For this document, relevant passages are marked with grey

ORDER on the Handbook on compliance with sustainability and greenhouse gas emissions saving requirements for biomass fuels and bioliquids for energy purposes (HB 2021)[1)]

Pursuant to Sections 56c(1–3) and 58b(1) of the Act on the promotion of renewable energy, cf. Consolidation Act No 1031 of 6 September 2024, the following is laid down pursuant to Section 4(1) of Order No 1705 of 30 December 2024 on the tasks and powers of the Danish Energy Agency:

Section 1. The Handbook on compliance with sustainability and greenhouse gas emissions saving requirements for biomass fuels and bioliquids for energy purposes, as set out in Annex 1 to this Order, is hereby published.

Section 2. *(1)* This Order shall enter into force on 21 May 2025.
(2) Order No 649 of 31 May 2023 on the Handbook on compliance with sustainability and greenhouse gas emissions saving requirements for biomass fuels and bioliquids for energy purposes (HB 2021) is repealed.

The Danish Energy Agency, xxx

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Annex 1

Handbook on compliance with sustainability and greenhouse gas emissions saving requirements for biomass fuels and bioliquids for energy purposes

Content

1 Introduction

1.1 Background

Order on sustainability and greenhouse gas emissions saving for biomass fuels and bioliquids for energy purposes, etc. (Sustainability Order) contains the requirements in brief. The Handbook supplements and elaborates on certain

requirements and provides guidance on compliance and evidence. From a legal point of view, the Handbook is also an Order, but will hereinafter be referred to as the ‘Handbook’.

The Sustainability Order and the Handbook implement the political agreement of 2 October 2020: *Sustainability requirements for woody biomass for energy* and furthermore, on 9 October 2024, the agreement to further lower the installation limit will be implemented, so that more, including smaller companies producing heat or importing wood fuels, will be covered by sustainability requirements. The Sustainability Order and the Handbook also implement sustainability and greenhouse gas emissions savings requirements set out in Directive 2018/2001/EU of the European Parliament and of the Council on the promotion of the use of energy from renewable sources as amended by Directive (EU) 2023/2413 of the European Parliament and of the Council (18 October 2023)[2)] (Renewable Energy Directive).

The Renewable Energy Directive contains mandatory sustainability criteria and criteria for greenhouse gas emissions saving for biomass fuels from agriculture, forestry, etc., used for the production of electricity, heating, cooling, or fuels in installations above a certain size. Biomass fuels are solid biofuels produced from biomass, such as straw, wood chips, and wood pellets, as well as biogas.

Compliance with the criteria in the Renewable Energy Directive is a condition for energy based on biomass to contribute to the fulfilment of Denmark's and the EU's targets for shares of renewable energy and to receive future aid. For solid and gaseous biomass fuels, the criteria of the Directive specify a minimum level and individual Member States have the possibility to introduce additional requirements.

The political agreements on sustainability requirements for woody biomass implement the criteria of the Renewable Energy Directive and build on the industry agreement that Dansk Energi (Danish Energy) and Dansk Fjernvarme (Danish District Heating Association) established in 2014 on sustainability of wood pellets and wood chips. In some respects, the political agreements go beyond the criteria of the Renewable Energy Directive and in other respects beyond the requirements of the inter-branch agreement.

For *agricultural biomass,* the Handbook deals with the criteria of the Renewable Energy Directive and a special requirement for the use of energy crops in biogas production.

The Handbook describes the requirements for *solid, liquid and gaseous biomass fuels*. Requirements for *biofuels* are described elsewhere[3)].

As can be seen, the Handbook relates only to the use of biomass *for energy purposes*. The companies concerned are therefore producers, importers and consumers of biomass fuels and bioliquids for energy purposes.

The exact requirements depend on

1) The biomass category, i.e. whether it is agricultural biomass, forest biomass, non-forest wood, etc.;

2) The form, i.e. whether it is solid biomass or gas; and on

3) The energy use, i.e. whether the biomass is burnt in installations for the production of electricity, heating, cooling, or whether it involves the import or production of, for example, wood pellets for households.

The Handbook clarifies and supplements the rules on how companies can meet the requirements, as well as the evidence that must be available. The Handbook describes the Danish control system, including requirements for verification and for the verifiers tasked with verifying that the requirements are met. The Handbook therefore also provides guidance for companies and verifiers. Finally, the Handbook describes the information that must be reported to the Danish Energy Agency.

2 Guidance on definitions and concepts

2.1 Definitions and explanations

This Chapter reproduces, elaborates on and supplements definitions of terms and concepts relevant to compliance with the requirements within the framework of the definitions in the Renewable Energy Act and the Sustainability Order.

Waste: As defined in SO No ### of ##/##/2025.

Wood industry residues: Clean wood industry residues, i.e. raw wood (including sawmill chips, bark and offcuts), clean wood (including chips and sawdust) and wood waste from the production and processing of clean glued wood with a glue content not exceeding 1% measured on dry matter. The definition corresponds to wood covered by points 1, 2 and 3 of Annex 1 to the Biomass Order No 1258 of 27/11/2024.

Other production: As defined in SO No ### of ##/##/2025.

The Sustainability Order: Order on sustainability and greenhouse gas emissions saving for biomass fuels and bioliquids for energy purposes, etc.

Biomass: As defined in SO No ### of ##/##/2025.

Agricultural biomass: As defined in SO ### of ##/##/2025. *Forest biomass:* As defined in SO No ### of ##/##/2025.

Biomass fuels: As defined in SO No ### of ##/##/2025.

Biofuel: Liquid fuel for transport produced from biomass.

By-product: A by-product is defined in accordance with the Order on waste (BEK No 573 of 23/05/2024).

Biogas: As defined in SO No ### of ##/##/2025.

Biowaste: Biodegradable garden and park waste, food and kitchen waste from households, offices, restaurants, wholesale, canteens, catering companies, and retail outlets, as well as similar waste from food processing plants, cf. EU Directive 2018/851 of 30 May 2018 amending Directive 2008/98/EC.

Greenhouse gas emissions: As defined in SO No ### of ##/##/2025.

Deadwood: As defined in Order ### of ##/##/2025. *Energy crops for biogas*: Crops harvested annually and grown on agricultural land for energy production. Includes the crops corn, beet, grass, clover grass, cereals, and Jerusalem artichokes, cf. Annex 1 to the Sustainability Order.

Energy wood from agricultural land: Tree species such as willow, poplar, and eucalyptus grown on agricultural land with a maximum 10-year rotation or coppicing interval. Also called short rotation coppice. English: Short rotation coppice (Directive term) and short rotation woody crops.

Forest energy wood: Whole trees from stands that are harvested predominantly for energy purposes, without being residual wood from the production of ornamental foliage, rubber, cork, pine nuts, Christmas trees in (DK) peace forest or equivalent.

Actual value: Greenhouse gas emissions saving at certain or all stages of a specific process for the production of biofuels or biomass fuels calculated in accordance with the methodology set out in Annex B.

Solid biomass fuels: As defined in SO No ### of ##/##/2025.

Bioliquids: As defined in SO No ### of ##/##/2025.

Voluntary scheme: As defined in SO No ### of ##/##/2025. *First gathering point for forest biomass*: The first gathering point for forest biomass is a storage or processing facility managed by a company that receives raw materials directly from primary producers of forest biomass.

Restoration: Regeneration of a forest stand by natural means (natural regeneration) or artificial means (planting) after removal of the previous forest stand by harvesting or as a result of natural causes, including fire and storm.

Geographical origin: As defined in SO No ### of ##/##/2025.

Approved certification scheme: As defined in SO No ### of ##/##/2025.

Garden/park waste: Trees, branches, hedge clippings, leaves, shrubs, flowers and weeds from private gardens, parks, cemeteries and public facilities.

Sourcing area: As defined in SO No ### of ##/##/2025.

Carbon stock: The quantity of carbon in land in the living and dead biomass. For wood, the carbon stock is often divided into five pools: Living above-ground biomass (tree trunks and branches), living below-ground biomass (tree roots), dead branches and trunks, soil layers of untransposed organic matter (dead leaves and needles = litter layer) as well as the organic material content of the mineral soil.

Carbon removals: Any process, activity or mechanism that absorbs a greenhouse gas, an aerosol or a precursor to a greenhouse gas from the atmosphere. It is also known as a 'sink'.

Municipal waste: Mixed waste and separately collected waste from households, including paper and cardboard, glass, metal, plastic, biowaste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators and bulky waste, including mattresses and furniture, as well as mixed waste and separately collected waste from other sources, where such waste is comparable in type and composition to waste from households. Municipal solid waste does not include waste from other production, agriculture, forestry, fisheries, septic tanks, sewage pipes and treatment, including sewage sludge, end-of-life vehicles or construction and demolition waste, cf. EU Directive 2018/851 of 30 May 2018 amending Directive 2008/98/EC.

Mass balance system: The mass balance system is an element of a traceability system ('*chain of custody*' system), which ensures that, when biomass lots are mixed together, there is transparency about the sustainability characteristics of biomass and greenhouse gas emissions throughout the value chain from production to end-use.

Country of origin: The country where the biomass was harvested. Also referred to as 'harvesting land' for forest biomass. For waste, the country of origin is the country where the biomass has become waste.

Plantation forest: As defined in SO No ### of ##/##/2025.

Residue: As defined in SO No ### of ##/##/2025.

Agricultural land residues: As defined in SO No ### of ##/##/2025.

Forestry residues: 1) Branches and tops; 2) Whole trees, which are residues from ongoing production of stemwood, including by thinning; and 3) Residual wood from the production of ornamental foliage, rubber, cork, pine nuts, or Christmas trees in (DK) protected forest or equivalent. Forest residues must not contain stumps and roots.

Raw material: As defined in SO No ### of ##/##/2025.

Forest: As defined in SO No ### of ##/##/2025.

Forest certification scheme: As defined in SO No ### of ##/##/2025.

Forest statistics: An inventory of a country's or area's forest resources, including forest land and carbon stock, carried out by an expert institution.

Traceability certification: As defined in SO No ### of ##/##/2025.

Stemwood: Tree trunk or part thereof – without roots, stump, branches, and top.

Default value: A value that, in circumstances specified in this Handbook, may be used instead of an actual value.

Stumps and roots: Parts of the whole tree volume excluding the volume of the woody biomass above the stump, since the stump height is considered as the height at which the tree would be harvested under normal harvesting practices in the relevant country or region.

Management system: A management system means an information management system operated by an economic operator to demonstrate that biomass procurement complies with the sustainability criteria at forest sourcing area level set out in Article 29(6)(b) and Article 29(7)(b) of the Renewable Energy Directive. The system shall include all criteria and refer to the sources of information verified to demonstrate compliance. In addition, a decision tree may be used to assist in the assessment of the available information. The system shall ensure that information necessary to demonstrate compliance is collected, verified, assessed and stored by the economic operator. The system must be accurate, reliable, and protected against fraud, and ensure that materials are not intentionally modified or discarded so that shipments or parts thereof may become waste or residue (Article 30(3) of the Renewable Energy Directive).

Wood waste: As defined in SO No ### of ##/##/2025.

Woody biomass: As defined in SO No ### of ##/##/2025.

Non-forest wood: As defined in SO No ### of ##/##/2025.

Verification: When a qualified third party, a verifier, examines and confirms that requirements have been met and that evidence to that effect is sufficient. Verification and requirements for the verifier are described in more detail in Chapter 10.

3 Covered companies and biomass

3.1 Agricultural biomass, waste and residues from other production, wood waste and municipal solid waste

Companies listed below must comply with sustainability and greenhouse gas emissions saving requirements when using biomass from agricultural land. Companies must comply with greenhouse gas emissions requirements when using

waste and residues from other production. In addition, they must comply with certain reporting requirements when using wood waste or municipal solid waste.

Companies using biomass fuels or bioliquids shall ensure that the biomass contained in the fuels complies with the requirements set out in Chapters 2 to 4 and 8 to 10 if the fuels are used or produced:

(1) for solid biomass fuels, in installations producing electricity, heating and cooling with a total rated thermal input equal to or exceeding 7.5 MW;

(2) for gaseous biomass fuels, in installations producing electricity, heating and cooling with a total rated thermal input of 2 MW or more; and

(3) in installations that produce gaseous biomass fuels, with the following average flow rate for biomethane:

> (a) above 200 m3 methane equivalent/h measured at standard temperature and pressure, i.e. 0 °C and 1 bar atmospheric pressure; and
>
> (b) if the biogas consists of a mixture of methane and non-combustible other gas, for the flow rate of methane, the threshold set out in point (a), recalculated proportionally to the volumetric share of methane in the mixture.

(3) installations using bioliquids, regardless of the size of the installation's total rated thermal input.

When calculating the total rated thermal input to determine whether the biomass must comply with the sustainability requirements, the rated thermal input of all installations combusting biomass fuels at the same geographical location shall be added.

Installations using biogas, regardless of their capacity, must also comply with the additional requirement to limit the use of energy crops as described in Section 4.1.2.

The companies listed above are legally responsible for compliance with the requirements. In order to do this, companies can impose requirements, including evidence requirements, on their biomass suppliers. Companies can also obtain external help with reporting and evidence, but this does not change the responsibility.

3.2 Forest biomass, wood industry residues and non-forest wood

Companies using solid biomass fuels from forest biomass, wood industry residues and non-forest wood shall ensure that the fuels comply with the requirements set out in Chapters 2–3 and 5–10 when:

1) The company uses solid biomass fuels for the production of electricity, heating or cooling in installations with a total rated thermal input equal to or exceeding 2.5 MW.

2) The company annually produces or imports at least 5 000 tonnes of wood pellets, 5 000 tonnes of wood briquettes or 5 000 tonnes of firewood.

3) The company uses gaseous biomass fuels:

in installations producing electricity, heating and cooling with a total rated thermal input equal to or exceeding 2 MW; and

in installations producing gaseous biomass fuels, with the following average flow rate for biomethane:

> (a) above 200 m3 methane equivalent/h measured at standard temperature and pressure, i.e. 0 °C and 1 bar atmospheric pressure; and
>
> (b) where the biogas consists of a mixture of methane and other non-combustible gas, for the methane flow rate, the threshold set out in point (a), recalculated proportionally to the volumetric share of methane in the mixture.

From 1 January 2028, the rules shall apply to companies using solid biomass fuels from woody biomass in installations producing electricity, heating or cooling with a total rated thermal input of 1 MW or more.

From 1 January 2028, the rules shall apply to companies that produce or import at least 5 000 tonnes of wood pellets, wood briquettes or firewood.

When calculating the total rated thermal input to determine whether the biomass must comply with the sustainability requirements, the rated thermal input of all installations combusting biomass fuels at the same geographical location shall be added.

The companies listed above are legally responsible for compliance with the requirements. In order to do this, companies can impose requirements, including evidence requirements, on their biomass suppliers. Companies can also obtain external help with reporting and evidence, but this does not change the responsibility.

3.3 Covered biomass

Different categories of biomass have to meet different requirements. It is therefore necessary to categorise biomass before the requirements it must meet can be determined.

The categorisation of biomass is shown in Figure 3.1. The requirements for each category are set out in Table 3.1. Requirements for 'Non-forest wood' shall not be met until 1 January 2022.

The categories ‘Agricultural biomass’ and ‘Forest biomass’ include both primary products and waste and residues. For several reasons, it is necessary to distinguish between primary products and residues:

Agricultural biomass:

– Monitoring or management plans are required for soil quality and soil carbon content for waste and residues from agricultural land. This requirement shall not apply to primary products from agricultural land.

– When calculating the greenhouse gas emissions saving, it is necessary to distinguish both between the overall categories and between different more detailed types of biomass in order to be able to use a default value for e.g. ‘agricultural residues’ or for a specific type, e.g. ‘corn’, ‘straw’, etc.

Forest biomass:

– When calculating the greenhouse gas emissions saving, it is necessary to distinguish between primary products (stemwood and energy wood) and residues. This is necessary, for example, to determine which default value to use.

Sustainability requirements apply to biomass, including waste and residues originating from agricultural land. In this context, it is important to note that, for example, manure and deep litter fall under the category of ‘waste and residues from other production’ and that the sustainability requirements for agricultural land therefore do not apply to these types of biomass.

The requirements to be met by each biomass are set out in Tables 3.1 and 3.2 below. Requirements resulting from the Renewable Energy Directive are marked with ‘X’, while additional requirements and requirements for additional categories of biomass are marked with ‘E’.

Table 3.1. Overview of requirements for agricultural biomass, waste and residues from other production, wood waste and municipal solid waste.

	Soil quality	Land, biodiversity and carbon stocks	Limitation of energy crops for biogas	Fossil greenhouse gas emissions saving	Third-party verification	Evidence of geographical origin, biomass type, quantity, etc.
Sections of the Handbook describing the requirement	4.2	4.3	4.4	9	10 5.7	10

Primary agricultural biomass		X	E	X[1]	X	X
Agricultural land waste and residues	X[2]	X		X[1]	X	X
Waste and residues from other production				X[1]	X	X
Municipal solid waste					X	X
Wood waste					X	X

Note 1: The requirement has been implemented with fewer exceptions than allowed by the Renewable Energy Directive III.

Note 2: However, the requirement does not apply to residual wood from agricultural land.

Table 3.2. Overview of requirements for woody biomass, i.e. forest biomass, wood industry residues, and non-forest wood.

	Restoration, biodiversity, LULUCF, etc. (forest)	Preservation of carbon stocks	Sustainable cascading use of woody biomass	Restoration and risk minimisation (non-forest)	Fossil greenhouse gas emissions savings	Third-party verification	Evidence of geographical origin, biomass type, quantity etc.
Sections of the Handbook describing the requirement	5.1 5.5	5.6	5.8	6	9	10 5.7	10
Forest biomass	X	E	X		E	X[1]	X
Wood industry residues	E		E		E	E	X
Non-forest wood			E	E	E	E	X

Note 1: For forest biomass, there is an additional requirement for third-party verification up to the first gathering point.

As a general rule, the requirements must be met for the entire quantity of biomass used, produced or imported. For wood industry waste and residues, at least 90% of the quantities of biomass used by a covered company must meet sustainability requirements for raw materials.

Imported and nationally produced wood pellets, wood briquettes, and firewood shall comply with sustainability and greenhouse gas emissions saving criteria unless the importer or producer can demonstrate that the wood pellets, wood briquettes, or firewood are not to be used to produce electricity or heating. Thus, where there is evidence that a specified quantity of wood pellets, firewood or wood briquettes will be used for purposes other than energy, compliance with sustainability requirements, etc. may be omitted for that quantity. Evidence be in the form of a declaration on the buyer's honour that they will not use the biomass for energy purposes and will not resell it.

4 Sustainability requirements for biomass from agricultural land

4.1 Solid and gaseous biomass fuels produced from agricultural biomass

In accordance with Article 29(2–5) of the Renewable Energy Directive, biomass fuels produced from agricultural biomass shall comply with the sustainability criteria referred to in this Chapter in order to minimise the risk of using biomass from unsustainable production.

Most of the criteria are based on the previous Directive[6)], which established sustainability criteria for the transport sector. Some of the criteria are therefore linked to the status of selected land in 'January 2008'.

The sustainability criteria are linked to land where the biomass used in production is produced. The criteria shall ensure the protection of three aspects:

– Soil quality and carbon content in soil (a)

– Biodiversity (b)

– High carbon stocks (c and d)

As a starting point, sustainability criteria a–d are considered to be met if the company or biomass is certified according to a voluntary scheme, e.g. ISCC EU or REDCert EU, approved by the European Commission. However, the verifier or supervisory authority may continue to request information on compliance and carry out random controls on compliance with criteria a–d.

If the company or biomass *is not* certified according to an EU-approved voluntary scheme, the criteria are met as described in the following Sections 4.2 and 4.3.

The Danish Energy Agency may decide that certain certification schemes may be used for a specified period as proof of compliance with sustainability requirements. The Danish Energy Agency will then publish this on its website.

In addition to the sustainability criteria a–d, there are specific requirements for the use of energy crops in the production of biogas produced from anaerobic turnover of organic material (see Sections 4.1.2 and 4.4).

4.1.1 Sustainability criteria for agricultural biomass

The specific sustainability criteria from the Renewable Energy Directive are described here. How compliance with the criteria is documented is elaborated in Sections 4.2 and 4.3.

(a) Agricultural land waste and residues shall only be taken into account if operators or national authorities have monitoring or management plans in place to address impacts on soil quality and soil carbon content.

(b) Biomass fuels shall not be made from raw materials obtained from land with a high biodiversity value. That is to say, land that had one of the following statuses in January 2008 or thereafter:

(i) Primary forest and other wooded land, namely forest and other wooded land of native species, where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed, and old-growth forests as defined in the country where the forest is located.

(ii) Forest and other highly biodiverse wooded land that is species-rich and not degraded and has been designated as highly biodiverse by the relevant competent authority, unless evidence is provided that the production of that raw material did not interfere with those nature protection purposes.

(iii) Areas:

- has been granted the status of a nature protection area by law, or

- For the protection of rare, threatened or endangered ecosystems or species recognised by international agreements or included in lists drawn up by intergovernmental organisations or the International Union for the Conservation of Nature.

- Unless evidence is provided that the production of that raw material did not interfere with those nature protection purposes.

(iv) Highly biodiverse grassland of more than 1 ha, which is:

- Natural, i.e. grassland that would remain grassland in the absence of human intervention and that maintains the natural species composition and ecological characteristics and processes; or:

- Non-natural, namely grassland that would cease to be grassland in the absence of human intervention, that is species-rich and not degraded and has been designated as highly biodiverse, unless evidence is provided that the harvesting of the raw material is necessary to maintain its status as highly biodiverse grassland.

(v) Heaths unless it is documented that the harvesting of the raw material is necessary to maintain their status as heaths.

(c) Biomass fuels shall not be made from raw material obtained from land that had a high carbon stock in 2008. That is to say, land that had one of the following statuses in January 2008 but no longer has this status:

(i) wetland, i.e. land that is covered or saturated by water on a permanent basis or for a significant part of the year.

(ii) continuous land spanning more than one hectare with trees higher than five metres and canopy cover of more than 30%, or trees able to reach those thresholds *in situ*.

(iii) land spanning more than one hectare with trees higher than five metres and a canopy cover of between 10% and 30%, or trees able to reach those thresholds *in*

situ, unless evidence is provided that the carbon stock of the land before and after conversion is such that, when the methodology laid down in Annex B to the Handbook, it would fulfil the greenhouse gas emissions savings requirements (see Chapter 9 of the Handbook).

(b) Biomass fuels shall not be made from raw material obtained from land that was peatland in January 2008, unless evidence is provided that the cultivation and harvesting of that raw material does not involve drainage of previously undrained soil.

4.1.2 Additional requirements to limit the use of energy crops for biogas production

An additional sustainability requirement applies to biogas in the form of a limitation on the use of energy crops. The requirement has been in force in Denmark since 2015 (until July 2022, however, only eligible biogas was covered by it).

In the Order on sustainability and greenhouse gas emissions saving for biomass fuels and bioliquids for energy purposes, etc., a ceiling has been established for the maximum amount of energy crops in the total biomass input in biogas production. Up to and including 31 July 2023, the limit is 12%. Cf. Agreement on new requirements for the use of energy crops for biogas production from June 2021 (which has since been slightly adjusted), the limit has been tightened. From 1 August 2023, the limit will be reduced to 9% and from 1 August 2024, the limit will be reduced to 4%.

In addition, a basic allowance will be introduced from 1 August 2023 for the first 50 000 tonnes of imported biomass, where up to 12% of energy crops can still be used. The basic allowance shall be reduced to 36 000 tonnes from 1 August 2025. All biomass used above the basic allowance limit is covered by the applicable energy crop limit at the time of the introduction of the biomass.

The total permitted quantity of energy crops is thus installation-specific. An example of this is an installation using 100 000 tons of biomass in the period 2023/2024:

$$(50.000\ t\ \text{biomasse} * 0{,}12) + (50.000\ t\ \text{biomasse} * 0{,}06) = 9.000\ t\ \text{energiafgrøder}$$

biomasse	biomass
energiafgrøder	energy crops

From 1 July 2023, the reporting period for installations using biogas shall be amended so that the reporting period follows the calendar year. This means that the limits for the use of energy crops will be lowered in the middle of the reporting periods (1 August) until 2025. This is addressed by calculating a weighted average

for each reporting period, which includes the current energy crop limits relative to the number of months for which they apply in each period. The use of energy crops, for each reporting period, shall thus not exceed the weighted average for that reporting period. Any allowance (if applicable) for future reporting periods shall also be calculated as a weighted average.

The weighted average of the maximum quantity of energy crops that may be used in biogas production for the given reporting periods is as follows:

Reporting period	Maximum quantity of energy crops allowed during the period
1 August 2022 to 31 December 2023 (17 months) - extended reporting[1])	11.12%
1 January 2024 to 31 December 2024 (12 months)	6.92%
1 January 2025 to 31 December 2025 (12 months)	4.00%

[1] Read more about the extended reporting period in Chapter 10.6 on the content of the reporting for biogas

Energy crops are defined in Annex 1 to the Sustainability Order as:

– Maize (cobs and whole crop)[7])

– Cereals (grains and whole crop)

– Beet (root)

– Grass and clover grass[8]) (whole crop from land in rotation)

– Jerusalem artichokes (root)

However, catch crops are not covered by the limitation. Catch crops are crops grown in the field for the primary purpose of reducing nitrogen leaching from the main crop and until a new main crop is established.

4.2 Compliance with soil quality and soil carbon content requirements

According to Article 29(2) of the Directive, agricultural land waste and residues for energy purposes may only be taken into account as renewable energy if operators or national authorities have monitoring or management plans in place to address impacts on soil quality and soil carbon content.

However, residual wood from agricultural land, such as waste fruit trees, is exempted from this requirement.

4.2.1 Evidence

The company using the biomass shall ensure that there is evidence that monitoring or management plans are in place at national/regional level or at farm or supplier level to address the effects on soil quality and carbon content on the agricultural land from which the waste or residue originates.

