.

Deviation	
Country Switzerland	art. 12b, para. 3, let. c MinöStG art. 19b, para. 1, let. a MinöStV TrÖbiV
Subclause 4.6 system boundaries	Sources of GHG emissions such as GHG emissions generated during manufacturing or maintenance of equipment such as farm machinery, process plants and transport vectors, are not included in the standard. System boundaries are therefore different in Swiss legislation.
Country Switzerland	art. 13 TrÖbiV
Subclause 4.8 allocation rules	The Swiss legislation prescribes an allocation based on economic value, whereas the standard foresees energetic allocation (allocation based on energy content). Moreover, the Swiss legislation uses only one method for the treatment of co-products and residues, which is allocation, whereas the standard uses allocation in certain cases and credits for other cases like excess electricity.
Country Switzerland	art. 2, para. 1, let. c TrÖbiV art. 5, 6, 7 TrÖbiV
Subclause 5.1 main steps of biofuels and bioliquids production chain	Sources of GHG emissions such as GHG emissions generated during manufacturing or maintenance of equipment such as farm machinery, process plants and transport vectors, are not included in the standard. System boundaries are therefore different in Swiss legislation.
Country Switzerland	art. 8 TrÖbiV
Subclause 5.2.3 and 6.3 degraded land bonus	Swiss legislation does not accord a GHG bonus for the restoration of degraded land. The positive effects on land due to cultivation are treated in a separate way. The use of bonuses cannot be accepted because they lack a legal basis.

Deviation	
Country Switzerland	 art. 13 TrÖbiV
Subclause 5.7 emission credits	Swiss legislation uses only allocation methodology and therefore does not give any credit for carbon storage or replacement. Such credits cannot be accepted because they lack a legal basis.
Country Switzerland	 art. 2, para. 1, let. c TrÖbiV
Subclause 6.2 disaggregated default values	The use of disaggregated default values is not foreseen in the Swiss legislation. All applicants shall deliver the specific data of their production pathway. Disaggregated default values cannot be accepted because they lack a legal basis.
Country Switzerland	 art. 13 TrÖbiV art. 14 TrÖbiV
Annex A GHG potentials	Swiss legislation calculates the greenhouse gas emissions equivalents based on the GHG potential of all possible emissions (not only CO_2, CH_4 and N_2O).

Annex D
(informative)

Relationship between this European Standard and the requirements of EU Directives 2009/28/EC and 98/70/EC

This European Standard has been prepared after an analysis requested from CEN by the European Commission to provide insight in challenges that may be foreseen with the practical application of the greenhouse gas calculation methodology set out in Annex V, Part C of the Directive 2009/28/EC on the promotion of the use of energy from renewable sources, also known as the Renewable Energy Directive (RED).

The part of this standard is intended to cover (as a minimum) the requirements included in Annex V of the RED, to which reference is made in Table D.1.

Table D.1 — Correspondence between this European Standard and Directive 2009/28/EC

Qualifying remarks / Item	(Sub-)clause(s) of this European Standard	Mandatory requirements of Directive 2009/28/EC
Biomass cultivation values in identified NUTS areas	5.3.1	Article 19.2
GHG emission terms	4.5 & 5.1	Annex V C1
Credit for CCS and CCR	6.7	Annex V C1
GWP	4.2	Annex V C5
Soil carbon stock	6.2.1	Annex V C7
Degraded land bonus	6.2.2	Annex V C8
Imported electricity	5.6.2.4	Annex V C11
Combined heat and power supply	5.6.3	Annex V C16
Exported electricity	5.6.5	Annex V C18
Allocation rules	5.7	Annex V C17
Disaggregated default values	6.2	Annex V D/E

For Directive 98/70/EC as regards the specification of petrol, diesel and gasoil and introducing a mechanism to monitor and reduce greenhouse gas emissions, also known as the Fuel Quality Directive (FQD), Table D.2 has been derived.

Table D.2 — Correspondence between this European Standard and Directive 98/70/EC

Qualifying remarks / Item	(Sub-)clause(s) of this European Standard	Mandatory requirements of Directive 98/70/EC
Biomass cultivation values in identified NUTS areas	5.3.1	Article 7d.2
GHG emission terms	4.5 & 5.1	Annex VI C1
Credit for CCS and CCR	6.7	Annex VI C1
GWP	4.2	Annex VI C5
Soil carbon stock	6.2.1	Annex VI C7
Degraded land bonus	6.2.2	Annex VI C8
Imported electricity	5.6.2.4	Annex VI C11
Combined heat and power supply	5.6.3	Annex VI C16
Exported electricity	5.6.5	Annex VI C18
Allocation rules	5.7	Annex VI C17
Disaggregated default values	6.2	Annex VI D/E

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BSI

389 Chiswick High Road London W4 4AL UK

Tel +44 (0)20 8996 9001
Fax +44 (0)20 8996 7001
www.bsigroup.com/standards

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