SLOVENSKI STANDARD
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Sonaravno proizvedena biomasa za energijsko uporabo - Načela, merila, kazalniki in preverjalniki biogoriv in biotekočin - 4. del: Računske metode za bilance emisij toplogrednih plinov z uporabo analize življenjskega cikla

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

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

Critères de durabilité pour la production de biocarburants et de bioliquides pour des applications énergétiques - Principes, critères, indicateurs et vérificateurs - Partie 4: Méthodes de calcul du bilan des émissions de GES utilisant une approche d'analyse du cycle de vie

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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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EUROPEAN COMMITTEE FOR STANDARDIZATION
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European foreword

This document (EN 16214-4:2013+A1:2019) 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of an identical text or by endorsement, at the latest by May 2020, and conflicting national standards shall be withdrawn at the latest by May 2020.

This document includes Amendment 1 approved by CEN on 13 November 2019.

[A1⟩ This document supersedes EN 16214-4:2013 ⟨A1].

"The start and finish of text introduced or altered by amendment is indicated in the text by tags [A1⟩ ⟨A1].

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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 [4] (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).

A1) Directive 2015/1513 [3], referred to as the ILUC Directive, amends both the RED and the FQD.

NOTE The ILUC Directive adds a new Annex VIII regarding estimated indirect land use change emissions. These do not affect the economic operator directly, but are directed towards the member states. (A1

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, [5]), 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 document 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.

[A1) The methodology strictly follows the principles and rules stipulated in the RED (amended by European Parliament and Council Directive 2015/1513, referred to as the ILUC Directive [3]), 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) [6] as well as any additional interpretation of the legislative text published by the EU Commission. (A1] 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 [7] 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" [8].

NOTE This edition of the standard does not cover the requirements in Directive 2018/EU/2001, the recast of the Renewable Energy Directive (referred to as RED II).

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 are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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+A1:2019, *Sustainably produced biomass for energy applications — Principles, criteria, indicators and verifiers for biofuels and bioliquids — Part 1: Terminology*

CEN/TS 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+A1:2019 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

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:

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

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:

$$F_{qx} = F_{ex} \times LHV_x \tag{4}$$

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:

$$C_x = Q_x \times F_{qx} = Q_x \times F_{ex} \times LHV_x \tag{5}$$

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:

$$\varepsilon_x = LHV_x \times Q_x \tag{6}$$

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