In Denmark, the criterion is considered fulfilled if the following four points are met:

1) Plans have been introduced to manage soil carbon content, either in the form of:

– Model data showing that soil carbon content will be stable or increasing in a medium to long-term perspective,

or

– Reference is made to concrete practices that require this, e.g. reduced ploughing or similar, which are more difficult to demonstrate quantitatively.

2) The fertilisation accounts have been reported to the Danish Agricultural Agency.

3) The requirement for crop diversification has been complied with, via reporting in the common form to the Danish Agricultural Agency.

4) The prohibition of field burning of straw has been complied with, in accordance with The Danish Environmental Protection Agency's rules.

The requirement in (1) can be complied with by presenting, for example, field plans in field management systems in which the soil carbon content is monitored. In general, there will be a high degree of methodological freedom to comply with the requirement. Examples of compliance may include a reference to the application of manure and/or the presence of catch crops on the farm. Compliance can also be demonstrated in the form of a projection showing the evolution of soil carbon content over time.

The supplier declares on his honour that all four points have been complied with at farm or supplier level, but may be required to provide evidence in connection with random controls. Random controls are carried out by a verifier (see Section 4.2.2), so evidence must be kept on the farm or by the supplier so that the control can be conducted.

When random controls are carried out, the supplier will be required to submit field plans and receipts for reports to the Danish Agricultural Agency.

4.2.2 Verification

The verifier shall confirm that systems are in place at farm or supplier level that address the effects on soil quality and soil carbon stock referred to in Section

4.2.1, and describe the evidence provided. The role of the verifier depends on whether the evidence consists of a reference to national/regional monitoring or management plans or whether the information needs to be verified at operator level.

4.3 Compliance with biodiversity requirements and requirements for the protection of large carbon stocks

It requires that solid and gaseous biomass fuels produced from biomass obtained from agricultural land shall not be produced from biomass obtained from land with high biodiversity or land with high carbon stocks. This applies to both primary products and agricultural land waste and residues. In individual cases, the biomass may be used, provided that it is demonstrated that the production and/or harvest does not conflict with the nature conservation objective of the area.

Highly biodiverse land is defined in this context as the type of land listed in Section 4.1.1(b)(i–v) that had one of the listed statuses in January 2008 or thereafter, regardless of whether the land has changed status since. In Denmark, these areas will usually be subject to some form of nature protection, e.g. Natura 2000 areas or Section 3 areas, while other legislation may be relevant if the company imports biomass.

In this context, land with large carbon stocks is defined as the types of land listed in Section 4.1.1(c)(i–ii) and (d). Biomass derived from such land that had large carbon stocks in 2008 may not be used in principle if the carbon stock of the land has been declining since 2008. If the land has not changed status since 2008, it is permitted to use biomass from here, which enables the use of harvested biomass in connection with, for example, nature conservation. For peatland, the special requirement is that no biomass may be used from land that was peatland in 2008, unless the cultivation and harvesting of the biomass have not entailed the drainage of previously undrained soil.

4.3.1 Evidence

If the biomass is not certified through an approved voluntary scheme, the company must be able to provide the following evidence:

(a) Evidence of the country of origin of the biomass.

(b) Reference to the relevant laws governing (b), (c) and/or (d) in Section 4.1.1 and reference to the authorities responsible for monitoring and enforcement of these laws.

In Denmark, point (b) above will be complied with automatically, as the operator is assumed to comply with the Nature Conservation Act, the Forest Act, and internationally protected areas, such as Natura 2000 sites, which protect these types of areas in Denmark.

In the absence of (b):

– For biodiversity:

Evidence that the agricultural land in 2008 or later has not had one or more of the listed statuses (i–v) (except for points 1 and 2 below).

1) In cases where the agricultural land has/has had the statuses referred to in point (ii) or (iii)(2) and biomass is used therefrom, evidence must be provided that the production on the land has not interfered with the purpose of nature protection of the land.

2) In cases where the agricultural land has/has had the status referred to in the second subparagraph of point (iv) and (v) and its biomass is used, evidence shall be provided that the harvesting of the biomass on the land is necessary to maintain the status of the land.

– For large carbon stocks:

Evidence that the biomass does not originate from land that had the statuses referred to in point (c)(i–iii) in 2008 and where the land no longer has that status, in the form of:

1) Evidence of the status of the land in January 2008

2) Evidence of the status of the land at the time of harvest for the biomass concerned

Especially for peatland:

1) Evidence of whether the land was drained in January 2008

2) Evidence of whether the land was drained at the time of harvesting for the biomass in question. Where the land has been drained, it shall be further documented that the cultivation and harvesting of the biomass in question is not the cause of the drainage.

The company shall require biomass suppliers to:

– draw up, update, store and provide, at the request of the verifier or the Danish Energy Agency, a list of the farms from which the biomass originates, on the basis of which random controls may be carried out.

provide, on request, evidence from the competent authority that the harvesting of the biomass has not taken place in the nature protection area or does not conflict with the protection objective.

4.3.2 Verification

Where biomass is not certified through a voluntary scheme, the verifier shall confirm that:

1) Evidence for the country of origin of the biomass has been provided.

2) Evidence that the maintenance of land biodiversity and carbon stock is ensured through legislation has been provided. The verifier may do so by comparing information on legislation provided by the company with information on the website of the competent national authority.

In the absence of (2), the verifier shall confirm:

For biodiversity:

– that evidence has been provided that the agricultural land does not have one of the statuses referred to in (i–v); or

– that evidence has been provided that the production or harvesting of the biomass has not interfered with the purpose of nature conservation of the land.

For large carbon stocks:

– that evidence of the status of the land in 2008 and the status of the land at the time of harvest, and compliance with the requirement.

Especially for peatland:

– that evidence was provided as to whether the land was drained in 2008 and at the time of harvest. Where the land has been drained, the verifier shall confirm that this is not due to the cultivation or harvesting of that biomass.

4.4 Compliance with specific requirements to limit energy crops for biogas

As described in the Sustainability Order, companies using energy crops for biogas must report once a year information on the type and weight of biomass used in production in the previous year. If the quantity of energy crops used does not exceed the fixed limit for the use of energy crops, cf. Section 9(2) of the Sustainability Order, the biogas used may continue to receive financial aid if the company is the beneficiary.

4.4.1 Evidence

Compliance with the energy crop limit shall be demonstrated through the following:

– An annual report on the types and quantities of biomass used in biogas production.

– The report shall be certified by the biogas producer.

For the purpose of regular controls, the company shall keep the following information:

– A logbook in which types and quantities of biomass used in biogas production are recorded on an ongoing basis.

4.4.2 Verification

For installations with a capacity of 2 MW (or 200 m3 of methane per hour) or more, the verifier shall establish whether the company's consumption of energy crops has met the requirement of limited use and whether the declared quantities of energy crops used in production are accurate.

5 Sustainability requirements for forest biomass

5.1 Sustainability requirements of the Renewable Energy Directive for biomass fuels from forest biomass

Solid and gaseous biomass fuels and bioliquids produced from forest biomass shall comply with the criteria below in order to minimise the risk of using biomass from unsustainable production. The requirements follow from the Renewable Energy Directive (Article 29(6)).

The sustainability criteria are considered fulfilled if the biomass is certified according to a voluntary scheme approved by the European Commission. However, the verifier or supervisory authority may still request information on compliance with the criteria. The Danish Energy Agency may decide that certain certification schemes may be used for a specified period as proof of compliance with sustainability requirements. The Danish Energy Agency will then publish this on its website.

If the biomass *is not* certified according to an approved voluntary scheme, the criteria described in this Chapter are met.

The requirements can be met through legislation at national level (a-level). If the necessary evidence is not available, management systems at forest sourcing area level shall instead be in place to ensure compliance with the requirements (b-level).

– **a level:** The country where the forest biomass was harvested has enacted national or regional legislation applicable in the harvesting area, along with monitoring and enforcement systems that ensure compliance with the requirement.

– **b level:** There are management systems in place at forest sourcing area level to ensure that the requirement is met.

The following requirements apply:

i. the legality of harvesting operations;

ii. forest regeneration of harvested land;

iii. areas designated by international or national law or by the relevant competent authority as nature protection areas, including wetlands, grassland, heaths and peatlands, are protected in order to preserve biodiversity and prevent habitat destruction;

iv. harvesting is carried out taking into account the maintenance of soil quality and biodiversity in accordance with the principles of sustainable forest management, with the aim of preventing all adverse impacts in such a way that harvesting of stumps and roots, degradation of primary and old-growth forests as defined in the country where the forest is located, or conversion into plantation forests and harvesting on vulnerable soils is avoided, harvesting is carried out in accordance with the maximum thresholds for large-scale clear-cuts as defined in the country where the forest is located and with locally and ecologically appropriate thresholds for the removal of deadwood, and harvesting is carried out in accordance with requirements on the use of harvesting systems that minimise all adverse impacts on soil quality, including soil compaction, and on biodiversity elements and habitats;

With the amendment of the sustainability requirements in 2025, qualitative requirements have been introduced for how biomass from Danish forests must comply with maximum thresholds for large clear-cuts and with local, ecologically appropriate thresholds for the removal of deadwood, cf. Section 12(5–7) of the Sustainability Order.

v. harvesting maintains or enhances the long-term production capacity of the forest.

The amendment of the sustainability requirements in 2025 introduces new requirements for natural areas from which forest biomass may not come (so-called no-go areas), cf. Section 12(1)(6–7) and (3) of the Sustainability Order.

In specific situations, some requirements may be covered by legislation, while others are met through management systems at sourcing area level.

Compliance with the requirement at a-level requires legislation to be in place to ensure that the requirement is met. For all requirements, the legislation must contain monitoring and enforcement obligations and specify a responsible organisation. Monitoring and enforcement systems must include risk-based controls; effective, dissuasive and proportionate sanctions; systems for appealing decisions; and public access to information. For all requirements, there must be no evidence from national or international governmental institutions of significant, systematic, and continued lack of enforcement.

In addition, Implementing Regulation (EU) 2022/2448 of 13 December 2022 on establishing operational guidance on the evidence for demonstrating compliance with the sustainability criteria for forest biomass needs to be taken into account.

5.2 Compliance with the sustainability requirements of the Renewable Energy Directive through legislation (a).

i. Legality of harvesting operations

This criterion is considered to be met when the requirements of the EU Timber Regulation are fulfilled.[9)] The EU Timber Regulation obliges all those who place timber products on the EU market to ensure, through a due diligence system that there is a 'negligible risk' that the timber has been illegally harvested, i.e. in breach of applicable legislation[10)] in the country of origin.

Relevant 'applicable legislation' deals with harvesting rights, forest management, environmental and nature protection including biodiversity, as well as payments and levies. In Denmark, relevant legislation is, for example:

1. The Forest Act on, among other things, protected forests

2. The Nature Protection Act on, among other things, conservations and protected wooded bogs

3. EUTR on trade in timber

4. The Environmental Objectives Act on Natura 2000 areas

5. The Environmental Assessment Act on, e.g., deforestation

When buying timber products produced within the internal market, it is the seller, i.e. *the producer*, who has an obligation to establish a due diligence system. Where timber products imported into the internal market are purchased, it is the *importer* in the first instance who has an obligation to establish a due diligence system.

The due diligence system comprises three steps, which are adapted to the specific conditions in the country of production:

1. Collection of relevant information, such as the legislation and enforcement of the country of origin, including access to harvesting rights, the occurrence of armed conflicts, the rights of indigenous peoples, and the occurrence of corruption.

2. Risk assessment. A systematic review of the supply chain to identify where and, if applicable, how risks of contamination of the supply chain by illegally harvested timber may arise.

3. Risk minimisation. What specific measures has the company taken to ensure that there is a 'negligible risk' that the woody biomass or parts thereof may have

been illegally harvested? If no negligible risk can be established, the company shall refrain from purchasing the biomass.

The due diligence system must be in writing, and its application to all imports and quantities must be documented. The system shall be evaluated at least annually and revised in connection with a change of supplier.

Traders who have not themselves placed the product on the market must document from whom they have purchased the product and to whom it has been sold.

In some cases, the conditions in the country of origin are very complicated, and it can be difficult to rule out the risk of illegal timber with sufficient certainty through one's own information gathering and visits to the country. In such cases, some companies rely on third-party certification, as certification companies often have first-hand knowledge of local conditions. However, certification is not automatically recognised as complying with the company's due diligence obligation. The company must thus document an independent assessment of the certification body's information.

The Danish Environmental Protection Agency is the competent authority for the EU Timber Regulation in Denmark.[13)]

ii Restoration

The requirement for restoration, including, for example, natural restoration, of harvested forest land is considered to be met at a-level if the restoration (regeneration) of harvested forest land is ensured by legislation in the country of origin. The laws in force must aim at the establishment of a new forest in the same area within 10 years of harvesting through natural or artificial regeneration or a combination. The legislation must ensure that the land is not transferred to another use and that primary forest is not converted into plantation. The legislation of the country of origin shall apply to all forests in the country or the entire relevant forest sourcing area.

iii Protection of designated natural areas

The requirement is considered fulfilled at a-level if there are nationally or internationally designated nature protection areas and legislation that protects these areas. The requirement is also met if the sourcing area neither contains nor borders nationally or internationally designated nature protection areas.

iv. The harvesting takes into account the maintenance of soil quality and biodiversity

The requirement is deemed to be met at a-level if there is legislation in the country of origin that regulates at the appropriate level the maintenance of soil quality and biodiversity. The laws must regulate when and how harvesting may be carried out in the interests of soil quality and biodiversity.

v. The harvesting maintains or improves the long-term production capacity of forests

The requirement is considered fulfilled at a-level when there are laws in the country of origin stipulating that harvesting must take place in such a way that the long-term production capacity of the forest is maintained or improved, and that these laws apply in the forest sourcing area.

Relevant laws may, for example, contain rules stipulating that

- harvesting must not exceed growth, unless this is due to documented disease, storm damage, or other external events.

- management shall prevent nutrient losses, for example by leaving needles and leaves in the forest.

5.2.1 Evidence

The company shall describe the country of origin, where applicable, the sub-national region where the biomass was harvested, including the forest sourcing area, and be able to provide the following evidence:

– Evidence that the entire biomass is certified according to approved voluntary schemes.

Alternatively, the company must be able to provide the following evidence:

– Evidence of the risk assessment or due diligence system which provides a ‘negligible risk’ of illegal timber.

– Indication on maps whether nature protection areas exist in, or are adjacent to, the forest sourcing area (i and iv)

– Reference to the relevant laws governing the requirements and reference to the authorities responsible for their monitoring and enforcement.

– An assessment of the extent to which the legislation ensures that the requirements are met and that the country of origin enforces the applicable rules. If the assessment reveals a risk of non-compliance or non-enforcement, the operator shall comply with the relevant requirement at forest sourcing area level (b).

Potential information sources:

– UN-FAO FAOLEX database of forest laws

– Transparency International PCI, Rule of Law

– Fragile States Index

– Preferred by Nature sourcing hub

– International Union for Conservation of Nature (IUCN) database

– World Database on Protected Areas (WDPA)

– UNEP-WCMC Country Overviews

– UNEP-WCMC briefing notes on EUTR implementation

– TREE (Timber Regulation Enforcement Exchange)

– NGO reports from WWF, EIA, Earthsight

– Commission Expert Group/Multi-Stakeholder Platform on Protecting and Restoring the World's Forests, including the EU Timber Regulation and the FLEGT Regulation (E03282)

– Websites of the relevant national authorities

5.2.2 Verification

If the entire biomass is certified according to approved voluntary schemes, the verifier shall not verify that the above requirements are met, but shall only confirm that the entire biomass is certified under approved schemes[15)]. If this is not the case, the verifier shall follow the guidelines below.

The verifier shall examine whether evidence regarding country of origin, region, and forest sourcing area, if any, is available, and whether the forest sourcing area is well-defined and mapped. The verifier shall also assess whether the forest sourcing area meets the requirements that reliable and independent information is available for the area and that the conditions are sufficiently homogeneous to assess the risk associated with the sustainability and legality characteristics of the forest biomass.

The verifier shall check whether the requirements are met either through national laws and enforcement (a) or through systems at forest sourcing area level (b).

For (a), the verifier shall verify that:

– evidence of the legality of harvesting operations has been provided (cf. 5.2.1);

– the laws referred to apply in the forest sourcing area;

– nature protection areas in – and adjacent to – the forest sourcing area are correctly indicated on maps;

– the laws contain provisions ensuring that the requirement in question is met;

– the responsible enforcement authorities are correctly indicated and comprehensive;

– there is an assessment which makes it probable that the legislation ensures a low risk of non-compliance

The verifier shall also confirm that there is no evidence of non-enforcement of any of the above laws by national or international governmental institutions.

In the course of its control, the verifier may compare information on legislation provided by the company with information from the above sources and on the website of the competent national authority.

5.3 Compliance at forest sourcing area level (b)

The company shall describe the country of origin and, where applicable, the sub-national region where the biomass was harvested, as well as the geographical boundaries of the forest sourcing area.

Approved voluntary schemes may be recognised as evidence that the requirements are met. Alternative evidence may also be recognised if it demonstrates that the criteria are met, as described below.

Compliance with the sustainability requirements at b-level requires that the relevant companies have management systems that:

– are able to demonstrate that all requirements are met;

– are used to collect, verify, assess and store data;

– are accurate, reliable and fraud-proof;

– contain references to the sources of information used.

Operators shall provide accurate, up-to-date and verifiable evidence of the following elements:

<u>i.</u> <u>Legality of harvesting operations</u>

The EU Timber Regulation must be complied with, cf. Section 5.2 above.

<u>ii Restoration</u>

The requirement for restoration, including, for example, natural regeneration, of harvested land means that the land must not be used for other purposes. The requirement must be met for the harvested land itself and cannot be met via ‘substitute land’ elsewhere. At b-level, the requirement can be considered fulfilled when a management system at forest sourcing area level ensures that the land is regenerated with forest within 10 years after the previous forest stand has been

removed. For example, the management system may ensure that restoration is included as a condition in relevant supplier contracts, including follow-up monitoring. The requirement can also be considered fulfilled if the forest is certified according to a forest certification scheme that ensures restoration. Restoration may be waived if it can be demonstrated that the land has been cleared for biodiversity reasons.

iii Protection of designated natural areas

The requirement can be considered fulfilled at b-level when a management system at forest sourcing area level ensures that the biomass does not originate from designated nature protection areas or that there is evidence that the harvest in the nature protection area does not conflict with the protection objective in the form of a declaration or order from the competent authority.

iv. The harvesting takes into account the maintenance of soil quality and biodiversity

The requirement can be considered fulfilled at b-level when a management system at forest sourcing area level ensures that risks of adverse impacts on soil quality and biodiversity are accounted for, as far as possible based on a risk assessment carried out by an independent party, and that measures have been taken to minimise these adverse impacts. The report shall indicate vulnerable areas and justify any harvesting in these areas. It must also demonstrate that stumps and roots are not removed. Measures taken to avoid adverse impacts may be those following Best Management Practises or those set out in relevant national forest standards, such as:

– no deep ploughing being carried out;

– harvesting being carried out using methods that protect the soil;

– harvesting taking place in late summer, when the soil is dry, or in winter, when the soil is frozen;

– the application of harvesting practices preventing erosion;

– harvesting taking place outside the breeding season or at a certain distance from breeding sites, in order not to harm breeding species;

– leaving life trees untouched;

– maintaining or building up a certain level of dead wood;

– no drainage taking place;

– no pesticides being used.

v. The harvesting maintains or improves the long-term production capacity of forests

The requirement can be considered fulfilled at b-level when a management system at the forest sourcing area level ensures that harvesting does not exceed the average annual growth of the forests in the sourcing area within the 10-year period leading up to the harvesting operation, unless other quantities are duly justified to improve the future production capacity of the forest or due to documented pests, storms, or other natural disturbances.

5.3.1 Evidence

The operator must be able to document that the entire biomass is certified according to approved voluntary schemes.

Alternatively, the operator shall:

– ensure that there is a description and evidence of the existence of a management system at forest area level that ensures compliance with the above requirements;

– ensure that there is a description of relevant risks of the forest management, harvesting methods, and considerations specifically taken into account in the forest sourcing area;

– ensure that there is an indication of whether forest sourcing areas contain or border nature protection areas, documented by satellite photos or maps;

– ensure that the biomass producer draws up, updates, stores, and provides, at the request of the verifier or the supervisory authority, a list of harvested land with associated satellite or orthophotos before and after, on the basis of which random controls can subsequently be carried out in relation to restoration and other requirements;

– ensure that biomass producers can provide evidence, on request, that harvesting forest biomass in a nature protection area is not contrary to the protection objective. This may be in the form of a declaration or order from the competent authority or a management plan for a Natura 2000 area stating that an area must be free of the tree growth in question.

– ensure that the biomass producer can, on request, provide evidence if reference is made to illness, windfall, or other external events, or consideration is given to age-class distribution or natural values.

Potential information sources:

– Management plans

– Work orders

– Harvesting protocols

– Harvesting permits, for example, time-bound harvesting permits above growth levels to even out the age-class distribution in forests.

– Map

- Satellite or orthophotos

5.3.2 Verification

Where the entire biomass is certified according to an approved voluntary scheme, the verifier may only confirm that the entire biomass is certified under such a scheme. If this is not the case, the verifier shall follow the guidelines below for the part of the biomass not certified according to a voluntary scheme.

The verifier shall examine whether evidence of country of origin and forest sourcing area exists and whether the forest sourcing area is well defined and mapped. The verifier shall also assess whether the forest sourcing area meets the requirements that reliable and independent information is available for the area and that the conditions are sufficiently homogeneous to assess the risk associated with the sustainability and legality characteristics of the forest biomass.

The verifier shall check whether the requirements are met either through national laws (a) or through systems at forest sourcing area level (b).

For b, the verifier shall confirm that a description and evidence of the existence of a management system ensuring compliance with the requirements have been provided and shall verify that:

– the forest sourcing area level management systems referred to ensure compliance with the requirement in question;

– nature protection areas in the forest sourcing area, and bordering the sourcing area, are correctly identified and documented by satellite, orthophotos, or maps;

– evidence can be provided that harvesting does not contravene the protection objective if the forest biomass originates in whole or in part from nature protection areas or has been cleared for biodiversity reasons. Evidence may be a statement from the responsible authority or a written opinion from an independent expert.

The verifier shall compare the biomass producer’s declarations and photos of whether the forest sourcing area contains designated natural areas with information on this on the website of the competent national authority, in the International Union for Conservation of Nature (IUCN) database or in the World Database on Protected Areas (WDPA). Where applicable, the verifier shall also confirm that the management system ensures that there is evidence proving that the harvesting does not conflict with the protective purpose.

Unapproved certification schemes may only be used as evidence of requirements if the verifier confirms that the actual standard applicable in the forest sourcing area and the related control system provide sufficient evidence of compliance with the relevant requirement.

5.4 Additional requirements for forest biomass concerning the protection of valuable areas and specific species (

Repealed)5.5 The Renewable Energy Directive's sustainability requirements for land use and LULUCF

Where the entire biomass is certified according to an approved voluntary scheme, the verifier may only confirm that the entire biomass is certified under such a scheme. If this is not the case, the verifier shall follow the guidelines in this Section 5.5 for the part of the biomass that is not certified according to a voluntary scheme.

Article 29(7) of the Renewable Energy Directive on solid and gaseous biomass fuels produced from forest biomass sets out the following criteria regarding land use, land use change and LULUCF:

(a) the country or regional economic integration organisation of origin of the forest biomass is a Party to the Paris Agreement and:

(i) it has submitted a nationally determined contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC), covering emissions and removals from agriculture, forestry and land use which ensures that changes in carbon stock associated with biomass harvest are included in the country's commitment to reduce or limit greenhouse gas emissions as specified in the NDC; or

(ii) it has national or sub-national laws in place, in accordance with Article 5 of the Paris Agreement, applicable in the area of harvest, to conserve and enhance carbon stocks and sinks, and provides evidence that reported LULUCF-sector emissions do not exceed removals;

(b) where evidence referred to in point (a) of this paragraph is not available, management systems shall be place at forest sourcing area level to ensure that carbon stocks and sinks levels in the forest are maintained, or strengthened over the long term.

In addition, Implementing Regulation (EU) 2022/2448 of 13 December 2022 on establishing operational guidance on the evidence for demonstrating compliance with the sustainability criteria for forest biomass needs to be taken into account.

5.5.1 Compliance with land use and LULUCF requirements at national level (a):

<u>Party to the Paris Agreement</u>

In order to meet the criteria of the Renewable Energy Directive on land use, land use change and forestry (LULUCF) at the a-level, the country of origin or regional economic integration organisation must be a party to the Paris Agreement. Whether this is the case is reflected in the UN list of parties to the Paris Agreement[26]. If this page does not indicate that the country of origin is a signatory to the Paris Agreement, the criterion at a-level is not met.

NDC, which includes LULUCF (i)

Criteria a–ii that the country of origin must have submitted a nationally determined contribution (NDC) to the UN Framework Convention on Climate Change, covering emissions and removals in agriculture, forestry and land use, can be verified via the UN NDC registry[27]. This shows whether the country has submitted an NDC. Whether the NDC includes emissions and removals in agriculture, forestry and land use is stated in the text of the NDC.

NDCs can be designed in many ways. It is not sufficient that the LULUCF or AFOLU[28] sector is mentioned in the NDC, or that it is stated that the NDC covers ‘all sectors’. If the criterion is to be met, the NDC must explicitly explain how the LULUCF sector is included in the reduction commitment and that its emissions and carbon sinks are included in relation to the country’s overall reduction target.

Laws on conserving and enhancing carbon stocks and sinks and net LULUCF removals (ii)

Criteria a–ii that the country of origin has national or regional laws in place in accordance with Article 5 of the Paris Agreement to conserve and enhance carbon stocks and sinks, are met if the country has laws specifically designed to conserve and enhance forest carbon stocks and sinks, if the laws contain relevant actions, and if a responsible and credible organisation for monitoring and enforcement is in place.

Criteria a–ii also require evidence that reported emissions from the LULUCF sector do not exceed removals. In some cases, this documentation can be found on the UN website[29], where country-specific LULUCF data can be retrieved via "flexible queries". Table 5.1 below provides an overview of the last 10 years of LULUCF emissions for Denmark, as well as the average for the last 5 and 10 years.

The criterion that reported emissions from the LULUCF sector do not exceed removals shall be considered fulfilled if the average emission over the last 10 years is negative. Negative emissions here correspond to removals. As can be seen from Table 5.1, Denmark does not fulfil this criterion as it has a positive average emission from the LULUCF sector over the last 10 years.

Query results for — Party: Denmark | Category: 4. Land Use, Land-Use Change and Forestry |

Classification: Total for category | Type of value: Net emissions/removals | Gas: Aggregate GHGs | Unit: kt CO_2 equivalent

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Party \ Unit	kt CO_2 e	kt CO_2 e	kt CO_2 e	kt CO_2 e	kt CO_2 e	kt CO_2 e	kt CO_2 e	kt CO_2 e	kt CO_2 e	kt CO_2 e	kt CO_2 e
Denmark	2.254,89	-2.354,48	1.955,15	-1.016,24	-2.619,51	-734,62	394,39	66,22	3.633,39	4.503,44	2.971,78

Note 1: The reporting and review requirements for GHG inventories are different for Annex I and non-Annex I Parties.
Note 2: Base year data in the data interface relate to the base year under the Climate Change Convention (UNFCCC).
Note 3: – means "No data available"
Note 4: Data displayed on the data interface are "as received" from Parties.

	kt CO_2 e
10 års gennemsnit	905,4416
5 års gennemsnit	2313,845

Source: UNFCCC GHG Data Interface

Report produced on Wednesday, 3 June 2020, 12:47:02 CEST

Table 5.1: Denmark's net CO_2 emissions in the last 10 years from the LULUCF sector.

Not all countries account for emissions from the LULUCF sector. Instead, some account for emissions from the AFOLU sector, which includes the LULUCF sector. Some do not report their emissions in such a way that they can be searched through 'flexible queries'. In this case, data may be available in the national greenhouse gas inventories of the countries concerned. These can be found on the UNFCCC website[30)] under 'Reporting and review under the Convention', where you can choose from:

– National Communications and Biennial Update Reports - non-Annex I Parties

– National Communications and Biennial Reports - Annex I Parties

– Greenhouse Gas Inventories - Annex I Parties

If the data mentioned above cannot be found, criterion a–ii cannot be considered fulfilled.

5.5.2 Evidence

Companies shall provide the following evidence:

For i:

- link to the relevant NDC on the UN website;

- description of where in the NDC it is indicated how LULUCF sector is included in the reduction commitment and that the emissions and carbon sinks of that sector are included in relation to the country's overall reduction target.

For ii:

- reference/link to the national or regional laws specifically aimed at conserving and enhancing forest carbon stocks and sinks; and

- reference to the responsible monitoring and enforcement organisation, as well as reference/link to evidence that reported emissions from the LULUCF sector do not exceed removals (10-year average).

5.5.3 Verification

If the entire biomass is certified by one or more voluntary schemes, the verifier may consider that the requirements to be a party to the Paris Agreement, as well as a–i or a–ii resulting directly from the Renewable Energy Directive, have been demonstrated to be met. In this case, the verifier shall only confirm that the entire biomass is covered by approved voluntary schemes.

Alternatively, the verifier shall confirm:

– That the country of origin is a party to the Paris Agreement and is on the UN list.

– For i: that the country of origin has an NDC containing the LULUCF sector and that it explains how the LULUCF sector is included in relation to the country's reduction targets.

– For ii: evidence exists of national or regional laws specifically aimed at conserving and enhancing forest carbon stocks and sinks, of a responsible monitoring and enforcement organisation, and that reported emissions from the LULUCF sector do not exceed removals.

The verifier shall describe in its verification report the basis for the confirmation.

5.5.4 Compliance with land use and LULUCF requirements at forest sourcing area level (b)

Where land use and LULUCF criteria cannot be met at national level (a), they can instead be met if 'management systems are in place at forest sourcing area level to ensure that carbon stocks and sinks levels in the forest are maintained, or strengthened over the long term'.

A company may meet this requirement by adapting existing methods to assess the evolution of forest carbon stock and removals, such as those developed in the context of the LULUCF regulation, and applying them to its forest sourcing area. This requires that the company

1. Defines the sourcing area.

2. Defines all relevant carbon stocks, i.e. above ground, below ground, deadwood, forest floor and soil carbon.

3. Defines a historical reference period, e.g. 2000–2009.

4. Describes forest management practices during the reference period.

5. Quantifies carbon stocks and carbon removals in the forest sourcing area during the reference period.

6. Defines the time period for 'long term'.

7. Describes management practices in the forest sourcing area during this long-term time period.

8. Quantifies the development of forest carbon stocks and removals over the long-term period.

9. Compares the average forest carbon stock and removals in the future period with the average forest carbon stock and removals in the reference period.

If the average forest carbon stock and removals in the future long-term period is equal to or greater than the average forest carbon stock and removals in the reference period, the requirement is fulfilled.

The company shall also ensure that forests are subject to appropriate management plans that ensure the expected development of forest carbon stocks and sinks takes place.

5.5.5 Evidence

As evidence of compliance with the requirement to maintain the level of carbon stocks and sinks in the long term, the operator shall be able to provide the material prepared pursuant to points 1–9 above. The operator shall also describe the management plans to which the forests are subject and which ensure that the described development in carbon stocks and sinks will take place.

5.5.6 Verification

At least one random check shall be performed per country of origin.

If that is not the case, the verifier shall confirm that the above evidence for compliance with requirement b is provided.

5.6 Extra climate requirements on forest biomass for maintaining carbon stocks

Solid and gaseous biomass fuels produced from forest biomass, regardless of country of origin, shall meet the extra climate requirement. Accordingly, it shall be documented, either for (i) the country of origin or (ii) the forest sourcing area, that the carbon stock of the forest is not going into decline in the short and medium term. Alternatively, the forests in the sourcing area shall be forest certified, or only forestry residues may be used.

5.6.1 Compliance with the extra climate requirement on forest biomass

The extra climate requirement can thus be met in one of three ways:

a) Documentation for either the country of origin or the forest sourcing area that the carbon stock of the forest is not in decline.

b) The forests in the sourcing area are forest certified.

a) The carbon stock of the forest is not in decline

There are two forms of documentation that can be used to show that the carbon stock of the forest is not in decline in the country of origin or the forest sourcing area:

– an inventory of forest statistics on the trending quantity of carbon of the standing volume and of any deadwood, showing that the carbon stock of the forest is not in decline;

– evidence that LULUCF emissions from the *forestry sector (category 4A)* in the country of origin do not exceed removal.

Forest statistics

The evidence can be national or regional forest statistics or forest statistics for the forest sourcing area compiled by an independent expert and showing that the carbon content of the standing volume (living trees above ground) and of any deadwood in the most recent 5-year period up to the most recent year of statistics year has not declined in relation to the average forest carbon stock in the previous 5-year period or in relation to the period of 2015–2020. The minimum necessary is that the statistics contain data for the *living biomass above ground* (standing volume), though the quantity of deadwood may also be included if reliable data is available.

LULUCF emissions

The requirement is considered to be met if the average net emissions from the forestry sector (LULUCF category 4A in reports of national greenhouse gas emissions to the UN Framework Convention on Climate Change) seen over the last 10 years are 0 or negative.

b) The forests in the forest sourcing area are forest certified

The extra climate requirement can also be met by the forests from which the forest biomass originate being forest certified by FSC Forest Management, PEFC Forest Management, or equivalent forest certification system approved by the Danish Energy Agency that includes requirements for the long-term management of the forest, which directly or indirectly maintains or increases the carbon stock of the forest and which the forest owner has committed to meeting.

5.6.2 Evidence

That the carbon stock of the forest is not in decline

The company shall be able to present forest statistics which show that the forest carbon stock in the living biomass and in any deadwood is not in decline (cf. above).

National forest statistics are available on the FAO website: fra-data.fao.org.

For countries with an area of more than 1.5 million km^2, the statistics used must be at most at the regional level, equivalent to a state in the United States. Forest statistics for the whole of the USA or Russia cannot be used as documentation. Countries larger than 1.5 million km^2 are, for example, Russia, Canada, the United States, Brazil, Australia, the Democratic Republic of the Congo, and Indonesia.

It is possible to present forest statistics for the forest sourcing area instead of national forest statistics. In such case, the statistics shall have been compiled by an independent expert.

LULUCF emissions from the *forestry sector* can be found on the UNFCCC website under ‘flexible queries’ (category 4 A, ‘total per category’ or ‘carbon stock above ground’, net emissions/removals, aggregate GHG, CO_2e) for Annex 1 countries or in the national greenhouse gas inventories for Annex 2 countries.

That the forests in the forest sourcing area are forest certified

The requirement can be documented as met through a chain of custody certificate which confirms that the forests in the forest sourcing area are certified by FSC Forest Management, PEFC Forest Management, or equivalent forest certification system. Such precludes the use of mix systems in the supply chain. SBP is in itself insufficient as evidence, as it does not certify the forest owners, but rather the biomass producers, who do not in all cases have a decisive influence on the management of the forests in the long term.

5.6.3 Verification

The verifier shall confirm that the forest carbon stock is not in decline and describe the documentation presented to that effect.

Alternatively, the verifier shall confirm that the forest biomass originates from forest-certified forests and indicate the supporting documentation.

5.7. Extra requirement for third-party verification of forest biomass

Solid and gaseous biomass fuels produced from forest biomass shall meet an extra requirement for third-party verification up to the first gathering point of the biomass. The Renewable Energy Directive does not require this in all cases and it is therefore not necessarily controlled under the voluntary schemes approved by the EU.

The requirement means that the verifier shall check that the biomass gathered at the first gathering point comes from the declared forest sourcing area and that it is of the declared biomass type, e.g. forestry residues or stemwood.

The verifier can do this by periodically visiting the relevant gathering points or obtaining other documentation of which biomass is being gathered.

This requirement is met if the wood comes from a forest that is certified according to PEFC Forest Management or FSC Forest Management and has a subsequent chain of custody certificate in all stages, or if the wood is SBP certified.

5.8 Requirements for sustainable cascading use of woody biomass

The amendment of the sustainability requirements in 2025 introduces a new requirement for sustainable cascading use of woody biomass, including forest biomass, cf. Section 16 of the Sustainability Order.

6 Requirements for non-forest wood

As of 1 January 2022 and onward, solid and gaseous biomass fuels produced from biomass from non-forest wood, e.g. hedges and other small wooded land in rural areas, shall meet the requirements on

– restoration and

– risk assessment and risk minimisation in relation to nature values.

Non-forest wood shall also meet requirements on evidence of biomass type and geographical origin as described in Chapter 10 and requirements on greenhouse gas emissions saving as described in Chapter 9.

The amendment of the sustainability requirements in 2025 introduces a new requirement for sustainable cascading use of woody biomass, including non-forest wood, cf. Section 16 of the Sustainability Order.

6.1.1 Compliance

The restoration requirement is deemed to be met if only pruning, including coppicing and thinning, is carried out, or if bushes or trees are actively replanted. The restoration requirement may be waived if there is a written assessment showing that permanent clear-cutting of the stands favours nature and biodiversity better than restoration, or if there is evidence that similar hedges or other small stands of equal or greater biodiversity scale and value are established elsewhere. Naturally regenerated forest is not sufficient to meet the restoration requirement for wood from areas outside forests (non-forest).

Requirements for risk assessment and risk minimisation in relation to natural values are considered to be fulfilled if a management system at sourcing area level ensures that, before harvesting, the area was:

1. examined in the field by a qualified person, who examines whether the harvesting area contains high biodiversity, suitable habitats for, or known occurrences of, particular animal, plant or fungal species, cultural heritage, landscape or other values;

2. the examination shall be documented in maps and guidance documents used by relevant parties, ensuring that the identified values are protected.

The assessment shall use appropriate methods, e.g. the HCV concept (High Conservation Value), or equivalent (cf. the information sources below). If possible, the assessment shall be based on existing maps of HCV areas.

'Particular species' are species that appear in the Danish Red List of Danish plant, animal, and fungal species that have been assessed as being at risk of extinction, and similar lists in other countries. These red list species are Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) according to the red list categories[31)].

In the case of harvesting areas of types where, without a field review, it can be established with a high degree of certainty that they will not contain high biodiversity or other values mentioned above, this may be justified in writing and the field review may be omitted. Potential information sources:

For Denmark:

– Key Biotopes in Forests[32)].

– Key to Determining Naturally Particularly Valuable Forest.[33)]

– Catalogue of Tree Microhabitats.[34)]

– Red List.[35)]

– Arter.dk.

– The Species Conservation Order.[36)]

– Biodiversity Map (www.biodiversitetskortet.dk).

– Miljøportalen (the environmental portal).

– Land registration information.

International.

– Guide for National Interpretations of High Conservation Values[37]. HCV Resource Network, 2019.

– Forestry and our cultural heritage.[38]

6.1.2 Evidence

There shall be a description of what has been done to identify particularly sensitive or valuable areas or species and how they have been protected in connection with the harvesting of biomass. It may also be a description of how systems at the level of sourcing area ensure that the requirement is met. If requested by the verifier or supervisory authority, it shall be possible to provide them with the name and education of the expert engaged, as well as the maps and specifications that have been prepared.

Certification systems may in certain cases be recognised as documentation that the requirement has been fulfilled if they explicitly contain requirements for the protection of nature values in non-forest areas.

6.1.3 Verification

The verifier shall confirm in its report that the criterion is met and describe the evidence on which the verifier has based its confirmation. Where certification is included, the verifier shall indicate which requirements, criteria and indicators in the certification system are assessed to ensure compliance with the requirement.

The verifier shall perform random controls of the above and in that connection request documentation for certification (cf. above) or names of experts as well as maps and specifications, etc. At least one random control shall be performed per country of origin. In their verification report, the verifier shall describe the results of the random controls and indicate the proportion of deliveries that are covered by the random controls.

7 Requirements on wood industry residues

Solid and gaseous biomass fuels produced from wood industry residues, e.g. sawdust, cuttings, shavings, etc., must meet the sustainability requirements laid down in the Renewable Energy Directive for forestry biomass, including the requirement for sustainable cascading use of woody biomass. Wood industry residues must also comply with greenhouse gas saving requirements and reporting requirements, etc. The requirements are set out in Table 3.1. For each covered company, a minimum of 90% of the quantity of wood industry residues used in the year in question must meet these requirements. That 90% is calculated on the basis of energy content.

The sustainability requirements are set out in Sections 5.1, 5.2, 5.3, 5.5 and 5.8. Greenhouse gas emissions saving requirements are met as described in Chapter 9 on greenhouse gas emissions saving. The requirement for documentation of biomass type and geographical origin is met as described in Chapter 10. For wood

industry residues, the requirement to indicate the geographical origin is limited to the country of origin, regardless of the size of the country.

Compliance with the requirements means that the wood industry shall know the country of origin of the wood that is procured and further processed, and stipulate requirements to its suppliers to meet the sustainability and documentation requirements.

8 Requirements for waste and residues from other production, municipal solid waste and wood waste

For biomass from the category of waste and residues from other production (other than forestry, agriculture and wood industry), the company must comply with the requirement to report information on geographical origin, type of biomass and quantity, etc. If an installation using 'Waste and residues from other production' is operational on or after 1 January 2021, the company must further comply with greenhouse gas emissions saving requirements. There is also a requirement for verification by a qualified third party or certification of the installation under an approved voluntary scheme. 'Waste and residues from other production' includes, inter alia, residues from animal husbandry, such as manure and deep litter, sewage sludge and residues from fisheries and aquaculture.

For biomass from the municipal solid waste category, such as biodegradable kitchen waste, the company shall only comply with requirements to report information on geographical origin, biomass type and quantity, as well as requirements for verification by a qualified third party or certification of the installation under an approved voluntary scheme.

For biomass from the category wood waste, such as wood from gardens and parks, etc., the company must meet requirements for reporting information on geographical origin, biomass type and quantity, as well as requirements for verification by a qualified third party.

Greenhouse gas emissions saving requirements are met as described in Chapter 9. Reporting requirements for biomass type and geographical origin, as well as verification requirements, are met as described in Chapter 10.

9 Greenhouse gas emission saving requirements

According to Article 29(10) of the Renewable Energy Directive, the greenhouse gas emissions savings from the use of biomass fuels must meet minimum requirements. The greenhouse gas emissions saving for biomass fuels is determined on the basis of default values or through a calculation method described in Annex IV to the Directive (see Annexes A to D to this Handbook), and the percentage greenhouse gas saving is calculated against a fossil reference set out in the Directive.

9.1 Greenhouse gas emissions savings requirements

A company that uses solid or gaseous biomass fuels produced from agricultural biomass and waste and residues from other production in installations for the production of electricity, heating, or that produces upgraded biogas, purified biogas or gasification gas from agricultural biomass, as well as waste and residues from other production, must meet the greenhouse gas emissions savings in relation to the EU fossil reference set out in Section 21 of the Sustainability Order.

There are special Danish requirements for installations using woody biomass, cf. Section 22 of the Sustainability Order.

A company that uses bioliquids for the production of electricity, heating or cooling, regardless of installation size, must meet the greenhouse gas savings requirements set out in Section 23 of the Sustainability Order.

The saving is calculated for each installation on an annual basis in relation to the EU fossil reference as specified in the Renewable Energy Directive. The fossil emission factors are set out in point 19 of Annex B but will normally be 183 grams CO_2e/MJ for electricity production and 80 grams CO_2e/MJ for heat. The calculation shall be as described in Section 9.2.

9.2 Calculation of greenhouse gas emissions savings

The greenhouse gas emissions saving from the use of biomass fuels used in installations producing biomass for heating, cooling and electricity shall be calculated in accordance with Article 31(1) of the Renewable Energy Directive.

The biomass referred to in Chapter 3 shall be subject to the requirements and shall thus be included in the calculation of the greenhouse gas emissions savings. It should be noted that the use of wood waste and municipal solid waste in the form of, for example, residual waste from households or garden/park waste is not covered by the greenhouse gas saving requirements; therefore, biomass of this category should not be included in the calculations.

The greenhouse gas emissions saving for solid and gaseous biomass fuels shall be calculated using one of the three methods described in Table 9.1. Each method is described in more detail in the following sections as well as in the annexes to this Handbook. Note that instead of the calculation of actual values (Method 2), the Biograce II programme may be used (see Chapter 9.2.4). Other programs may also be used if they follow the calculation methods described.

Table 9.1 Methods for calculating greenhouse gas emissions saving

	Method 1: Default values	**Method 2: Actual values**	**Method 3: Sum of factors**
Description	Default values shall be used for greenhouse gas emissions savings	Actual values for greenhouse gas emissions saving can be calculated using four different	The greenhouse gas emissions saving shall be calculated as the sum of the factors involved in the

		methods (a–d) which include inputs such as emissions, emissions savings, share of feedstock used, water content, energy yield, etc.	calculation of actual values (Method 2), where disaggregated default values (Part C) may be used for some factors.
Prerequisites for the application of the method	1. The annual emissions from changes in the carbon stock of the land concerned due to land use changes shall be equal to or less than zero compared to the 2008 reference. 2. The raw materials listed in Section 9.2.1 (Table 9.2) are used in production. 3. The transport distance of the fuel, raw materials, and semi-finished products used is known. 4. For fuels processed using energy: The source of process heat and/or electricity used for the production of the fuel is known. 5. For biogas/upgraded biogas: there is knowledge of whether the post-storage tank is open or closed, as well as which upgrading technology is used if the gas is upgraded.	1. All relevant information on inputs (see Table 9.3) for the calculation is available.	*For factors calculated using Method 2:* 1. All relevant information on the input to the calculation is available (see necessary *inputs* to the calculation methods under Section 9.2.2 in Table 9.3). *For disaggregated default values:* 2. The raw materials listed in Section 9.2.3 (Table 9.4) are used in the production 3. The transport distance of the fuel, raw materials, and semi-finished products used is known. 4. For fuels processed during energy consumption: the source of process heat and/or electricity used for the production of the fuel is known. 5. For biogas/upgraded biogas: there is knowledge of whether the post-storage tank is open or closed, as well as which upgrading technology is used if the gas is upgraded.
See the annexes to the Handbook:	Annex A	Annex B (Values from Annex C and Annex D may be used in some cases)	Annex B and Annex C
The VE Directive	Annex VI, Part A	Annex VI, Part B and Part D	Annex VI, Part B, point 1, and Part C

9.2.1 Method 1: Default values

For *Method 1*, default values for greenhouse gas emissions savings for a given production pathway, as set out in Annex A, shall be used.

Method 1 may be applied in situations where the annual emissions from changes in carbon stocks due to land use changes of the land concerned since 2008 are equal to or less than zero. The default value can therefore only be used if the land's carbon stock above and in the soil has remained unchanged or increased since 2008. For example, the carbon stock is unchanged if the land use is the same as in 2008. It shall be possible to provide reliable and verifiable evidence of the unchanged land use or of the evolution of the carbon stock on the land. The method of calculation is set out in point 7 of Annex B.

In order to be able to use the default values, the biomass fuel in question must be produced from one or more of the biomasses listed in Table 9.2. If energy, in the form of process heat and/or electricity, has been used to process the fuel, its source must be known. In addition, the transport distance of the fuel, semi-finished products and raw materials used must be known. For biogas and upgraded biogas, it may also be necessary to have knowledge of whether the biogas installation's post-storage tank is open or closed, as well as of the type of upgrade technology (with/without off-gas combustion) in the case of upgraded biogas (see Table 9.2).

Table 9.2 Prerequisites for the use of default values under Method 1[39)]

Biofuel		**Woody biomass**		**Agricultural biomass for electricity and heating**	**Biogas**	**Upgraded biogas (biomethane)**
Biomass used in energy production		Wood chips from Forestry residues Stemwood Wood industry residues	Wood briquettes/pellets from Forestry residues Stemwood Wood industry residues	Agricultural residues Straw pellets Bagasse briquettes Palm kernel meal Short rotation coppice (=Energy wood from agricultural land for a maximum of 10 years rotation or coppicing interval)	Manure Corn Biowaste	Manure Corn Biowaste
Necessary knowledge of	Source of process heat and/or electricity	No	Yes	No	Yes	No
	Transport distance	Yes	Yes	Yes	No	No
	Post-storage tank (open or closed)	-	-	-	Yes	Yes
	Type of upgrade	-	-	-	-	Yes

	technology					

If the biomass used is shown in Table 9.2 and if the necessary knowledge about the biomass fuel is available, the default values for greenhouse gas emissions savings as specified in Part A of Annex VI to the Renewable Energy Directive may be used. These default values can be found in Annex A to the Handbook. Default values for greenhouse gas emissions savings.

9.2.2 Method 2: Actual values

The formulas set out in *Method 2* in Annex B shall be used to calculate actual values for greenhouse gas emissions saving. First, the greenhouse gas emissions are calculated, and then the saving. Alternatively, the Biograce II programme (see Section 9.2.4) or similar tools may be used to perform the calculation.

Calculation of greenhouse gas emissions

Annex B, point 1, lists four (a–d) methods that can be used for the calculation of greenhouse gas emissions for respectively:

(a) the production and use of biomass fuels before conversion to electricity, heating or cooling;

(b) the co-digestion of different substrates in a biogas installation into biogas or biomethane;

(c) the co-digestion of different substrates in a biogas installation into electricity or biomethane;

(d) the production and use of biomass fuels, including conversion to electricity, heating or cooling;

Table 9.3 provides an overview of these methods, as well as the inputs each method requires in order to be used for calculating a fuel's greenhouse gas emissions. Emissions from the greenhouse gases CO_2 (carbon dioxide), N_2O (nitrous oxide) and CH_4 (methane) shall be included, and the coefficients specified in Annex B shall be used for the calculation of CO_2 equivalents.

Table 9.3 Description of the calculation of actual values for greenhouse gas emissions under Method 2

Method	Description	Input for calculation
(a)	Calculation of greenhouse gas emissions for the production and use of biomass fuels prior to conversion to electricity, heating and cooling.	Emissions from: - Extraction/cultivation[1)] of raw materials - Annual change in carbon stock due to land use change - Processing[2)] - Transport and distribution - Use of the fuel

			Emissions savings from: - Accumulation of soil carbon through improved agricultural management[3)] - Capture and geological storage of CO_2 - Separation and replacement of CO_2 *Emissions from the fossil reference of biomass fuel* Emissions from the manufacture of machinery and equipment shall not be included. For waste and residues, greenhouse gas emissions shall be set to zero in the processes of their life cycle that precede the collection of those materials.
(b)	Calculation of default values for greenhouse gas emissions per unit of energy in cases of co-digestion of substrates (corn/manure/biowaste) in the biogas installation		- Energy yield per kg of wet feedstock input (indicated in Annex) - Annual input of fresh substrate into reactor tank - Average annual moisture content of the substrate - Standard moisture content of the substrate (indicated in Annex) - Total default emission values for the given production pathway (indicated in Annex D to the Handbook or Part D of Annex VI to the Renewable Energy Directive II) based on knowledge of the type of process heat and/or electricity used, whether the post-storage tank is open or closed, and/or the type of upgrade technology (if applicable).
(c)	Calculation of actual greenhouse gas emissions prior to conversion to electricity or upgraded biogas/biomethane in cases of co-digestion of substrates in the biogas installation		- Share of raw product fed into the reactor vessel out of the total input Emissions from: - Extraction/cultivation of raw product - Transport of raw material to reactor tank - Annual change in carbon stock due to land use change - Processing - Transport and distribution of biogas/biomethane - Use/combustion of the fuel Emissions savings from: - Better agricultural management of feedstock - Capture and geological storage of CO_2 - Separation and replacement of CO_2
(d)	Calculation of	(i) For energy	- Total greenhouse gas emissions from the

	greenhouse gas emissions per unit of energy from the use of biomass fuels for electricity production, and/or heating or cooling, in the following cases (i–iv)	installations that only supply heat	fuel before final conversion (a) - Heat efficiency (annual useful heat production divided by annual fuel input based on fuel energy content)
		(ii) For energy installations supplying only electricity	- Total greenhouse gas emissions from the fuel before final conversion (a) - Electricity efficiency (annual electricity production divided by annual fuel input based on the energy content of the fuel)
		For the electrical or mechanical energy from energy installations providing useful heat[4)] together with electricity and/or mechanical energy	- Total greenhouse gas emissions from the fuel before final conversion (a) - Electricity efficiency (annual electricity production divided by annual fuel input based on the energy content of the fuel) - Heat efficiency (annual useful heat production divided by annual fuel input based on fuel energy content) - The fraction of exergy in electricity and/or mechanical energy, set at 100%. - Carnot efficiency (fraction of exergy in useful heat)
		(iv) For the useful heat from energy installations supplying heat together with electricity and/or mechanical energy	- Total greenhouse gas emissions from the fuel before final conversion (a) - Electricity efficiency (annual electricity production divided by annual fuel input based on the energy content of the fuel) - Heat efficiency (annual useful heat production divided by annual fuel input based on fuel energy content) - The fraction of exergy in electricity and/or mechanical energy, set at 100%. - Carnot efficiency (fraction of exergy in useful heat)

1) Emissions from the extraction, harvesting or cultivation of raw materials shall include emissions from the following: the extraction, harvesting or cultivation process itself; the collection, drying and storage of raw materials; losses and leaks; the production of chemicals or products used in extraction or cultivation. Capture of CO_2.

2) Emissions from processing shall include emissions from the following: the processing itself, losses, and leaks; the production of chemicals or products used in processing, including CO_2.

3) Emissions savings from improved agricultural management shall only be taken into account if reliable and verifiable evidence of increased soil carbon is provided or if it can reasonably be expected that carbon has increased over the period in which the raw materials concerned were cultivated, despite possible emissions from, for example, fertilisers and herbicides used. Direct measurement (possibly

using representative measurements before the second measurement is available) of the change in soil carbon over time may constitute evidence.

4) ‘useful heat’: Heat produced to satisfy an economically justified demand for heat for heating or cooling.

Estimates based on regional averages of cultivation emissions contained in the reports referred to in Article 31(4) of the Renewable Energy Directive or the information on the disaggregated default values for cultivation emissions in Annex C to the Renewable Energy Directive (Annex C to the Handbook) may be used instead of the actual values of emissions from cultivation of agricultural biomass. In the absence of relevant information in the said reports, it is permitted to calculate averages on the basis of local agricultural practices, e.g. from data on groups of farms, as an alternative to the use of actual values.

Estimates based on averages of cultivation and harvesting emissions calculated for geographical areas at national level may be used instead of actual values of cultivation and harvesting emissions of forest biomass

The detailed formulas for methods a–d, as well as formulas for converting different units, can be found in Annex B to the Handbook.

Calculation of greenhouse gas emissions savings

Where greenhouse gas emissions have been calculated using one of the methods set out in Table 9.3, the greenhouse gas emissions saving may be calculated. The final calculation of the greenhouse gas emissions saving through Method 2 can be found in point 3, Part B, Annex IV to the Renewable Energy Directive II, where the saving is calculated by comparison with the fossil alternative of the biomass fuel.

The methodology for calculating greenhouse gas emissions savings is further set out in point 3 of Annex B to this Handbook.

9.2.3 Method 3: Sum of factors

In *Method 3*, the formulas set out in point 1 of part B of Annex VI to the Renewable Energy Directive are used (see *Method 2*(a–d) in Table 9.3). However, under *Method 3*, it is possible to use the disaggregated default values in Part C of Annex VI to the Renewable Energy Directive II as some factors in the formulas, as long as all other factors have been calculated using the method set out in Part B of that Annex (*Method 2*).

In order to be able to use the disaggregated default values in the Annex, the biomass fuel in question must be produced from one or more of the biomasses listed in Table 9.4 under woody biomass, agricultural biomass, biogas, or upgraded biogas, respectively. In some cases, it is necessary to have background knowledge of the source of the process heat and/or electricity used in the production of the fuel, and knowledge of the distance the fuel, raw materials, and semi-finished products have been transported. For biogas and upgraded biogas, it may also be

necessary to have knowledge about whether the biogas installation's post-storage tank is open or closed, as well as about the type of upgrade technology (with/without off-gas combustion) in the case of upgraded biogas (see table).

Table 9.4 Prerequisites for the use of disaggregated default values under Method 3[40)]

Biofuel		**Woody biomass**		**Agricultural biomass for electricity and heat**	**Biogas**	**Upgraded biogas (biomethane)**
Biomass used in energy production		Wood chips from Forestry residues Stemwood Wood industry residues	Wood briquettes/pellets from Forestry residues Stemwood Wood industry residues	Agricultural residues Straw pellets Bagasse briquettes Palm kernel meal Short rotation coppice (=Energy wood from agricultural land for a maximum of 10 years rotation or coppicing interval)	Manure Corn Biowaste	Manure Corn Biowaste
Necessary knowledge of	Source of process heat and/or electricity	No	Yes	No	Yes	No
	Transport distance	Yes	Yes	Yes	No	No
	Post-storage tank (open or closed)	-	-	-	Yes	Yes
	Type of upgrade technology	-	-	-	-	Yes

The disaggregated default values from Part C of Annex VI to the Renewable Energy Directive can be found in Annex C to the Handbook.

9.2.4 Biograce and other calculation tools

The calculation of greenhouse gas savings can be done with calculation tools such as the Biograce II programme (https://www.biograce.net/biograce2), provided that they comply with the calculation methods described above. Biograce II is an Excel-based programme developed to calculate greenhouse gas emissions based on the principles of the Renewable Energy Directive.

9.3 Calculation of greenhouse gas emissions for producers and importers of wood pellets

Producers and importers of wood pellets, briquettes, etc. shall, when selling the biomass fuels on to retail, other sales outlets or directly to households, calculate the greenhouse gas emissions savings according to the same methods as above, even if they do not use the wood pellets in an energy installation.

– Default values according to method 1 can be used under the same conditions, as the transport distance is calculated from the area of origin to the location where the biomass fuels are delivered to the end customer.

– Actual values according to Method 2 can be used, as the transport distance is calculated from the area of origin to the location where the biomass fuels are delivered to the end customer, and as it is assumed that the wood pellets are used for heat production with a heat efficiency of 90%.

– The sum of factors according to Method 3 may be used, taking into account the transport distance from the area of origin to the place where the biomass fuels are delivered to the final customer, and the non CO_2 emissions from the use of the biomass fuel are accounted for at 0.3 g CO_2e/mj.

Producers or importers of wood pellets, wood briquettes, etc. who resell biomass fuels to companies that are subject to the greenhouse gas savings requirements of this Handbook shall not themselves report the greenhouse gas savings for the quantity of biomass fuels in question. Instead, the necessary information on greenhouse gas emissions, etc. shall be passed on to the customer for use in their reporting. However, producers and suppliers of wood pellets, wood briquettes, etc. shall state in their reporting the quantities that have been sold to covered companies.

They will also be able to use BioGrace II, as the heat efficiency is set at 90% and the transport distance is calculated to the location where the biomass fuel is delivered to the end customer.

9.4 Calculation of emissions for categories and types of biomass without specified default values.

For the calculation of greenhouse gas emissions savings for woody biomass of the category ‘non-forest wood’, the same default values and disaggregated default values as for the biomass type ‘forestry residues’ may be used.

For the calculation of greenhouse gas emissions savings for biomass of the ‘forest energy wood’ type, the same default values and disaggregated default values as for the ‘stemwood’ biomass type may be used.

9.5 Requirements for the verification of greenhouse gas emissions savings

The verifier shall carry out random controls if the company is subject to the requirement to save greenhouse gas emissions.

10 Reporting and verification requirements

10.1 Requirements of the Renewable Energy Directive

The Renewable Energy Directive requires Member States to take measures to ensure that covered companies provide reliable information on compliance with sustainability criteria and greenhouse gas emissions saving criteria.

Member States shall ensure that covered companies make available to the relevant Member State, upon request, the data used to produce the information. Member States shall require covered companies to ensure an adequate standard of independent verification of the information they provide and to demonstrate that this has been done.

The mandatory, independent and transparent verification shall be carried out in accordance with Implementing Regulation (EU) 2022/996 on rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land-use change-risk criteria.

The Directive requires the verification to confirm that the systems used by the covered companies are accurate, reliable and fraud-proof, including by means of an inspection to ensure that materials are not intentionally modified or discarded so that the lot or part thereof may become waste or a residue.

Finally, it follows from the Directive that information on the geographical origin and feedstock type of biomass fuels must be made available to consumers on the websites of the covered companies, suppliers or the relevant competent authorities and updated on an annual basis.

10.2 The Danish control system

Covered companies shall report annually on their biomass consumption, imports or production of biomass, and information on compliance with sustainability and greenhouse gas emissions savings requirements. The reporting is described in more detail in Section 10.4.

Companies must ensure that the information is verified by an independent inspector before it is reported to the Danish Energy Agency. The inspector shall verify that the information provided by the company, including on compliance with sustainability and greenhouse gas saving requirements, is accurate and complete in relation to the guidance provided in this Handbook.

For agricultural biomass, which only has to comply with the minimum requirements of the Renewable Energy Directive, certification according to a voluntary scheme may in itself constitute sufficient control. In the absence of

certification according to a voluntary scheme, compliance shall be verified by a Verifier.

For non-agricultural woody biomass, a verifier will be required in all cases. The verifier shall at least verify that relevant additional requirements, in addition to the minimum requirements of the Renewable Energy Directive, are met. If the biomass supplied is certified according to an EU-approved voluntary scheme, the verifier will be able to rely on this certification for the requirements for which the voluntary scheme is approved to document. In this case, the verifier will only have to control that the biomass has been certified according to a voluntary scheme and that it has been approved to demonstrate compliance with the requirements. The verifier may ask the company or voluntary scheme for additional information regarding compliance with requirements, in accordance with the guidelines set out in this Handbook. This may be relevant, for example, in relation to the additional requirement of third-party verification up to the first gathering point for forest biomass described in Section 5.7.

So-called 'ex-post' controls may be carried out. This means that the controls are carried out after the products have been delivered from the producers concerned in the production chain. The controls are normally carried out through a risk-based sampling and therefore not all data will be controlled. The level of sampling shall be assessed by the verifier on the basis of guidelines specified in this Handbook. Ex-post controls should be supplemented by random controls in relevant production and gathering points.

After verification, the verifier shall provide a statement confirming compliance with the requirements and a verification report. The declaration must be submitted to the Danish Energy Agency together with the report.

It is recommended that companies contact a verifier at an early stage in relation to the delivery of the products and the conclusion of contracts to ensure that the relevant information and evidence can be obtained and that the necessary evidence systems are in place. 10.3 Requirements for the verifier

Verifiers shall be approved or accredited to carry out certification in accordance with:

For woody biomass:

– at least one forest certification scheme, such as FSC-Forest Management or PEFC-Forest Management;

– at least one certification scheme for biomass production, e.g. SBP; and

– at least one traceability certification scheme, e.g. FSC-CoC or PEFC-CoC.

For agricultural biomass:

– at least one voluntary scheme, e.g. ISCC EU or RedCERT EU.

For waste and residues from other production, as well as for woody waste and municipal solid waste, it shall be assumed that the verifier is qualified to carry out certification of these biomasses provided that the verifier meets the above requirements for woody biomass or agricultural biomass.

The Danish Energy Agency may grant exemptions from the above requirements on the basis of a specific assessment. The Danish Energy Agency may also decide that schemes other than those mentioned here may be the basis of qualification for the verifier. The Danish Energy Agency will publish a list of these schemes on its website.

10.4 Annual reporting

Covered companies shall report annually to the Danish Energy Agency on the geographical origin, quantities and types of biomass, and on compliance with requirements for biomass fuels and bioliquids used, produced or imported in the previous year. The content of the reporting for solid biofuels for combustion is described in Section 10.5. The content of the reporting for biogas is described in Section 10.6. Reporting shall be carried out in tabular form (spreadsheets) in accordance with a template drawn up by the Danish Energy Agency. The reporting may later become electronic via an IT platform.

If the biomass type is subject to third-party verification, the report shall be accompanied by a statement from the verifier confirming compliance with sustainability requirements, etc. In addition, the verifier shall prepare a verification report for the operator, cf. Figure 10.1. However, for agricultural biomass that only has to comply with the minimum requirements of the Renewable Energy Directive, it is sufficient to submit evidence that the company/biomass is certified according to a voluntary scheme.

Indberetning	Reporting
Verifikator-erklæring	Verifier's declaration
Verifikations-rapport	Verification report

Figure 10.1 The covered companies are responsible for preparing an annual verified report. The verifier shall also draw up a verification report for the company.

On the basis of the reports, the Danish Energy Agency will publish aggregated inventories of Denmark’s total consumption of biomass fuels and bioliquids,

broken down by biomass types and geographical origin, greenhouse gas emissions savings, etc.

The reports will form the basis for reporting to the EU as a result of e.g. the Governance Regulation[41)] and be used for necessary reporting as a result of the Climate Act[42)].

Declaration by verifier

In the declaration, the verifier concludes:

– whether the information provided in the reporting, including compliance with traceability, completeness, reliability and accuracy requirements, are accurate;

– whether the company's biomass consumption has met sustainability criteria, as described in this Handbook or through voluntary schemes;

– if applicable, whether the declared quantities of energy crops used in production are true and fair;

– if applicable, whether the company has complied with the greenhouse gas emissions criteria as described in this Handbook;

– declaration that the verifier has not become aware of facts indicating that there may be material errors, subject to an appropriate level of investigation.

The verifier carries out the verification process and summarises in the declaration what the assessment is based on. In order to ensure consistency of controls between companies, Annex F to this Handbook provides guidance on the information to be included in the verifier's declaration.

The Danish Energy Agency expects all the information requested in Annex F to be covered by the declaration. If there is no evidence for a particular point, the Danish Energy Agency will assess the consequences of this on the basis of the verifier's explanation of the reason for the lack of evidence and the seriousness of the deficiency.

Verification report

In addition to the declaration, the verifier shall submit a report to their client (company). The verifier shall describe in detail in the verification report how the company's information has been verified.

This includes:

1) Evaluation process.

2) Observations on the company's system for collecting information on compliance with sustainability criteria.

3) Stakeholder involvement.

4) Observations on traceability.

5) Description of how the correct inventory of quantities and types of biomass is ensured.

6) Information on how criteria compliance has been assessed, in accordance with the requirements for verification under each criterion.

7) Description, if applicable, of background data not included in the reporting on which the assessment is based.

8) Possible recommendations for improvements to the company

9) Evidence showing that the Danish Energy Agency's qualification requirements for verifiers have been met.

The purpose of such information is to make it easier for companies to understand the process and improve performance. In addition, such information increases the ability of the verifier to transfer knowledge to the company. The verifier's report shall be sent to those responsible from the reporting company. The verification report is not part of the annual report but is provided to the supervisory authority on request.

10.5 Content of the reporting for solid biomass fuels and bioliquids for combustion

This section is relevant for companies burning solid biomass fuels and bioliquids in heat plants, combined heat and power plants or in industrial companies, as well as for companies importing or producing wood pellets, briquettes or firewood.

Reporting shall be carried out for the first time in the spring of 2022 for 1 July–31 December 2021 and thereafter each spring for the previous calendar year. The Danish Energy Agency shall set a deadline for reporting and publish it on its website. The requirements for non-forest wood will only enter into force on 1 January 2022 and will therefore not be included in the first report.

The report is prepared for each company and may therefore include the company's total consumption of biomass for one or more plants or installations owned by the company.

For producers and importers of wood pellets, firewood or wood briquettes, the report shall indicate the volume of imports or production marketed to companies subject to the requirements of this Handbook, as well as the volume marketed for non-energy purposes. The company may omit to report details of these quantities.

The report shall include information on the company’s:

– total consumption, imports or production;

– CVR/CPR number, address, etc.

– The company's covered installations, as well as their greenhouse gas emissions saving, etc.

The methodology for calculating greenhouse gas emissions shall be set out. If default values have been used, it shall be stated whether it has been assessed whether the biomass has been produced without net carbon emissions due to land use change (LUC assessment).

The reporting shall categorise biomass into biomass categories, i.e.

1. Forest biomass.

2. Agricultural biomass.

3. Wood industry residues.

4. Waste and residues from other production.

5. Wood waste and municipal solid waste.

6. Non-forest wood.

For each category of biomass, a table shall be completed with the following information for each lot of biomass: Biomass type, quantity (tonnes, MJ), geographical origin (country/region/sourcing area), certification (if applicable), greenhouse gas emissions (grams CO_2 per MJ), greenhouse gas emissions saving (per cent) and information on compliance with sustainability requirements.

The biomass type is a specification of the raw material within the category. For ‘forest biomass’, for example, the following types of biomass may exist:

1. Forestry residues.

2. Stemwood.

3. Forest energy wood.

The Danish Energy Agency will publish an overview of biomass types on the Danish Energy Agency's website.

The report shall also specify the type of fuel concerned, e.g. wood chips, pellets, wood briquettes, firewood, etc.

The verifier statement shall be attached to the report.

In addition, if there is an applicable implementing act of the European Commission, it must be taken into account.

10.6 Content of the reporting for biogas

Once a year, all covered companies shall report their biomass consumption and information on compliance with sustainability and greenhouse gas emissions savings requirements in the previous reporting year. The reporting applies to both biogas produced from anaerobic turnover of organic material and biogas produced by thermal gasification.

For the reporting year running from 1 August 2020 to 31 July 2021, compliance with the Renewable Energy Directive II's sustainability and greenhouse gas emissions savings requirements is only required for July 2021, as the Renewable Energy Directive II enters into force from 30 June 2021. However, on 1 September 2021, energy crops must be reported as usual, where the report on 1 September 2022 will request a separate report for July 2021 in which the requirements of the Renewable Energy II Directive must be reported. See Table 10.1 with an overview of when to report and which requirements to document for the different periods.

From July 2023, the reporting period is amended so that it follows the calendar year rather than the harvesting year with the reporting date each year being 31 March. The first report falls on 31 March 2024, thus covering an extended reporting period running from 1 August 2022 to 31 December 2023 (17 months). By 31 March 2024, two separate biomass inventories shall be submitted for the last five months of 2022 and for the whole year 2023, respectively. The total quantity of energy crops used during the whole period (1 August 2022 to 31 December 2023) shall not exceed 11.12% of the total biomass used, measured in weight input per installation (cf. Chapter 4.1.2). The following reports shall be submitted for the 12 months of the calendar year.

Table 10.1 Overview of reporting periods and requirements to be documented

Date of reporting	**Reporting period**	**Requirements to be documented in the reporting**	
		Energy crop requirements	**Renewable Energy Directive II requirements**
1 September 2021	1 August 2020 to 31 July 2021	x	
1 September 2022	1 July 2021 to 31 July 2021 1 August 2021 to 31 July 2022	x	x
31 March 2024	1 August 2022 to 31 December 2023	x	x
31 March 2025 onwards	1 January to 31 December	x	x

The Danish Energy Agency will issue further information and a reporting form.

The reporting shall be drawn up for each installation covered and a distinction shall be made in the reporting between biogas produced from anaerobic turnover of organic material and biogas produced by thermal gasification. The following information shall be included in the reporting.

For biogas produced from anaerobic turnover

Content

1) Information about the company:

– CVR/CPR number

– Installation name and address

– GSRN no.

– Contact details (email and phone)

– Total production and consumption

2) Reporting of biomass:

– Total biomass/raw material consumption in the previous reporting year by biomass types and quantities

– Geographical origin of biomass

3) Verifier statement or evidence of certification according to a voluntary scheme

For biogas produced through anaerobic turnover of organic material, in addition to the purposes mentioned in Section 10.4, the information reported will also be used to verify the total share of energy crops used in biogas production. Where a verifier is used, the verifier statement and the verification report shall also include information on whether the company's consumption of energy crops has complied with the limited use requirement and whether the declared quantities of energy crops used in production are true and fair.

For biogas produced by thermal gasification

For biogas produced by thermal gasification, the reporting must contain the information described in the previous Section 10.5 on 'Content of the reporting for solid biomass for combustion'.

Installations below 2 MW or 200 m3 of methane per hour

Companies using biogas in an installation with a total rated thermal input of less than 2 MW or an upgrade installation with a capacity of less than 200 m3 of methane per hour shall only comply with the requirement to limit energy crops in

biogas production as described in Section 4.1.2. These installations can thus disregard the reporting requirements set out in the first part of Section 10.6 and focus on the following.

All companies using biogas shall report annually, before 31 March, all types and quantities of biomass used in biogas production in the previous calendar year. The first reporting falls on 31 March 2024, thus covering an extended reporting period running from 1 August 2022 to 31 December 2023 (17 months). By 31 March 2024, two separate biomass inventories shall be submitted for the last five months of 2022 and for the whole year 2023, respectively. The total quantity of energy crops used during the whole period (1 August 2022 to 31 December 2023) shall not exceed 11.12% of the total biomass used, measured in weight input per installation (cf. Chapter 4.1.2). The following reports shall be submitted for the 12 months of the calendar year.

The information reported under these categories is used to check the total share of energy crops used in biogas production. On the basis of the reports, the Danish Energy Agency may also publish inventories of Denmark's total consumption of biomass broken down by biomass types. The reports will form the basis for reporting to the EU as a result of the Governance Regulation[43)] and be used for necessary reporting as a result of the Climate Act[44)].

The reporting shall be prepared for each company and the information below shall be included in the reporting.

Content

1) Information about the company:

– Installation name and address

– CVR/CPR number

– GSRN no.

– Contact details (email and phone)

2) Reporting of biomass

– Total biomass consumption in the previous reporting year by biomass types and quantities of each type

– The report must be certified by the biogas producer

No certification, verifier statement or verification report is required. The Danish Energy Agency may require the company to submit an auditor's declaration, cf. the Order on sustainability and greenhouse gas emissions saving for biomass fuels and bioliquids for energy purposes, etc.

10.7 Companies' management of data collection, reporting, and control

In order to be able to provide reliable sustainability information in connection with the reporting to the Danish Energy Agency, the covered companies should ensure that they and their suppliers have effective systems in place to be able to report, obtain and store sufficient and relevant evidence of the information.

This means that they must have a verifiable system to document the information they pass on, that the evidence must be kept for at least five years, and that they must assume responsibility for making evidence and other information available to the verifier and the supervisory authority.

The Danish Energy Agency recommends that the covered companies appoint a contact person responsible for reporting sustainability information.

It is good practice to:

1) keep in touch with suppliers in the production chain to ensure awareness of the need for cooperation and for verifiable compliance with the principles;

2) present data in a clear way and as consistent as possible over the years (but with room for improvement of the methodology);

3) ensure that the responsibility for the provision of information is placed on the relevant suppliers;

4) map the data flow within the company and in the production chain;

5) ensure adequate controls of data;

6) document the system (who does what, when, etc.);

7) ensure traceability of data over time;

8) enable relevant knowledge from external stakeholders to be involved.

<u>Control organisation</u>

All covered companies must contract a verifier for verification. Verification requires the company to go through the following steps:

Step 1	Enter into agreement with a verifier who meets the qualification requirements
Step 2	Provide relevant biomass and sustainability information to the verifier
Step 3	Provide supporting information and evidence in the company’s possession
Step 4	Allow visits from the verifier
Step 5	Reply to all the verifier's questions

Step 6	Correct any materially incorrect information discovered by the verifier
Step 7	Submit the verifier's declaration to the Danish Energy Agency together with the annual report

The verification process may take several weeks or longer, especially if the production chain is complex or long and if answers to questions from the verifier drag on. The Danish Energy Agency recommends that companies find their independent verifiers as early as possible in the process, i.e. well in advance of the deadline for submitting the annual report to the Danish Energy Agency.

10.7.1 Verification of the report

The verifier shall check all information contained in the annual report and the underlying evidence thereof. Controls shall include, for example, the following information:

Information for each lot of biomass

– Quantity of biomass supplied (tonnes, MJ);

– Biomass type;

– Biomass fuel type;

– Production process

– Geographical origin;

– Optional certification according to a voluntary scheme or other certification schemes;

– Evidence of compliance with sustainability criteria, as required by this Handbook;

– Evidence of greenhouse gas saving and associated background data if actual values are used;

– Where applicable, evidence of assessment of LUC if default values are used;

– Documents demonstrating compliance with mass balance principles when mixing biomass with different characteristics.

‘Lot’ means one or more supplies with the same characteristics. If the supplies come from the same geographical origin, cover the same fuel and biomass type and have the same sustainability characteristics, they could be merged into a ‘lot’.

The verifier shall use the following criteria:

1. Traceability

a. Can the reported information be traced back to suppliers that generated the original information?

b. Is there sufficient and relevant evidence to support all reported information, i.e. is there information available to demonstrate compliance with all sustainability, greenhouse gas savings and mass balance requirements, if any?

2. Completeness

a. Is information available for all lots of biomass?

b. Does the report reflect the total quantity of biomass supplied or received by the company?

3. Reliability

a. Have reliable methods been used to calculate and report actual CO_2 data?

b. Are the reported biofuel feedstock types from operators higher up the production chain representative of the actual feedstock supplied?

c. For biofuels supplied with specific information on feedstock mixture (e.g. when mixing for technical reasons), does the sustainability information reported correspond to the actual feedstock composition?

4. Accuracy

a. Has the reported information been collected in a thorough and error-minimising manner?

Not all of these criteria will be relevant for all reports (e.g. not all companies use actual data on CO_2 emissions). In addition, some verifiers may choose to apply additional criteria.

Apart from the information reported or verified by the verifier, evidence of information, including compliance with the sustainability criteria, may remain with the company in the chain to which the evidence relates and thus shall not be disclosed to the following stages of the production chain. However, all evidence must be kept and made available on request in connection with the verification or the Danish Energy Agency's supervision. For example, there may be maps, invoices, information on greenhouse gas emissions, certificates, etc.

When performing the random control, the verifier will have to work backwards in the production chain, including using the information provided in accordance with the mass balance principles. It is therefore important that the operators in the production chain work together to disseminate this information.

The verifier will visit companies and their suppliers as appropriate. The verifier will review the verification process and meet the person responsible for the

information reported. The verifier looks at the entire production chain and data flow and performs checks. Typically, not all companies in the production chain will be contacted. The exact approach may vary depending on the verifier and production chain.

The verifier may also choose to carry out tests during the year to avoid possible bottlenecks at the end of the year.

If the control reveals that certain information in the reporting is not documented, the companies must obtain the necessary evidence. The verifier shall not approve the report without annotating the matter if the information concerned is not changed. Comments shall be provided on which and how many data have changed, where appropriate. Biomass for which it has not been possible to document and verify the required sustainability information cannot be considered as complying with the sustainability criteria.

10.8 Evidence of compliance with the mass balance principle

The Renewable Energy Directive allows lots of biomass with different sustainability and greenhouse gas emissions characteristics to be mixed in the production chain, compliance with the requirements can be demonstrated by means of a so-called ‘mass balance system’.

The mass balance system shall ensure that, when biomass lots are mixed together, there is transparency about the sustainability characteristics of biomass and greenhouse gas emissions throughout the value chain, from production to end use. The system must thus ensure that lots with certain characteristics can be extracted from the mixture. For example, if a wood pellet producer receives one delivery from certified forest and one from a non-certified forest, it must be possible to split the two deliveries into the subsequent distribution, even if the biomass has been physically mixed.

The mass balance system shall further ensure that each lot is counted only once when calculating the gross final consumption of energy from renewable sources in Denmark (cf. Article 7 of the Renewable Energy Directive II) and shall also ensure that it is possible to find information on whether aid has been paid and, if so, from what type of aid scheme.

The mass balance system is an element of traceability (chain of custody) system. There are other methods of calculation in chain of custody systems, but the only thing allowed under Renewable Energy Directive II is the mass balance system if biomass is mixed up in the production chain. The system has also been used in the previous Renewable Energy Directive, which only set sustainability requirements for biogas for transport and for biofuels.

Guarantees of origin, which are also extended to biomass fuels in the Directive, are a so-called book and claim system that can demonstrate that a given share or quantity of energy was produced from renewable energy. There is no other information that can be traced through the value chain. Guarantees of origin are

not sufficient evidence, as the exact sustainability characteristics and greenhouse gas emissions must be known.

10.8.1 What needs to be documented through the value chain?

The information for each lot of biomass described in Sections 10.4 and 10.5 shall follow each lot. Including the documents necessary to maintain a mass balance system. Each operator in the value chain has an obligation to document inputs and outputs. If a link in the value chain is not properly documented, the use of biomass cannot meet the sustainability criteria and savings requirements of the Renewable Energy Directive II. The evidence shall include:

1) Invoices

2) Descriptions of the physical product

3) Volume of input/output on the given product

4) Documentation of conversion factors

5) Suppliers and customers of the product

6) Transaction dates

7) Sustainability and greenhouse gas emissions information

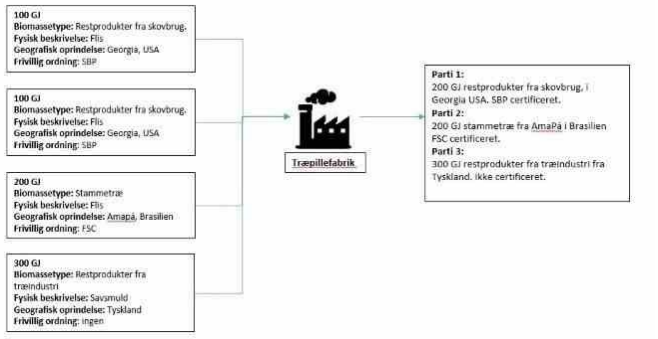
It is the responsibility of each operator to maintain the evidence when the product passes further down the value chain so that it can be inspected during an inspection.

10.8.2. How can lots be mixed?

When mixing lots, there are two types of information that need to be taken into account: 1) Sustainability characteristics and 2) Greenhouse gas emissions through the value chain.

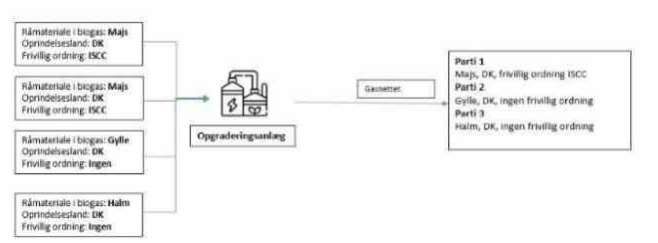
10.8.2.1 Sustainability characteristics

The first is illustrated in Figure 10.3 based on a wood pellet factory and in Figure 10.4 based on an upgrade installation. The principle of solid and gaseous biomass fuels is the same, although the distribution methods are different. The user of the biomass fuel is responsible for ensuring that the evidence is kept up-to-date throughout the chain.



100 GJ **Biomassetype:** Restprodukter fra skovbrug **Fysisk beskrivelse:** Flis **Geografisk oprindelse:** Georgia, USA **Frivillig ordning:** SBP	**100 GJ** **Biomass type:** Forestry residues **Physical description:** Chips **Geographical origin:** Georgia, United States **Voluntary scheme:** SBP
200 GJ **Biomassetype:** Stammetræer **Fysisk beskrivelse:** Flis **Geografisk oprindelse:** Amapá, Brasilien **Frivillig ordning:** FSC	**200 GJ** **Biomass type:** Stemwood **Physical description:** Chips **Geographical origin:** Amapá, Brazil **Voluntary scheme:** FSC
300 GJ **Biomassetype:** Restprodukter fra træindustri **Fysisk beskrivelse:** Savsmuld **Geografisk oprindelse:** Tyskland **Frivillig ordning:** Ingen	**300 GJ** **Biomass type:** Wood industry residues **Physical description:** Sawdust **Geographical origin:** Germany **Voluntary scheme:** None
Træpillefabrik	Wood pellet factory
Parti 1: 200 GJ restprodukter fra skovbrug, i Georgia, USA. SBP certificeret. **Parti 2:** 200 GJ stammetræer fra Amapá i Brasilien. FSC certificeret. **Parti 3:** 300 GJ restprodukter fra træindustrien fra Tyskland. Ikke certificeret.	**Lot 1:** 200 GJ forestry residues, in Georgia, USA. SBP certified. **Lot 2:** 200 GJ stemwood from Amapá in Brazil. FSC certified. **Lot 3:** 300 GJ wood industry residues from Germany. Not certified.

Figure 10.3 Example of how different lots with different sustainability characteristics can be mixed in a wood pellet factory.

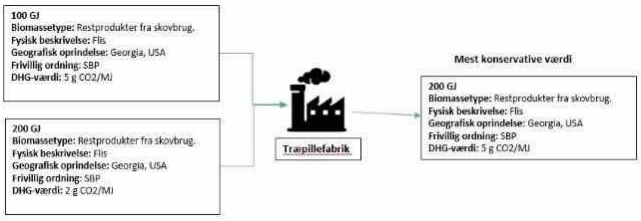


Råmateriale i biogas: Majs **Oprindelsesland:** DK **Frivillig ordning:** ISCC	**Raw material in biogas:** Corn **Country of origin:** DK **Voluntary scheme:** ISCC
Råmateriale i biogas: Gylle **Oprindelsesland:** DK **Frivillig ordning:** Ingen	**Raw material in biogas:** Manure **Country of origin:** DK **Voluntary scheme:** None
Råmateriale i biogas: Halm **Oprindelsesland:** DK **Frivillig ordning:** Ingen	**Raw material in biogas:** Straw **Country of origin:** DK **Voluntary scheme:** None
Opgraderingsanlæg	Upgrade installation
Gasnettet	Gas grid
Parti 1: Majs, DK, frivillig ordning ISCC **Parti 2:** Gylle, DK, ingen frivillig ordning **Parti 3:** Halm, DK, ingen frivillig ordning	**Lot 1:** Corn, DK, voluntary scheme ISCC **Lot 2:** Slurry, DK, no voluntary scheme **Lot 3:** Straw, DK, no voluntary scheme

Figure 10.4 Example of how different lots with different sustainability characteristics can be mixed in the gas grid.

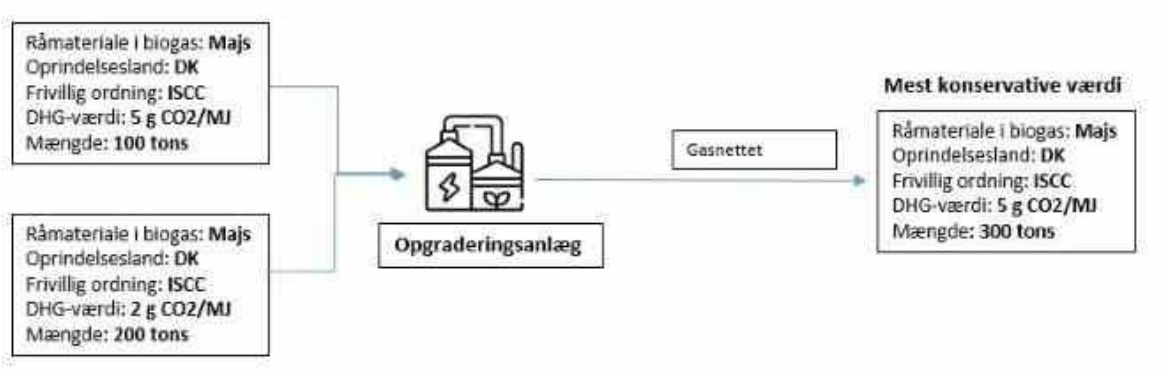
10.8.2.2 Greenhouse gas emissions

In addition, lots with different greenhouse gas emissions must be able to be mixed. There are two possibilities here. Either you can choose the most conservative value or you can calculate a weighted average. This is illustrated in Figure 10.5 and Figure 10.6, which are based on a wood pellet factory and an upgrade installation. Using the most conservative value takes the highest greenhouse gas value of the lots being mixed (see Figure 10.5).



100 GJ **Biomassetype:** Restprodukter fra skovbrug **Fysisk beskrivelse:** Flis **Oprindelsesland:** Georgia, USA **Frivillig ordning:** SBP **ENG-værdi:** 5 g CO_2/MJ	**100 GJ** **Biomass type:** Forestry residues **Physical description:** Chips **Country of origin:** Georgia, United States **Voluntary scheme:** SBP **ENG value:** 5 g CO_2/MJ
200 GJ **Biomassetype:** Restprodukter fra skovbrug **Fysisk beskrivelse:** Flis **Oprindelsesland:** Georgia, USA	**200 GJ** **Biomass type:** Forestry residues **Physical description:** Chips **Country of origin:** Georgia, United States

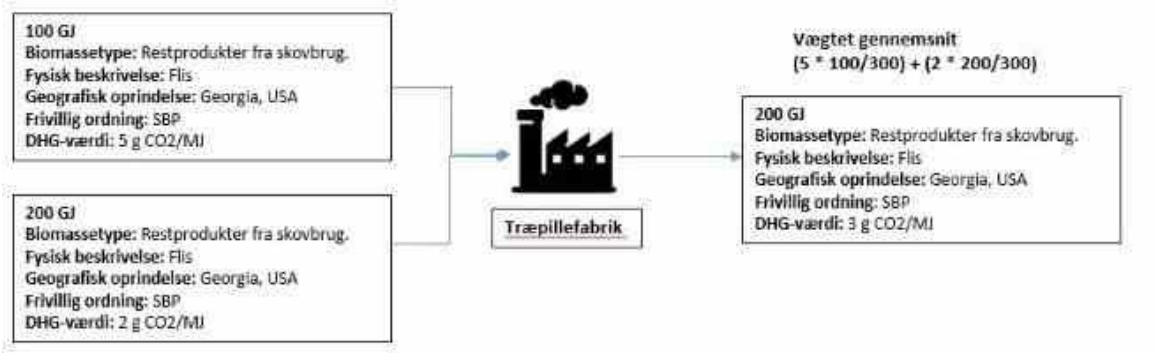
Frivillig ordning: SBP **ENG-værdi:** 2 g CO_2/MJ	**Voluntary scheme:** SBP **ENG value:** 2 g CO_2/MJ
Træpillefabrik	Wood pellet factory
Mest konsumerbare værdi	Most measurable value
300 GJ **Biomassetype:** Restprodukter fra skovbrug **Fysisk beskrivelse:** Flis **Oprindelsesland:** Georgia, USA **Frivillig ordning:** SBP **ENG-værdi:** 3 g CO_2/MJ	**300 GJ** **Biomass type:** Forestry residues **Physical description:** Chips **Country of origin:** Georgia, United States **Voluntary scheme:** SBP **ENG value:** 3 g CO_2/MJ



Råmateriale i biogas: Majs **Oprindelsesland:** DK **Frivillig ordning:** ISCC **GHG-værdi:** 5 g CO_2/MJ **Mængde:** 100 tons	**Raw material in biogas:** Corn **Country of origin:** DK **Voluntary scheme:** ISCC **GHG value:** 5 g CO_2/MJ **Volume:** 100 tonnes
Råmateriale i biogas: Majs **Oprindelsesland:** DK **Frivillig ordning:** ISCC **GHG-værdi:** 2 g CO_2/MJ **Mængde:** 200 tons	**Raw material in biogas:** Corn **Country of origin:** DK **Voluntary scheme:** ISCC **GHG value:** 2 g CO_2/MJ **Volume:** 200 tonnes
Opgraderingsanlæg	Upgrade installation
Gasnettet	Gas grid
Mest konservative værdi	**Most conservative value**
Råmateriale i biogas: Majs **Oprindelsesland:** DK **Frivillig ordning:** ISCC **GHG-værdi:** 5 g CO_2/MJ **Mængde:** 300 tons	**Raw material in biogas:** Corn **Country of origin:** DK **Voluntary scheme:** ISCC **GHG value:** 5 g CO_2/MJ **Volume:** 300 tonnes

Figure 10.5 Calculation of DHG emissions using the most conservative value.

Using a weighted average, greenhouse gas emissions are calculated for each share entering the wood pellet factory/upgrade installation and summed on the output side (see Figure 10.6).



100 GJ **Biomassetype:** Restprodukter fra skovbrug **Fysisk beskrivelse:** Flis **Geografisk oprindelse:** Georgia, USA **Frivillig ordning:** SBP **DHG-værdi:** 5 g CO_2/MJ	**100 GJ** **Biomass type:** Forestry residues **Physical description:** Chips **Geographical origin:** Georgia, United States **Voluntary scheme:** SBP **DHG value:** 5 g CO_2/MJ
200 GJ **Biomassetype:** Restprodukter fra skovbrug **Fysisk beskrivelse:** Flis **Geografisk oprindelse:** Georgia, USA **Frivillig ordning:** SBP **DHG-værdi:** 2 g CO_2/MJ	**200 GJ** **Biomass type:** Forestry residues **Physical description:** Chips **Geographical origin:** Georgia, United States **Voluntary scheme:** SBP **DHG value:** 2 g CO_2/MJ
Træpillefabrik	**Wood pellet factory**
Mest konsumerbare værdi	Most measurable value
Vægtet gennemsnit	**Weighted average**
200 GJ **Biomassetype:** Restprodukter fra skovbrug **Fysisk beskrivelse:** Flis **Geografisk oprindelse:** Georgia, USA **Frivillig ordning:** SBP **DHG-værdi:** 3 g CO_2/MJ	**200 GJ** **Biomass type:** Forestry residues **Physical description:** Chips **Geographical origin:** Georgia, United States **Voluntary scheme:** SBP **DHG value:** 3 g CO_2/MJ

Råmateriale i biogas: **Majs** Oprindelsesland: **DK** Frivillig ordning: **ISCC**	Raw material in biogas: **Corn** Country of origin: **DK** Voluntary scheme: **ISCC**

GHG-værdi: **5 g CO_2/MJ** Mængde: **100 tons**	GHG value: **5 g CO_2/MJ** Volume: **100 tonnes**
Råmateriale i biogas: **Majs** Oprindelsesland: **DK** Frivillig ordning: **ISCC** GHG-værdi: **2 g CO_2/MJ** Mængde: **200 tons**	Raw material in biogas: **Corn** Country of origin: **DK** Voluntary scheme: **ISCC** GHG value: **2 g CO_2/MJ** Volume: **200 tonnes**
Opgraderingsanlæg	**Upgrade installation**
Gasnettet	Gas grid
Vægtet gennemsnit	**Weighted average**
Råmateriale i biogas: **Majs** Oprindelsesland: **DK** Frivillig ordning: **ISCC** GHG-værdi: **5 g CO_2/MJ** Mængde: **300 tons**	Raw material in biogas: **Corn** Country of origin: **DK** Voluntary scheme: **ISCC** GHG value: **5 g CO_2/MJ** Volume: **300 tonnes**

Figure 10.6 Calculating greenhouse gas emissions using weighted averages.

10.8.2.3 Conversion factors

When an operator processes the material in its part of the value chain, the operator shall document the use of conversion factors. According to Article 30(2) of the Renewable Energy Directive II, the conversion factors are to be calculated as the ratio between the mass of the output and the mass of the raw material in the input. Operators shall record which conversion factors they use in relation to:

1) Which input is referred to

2) Which output is referred to

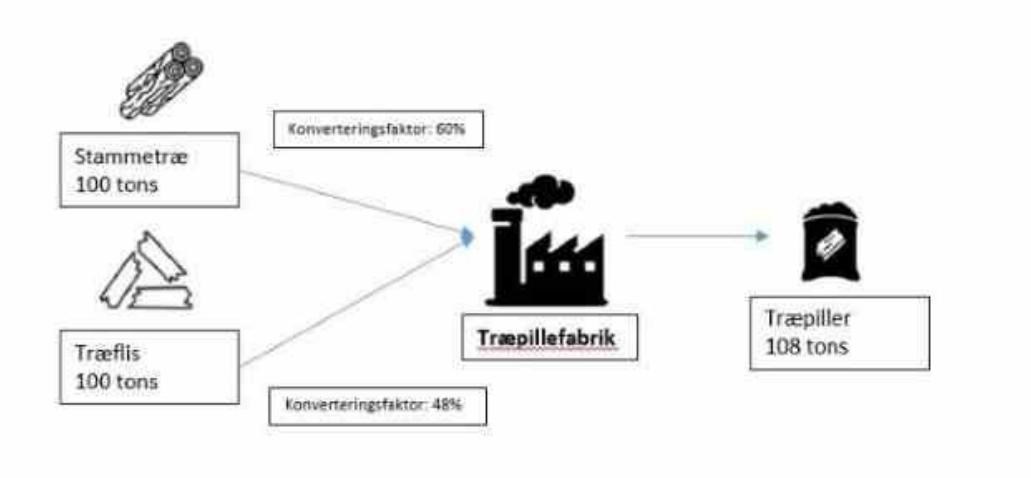
3) Units of conversion factors

4) Values of conversion factors

5) Dates when a specific conversion factor is valid

6) Calculations and other evidence relevant to the conversion factor.

The principles of how the conversion factors are applied are illustrated in Figure 10.7, which is based on a wood pellet factory and an upgrade installation.



Stammetræ 100 tons	Stemwood 100 tons
Træflis 100 tons	Wood chips 100 tons
Konverteringsfakor: 60%	Conversion factor: 60%
Træpillefabrik	Wood pellet factory
Træpiller 108 tons	Wood pellets 108 tons

Majs 100 tons	Corn 100 tonnes
Gylle 100 tons	Slurry 100 tons
Konverteringsfakor	Conversion factor
Opgraderingsanlæg	Upgrade installation
Biometan 294 GJ	Biomethane 294 GJ

Figure 10.7 Example of the use of conversion factors.

Operators should also take into account that there may be additions or losses of material in the production that may give rise to adjustments of data along the value chain.

A mass balance system shall be established and maintained for each installation. For example, if a company owns a number of different installations, each installation must have its own system. In addition, if two or more different legal entities (e.g. two companies) use the same installation, each company must have its own mass balance system.

Annex A

Default values for greenhouse gas emissions savings

Default values for greenhouse gas emissions savings of biomass fuels when produced with no net carbon emissions from land use change.

Chipped wood					
Biomass fuel production system	**Transport distance**	**Greenhouse gas emissions savings – typical value**		**Greenhouse gas emissions savings – default value**	
		heat	**electricity**	**heat**	**electricity**
Wood chips from forestry residues	1–500 km	93%	89%	91%	87%
	500–2 500 km	89%	84%	87%	81%
	2 500–10 000 km	82%	73%	78%	67%
	more than 10 000 km	67%	51%	60%	41%
Wood chips from short rotation coppice (eucalyptus)	2 500–10 000 km	77%	65%	73%	60%
Wood chips from short rotation coppice (poplar – fertilised)	1–500 km	89%	83%	87%	81%
	500–2 500 km	85%	78%	84%	76%
	2 500–10 000 km	78%	67%	74%	62%
	more than 10 000 km	63%	45%	57%	35%
Wood chips from short rotation coppice (poplar – no fertilisation)	1–500 km	91%	87%	90%	85%
	500–2 500 km	88%	82%	86%	79%

	2 500–10 000 km	80%	70%	77%	65%
	more than 10 000 km	65%	48%	59%	39%
Wood chips from stemwood	1–500 km	93%	89%	92%	88%
	500–2 500 km	90%	85%	88%	82%
	2 500–10 000 km	82%	73%	79%	68%
	more than 10 000 km	67%	51%	61%	42%
Wood chips from industrial residues	1–500 km	94%	92%	93%	90%
	500–2 500 km	91%	87%	90%	85%
	2 500–10 000 km	83%	75%	80%	71%
	more than 10 000 km	69%	54%	63%	44%

Wood pellets*						
Biomass fuel production system		**Transport distance**	**Greenhouse gas emissions savings – typical value**		**Greenhouse gas emissions savings – default value**	
			Heat	**Electricity**	**Heat**	**Electricity**
Wood briquettes or pellets from forestry residues	Case 1	1–500 km	58%	37%	49%	24%
		500–2 500 km	58%	37%	49%	25%
		2 500–10 000 km	55%	34%	47%	21%
		more than 10 000 km	50%	26%	40%	11%
	Case 2a	1–500 km	77%	66%	72%	59%
		500–2 500 km	77%	66%	72%	59%
		2 500–10 000 km	75%	62%	70%	55%
		more than 10 000 km	69%	54%	63%	45%
	Case 3a	1–500 km	92%	88%	90%	85%
		500–2 500 km	92%	88%	90%	86%
		2 500–10 000 km	90%	85%	88%	81%
		more than	84%	76%	81%	72%

		10 000 km				
Wood briquettes or pellets from short rotation coppice (eucalyptus)	Case 1	2 500–10 000 km	52%	28%	43%	15%
	Case 2a	2 500–10 000 km	70%	56%	66%	49%
	Case 3a	2 500–10 000 km	85%	78%	83%	75%
Wood briquettes or pellets from short rotation coppice (poplar – fertilised)	Case 1	1–500 km	54%	32%	46%	20%
		500–10 000 km	52%	29%	44%	16%
		more than 10 000 km	47%	21%	37%	7%
	Case 2a	1–500 km	73%	60%	69%	54%
		500–10 000 km	71%	57%	67%	50%
		more than 10 000 km	66%	49%	60%	41%
	Case 3a	1–500 km	88%	82%	87%	81%
		500–10 000 km	86%	79%	84%	77%
		more than 10 000 km	80%	71%	78%	67%
Wood briquettes or pellets from short rotation coppice (poplar – no fertilisation)	Case 1	1–500 km	56%	35%	48%	23%
		500–10 000 km	54%	32%	46%	20%
		more than 10 000 km	49%	24%	40%	10%
	Case 2a	1–500 km	76%	64%	72%	58%
		500–10 000 km	74%	61%	69%	54%
		more than 10 000 km	68%	53%	63%	45%
	Case 3a	1–500 km	91%	86%	90%	85%
		500–10 000 km	89%	83%	87%	81%
		more than 10 000 km	83%	75%	81%	71%
Stemwood	Case 1	1–500 km	57%	37%	49%	24%
		500–2 500 km	58%	37%	49%	25%
		2 500–10 000 km	55%	34%	47%	21%
		more than	50%	26%	40%	11%

		10 000 km				
	Case 2a	1–500 km	77%	66%	73%	60%
		500–2 500 km	77%	66%	73%	60%
		2 500–10 000 km	75%	63%	70%	56%
		more than 10 000 km	70%	55%	64%	46%
	Case 3a	1–500 km	92%	88%	91%	86%
		500–2 500 km	92%	88%	91%	87%
		2 500–10 000 km	90%	85%	88%	83%
		more than 10 000 km	84%	77%	82%	73%
Wood briquettes or pellets from wood industry residues	Case 1	1–500 km	75%	62%	69%	55%
		500–2 500 km	75%	62%	70%	55%
		2 500–10 000 km	72%	59%	67%	51%
		more than 10 000 km	67%	51%	61%	42%
	Case 2a	1–500 km	87%	80%	84%	76%
		500–2 500 km	87%	80%	84%	77%
		2 500–10 000 km	85%	77%	82%	73%
		more than 10 000 km	79%	69%	75%	63%
	Case 3a	1–500 km	95%	93%	94%	91%
		500–2 500 km	95%	93%	94%	92%
		2 500–10 000 km	93%	90%	92%	88%
		more than 10 000 km	88%	82%	85%	78%

* *Case 1* refers to processes in which a Natural Gas boiler is used to provide the process heat to the pellet mill. The electricity for the pellet press is supplied from the grid.

Case 2a refers to processes in which a boiler fuelled with wood chips is used to provide the process heat to the pellet mill. The electricity for the pellet press is supplied from the grid.

Case 3a refers to processes in which a CHP, fuelled with wood chips, is used to provide heat and electricity to the pellet mill.

Agricultural production pathways					
Biomass fuel production system	**Transport distance**	**Greenhouse gas emissions savings – typical value**		**Greenhouse gas emissions savings – default value**	
		Heat	**Electricity**	**Heat**	**Electricity**
Agricultural residues with a density of < 0,2 t/m^3 *	1–500 km	95%	92%	93%	90%
	500–2 500 km	89%	83%	86%	80%
	2 500–10 000 km	77%	66%	73%	60%
	more than 10 000 km	57%	36%	48%	23%
Agricultural residues with a density of > 0,2 t/m^3 **	1–500 km	95%	92%	93%	90%
	500–2 500 km	93%	89%	92%	87%
	2 500–10 000 km	88%	82%	85%	78%
	more than 10 000 km	78%	68%	74%	61%
Straw pellets	1–500 km	88%	82%	85%	78%
	500–10 000 km	86%	79%	83%	74%
	more than 10 000 km	80%	70%	76%	64%
Bagasse briquettes	500–10 000 km	93%	89%	91%	87%
	more than 10 000 km	87%	81%	85%	77%
Palm kernel meal	more than 10 000 km	20%	– 18%	11%	– 33%
Palm kernel meal (no CH_4 emissions from the oil mill)	more than 10 000 km	46%	20%	42%	14%

* This group of materials includes agricultural residues with a low bulk density and includes materials such as straw bales, oat hulls, rice husks and bagasse bales (non-exhaustive list).

** This group of agricultural residues with higher bulk density includes materials such as corn cobs, nut shells, soy shells, palm kernel shells (non-exhaustive list).

Biogas for electricity *				
Biogas production system		**Technological opportunities**	**Greenhouse gas emissions savings – typical value**	**Greenhouse gas emissions savings – default value**
Slurry [1]	Case	open digestate[2]	146%	94%

	1	closed digestate[3]	246%	240%
	Case 2	open digestate	136%	85%
		closed digestate	227%	219%
	Case 3	open digestate	142%	86%
		closed digestate	243%	235%
Corn (Maize), whole plant [4])	Case 1	open digestate	36%	21%
		closed digestate	59%	53%
	Case 2	open digestate	34%	18%
		closed digestate	55%	47%
	Case 3	open digestate	28%	10%
		closed digestate	52%	43%
Biowaste	Case 1	open digestate	47%	26%
		closed digestate	84%	78%
	Case 2	open digestate	43%	21%
		closed digestate	77%	68%
	Case 3	open digestate	38%	14%
		closed digestate	76%	66%

1) *Values for the production of biogas from manure include negative emissions for emissions saved through the management of unprocessed manure. The value of e_{sca} is equal to – 45 g CO_2 eq/MJ of manure used in anaerobic digestion.*

2) *Post-storage tank without cover: Open digestate storage accounts for additional emissions of CH4 and N2O. The magnitude of these emissions changes according to ambient conditions, substrate types and degradation efficiency.*

3) *Post-storage tank with cover and gas collection: Closed storage means that the digestate resulting from the degradation process is stored in a gas-tight tank and that the additional biogas released during storage is considered to have been recovered for the production of additional electricity or biomethane. No greenhouse gas emissions are included in this process.*

4) *Corn (Maize), whole plant: maize harvested as feed and ensiled for preservation.*

* Case 1 refers to pathways in which electricity and heat required in the process are supplied by the CHP engine itself.

Case 2 refers to pathways in which the electricity required in the process is taken from the grid and the process heat is supplied by the CHP engine itself. In some Member States, operators are not allowed to claim the gross production for subsidies and case 1 is the more likely configuration.

Case 3 refers to pathways in which the electricity required in the process is taken from the grid and the process heat is supplied by a biogas boiler. This case applies to some installations in which the CHP engine is not on-site and biogas is sold (but not upgraded to biomethane).

Biogas for electricity production – mixtures of manure and corn (maize)

Biogas production system		Technological opportunities	Greenhouse gas emissions savings – typical value	Greenhouse gas emissions savings – default value
Manure – corn (maize) 80%–20%	Case 1	Open digestate [1)]	72%	45%
		Closed digestate [2)]	120%	114%
	Case 2	Open digestate	67%	40%
		Closed digestate	111%	103%
	Case 3	Open digestate	65%	35%
		Closed digestate	114%	106%
Manure – corn (maize) 70%–30%	Case 1	Open digestate	60%	37%
		Closed digestate	100%	94%
	Case 2	Open digestate	57%	32%
		Closed digestate	93%	85%
	Case 3	Open digestate	53%	27%
		Closed digestate	94%	85%
Manure – corn (maize) 60%–40%	Case 1	Open digestate	53%	32%
		Closed digestate	88%	82%
	Case 2	Open digestate	50%	28%
		Closed digestate	82%	73%
	Case 3	Open digestate	46%	22%
		Closed digestate	81%	72%

1) *Post-storage tank without cover.*

2) *Post-storage tank with cover and gas collection.*

Biomethane for transport *			
Biomethane production system	**Technological opportunities**	**Greenhouse gas emissions savings – typical value**	**Greenhouse gas emissions savings – default value**
Manure	Open digestate, without off-gas combustion [1)]	117%	72%
	Open digestate, with off-gas combustion [2)]	133%	94%
	Closed digestate, without off-gas combustion [3)]	190%	179%
	Closed digestate, with off-gas combustion [4)]	206%	202%
Maize (corn), whole plant	Open digestate, without off-gas combustion	35%	17%
	Open digestate, with off-gas combustion	51%	39%
	Closed digestate, without off-gas combustion	52%	41%
	Closed digestate, with	68%	63%

	off-gas combustion		
Biowaste	Open digestate, without off-gas combustion	43%	20%
	Open digestate, with off-gas combustion	59%	42%
	Closed digestate, without off-gas combustion	70%	58%
	Closed digestate, with off-gas combustion	86%	80%

1) *Post-storage tank with cover and gas collection or torch for burning the biogas that is not recovered.*

2) *Post-storage tank without cover but with gas collection and torch for burning the biogas that is not recovered.*

3) *Post-storage tank with cover without gas collection and torch for burning the biogas that is not recovered.*

4) *Post-storage tank with cover with gas collection and torch for burning the biogas that is not recovered.*

* Greenhouse gas emissions savings for biomethane refer only to compressed biomethane relative to the fossil fuel comparator for transport of 94 g CO_2eq/MJ

Biomethane – mixtures of manure and corn (maize) *			
Biomethane production system	**Technological opportunities**	**Greenhouse gas emissions savings – typical value**	**Greenhouse gas emissions savings – default value**
Manure – Corn (Maize) 80%–20%	Open digestate, without off-gas combustion [1)]	62%	35%
	Open digestate, with off-gas combustion [2)]	78%	57%
	Closed digestate, without off-gas combustion	97%	86%
	Closed digestate, with off-gas combustion	113%	108%
Manure – Corn (Maize) 70%–30%	Open digestate, without off-gas combustion	53%	29%
	Open digestate, with off-gas combustion	69%	51%
	Closed digestate,	83%	71%

	without off-gas combustion		
	Closed digestate, with off-gas combustion	99%	94%
Manure – Corn (Maize) 60%–40%	Open digestate, without off-gas combustion	48%	25%
	Open digestate, with off-gas combustion	64%	48%
	Closed digestate, without off-gas combustion	74%	62%
	Closed digestate, with off-gas combustion	90%	84%

1) This category includes the following categories for technologies upgrading biogas to biomethane: PSA (Pressure Swing Adsorption), PWS (Pressure Water Scrubbing), membranes, cryogenic and OPS (Organic Physical Scrubbing). It includes an emission of 0.03 MJ CH_4/MJ of biomethane for methane emissions in the off-gases.

2) This category includes the following categories for technologies upgrading biogas to biomethane: PWS (Pressure Water Scrubbing) when water is recycled, PSA (Pressure Swing Adsorption), chemical scrubber, OPS (Organic Physical Scrubbing), membranes and cryogenic upgrade. No methane emissions are included for this category (the methane in the off-gas is combusted if present).

* The greenhouse gas emissions savings for biomethane refer only to compressed biomethane relative to the fossil fuel comparator for transport of 94 g CO_2eq/MJ.

Annex B

Calculation of actual greenhouse gas emissions saving

Methods for calculating actual values for greenhouse gas emissions saving

1. Greenhouse gas emissions from the production and use of biomass fuels shall be calculated as follows:

a. The greenhouse gas emissions from the production and use of biomass fuels prior to their conversion to electricity, heating and cooling shall be calculated using the following formula:

$E = e_{ec} + e_{l} + e_{p} + e_{td} + e_{u} - e_{sca} - e_{ccs} - e_{ccr}$,

where

E = total emissions from the production of the fuel before energy conversion

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

e_{l} = annual emissions from carbon stock changes due to land use change

e_{p} = emissions from processing

e_{td} = emissions from transport and distribution

e_{u} = emissions from the use of the fuel itself

e_{sca} = emissions savings from soil carbon accumulation through improved agricultural management

e_{ccs} = emissions savings from the capture and geological storage of CO_2 and

e_{ccr} = emissions savings from the capture and replacement of CO_2

Emissions from the manufacture of machinery and equipment shall not be included.

b. In the case of co-digestion of different substrates in a biogas installation for the production of biogas or biomethane, the default greenhouse gas emission values shall be calculated using the following formula:

$$E = \sum_{1}^{n} S_n \cdot E_n$$

where

E = greenhouse gas emissions per MJ of biogas or biogas produced from co-digestion of the defined mixture of substrates

S_n = share of feedstock n in energy content

E_n = emissions in g CO_2/MJ for production path n as specified in Part D of this Annex*

$$S_n = \frac{P_n \cdot W_n}{\sum_{1}^{n} P_n \cdot W_n}$$

where

P_n = energy yield [MJ] per kg of wet feedstock input n**

W_n = weighting factor of substrate n, defined as:

$$W_n = \frac{I_n}{\sum_1^n I_n} \cdot \left(\frac{1 - AM_n}{1 - SM_n}\right)$$

Where

I_n = annual input to reactor vessel of substrate n [tonnes of fresh product]

AM_n = average annual moisture content of substrate n [kg water/kg fresh product]

SM_n = standard moisture content for substrate n***.

* For manure used as substrate, a bonus of 45 g CO_2eq/MJ of manure (-54 kg CO_2eq/t fresh product) for improved agricultural and manure management.

** The following values P_n shall be used for the calculation of default values:

P(Corn): 4.16 [MJ_{biogas}/kg $_{\text{wet corn with 65\% moisture}}$]

P(Manure): 0.50 [MJ_{biogas}/kg $_{\text{slurry with 90\% moisture}}$]

P(Biowaste) 3,41 [MJ_{biogas}/kg $_{\text{wet biowaste with 76\% moisture}}$]

*** The following values for the standard water content of substrate SM_n shall be used:

SM(Corn): 0.65 [kg water/kg fresh product]

SM(Manure): 0.90 [kg water/kg fresh product]

SM(Biowaste): 0.76 [kg water/kg fresh product]

c. In the case of co-digestion of n substrates in a biogas installation for electricity or biomethane production, the actual greenhouse gas emissions of biogas and biomethane shall be calculated as follows:

$$E = \sum_1^n S_n \cdot (e_{ec,n} + e_{td,råprodukt,n} + e_{l,n} - e_{sca,n}) + e_p + e_{td,produkt} + e_u - e_{ccs} - e_{ccr}$$

where

E = total emissions from the production of biogas or biomethane before energy conversion

S_n = share of feedstock n as a fraction of feed into the reactor vessel

$e_{ec,n}$ = emissions from the extraction or cultivation of feedstock n

$e_{td,feedstock,n}$ = emissions from the transport of feedstock to the reactor vessel

$e_{l,n}$ = annual emissions from carbon stock changes due to land use change, for feedstock n

e_{sca} = emissions savings from improved agricultural management of feedstock n*

e_p = emissions from processing

$e_{td,product}$ = emissions from the transport and distribution of biogas and/or biomethane

e_u = emissions from the fuel use itself, i.e. the greenhouse gas emissions associated with combustion

e_{ccs} = emissions savings from the capture and geological storage of CO_2 and

e_{ccr} = emissions savings from carbon capture and replacement.

* A bonus of 45 g CO_2eq/MJ of manure applies for e_{sca} for improved agricultural and manure management if manure is used as substrate for the production of biogas and biomethane.

d. Greenhouse gas emissions from the use of biomass fuels for electricity, heating or cooling, including the energy conversion to the electricity and/or heating or cooling produced, shall be calculated as follows:

(i) In the case of energy installations supplying only heat:

$$EC_h = \frac{E}{\eta_h}$$

(ii) Energy installations supplying only electricity:

$$EC_{el} = \frac{E}{\eta_{el}}$$

where

$EC_{h,el}$ = Total greenhouse gas emissions from the final energy product.

E = Total greenhouse gas emissions from the fuel before final conversion.

$\eta_{electricity}$ = Electricity efficiency, defined as the annual electricity production divided by the annual fuel input based on its energy content.

η_h = Heat efficiency, defined as the annual useful heat production divided by the annual fuel input based on its energy content.

Producers and importers of wood pellets that do not use the fuel in an installation but sell it may use a value of 90% for η_h.

(iii) For the electrical or mechanical energy from energy installations providing useful heat together with electricity and/or mechanical energy:

$$EC_{el} = \frac{E}{\eta_{el}} \left(\frac{C_{el} \cdot \eta_{el}}{C_{el} \cdot \eta_{el} + C_h \cdot \eta_h} \right)$$

(iv) For useful heat from energy installations providing heat together with electricity and/or mechanical energy:

$$EC_h = \frac{E}{\eta_h} \left(\frac{C_h \cdot \eta_h}{C_{el} \cdot \eta_{el} + C_h \cdot \eta_h} \right)$$

where

$EC_{h,el}$ = Total greenhouse gas emissions from the final energy product.

E = Total greenhouse gas emissions from the fuel before final conversion.

$\eta_{electricity}$ = Electricity efficiency, defined as the annual electricity production divided by the annual energy input based on its energy content.

η_h = Heat efficiency, defined as the annual useful heat production divided by the annual energy input based on its energy content.

$C_{electricity}$ = The fraction of exergy in electricity and/or mechanical energy, set at 100% ($C_{electricity}$ = 1).

C_h = Carnot efficiency (fraction of exergy in useful heat).

Carnot efficiency, C_h, for useful heat at different temperatures is defined as:

$$C_h = \frac{T_h - T_0}{T_h}$$

where

T_h = Temperature of useful heat, measured in absolute temperature (kelvin) at the point of delivery.

T_0 = Ambient temperature, set at 273.15 kelvin (equivalent to 0 °C)

If the excess heat is transferred for heating buildings at a temperature below 150 °C (423.15 kelvin), Ch can alternatively be defined as follows:

C_h = Carnot efficiency for heat at 150 °C (423.15 kelvin), which is: 0.3546

For the purposes of this calculation, the following definitions shall apply:

(i) ‘cogeneration’: simultaneous generation in one process of thermal energy and electrical or mechanical energy

(ii) ‘useful heat’: heat produced to satisfy an economically justifiable demand for heat for heating or cooling

(iii) ‘economically justifiable demand’: the demand that does not exceed the heating or cooling demand and that could otherwise be met under market conditions.

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

(a) Greenhouse gas emissions from biomass fuels, E, shall be expressed in grams of CO_2 equivalents per MJ of biomass fuel, g CO_2eq/MJ.

(b) Greenhouse gas emissions from heating or electricity produced from biomass fuel, EC, shall be expressed in grams of CO_2 equivalents per MJ of final energy product (heat or electricity), g CO_2eq/MJ.

Where heating and cooling are produced in one process with electricity, emissions shall be divided between heat and electricity (as under point 1(d)), regardless of whether the heat is actually used for heating or cooling.[45)]

Where the greenhouse gas emissions from the extraction or cultivation of the raw materials eec are expressed in units g CO_2eq/dry tonne of feedstock, the conversion to grams of CO_2 equivalent per MJ of fuel, g CO_2eq/MJ, shall be calculated as follows:[46)]

$$e_{ec}brændstof_a\left[\frac{gCO_2eq}{MJ\ brændstof}\right]_{ec} = \frac{e_{ec}\ råprodukt_a\left[\frac{gCO_2eq}{t_{tør}}\right]}{LHV_a\left[\frac{MJ\ råprodukt}{t\ tørt\ råprodukt}\right]} * Brændstof\ råprodukt\ faktor_a * Fordelingsfaktor\ brændstof_a$$

$e_{ec}brændstof_a$	$e_{ec}fuel_a$
MJbrændstof	MJfuel
$e_{ec}råprodukt_a$	$e_{ec}feedstock_a$
$t_{tør}$	t_{dry}
MJ råprodukt | ttørt råprodukt	MJ feedstock | dry feedstock
Brændstof råprodukt faktor$_a$ • Fordelingsfaktor brændstof$_a$	Fuel feedstock factor$_a$ • Distribution factor fuel$_a$

Where

$$Fordelingsfaktor\ brændstof_a = \left[\frac{Brændstoffets\ energiindhold}{Energi\ brændstof + Energi\ i\ biprodukter}\right]$$

$$Brændstof\ råprodukt\ faktor_a = [Forholdet\ mellem\ MJ\ råprodukt, der\ kræves\ til\ at\ fremstille\ 1\ MJ\ brændstof]$$

Fordelingsfaktor brandstof$_a$	Distribution factor fuel$_a$
[Brandstoffets energiindhold | Energi brandstof + Energi i biprodukte]	[Energy content of the fuel | Energy fuel + Energy in by-products]
Brandstof råprodukt faktor$_a$	Fuel feedstock factor$_a$
[Forholdet mellem M] råprodukt, der kraves til at fremstille 1 MJ brandstof]	[Ratio of M] feedstock required to produce 1 MJ of fuel]

Emissions per dry tonne of feedstock shall be calculated as follows:

$$e_{ec}råprodukt_a\left[\frac{gCO_2eq}{t_{tør}}\right] = \frac{e_{ec}råprodukt_a\left[\frac{gCO_2eq}{t_{fugtig}}\right]}{(1 - fugtindholdet)}$$

e_{ec}råprodukt$_a$	e_{ec}feedstock$_a$
$t_{tør}$	t_{dry}
t_{fugtig}	t_{moist}
fugtindholdet	moisture content

3. The greenhouse gas emissions savings from biomass fuels shall be calculated as follows:

(a) greenhouse gas emissions savings from biomass fuels used as transport fuels:

SAVING = $(E_{F(t)} - E_B)/E_{F(t)}$,

where

E_B = total emissions from biofuels used as transport fuels; and

$E_{F(t)}$ = total emissions from the fossil fuel comparator for transport

(b) greenhouse gas emissions savings from heating and cooling and electricity produced from biomass fuels, as follows:

SAVING = $(EC_{F(h\&c,electricity)} - EC_{B(h\&c,electricity)})/EC_{F\ (h\&c,electricity)}$,

where

$EC_{B(h\&c,electricity)}$ = total emissions from the heat or electricity

$EC_{F(h\&c,electricity)}$ = total emissions from the fossil fuel comparator for useful heat or electricity.

4. For the purposes of the calculation referred to in point 1, the following greenhouse gases shall be included: CO_2, N_2O and CH_4. The following coefficients shall be used for the calculation of CO_2-equivalents:

CO_2 1

N_2O 298

CH_4 25

5. In emissions from the extraction, harvesting or cultivation of raw materials, e_{ec}, the following emissions shall be included: the extraction, harvesting or cultivation process itself; the collection, drying and storage of raw materials; losses and leaks; the production of chemicals or products used in extraction or cultivation. The capture of CO_2 through the cultivation of raw materials shall not be included. Estimates of emissions from the cultivation of agricultural biomass may be replaced by estimates based on regional averages of cultivation emissions contained in the reports referred to in Article 28(4) of this Directive or the information on the disaggregated default values for cultivation emissions set out in this Annex. In the absence of relevant information in the said reports, it is allowed to calculate averages on the basis of local agricultural practices, e.g. from data on groups of farms, as an alternative to the use of actual values.

Estimates based on averages of cultivation and harvesting emissions calculated for geographical areas at national level may be used instead of actual values of cultivation and harvesting emissions of forest biomass.

6. For the purposes of the calculation referred to in point 1(a), greenhouse gas emissions savings from improved agriculture management, esca, such as shifting to reduced or zero-tillage, improved crop/rotation, the use of cover crops, including crop residue management, and the use of organic soil improver, such as compost and manure fermentation digestate, shall be taken into account only if they do not risk negatively affecting biodiversity. In addition, reliable and verifiable evidence of increased soil carbon shall be provided, or where it is reasonable to expect that carbon has increased over the period in which the raw materials concerned were cultivated, while also taking into account emissions where such practices have led to the increased use of fertilisers and herbicides

[47)].

7. Annual emissions from carbon stock changes due to land use change, e_l, shall be calculated by distributing the total emissions equally over 20 years. Such emissions shall be calculated in accordance with the following formula:

$e_l = (CS_R – CS_A) \times 3.664 \times 1/20 \times 1/P – e_B$,[48)]

where

e_l = annualised greenhouse gas emissions from carbon stock change due to land-use change (measured as mass (grams) of CO_2 equivalents per unit of biomass fuel energy). ‘Cultivated land’[49)] and ‘cultivated land with perennial crops’[50)] are considered as single land use.

CS_R = the carbon stock per unit area associated with the reference land-use (measured as mass (tonnes) of carbon per unit area, including both soil and vegetation). The reference land use shall be the land use in January 2008, or 20 years before the raw material is harvested, whichever is the latest;

CS_A = the carbon stock per unit area associated with the actual land-use (measured as mass (tonnes) of carbon per unit area, including both soil and vegetation). In cases where carbon stocks accumulate over more than one year, the value attributed to CS_A, shall be the estimated stock per unit land after 20 years or when the crop is ripe, whichever occurs first; and

P = productivity of the crop (measured as biomass fuel energy per unit land per year).

e_B = bonus of 29 g CO_2eq /MJ of biomass fuel, provided that the biomass is obtained from restored degraded land under the conditions laid down in point 8.

8. The bonus of 29 g CO_2eq /MJ shall apply provided that it can be demonstrated that the land concerned:

(a) was not used for agricultural purposes in January 2008 or for any other activity; and

(b) is severely degraded land, including such land that has previously been used for agricultural purposes.

The bonus of 29 g CO_2eq/MJ shall apply for a period of up to 20 years from the date of conversion of the land to agricultural use, provided that the land falling under point (b) ensures a regular growth of carbon stock as well as a significant reduction of erosion.

9. ‘Severely degraded land’ means land that, for a significant period of time, has either been significantly salinated or has had a particularly low organic matter content and has been severely eroded.

10. In accordance with point 10 of Part C of Annex V to this Directive, Commission Decision 2010/335/EU shall[51)] prove guidance for the calculation of land carbon stocks for the purposes of this Directive based on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories – volume 4 and in accordance with Regulations (EU) No 525/2013 and (EU) 2018/841 as a basis for the calculation of land carbon stocks.

11. Emissions from processing, ep, shall include emissions from the following: the processing itself, losses and leaks; the production of chemicals or products used in processing, including CO_2 emissions equal to the carbon content of fossil inputs, regardless of whether they are actually combusted in the process.

For the purpose of accounting for electricity consumption not produced by the installation producing solid or gaseous biomass fuel itself, the greenhouse gas

emission intensity of the production and distribution of that electricity shall be assumed to be equal to the average emission intensity of the production and distribution of electricity in a defined area. By way of derogation from this rule, producers may use an average value for the electricity production of a single power plant if that plant is not connected to the electricity grid.

Emissions from processing shall include emissions from the drying of intermediate products and materials, where applicable.

12. In emissions from transport and distribution, e_{td}, emissions from the transport of raw materials and semi-finished products, as well as from the storage and distribution of finished products, shall be included. Emissions from transport and distribution included in accordance with point 5 shall not be covered by this point.

13. CO_2 emissions from the actual use of the fuel, e_u, shall be set to zero for biomass fuels. Emissions of non CO_2 greenhouse gases (CH_4 and N_2O) from the fuel used shall be included in the eu factor.

14. Emissions saving from the capture and geological storage of CO_2, e_{ccs}, that is not already included in ep, shall only cover emissions avoided through the capture and storage of CO_2, the emission of which is directly linked to the extraction, transport, processing and distribution of biomass fuels, provided that storage is carried out in accordance with Directive 2009/31/EC.

15. Emissions saving from the capture and replacement of CO_2, e_{ccr}, shall be directly connected to the production of biomass fuels to which they are linked and shall only cover emissions avoided by capturing CO_2, the carbon of which is derived from biomass and which is used to replace fossil-derived CO_2 during the production of commercial products and services before 1 January 2036.

16. Where a cogeneration unit – which supplies heat and/or electricity to a biomass fuel production process for which emissions are calculated – produces excess electricity and/or excess useful heat, the greenhouse gas emissions shall be divided between the electricity and the useful heat according to the temperature of the heat (reflecting the usefulness (utility) of the heat). The useful part of the heat is obtained by multiplying its energy content with the Carnot efficiency C_h, calculated as follows:

$$C_h = \frac{T_h - T_0}{T_h}$$

T_h = Temperature of useful heat, measured in absolute temperature (kelvin) at the point of delivery.

T_0 = Ambient temperature, set at 273.15 kelvin (equivalent to 0 °C

If the excess heat is transferred for heating buildings at a temperature below 150 °C (423.15 kelvin), C_h may alternatively be defined as follows:

C_h = Carnot efficiency for heat at 150 °C (423.15 kelvin), which is: 0.3546

For the purposes of this calculation, the actual efficiencies shall be used, defined as the annual mechanical energy, electricity and heat produced, each divided by the annual energy input.

For the purposes of this calculation, the following definitions shall apply:

(a) ‘cogeneration’: simultaneous production of thermal energy and electrical and/or mechanical energy in one and the same process;

(b) ‘useful heat’: heat produced to satisfy an economically justifiable demand for heat for heating or cooling;

‘economically justifiable demand’: the demand that does not exceed the heating or cooling demand and that would otherwise be satisfied under market conditions;

17. Where a biomass fuel production process produces a combination of the fuel for which emissions are calculated and one or more other products (‘by-products’), greenhouse gas emissions shall be divided between the fuel or its intermediate product and the by-products in proportion to their energy content (expressed in terms of net calorific value for all by-products other than electricity and heat). The greenhouse gas intensity of excess useful heat or excess electricity shall be the same as the greenhouse gas intensity of heat or electricity supplied to the biomass fuel production process and shall be determined by calculating the greenhouse gas intensity of all inputs and emissions, including feedstock and CH_4 and N_2O emissions, to and from the cogeneration unit, boiler or other equipment supplying heat or electricity to the biomass fuel production process. In the case of simultaneous production of heat and electricity (cogeneration), the calculation shall be carried out as in point 16.

18.

The emissions to be distributed for the purposes of the calculations referred to in point 17 shall be eec + electricity + esca +, the fractions of ep, etd, eccs and eccr that take place up to and including the final process step in the production of the by-product. Where by-products have been allocated at an earlier process step in the life cycle, the fraction of those emissions attributed to the intermediate fuel product in the final process step shall replace the full emission in the calculation.

For biogas and biomethane, all by-products not covered by point 17 shall be included in the calculation. By-products with negative energy content shall be considered for the calculation to have an energy content of zero.

As a general rule, waste and residues, including all waste and residues listed in Annex IX, shall be considered to have zero life-cycle greenhouse gas emissions in the processes preceding the collection of those materials, regardless of whether they are processed into intermediates before being transformed into the final product.

In the case of fuels produced in refineries, other than the combination of processing plants with boilers or cogeneration units supplying heat and/or electricity to the processing installation, the unit of analysis for the purposes of the calculation referred to in point 17 shall be the refinery.

19. For the purposes of calculations according to the formula in point 3 for biomass fuels used for electricity production, the ECF(electricity) value of 183 g CO_2eq/MJ of electricity or 212 g CO_2eq/MJ of electricity for the outermost regions shall be used for emissions from the fossil fuel comparator.

For the purposes of calculations according to the formula in point 3 for biomass fuels used for the useful heat production, heating and/or cooling, the $EC_{F(h)}$ value of 80 g CO_2eq/MJ of heat shall be used for emissions from the fossil fuel comparator. This value is also to be used by producers and importers of wood pellets for the share of wood pellets sold to private households.

For the purposes of calculations according to the formula in point 3 for biomass fuels used for useful heat production where a direct physical substitution of coal can be demonstrated, the $EC_{F(h)}$ value of 124 g CO_2eq/MJ of heat shall be used for the emissions from the fossil fuel comparator.

For the purposes of calculations according to the formula in point 3 for biomass fuels used in transport, the $EC_{F(t)}$ value of 94 g CO_2eq/MJ shall be used for the fossil fuel comparator.

Annex C

Disaggregated default values for greenhouse gas emissions

Disaggregated default values for greenhouse gas emissions from biomass fuels

Biomass fuel production system	**Transport distance**	**Greenhouse gas emissions – typical value (g CO_2 eq/MJ)**				**Greenhouse gas emissions – default value (g CO_2 eq/MJ)**			
		Cultivation	**Processing**	**Transport**	**Non CO_2 emissions from the use of the fuel itself**	**Cultivation**	**Processing**	**Transport**	**Non CO_2 emissions from the use of the fuel itself**
Wood chips from forestry residues	1–500 km	0.0	1.6	3.0	0.4	0.0	1.9	3.6	0.5
	500–2 500 km	0.0	1.6	5.2	0.4	0.0	1.9	6.2	0.5
	2 500–10 000	0.0	1.6	10.5	0.4	0.0	1.9	12.6	0.5

	km								
	Over 10 000 km	0.0	1.6	20.5	0.4	0.0	1.9	24.6	0.5
Wood chips from short rotation coppice (eucalyptus)	2 500–10 000 km	4.4	0.0	11.0	0.4	4.4	0.0	13.2	0.5
Wood chips from short rotation coppice (poplar – fertilised)	1–500 km	3.9	0.0	3.5	0.4	3.9	0.0	4.2	0.5
	500–2 500 km	3.9	0.0	5.6	0.4	3.9	0.0	6.8	0.5
	2 500–10 000 km	3.9	0.0	11.0	0.4	3.9	0.0	13.2	0.5
	Over 10 000 km	3.9	0.0	21.0	0.4	3.9	0.0	25.2	0.5
Wood chips from short rotation coppice (poplar – no fertilisation)	1–500 km	2.2	0.0	3.5	0.4	2.2	0.0	4.2	0.5
	500–2 500 km	2.2	0.0	5.6	0.4	2.2	0.0	6.8	0.5
	2 500–10 000 km	2.2	0.0	11.0	0.4	2.2	0.0	13.2	0.5
	Over 10 000 km	2.2	0.0	21.0	0.4	2.2	0.0	25.2	0.5
Wood chips from stemwood	1–500 km	1.1	0.3	3.0	0.4	1.1	0.4	3.6	0.5
	500–2 500 km	1.1	0.3	5.2	0.4	1.1	0.4	6.2	0.5
	2 500–10 000 km	1.1	0.3	10.5	0.4	1.1	0.4	12.6	0.5
	Over 10 000 km	1.1	0.3	20.5	0.4	1.1	0.4	24.6	0.5
Wood chips from	1–500 km	0.0	0.3	3.0	0.4	0.0	0.4	3.6	0.5
	500–2 5	0.0	0.3	5.2	0.4	0.0	0.4	6.2	0.5

wood industry residues	00 km								
	2 500–10 000 km	0.0	0.3	10.5	0.4	0.0	0.4	12.6	0.5
	Over 10 000 km	0.0	0.3	20.5	0.4	0.0	0.4	24.6	0.5

Wood briquettes or pellets

Biomass fuel production system	**Transport distance**	**Greenhouse gas emissions – typical value (g co_2 eq/mj)**				**Greenhouse gas emissions – default value (g co_2 eq/mj)**			
		Cultivation	**Processing**	**Transport and distribution**	**Non CO_2 emissions from the use of the fuel itself**	**Cultivation**	**Processing**	**Transport and distribution**	**Non CO_2 emissions from the use of the fuel itself**
Wood briquettes or pellets from forestry residues (case 1)	1–500 km	0.0	25.8	2.9	0.3	0.0	30.9	3.5	0.3
	500–2 500 km	0.0	25.8	2.8	0.3	0.0	30.9	3.3	0.3
	2 500–10 000 km	0.0	25.8	4.3	0.3	0.0	30.9	5.2	0.3
	more than 10 000 km	0.0	25.8	7.9	0.3	0.0	30.9	9.5	0.3
Wood briquettes or pellets from forestry residues (case 2a)	1–500 km	0.0	12.5	3.0	0.3	0.0	15.0	3.6	0.3
	500–2 500 km	0.0	12.5	2.9	0.3	0.0	15.0	3.5	0.3
	2 500–10 000 km	0.0	12.5	4.4	0.3	0.0	15.0	5.3	0.3
	more than 10 000 km	0.0	12.5	8.1	0.3	0.0	15.0	9.8	0.3
Wood briquette	1–500 km	0.0	2.4	3.0	0.3	0.0	2.8	3.6	0.3

s or pellets from forestry residues (case 3a)	500–2 500 km	0.0	2.4	2.9	0.3	0.0	2.8	3.5	0.3
	2 500–10 000 km	0.0	2.4	4.4	0.3	0.0	2.8	5.3	0.3
	more than 10 000 km	0.0	2.4	8.2	0.3	0.0	2.8	9.8	0.3
Wood briquettes from short rotation coppice (eucalyptus – case 1)	2 500–10 000 km	3.9	24.5	4.3	0.3	3.9	29.4	5.2	0.3
Wood briquettes from short rotation coppice (eucalyptus – case 2a)	2 500–10 000 km	5.0	10.6	4.4	0.3	5.0	12.7	5.3	0.3
Wood briquettes from short rotation coppice (eucalyptus – case 3a)	2 500–10 000 km	5.3	0.3	4.4	0.3	5.3	0.4	5.3	0.3
Wood briquettes from short rotation coppice (poplar – fertilised – case 1)	1–500 km	3.4	24.5	2.9	0.3	3.4	29.4	3.5	0.3
	500–10 000 km	3.4	24.5	4.3	0.3	3.4	29.4	5.2	0.3
	more than 10 000 km	3.4	24.5	7.9	0.3	3.4	29.4	9.5	0.3
Wood briquette	1–500 km	4.4	10.6	3.0	0.3	4.4	12.7	3.6	0.3

s from short rotation coppice (poplar – fertilised – case 2a)	500–10 000 km	4.4	10.6	4.4	0.3	4.4	12.7	5.3	0.3
	more than 10 000 km	4.4	10.6	8.1	0.3	4.4	12.7	9.8	0.3
Wood briquettes from short rotation coppice (poplar – fertilised – case	1–500 km	4.6	0.3	3.0	0.3	4.6	0.4	3.6	0.3
	500–10 000 km	4.6	0.3	4.4	0.3	4.6	0.4	5.3	0.3
	more than 10 000 km	4.6	0.3	8.2	0.3	4.6	0.4	9.8	0.3
Wood briquettes from short rotation coppice (poplar – no	1–500 km	2.0	24.5	2.9	0.3	2.0	29.4	3.5	0.3
	500–2 5 00 km	2.0	24.5	4.3	0.3	2.0	29.4	5.2	0.3
	2 500–10 000 km	2.0	24.5	7.9	0.3	2.0	29.4	9.5	0.3
Wood briquettes from short rotation coppice (poplar – no fertilisati	1–500 km	2.5	10.6	3.0	0.3	2.5	12.7	3.6	0.3
	500–10 000 km	2.5	10.6	4.4	0.3	2.5	12.7	5.3	0.3
	more than 10 000 km	2.5	10.6	8.1	0.3	2.5	12.7	9.8	0.3
Wood briquettes from short rotation coppice (poplar – no fertilisati	1–500 km	2.6	0.3	3.0	0.3	2.6	0.4	3.6	0.3
	500–10 000 km	2.6	0.3	4.4	0.3	2.6	0.4	5.3	0.3
	more than 10 000 km	2.6	0.3	8.2	0.3	2.6	0.4	9.8	0.3
Wood briquettes or pellets from stemwoo	1–500 km	1.1	24.8	2.9	0.3	1.1	29.8	3.5	0.3
	500–2 5 00 km	1.1	24.8	2.8	0.3	1.1	29.8	3.3	0.3
	2 500–10 000	1.1	24.8	4.3	0.3	1.1	29.8	5.2	0.3

no fertilisati	km								
Wood briquettes or pellets from stemwood (case 1)	1–500 km	1.1	24.8	2.9	0.3	1.1	29.8	3.5	0.3
	500–2 500 km	1.1	24.8	2.8	0.3	1.1	29.8	3.3	0.3
	2 500–10 000 km	1.1	24.8	4.3	0.3	1.1	29.8	5.2	0.3
	more than 10 000 km	1.1	24.8	7.9	0.3	1.1	29.8	9.5	0.3
Wood briquettes or pellets from stemwood (case 2a)	1–500 km	1.4	11.0	3.0	0.3	1.4	13.2	3.6	0.3
	500–2 500 km	1.4	11.0	2.9	0.3	1.4	13.2	3.5	0.3
	2 500–10 000 km	1.4	11.0	4.4	0.3	1.4	13.2	5.3	0.3
	more than 10 000 km	1.4	11.0	8.1	0.3	1.4	13.2	9.8	0.3
Wood briquettes or pellets from stemwood (case 3a)	1–500 km	1.4	0.8	3.0	0.3	1.4	0.9	3.6	0.3
	500–2 500 km	1.4	0.8	2.9	0.3	1.4	0.9	3.5	0.3
	2 500–10 000 km	1.4	0.8	4.4	0.3	1.4	0.9	5.3	0.3
	more than 10 000 km	1.4	0.8	8.2	0.3	1.4	0.9	9.8	0.3
Wood briquettes or pellets from wood industry residues (case 1)	1–500 km	0.0	14.3	2.8	0.3	0.0	17.2	3.3	0.3
	500–2 500 km	0.0	14.3	2.7	0.3	0.0	17.2	3.2	0.3
	2 500–10 000 km	0.0	14.3	4.2	0.3	0.0	17.2	5.0	0.3
	more	0.0	14.3	7.7	0.3	0.0	17.2	9.2	0.3

	than 10 000 km								
Wood briquettes or pellets from wood industry residues (case 2a)	1–500 km	0.0	6.0	2.8	0.3	0.0	7.2	3.4	0.3
	500–2 500 km	0.0	6.0	2.7	0.3	0.0	7.2	3.3	0.3
	2 500–10 000 km	0.0	6.0	4.2	0.3	0.0	7.2	5.1	0.3
	more than 10 000 km	0.0	6.0	7.8	0.3	0.0	7.2	9.3	0.3
Wood briquettes or pellets from wood industry residues (case 3a)	1–500 km	0.0	0.2	2.8	0.3	0.0	0.3	3.4	0.3
	500–2 500 km	0.0	0.2	2.7	0.3	0.0	0.3	3.3	0.3
	2 500–10 000 km	0.0	0.2	4.2	0.3	0.0	0.3	5.1	0.3
	more than 10 000 km	0.0	0.2	7.8	0.3	0.0	0.3	9.3	0.3

Agricultural production pathways

Biomass fuel production system	**Transport distance**	**Greenhouse gas emissions – typical value (g CO_2 eq/MJ)**				**Greenhouse gas emissions – default value (g CO_2 eq/MJ)**			
		Cultivation	**Processing**	**Transport and distribution**	**Non CO_2 emissions from the use of the fuel itself**	**Cultivation**	**Processing**	**Transport and distribution**	**Non CO_2 emissions from the use of the fuel itself**
Agricultural residues with a density of < 0,2	1–500 km	0.0	0.9	2.6	0.2	0.0	1.1	3.1	0.3
	500–2 500 km	0.0	0.9	6.5	0.2	0.0	1.1	7.8	0.3
	2 500–10 000	0.0	0.9	14.2	0.2	0.0	1.1	17.0	0.3

t/m³	km								
	more than 10 000 km	0.0	0.9	28.3	0.2	0.0	1.1	34.0	0.3
Agricultural residues with a density of > 0,2 t/m³	1–500 km	0.0	0.9	2.6	0.2	0.0	1.1	3.1	0.3
	500–2 500 km	0.0	0.9	3.6	0.2	0.0	1.1	4.4	0.3
	2 500–10 000 km	0.0	0.9	7.1	0.2	0.0	1.1	8.5	0.3
	more than 10 000 km	0.0	0.9	13.6	0.2	0.0	1.1	16.3	0.3
Straw pellets	1–500 km	0.0	5.0	3.0	0.2	0.0	6.0	3.6	0.3
	500–10 000 km	0.0	5.0	4.6	0.2	0.0	6.0	5.5	0.3
	more than 10 000 km	0.0	5.0	8.3	0.2	0.0	6.0	10.0	0.3
Bagasse briquettes	500–10 000 km	0.0	0.3	4.3	0.4	0.0	0.4	5.2	0.5
	more than 10 000 km	0.0	0.3	8.0	0.4	0.0	0.4	9.5	0.5
Palm kernel meal	more than 10 000 km	21.6	21.1	11.2	0.2	21.6	25.4	13.5	0.3
Palm kernel meal (no CH_4 emissions from the oil mill)	more than 10 000 km	21.6	3.5	11.2	0.2	21.6	4.2	13.5	0.3

Disaggregated default values for biogas for electricity production

Biomass	**Techno**	**Typical value (g CO_2 eq/MJ)**	**Default value (g CO_2 eq/MJ)**

fuel production system		logy	Cultivation	Processing	Non CO_2 emissions from the use of the fuel itself	Transport	Fertiliser credits	Cultivation	Processing	Non CO_2 emissions from the use of the fuel itself	Transport	Fertiliser credits
Slurry [1)]	Case 1	Open digestate	0.0	69.6	8.9	0.8	-107.3	0.0	97.4	12.5	0.8	-107.3
		Closed digestate	0.0	0.0	8.9	0.8	-97.6	0.0	0.0	12.5	0.8	-97.6
	Case 2	Open digestate	0.0	74.1	8.9	0.8	-107.3	0.0	103.7	12.5	0.8	-107.3
		Closed digestate	0.0	4.2	8.9	0.8	-97.6	0.0	5.9	12.5	0.8	-97.6
	Case 3	Open digestate	0.0	83.2	8.9	0.9	-120.7	0.0	116.4	12.5	0.9	-120.7
		Closed digestate	0.0	4.6	8.9	0.8	-108.5	0.0	6.4	12.5	0.8	-108.5
Corn (Maize), the whole plant [2)]	Case 1	Open digestate	15.6	13.5	8.9	0,0 [3)]	—	15.6	18.9	12.5	0.0	—
		Closed digestate	15.2	0.0	8.9	0.0	—	15.2	0.0	12.5	0.0	—
	Case 2	Open digestate	15.6	18.8	8.9	0.0	—	15.6	26.3	12.5	0.0	—

		Closed digestate	15.2	5.2	8.9	0.0	—	15.2	7.2	12.5	0.0	—
	Case 3	Open digestate	17.5	21.0	8.9	0.0	—	17.5	29.3	12.5	0.0	—
		Closed digestate	17.1	5.7	8.9	0.0	—	17.1	7.9	12.5	0.0	—
Biowaste	Case 1	Open digestate	0.0	21.8	8.9	0.5	—	0.0	30.6	12.5	0.5	—
		Closed digestate	0.0	0.0	8.9	0.5	—	0.0	0.0	12.5	0.5	—
	Case 2	Open digestate	0.0	27.9	8.9	0.5	—	0.0	39.0	12.5	0.5	—
		Closed digestate	0.0	5.9	8.9	0.5	—	0.0	8.3	12.5	0.5	—
	Case 3	Open digestate	0.0	31.2	8.9	0.5	—	0.0	43.7	12.5	0.5	—
		Closed digestate	0.0	6.5	8.9	0.5	—	0.0	9.1	12.5	0.5	—

1) Values for the production of biogas from manure include negative emissions for emissions saved through the management of unprocessed manure. The value of e_{sca} is equal to -45 g CO_2eq/MJ of manure used in anaerobic digestion.

2) Corn (Maize), whole plant: maize harvested as feed and ensiled for preservation.

3) Transport of agricultural raw materials to the conversion installation is included in accordance with the methodology set out in the European Commission report of 25 February 2010 on sustainability requirements for the use of solid and gaseous

biomass sources in electricity, heating and cooling, included in the ‘cultivation’ value.

Disaggregated default values for biomethane

Biomethane production system	Technological opportunities		Typical value (g CO_2 eq/MJ)						Default value (g CO_2 eq/MJ)					
			Cultivation	Processing	Upgrading	Transport	Compression at gas station	Fertiliser credits	Cultivation	Processing	Upgrading	Transport	Compression at gas station	Fertiliser credits
Manure	Open digestate	without off-gas combustion	0.0	84.2	19.5	1.0	3.3	-124.4	0.0	117.9	27.3	1.0	4.6	-124.4
		with off-gas combustion	0.0	84.2	4.5	1.0	3.3	-124.4	0.0	117.9	6.3	1.0	4.6	-124.4
	Closed digestate	without off-gas combustion	0.0	3.2	19.5	0.9	3.3	-111.9	0.0	4.4	27.3	0.9	4.6	-111.9
		with off-gas combustion	0.0	3.2	4.5	0.9	3.3	-111.9	0.0	4.4	6.3	0.9	4.6	-111.9
Maize, the whole plant	Open digestate	without off-gas combustion	18.1	20.1	19.5	0.0	3.3	—	18.1	28.1	27.3	0.0	4.6	—
		with off-gas combustion	18.1	20.1	4.5	0.0	3.3	—	18.1	28.1	6.3	0.0	4.6	—
	Clos	witho	17.6	4.3	19.5	0.0	3.3	—	17.6	6.0	27.3	0.0	4.6	—

	ed digestate	ut off-gas combustion											
		with off-gas combustion	17.6	4.3	4.5	0.0	3.3	—	17.6	6.0	6.3	0.0	4.6	—
Biowaste	Open digestate	without off-gas combustion	0.0	30.6	19.5	0.6	3.3	—	0.0	42.8	27.3	0.6	4.6	—
		with off-gas combustion	0.0	30.6	4.5	0.6	3.3	—	0.0	42.8	6.3	0.6	4.6	—
	Closed digestate	without off-gas combustion	0.0	5.1	19.5	0.5	3.3	—	0.0	7.2	27.3	0.5	4.6	—
		with off-gas combustion	0.0	5.1	4.5	0.5	3.3	—	0.0	7.2	6.3	0.5	4.6	—

Annex D

Default values for greenhouse gas emissions

Total typical and default values for biomass fuel pathways

Biomass fuel production system	**Transport distance**	**Greenhouse gas emissions – typical value (g CO_2 eq/MJ)**	**Greenhouse gas emissions – default value (g CO_2 eq/MJ)**
Wood chips from forestry residues	1–500 km	5	6
	500–2 500 km	7	9
	2 500–10 000 km	12	15
	more than	22	27

	10 000 km		
Wood chips from short rotation coppice (eucalyptus)	2 500–10 000 km	16	18
Wood chips from short rotation coppice (poplar – fertilised)	1–500 km	8	9
	500–2 500 km	10	11
	2 500–10 000 km	15	18
	more than 10 000 km	25	30
Wood chips from short rotation coppice (poplar – no fertilisation)	1–500 km	6	7
	500–2 500 km	8	10
	2 500–10 000 km	14	16
	more than 10 000 km	24	28
Wood chips from stemwood	1–500 km	5	6
	500–2 500 km	7	8
	2 500–10 000 km	12	15
	more than 10 000 km	22	27
Wood chips from industrial residues	1–500 km	4	5
	500–2 500 km	6	7
	2 500–10 000 km	11	13
	more than 10 000 km	21	25
Wood briquettes or pellets from forestry residues (case 1)	1–500 km	29	35
	500–2 500 km	29	35
	2 500–10 000 km	30	36
	more than 10 000 km	34	41
Wood briquettes or pellets from forestry residues (case 2a)	1–500 km	16	19
	500–2 500 km	16	19
	2 500–10 000 km	17	21

2) This group of agricultural residues with higher bulk density includes materials such as corn cobs, nut shells, soya shells, palm kernel shells (non-exhaustive list).

Typical and default values – biogas for electricity

Biogas production system	Technological opportunities		Typical values	Default values
			Greenhouse gas emissions (g CO_2 eq/MJ)	Greenhouse gas emissions (g CO_2 eq/MJ)
Biogas for electricity from slurry	Case 1	Open digestate [1)]	– 28	3
		Closed digestate [2)]	– 88	– 84
	Case 2	Open digestate	– 23	10
		Closed digestate	– 84	– 78
	Case 3	Open digestate	– 28	9
		Closed digestate	– 94	– 89
Biogas for electricity from corn (Maize), whole plant	Case 1	Open digestate	38	47
		Closed digestate	24	28
	Case 2	Open digestate	43	54
		Closed digestate	29	35
	Case 3	Open digestate	47	59
		Closed digestate	32	38
Biogas for electricity from biowaste	Case 1	Open digestate	31	44
		Closed digestate	9	13
	Case 2	Open digestate	37	52
		Closed digestate	15	21
	Case 3	Open digestate	41	57
		Closed digestate	16	22

1) *Post-storage tank without cover*: Open digestate/degassed manure storage accounts for additional methane emissions, which change depending on the weather, substrate and degradation efficiency. For the purposes of these calculations, the quantities shall be taken to be equal to 0.05 MJ CH_4.

2) *Post-storage tank with cover*: Closed storage means that the digestate/degassed manure resulting from the degradation process is stored in a

gas-tight tank and the additional biogas released during storage is considered to be recovered for the production of additional electricity or biomethane.

Typical and default values for biomethane

Biomethane production system	Technological opportunities	Greenhouse gas emissions – typical value (g CO_2 eq/MJ)	Greenhouse gas emissions – default value (g CO_2 eq/MJ)
Biomethane from slurry	Open digestate, without off-gas combustion [1]	– 20	22
	Open digestate, with off-gas combustion [2]	– 35	1
	Closed digestate, without off-gas combustion	– 88	– 79
	Closed digestate, with off-gas combustion	– 103	– 100
Biomethane from corn (Maize), whole plant	Open digestate, without off-gas combustion	58	73
	Open digestate, with off-gas combustion	43	52
	Closed digestate, without off-gas combustion	41	51
	Closed digestate, with off-gas combustion	26	30
Biomethane from biowaste	Open digestate, without off-gas combustion	51	71
	Open digestate, with off-gas combustion	36	50
	Closed digestate, without off-gas combustion	25	35
	Closed digestate, with off-gas combustion	10	14

1) This category includes the following categories for technologies upgrading biogas to biomethane: PSA (Pressure Swing Adsorption), PWS (Pressure Water Scrubbing), membranes, cryogenic and OPS (Organic Physical Scrubbing). It includes an emission of 0.03 M JCH_4 / MJ of biomethane for methane emissions in the off-gases.

2) This category includes the following categories for technologies upgrading biogas to biomethane: PWS (Pressure Water Scrubbing) when water is recycled, PSA (Pressure Swing Adsorption), chemical scrubber, OPS (Organic Physical Scrubbing), membranes and cryogenic upgrade. No methane emissions are included for this category (the methane in the off-gas is combusted if present).

Typical and default values – biogas for electricity production – mixtures of manure and corn (Maize): greenhouse gas emissions expressed as shares on the basis of fresh mass

Biogas production system		Technological opportunities	Greenhouse gas emissions – typical value (g CO_2 eq/MJ)	Greenhouse gas emissions – default value (g CO_2 eq/MJ)
Manure – Corn (Maize) 80%–20%	Case 1	Open digestate	17	33
		Closed digestate	-12	-9
	Case 2	Open digestate	22	40
		Closed digestate	-7	-2
	Case 3	Open digestate	23	43
		Closed digestate	-9	-4
Manure – Corn (Maize) 70%–30%	Case 1	Open digestate	24	37
		Closed digestate	0	3
	Case 2	Open digestate	29	45
		Closed digestate	4	10
	Case 3	Open digestate	31	48
		Closed digestate	4	10
Manure – Corn (Maize) 60%–40%	Case 1	Open digestate	28	40
		Closed digestate	7	11
	Case 2	Open digestate	33	47
		Closed digestate	12	18
	Case 3	Open digestate	36	52
		Closed digestate	12	18

Remarks:

Case 1 refers to production pathways where the electricity and heat required for the process is supplied by the engine itself of the cogeneration installation.

Case 2 refers to production pathways where the electricity required for the process is taken from the grid and the process heat is supplied by the engine itself of the cogeneration installation. In some Member States, operators are not allowed to claim the gross production for subsidies and case 1 is the more likely configuration.

Case 3 refers to pathways in which the electricity required in the process is taken from the grid and the process heat is supplied by a biogas boiler. This case applies to some installations in which the CHP engine is not on-site and biogas is sold (but not upgraded to biomethane).

Typical and default values – biomethane – mixtures of manure and corn (Maize): greenhouse gas emissions expressed as shares on the basis of fresh mass

Biomethane production system	Technological opportunities	Typical value	Default value
		(g CO_2 eq/MJ)	(g CO_2 eq/MJ)
Manure – Corn (Maize) 80%–20%	Open digestate, without off-gas combustion	32	57
	Open digestate, with off-gas combustion	17	36
	Closed digestate, without off-gas combustion	-1	9
	Closed digestate, with off-gas combustion	-16	-12
Manure – Corn (Maize) 70%–30%	Open digestate, without off-gas combustion	41	62
	Open digestate, with off-gas combustion	26	41
	Closed digestate, without off-gas combustion	13	22
	Closed digestate, with off-gas combustion	-2	1
Manure – Corn (Maize) 60%–40%	Open digestate, without off-gas combustion	46	66
	Open digestate, with off-gas combustion	31	45
	Closed digestate, without off-gas combustion	22	31
	Closed digestate, with off-gas combustion	7	10

For biomethane used as compressed biomethane as fuel for transport, a value of 4.6 g CO_2eq/MJ of biomethane shall be added to the default values.

Annex E

Rules for calculating the greenhouse gas impacts of biofuels, bioliquids and the fossil fuels with which they are compared

1. Greenhouse gas emissions from the production and use of transport fuels, biofuels and bioliquids shall be calculated as follows:

(a) Greenhouse gas emissions from the production and use of biofuels shall be calculated using the following formula:

$E = e_{ec} + e_{lectricity} + e_p + e_{td} + e_u — e_{sca} — e_{ccs} — e_{ccr}$,

Where

E = total emissions from the use of the fuel
e_{ec} = emissions from the extraction or cultivation of raw materials
e_l = annual emissions from carbon stock changes due to land use change;
e_p = emissions from processing
e_{td} = emissions from transport and distribution;
e_u = emissions from the use of the fuel itself
e_{sca} = emissions saving from soil carbon accumulation through improved agricultural management
e_{ccs} = emissions saving from capture and geological storage of CO_2; and
e_{ccr} = emissions savings from the capture and replacement of CO_2.

Emissions from the manufacture of machinery and equipment shall not be included.

(b) Greenhouse gas emissions from the production and use of bioliquids shall be calculated as for biofuels (E), but with the necessary extension to include the energy conversion to electricity and/or heating and cooling produced, as follows:

(i) Energy installations supplying only heat:

$$EC_h = \frac{E}{\eta_h}$$

(ii) Energy installations supplying only electricity:

$$EC_{el} = \frac{E}{\eta_{el}}$$

Where

$E_{Ch,electricity}$ = Total greenhouse gas emissions from the final energy product.
E = Total greenhouse gas emissions from the bioliquid before the final conversion.
η_{el} = Electricity efficiency, defined as the annual electricity production divided by the annual input of the bioliquid based on its energy content.
η_h = Heat efficiency, defined as the annual useful heat production divided by the annual input of the bioliquid based on its energy content.

(iii) For the electrical or mechanical energy from energy installations providing useful heat together with electricity and/or mechanical energy:

$$EC_{el} = \frac{E}{\eta_{el}} \left(\frac{C_{el} \cdot \eta_{el}}{C_{el} \cdot \eta_{el} + C_h \cdot \eta_h} \right)$$

(iv) For useful heat from energy installations providing heat together with electricity and/or mechanical energy:

$$EC_h = \frac{E}{\eta_h}\left(\frac{C_h \cdot \eta_h}{C_{el} \cdot \eta_{el} + C_h \cdot \eta_h}\right)$$

where

$E_{Ch,electricity}$ = Total greenhouse gas emissions from the final energy product.

E = Total greenhouse gas emissions from the bioliquid before the final conversion.

η_{el} = Electricity efficiency, defined as the annual electricity production divided by the annual fuel input based on its energy content.

η_h = Heat efficiency, defined as the annual useful heat production divided by the annual fuel input based on its energy content.

C_{el} = The fraction of energy in electricity and/or mechanical energy, set at 100% (Cel = 1).

C_h = Carnot efficiency (fraction of exergy in useful heat).

Carnot efficiency, Ch, of useful heat at different temperatures is defined as:

$$C_h = \frac{T_h - T_0}{T_h}$$

Where

T_h = Useful heat temperature, measured in absolute temperature (kelvin) at the point of delivery.

T_0 = Ambient temperature, set at 273.15 kelvin (equivalent to 0 °C)

If the excess heat is transferred for heating buildings at a temperature below 150 °C (423.15 kelvin), Ch can alternatively be defined as follows:

C_h = Carnot efficiency for heat at 150 °C (423.15 kelvin), which is: 0.3546

For the purposes of this calculation, the following definitions shall apply:

(a) 'cogeneration': simultaneous generation of thermal energy and electrical and/or mechanical energy in one and the same process;

(b) 'useful heat': heat produced to satisfy an economically justifiable demand for heat for heating or cooling;

(c) 'economically justifiable demand': the demand that does not exceed the heating or cooling demand and that could otherwise be met under market conditions.

2. Greenhouse gas emissions from biofuels and bioliquids shall be expressed as follows:

(a) greenhouse gas emissions from biofuels, E, shall be expressed in grams of CO_2 equivalent per MJ of fuel, g CO_2eq/MJ;

(b) greenhouse gas emissions from bioliquids, EC, shall be expressed in grams of CO_2 equivalent

Where heating and cooling are produced in one process with electricity, emissions shall be divided between heat and electricity (as under point 1(b)), regardless of whether the heat is actually used for heating or cooling[52)].

Where the greenhouse gas emissions from the extraction or cultivation of the raw materials eec are expressed in the unit g CO_2eq/dry tonne of feedstock, the conversion to grams of CO_2 equivalent per MJ of fuel, g CO_2eq/MJ shall be calculated as follows[53)]:

$$e_{ec}\text{brændstof}_a \left[\frac{gCO_2eq}{MJbrændstof}\right]_{ec} = \frac{e_{ec}\text{råprodukt}_a \left[\frac{gCO_2eq}{t_{tør}}\right]}{LHV_a \left[\frac{MJråprodukt}{ttørt\ råprodukt}\right]} \cdot \text{Brændstof råprodukt faktor}_a \cdot \text{Fordelingsfaktor brændstof}_a$$

e_{ec}brændstof$_a$	e_{ec}fuel$_a$
MJbrændstof	MJfuel
e_{ec}råprodukt$_a$	e_{ec}feedstock$_a$
$t_{tør}$	t_{dry}
MJ råprodukt | ttørt råprodukt	MJ feedstock | dry feedstock
Brændstof råprodukt faktor$_a$ • Fordelingsfaktor brændstof$_a$	Fuel feedstock factor$_a$ • Distribution factor fuel$_a$

where

$$\text{Fordelingsfaktor brændstof}_a = \left[\frac{\text{Brændstoffets energiindhold}}{\text{Energi brændstof} + \text{Energi i biprodukter}}\right]$$

$$\text{Brændstof råprodukt faktor}_a = [\text{Forholdet mellem MJ råprodukt,der kræves til at fremstille 1 MJ brændstof}]$$

Fordelingsfaktor brandstof$_a$	Distribution factor fuel$_a$
[Brandstoffets energiindhold | Energi brandstof + Energi i biprodukte]	[Energy content of the fuel | Energy fuel + Energy in by-products]
Brandstof råprodukt faktor$_a$	Fuel feedstock factor$_a$
[Forholdet mellem M] råprodukt, der kraves til at fremstille 1 MJ brandstof]	[Ratio of M] feedstock required to produce 1 MJ of fuel]

Emissions per dry tonne of feedstock shall be calculated as follows:

$$e_{ec}\text{råprodukt}_a \left[\frac{gCO_2eq}{t_{tør}}\right] = \frac{e_{ec}\text{råprodukt}_a \left[\frac{gCO_2eq}{t_{fugtig}}\right]}{(1 - \text{fugtindholdet})}$$

e_{ec}råprodukt$_a$	e_{ec}feedstock$_a$
$t_{tør}$	t_{dry}
t_{fugtig}	t_{moist}
fugtindholdet	moisture content

3. Greenhouse gas emissions savings from biofuels and bioliquids shall be calculated as follows:

(a) greenhouse gas emissions savings from biofuels:

SAVING = $(E_{F(t)} — E_B)/E_{F(t)}$,

Where

E_B = total emissions from the biofuel and

$E_{F(t)}$ = total emissions from the fossil fuel comparator for transport.

(b) greenhouse gas emissions savings from heating and cooling and electricity produced from bioliquids:

$$SAVING = (EC_{F(h\&c,electricity)} — EC_{B(h\&c,el)})/EC_{F(h\&c,el)},$$

Where

$EC_{B(h\&c,el)}$ = total emissions from the heat or electricity and

$EC_{F(h\&c,el)}$ = total emissions of the fossil fuel comparator for useful heat or electricity.

4. For the purposes of the calculation referred to in point 1, the following greenhouse gases shall be included: CO_2, N_2O and CH_4. The following coefficients shall be used for the calculation of CO_2 equivalents:

CO_2	:	1
N_2O	:	298
CH_4	:	25

5. In emissions from the extraction or cultivation of raw materials, e_{ec}, shall include emissions from the following: the extraction or cultivation process itself; the collection, drying and storage of raw materials; losses and leaks; the production of chemicals or products used in extraction or cultivation. The capture of CO_2 through the cultivation of raw materials shall not be included. Estimates of emissions from cultivation of agricultural biomass may be replaced by estimates based on regional averages of cultivation emissions in the reports referred to in Article 31(4) or by the information on the disaggregated default values for cultivation emissions in this Annex. In the absence of relevant information in these reports, it is allowed to calculate averages on the basis of local agricultural practices, e.g. from data on groups of farms, as an alternative to the use of actual values.

6. For the purposes of the calculation referred to in point 1(a), greenhouse gas emissions savings from improved agriculture management, esca, such as shifting to reduced or zero-tillage, improved crop/rotation, the use of cover crops, including crop residue management, and the use of organic soil improver, such as compost and fermented manure digestate, shall be taken into account only if they do not risk negatively affecting biodiversity. In addition, reliable and verifiable evidence of increased soil carbon shall be provided, or where it is reasonable to expect that carbon has increased over the period in which the raw materials concerned were cultivated, while also taking into account emissions where such practices have led to the increased use of fertilisers and herbicides[54)].

7. Annual emissions from carbon stock changes due to land use change, e_l, shall be calculated by distributing the total emissions equally over 20 years. Such emissions shall be calculated in accordance with the following formula:

$$e_l = (CS_R — CS_A) \times 3.664 \times 1/20 \times 1/P — e_B,$$[55)]

e_l = annualised greenhouse gas emissions from carbon stock change due to land-use change (measured as mass (grams) of CO_2 equivalent per unit of biofuel or bioliquid energy (megajoules)). 'Cultivated land'[1)] and 'cultivated land with perennial crops'[2)] shall be regarded as one land use.

CS_R = the carbon stock per unit area associated with the reference land-use (measured as mass (tonnes) of carbon per unit area, including both soil and vegetation). The reference land use shall be the land use in January 2008, or 20 years before the raw material is harvested, whichever is the latest;

CS_A = the carbon stock per unit area associated with the actual land-use (measured as mass (tonnes) of carbon per unit area, including both soil and vegetation). In cases where carbon stocks accumulate over more than one year, the value attributed to CS_A, shall be the estimated stock per unit land after 20 years or when the crop is ripe, whichever is earlier;

P = the productivity of the crop (measured as biofuel or bioliquid energy per unit land per year); and

e_B = bonus of 29 g CO_2eq/MJ of biofuel or bioliquid if the biomass is obtained from restored degraded land under the conditions referred to in point 8.

1) Cultivated land as defined by the IPCC.

2) Perennial crops are defined as multi-annual crops, the stem of which is usually not annually harvested such as short rotation coppice and oil palm.

8. The bonus of 29 g CO_2eq/MJ shall apply provided that it can be demonstrated the concerned land:

(a) was not used for agricultural purposes or any other activity in January 2008; and

(b) is severely degraded land, including such land that has previously been used for agricultural purposes.

The bonus of 29 g CO_2eq/MJ shall apply for a period of up to 20 years from the date of conversion of the land to agricultural use, provided that on land falling under (b) a regular increase in carbon stock is ensured as well as a significant reduction in erosion.

9. 'Severely degraded land' means land that, for a significant period of time, has either been significantly salinated or has had a particularly low organic matter content and has been severely eroded.

10. The Commission shall, by 31 December 2020, review guidelines for the calculation of land carbon stocks.[56)] on the basis of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories – volume 4 and in accordance with Regulation (EU) No 525/2013 and Regulation (EU) 2018/841 of the European Parliament and of the Council[56)]. The Commission guidelines shall serve as a basis for calculating land carbon stocks for the purposes of this Directive.

11. In emissions from processing, e_p,the emissions from the following shall be included: the processing itself, losses and leaks; the production of chemicals or products used in processing, including CO_2 emissions corresponding to the carbon content of fossil inputs, regardless of whether they are actually combusted in the process.

For the purpose of accounting for electricity consumption not generated by the fuel production installation itself, the greenhouse gas emission intensity of the production and distribution of that electricity shall be assumed to be equal to the average emission intensity of the production and distribution of electricity in a defined area. By way of derogation from this rule, producers may use an average value for the electricity production of a single power plant if that plant is not connected to the electricity grid.

Emissions from processing shall include emissions from the drying of intermediate products and materials, where applicable.

12. In emissions from transport and distribution, e_{td}, emissions from the transport of raw materials and semi-finished products, as well as from the storage and distribution of finished products, shall be included. Emissions from transport and distribution included in accordance with point 5 shall not be covered by this point.

13. Emissions from the use of the fuel itself, e_u, shall be set to zero for biofuels and bioliquids.

Emissions of non CO_2 greenhouse gases (N_2O and CH_4) from the fuel used are included in the e_u factor for bioliquids.

14. Emissions saving from the capture and geological storage of CO_2, eccs, not already included in ep, shall only include emissions avoided through the capture and storage of CO_2 the emissions of which are directly related to the extraction, transport, processing and distribution of fuel, if stored in accordance with Directive 2009/31/EC of the European Parliament and of the Council;[58)] on the geological storage of carbon dioxide.

15. Emissions saving from the capture and replacement of CO_2, e_{ccr}, shall be directly connected to the production of biofuels or bioliquids to which they are linked and shall only include emissions avoided through the capture of CO_2 of which the carbon originates from biomass and which is used to replace fossil-derived CO_2 during the production of commercial products and services before 1 January 2036.

16. Where a cogeneration unit — which supplies heat and/or electricity to a fuel production process for which emissions are calculated — produces excess electricity and/or excess useful heat, the greenhouse gas emissions shall be divided between the electricity and the useful heat according to the temperature of the heat (reflecting the usefulness (utility) of the heat). The useful part of the heat is obtained by multiplying its energy content with the Carnot efficiency C_h, calculated as follows:

$$C_h = \frac{T_h - T_0}{T_h}$$

where

T_h = Useful heat temperature, measured in absolute temperature (kelvin) at the point of delivery.
T_0 = Ambient temperature, set at 273.15 kelvin (equivalent to 0 °C)
If the excess heat is transferred for heating buildings at a temperature below 150 °C (423.15 kelvin), C_h may alternatively, it is defined as follows:

C_h = Carnot efficiency for heat at 150 °C (423.15 kelvin), which is: 0.3546
For the purposes of this calculation, the actual efficiencies shall be used, defined as the annual mechanical energy, electricity and heat produced, each divided by the annual energy input.

For the purposes of this calculation, the following definitions shall apply:

(a) 'cogeneration': simultaneous generation of thermal energy and electrical and/or mechanical energy in one and the same process;

(b) 'useful heat': heat produced to satisfy an economically justifiable demand for heat for heating or cooling;

(c) 'economically justifiable demand': the demand that does not exceed the heating or cooling demand and that could otherwise be met under market conditions.

17. Where a fuel production process produces a combination of the fuel for which emissions are calculated and one or more other products (by-products), greenhouse gas emissions shall be divided between the fuel or its intermediate product and the by-products in proportion to their energy content (expressed at net calorific value for all by-products other than electricity and heat). The greenhouse gas intensity of excess useful heat or excess electricity shall be the same as the greenhouse gas intensity of heat or electricity supplied to the fuel production process and shall be determined by calculating the greenhouse gas intensity of all inputs and emissions, including feedstock and CH4 and N2O emissions, to and from the cogeneration unit, boiler or other equipment providing heat or electricity to the fuel production process. In the case of simultaneous production of heat and electricity (cogeneration), the calculation shall be carried out as in point 16.

18.

The emissions to be distributed for the purposes of the calculations referred to in point 17 shall be eec + electricity + esca +, the fractions of ep, etd, eccs and eccr that take place up to and including the final process step in the production of the by-product. Where by-products have been allocated at an earlier process step in the life cycle, the fraction of those emissions attributed to the intermediate fuel product in the final process step shall replace the full emission in the calculation. For biofuels and biofuel, all by-products not covered by point 17 shall be taken into account for the purposes of the calculation.

By-products with negative energy content shall be considered for the calculation to have an energy content of zero.

As a general rule, waste and residues, including all waste and residues listed in Annex IX, shall be considered to have zero life-cycle greenhouse gas emissions in the processes preceding the collection of those materials, regardless of whether they are processed into intermediates before being transformed into the final product.

In the case of fuels produced in refineries, other than the combination of processing plants with boilers or cogeneration units supplying heat and/or electricity to the processing installation, the unit of analysis for the purposes of the calculation referred to in point 17 shall be the refinery.

19. For the purposes of calculations according to the formula in point 3 for biomass fuels used in transport, the value of $EC_{F(t)}$ 94 g CO_2eq/MJ shall be used for the fossil fuel comparator.

For the purposes of calculations according to the formula in point 3 for biomass fuels used for electricity production, the value of $EC_{F(e)}$ 183 g CO_2eq/MJ of electricity shall be used the fossil fuel comparator.

For the purposes of calculations according to the formula in point 3 for bioliquids used for the production of useful heat and for the production of heating and/or cooling, the $EC_{F(h\&c)}$ value of 80 g CO_2eq/MJ shall be used for the emission from the fossil fuel comparator.

Annex F

Verifier's declaration

	Must contain the words ‘Verifier's declaration’
Addressee	The addressee is the covered company to which the declaration is addressed, i.e. the management of the company which entrusted the inspector with the task.
Subject	Reference to the specific document covered by this declaration.
Criteria	Indicate the criteria used to evaluate the company’s reporting.
Reported information	All necessary information according to this guidance document.
Summary of the work carried out	A summary of the work carried out, including any limitations in the design, timing and scope of the evidence-gathering procedures. The description shall be sufficiently detailed to enable the reader of the declaration to understand easily the work carried out by the verifier. It shall include a description of which activities have been carried out within the company and how evidence

	of sustainability information through the production chain has been tested. For example: Conducted interviews with _____ to gain an understanding of _____. Carried out a review of carbon and sustainability data, collection and reporting systems and processes, including _____. Reviewed mass balance information, including _____. Conducted interviews with suppliers to determine _____.
Limitations	Any limitations on the controls carried out on the basis of the criteria laid down. Listed limitations should only be included to clarify the scope of the control activities – not as a contradiction of the formal declaration.
Conclusion and reservations	Conclusion and possible reservations on this conclusion Please note that a report with qualified conclusions will be carefully assessed by the Danish Energy Agency and that this may lead to the Danish Energy Agency not being able to approve the covered biomass fuels as sustainable.
Other relevant comments	All other relevant comments (as appropriate) – they must be clearly separated from the conclusion and formulated in such a way that they do not affect it.

Official notes

[1)] This Order implements parts of Directive 2018/2001/EU of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast), OJ L 328, p. 82; as amended by Directive (EU) 2023/2413 of the European Parliament and of the Council, Official Journal 2023, L of 18 October 2023.

[2)] Directive 2018/2001/EU of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast), Official Journal 2018, L 328, p. 82, as amended by Directive (EU) 2023/2413 of the European Parliament and of the Council (18 October 2023).

[3)] Order on the Handbook on proof of sustainability of biofuels (HB 2021).

[5)] Food and Agriculture Organization.

[6)] Directive (EU) 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources, as amended by Directive (EU) 2023/2413 of the European Parliament and of the Council (18 October 2023).

[7)] Whole crop means a crop in which the whole plant is harvested and used together.

[8)] Grass and clover grass from perennial land, i.e. land that has not been ploughed up for at least 5 years, are excluded. Clover grass from organic land is excluded.

[9)] REGULATION (EU) No 995/2010 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 October 2010 laying down the obligations of operators who place timber and timber products on the market.

[10)] 'applicable legislation' is defined in Article 2(h) of Regulation (EU) No 995/2010.

[12)] https://preferredbynature.org/sourcinghub/timber

[13)] http://eutr.dk/lovligt-trae/

[14)] www.unep-wcmc.org/featured-projects/eu-timber-regulation-and-flegt

[15)] https://energy.ec.europa.eu/topics/renewable-energy/bioenergy/voluntary-schemes_en

[16] https://bios.au.dk/forskningraadgivning/temasider/redlistframe/om-roedlisten/roedlistekategorierne/

[26] https://unfccc.int/process-and-meetings/the-paris-agreement [27] https://unfccc.int/NDCREG

[28] AFOLU = Agriculture, forestry and land use. AFOLU is the agriculture + LULUCF sector.

[29] https://unfccc.int/process-and-meetings/transparency-and-reporting/greenhouse-gas-data/ghg-data-unfccc/ghg-data-from-unfccc

[30] https://unfccc.int/process-and-meetings#:0c4d2d14-7742-48fd-982e-d52b41b85bb0:f666393f-34f5-45d6-a44e-8d03be236927:cc852874-8331-492c-a332-cc6313dec434

[31] https://bios.au.dk/forskningraadgivning/temasider/redlistframe/om-roedlisten/roedlistekategorierne/

[32] https://naturstyrelsen.dk/publikationer/2008/dec/noeglebiotoper-i-skov

[33] https://mst.dk/publikationer/2017/juni/noegle-til-kortlaegning-af-naturmaessigt-saerlig-vaerdifuld-skov

[34] http://iplus.efi.int/uploads/Tree%20Microhabitat%20Catalogues/Catalogue_TreeMicrohabitats_DK.pdf

[35] https://ecos.au.dk/forskningraadgivning/temasider/redlist

[36] https://www.retsinformation.dk/eli/lta/2021/521

[37] https://www.hcvnetwork.org/library/guide-for-hcv-national-interpretations-2019

[38] https://foresteurope.org/publications_type/forestry-and-our-cultural-heritage-2006/ [39] See Section 9.4 for the calculation of emissions for categories and types of biomass without declared default values.

[40] See Section 9.4 for calculation of emissions for categories and types of biomass without declared disaggregated default values.

[41] REGULATION (EU) 2018/1999 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the Governance of the Energy Union and Climate Action, Article 20 and Annex IX Part 1.

[42] ACT No 965 of 26 June 2020.

[43] REGULATION (EU) 2018/1999 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the Governance of the Energy Union and Climate Action, Article 20 and Annex IX Part 1.

[44] ACT No 965 from 26 June 2020

[45] Heat or waste heat is used to produce cooling (cold air or cold water) via absorption chillers. It is therefore appropriate to calculate only the emissions linked to the heat per MJ of heat, regardless of whether the end-use of that heat is actually heating or cooling via absorption chillers.

[46] The formula for calculating greenhouse gas emissions from the extraction or cultivation of raw materials eec describes cases where feedstock is converted into biofuel in a single step. For more complex supply chains, adjustments are necessary for the purposes of calculating greenhouse gas emissions from the extraction or cultivation of raw materials eec for intermediate products.

[47] The measurement of soil carbon may constitute such evidence, for example by an initial measurement before cultivation and subsequent measurements at regular intervals separated by several years. In this case, before the second measurement is available, the increase in soil carbon is estimated on the basis of representative experiments or soil models. From the second measurement onwards, the measurements will provide a basis for determining that the carbon in the soil has increased and its size.

[48] The quotient obtained by dividing the molecular weight of CO_2 (44.010 g/mol) by the molecular weight of carbon (12.011 g/mol) is 3.664.

[49] Cultivated land as defined by the IPCC.

[50] Perennial crops are defined as multi-annual crops, the stem of which is usually not annually harvested such as short rotation coppice and oil palm.

[51] Commission Decision 2010/335/EU of 10 June 2010 establishing guidelines for the calculation of land carbon stocks for the purpose of Annex V to Directive 2009/28/EC (OJ L 151, 17.6.2010, p. 19).

[52] Heat or waste heat is used to produce cooling (cold air or cold water) via absorption chillers. It is therefore appropriate to calculate only the emissions linked to the heat per MJ of heat, regardless of whether the end-use of that heat is actually heating or cooling via absorption chillers.

[53] The formula for calculating greenhouse gas emissions from the extraction or cultivation of raw materials eec describes cases where feedstock is converted into biofuel in a single step. For more

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[55)] The quotient obtained by dividing the molecular weight of CO_2 (44.010 g/mol) by the molecular weight of carbon (12.011 g/mol) is 3.664.

[56)] Commission Decision 2010/335/EU of 10 June 2010 establishing guidelines for the calculation of land carbon stocks for the purpose of Annex V to Directive 2009/28/EC (OJ L 151, 17.6.2010, p. 19).

[57)] Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU (OJ L 156, 19.6.2018, p. 1).

[58)] Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006 (OJ L 140, 5.6.2009, p. 114).